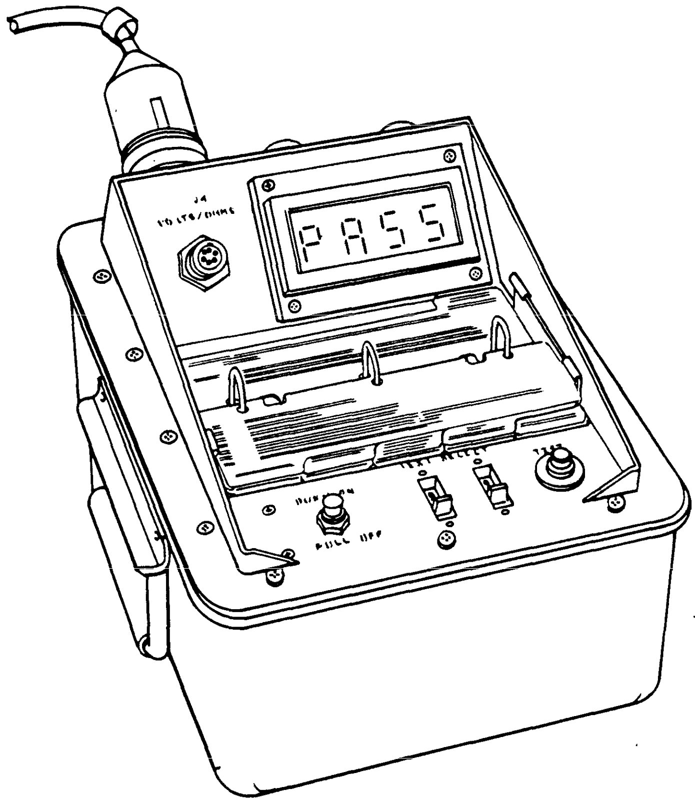
Supersedes copy dated October 1984

TECHNICAL MANUAL

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST



SIMPLIFIED TEST EQUIPMENT FOR INTERNAL COMBUSTION ENGINES REPROGRAMMABLE (STE/ICE-R) (NSN 4910-01-222-6589)

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HEADQUARTERS, DEPARTMENT OF THE ARMY
25 MARCH 1988

CHANGE

NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 10 January 1992

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

SIMPLIFIED TEST EQUIPMENT FOR INTERNAL COMBUSTION ENGINE (NSN 4910-00-124-2554)

Current as of 16 September 1991

TM 9-4910-571-12&P, 25 March 1988, is changed as follows:

1. Remove old pages and insert new pages as indicated below.
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Remove Pages	Insert Pages
TOC i and ii	TOC i through i.2/(i.3 blank)
2-55/(2-56) blank	2–55/(2-56) blank
2-127 and 2–128	2–127 and 2-128
2–157 and 2–158	2-157 and 2–158
E-1through E-16 (blank)	E-1 through 1-5
Index 3 through Index 5 (Index–6 blank)	Index 3 through Index 5 (Index-6 blank)

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General, United States Army
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Official:

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No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
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OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST SIMPLIFIED TEST EQUIPMENT FOR INTERNAL COMBUSTION ENGINE (NSN 4910-00-124-2554)

TM 9-4910-571-12&P, 25 March 1988 is changed as follows:

1. The title page is changed to read as shown above.
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1-23 and 1-24	1-23 and 1-24
1-25 and 1-26	1-25 and 1-26
1-27 and 1-28	1-27 and 1-28
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1-31 and 1-32	1-31 and 1-32

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By Order of the Secretary of the Army:

CARL E. WONO
General, United States Army
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General, United States Army
The Adjutant General

Distribution:

Distribute LAW DA Form 12-38R (Block Nos. 305 and 306) Technical Manual Requirements for Simplified Test Equipment for Internal Combustion Engine.

WARNING

CARBON MONOXIDE POISONING CAN BE DEADLY

Carbon monoxide is a colorless, odorless, deadly poisonous gas, which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air contaminated with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, coma. Permanent brain damage or death can result from severe exposure.

Carbon monoxide occurs in the exhaust fumes of fuel-burning heaters and internal-combustion engines and becomes dangerously concentrated under conditions of inadequate ventilation. The following precautions must be observed to insure the safety of personnel whenever the personnel heater, main, or auxiliary engine of any vehicle is operated for maintenance purposes or tactical use.

1. Do not operate heater or engine in an enclosed area unless it is adequately ventilated.

2. Do not idle engine for long periods without maintaining adequate ventilation in personnel compartments.

3. Do not drive any vehicle with inspection plates, cover plates, engine compartment doors removed unless necessary for maintenance purposes.

4. Be alert at all times during operation for exhaust odors and exposure symptoms. If either are present, immediately ventilate personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: Expose to fresh air, keep warm, and do not permit physical exercise. If necessary, administer artificial respiration.

The best defense against carbon monoxide poisoning is adequate ventilation.

WARNING

Explosive fumes may accumulate in the transit case. Do not open, use, or store the STE/ICE-R transit case near an open flame.

WARNING

Do not connect VTM to power source switch while VTM power is on.

Battery explosion could occur.

WARNING

Electrical shock hazard. Insure circuit is off before attaching leads. Failure to heed warning could cause shock, injury or death. If electrical shock occurs, administer first aid and seek medical assistance immediately.

WARNING

Observe polarity as indicated on cable tags when installing batteries or slaving vehicle.
Remove ground (negative) cable terminal from battery before performing any work on the batteries or the vehicle electrical system.
Do not short circuit the battery post with tools, or battery cover.
Avoid getting acid on hands or clothing.
Do not use open flame or spark producing device while working on batteries.

WARNING

Engine Compartment

Accumulation of oil or grease on the engine will create a serious fire hazard. Clean as required.

WARNING

Specific warnings are used throughout Chapter 2 when any of the following are applicable:

- Vehicle engine must be off before installing cables and transducers and while performing engine tightness tests.

- Do not smoke when disconnecting SI fuel line. Do not use a styrofoam cup to catch or hold fuel.

- Keep clear of rotating parts while engine is cranking. Do not crank engine while looking into the carburetor of SI engines; personal injury may. result if engine fires.

- Remove all electrically fired ammunition before using STE/ICE-R.

TECHNICAL MANUAL

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D. C.,25 March 1988

OPERATOR'S AND ORGANIZATIONAL MAINTENANCE MANUAL
(Including Repair Parts and Special Tools List)

SIMPLIFIED TEST EQUIPMENT FOR INTERNAL COMBUSTION ENGINES - REPROGRAMMABLE
(STE/ICE-R)

REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual. Mail the form directly to: Commander, US Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, Michigan 48397-5000. A reply will be furnished directly to you.

TABLE OF CONTENTS

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*This manual supersedes TM 9-4910-571-12&P, dated 15 October 1984, including all changes.

TABLE OF CONTENTS (cont)

LIST OF TABLES

HOW TO USE THIS MANUAL

As a maintainer of military equipment, you will need to know how to use Simplified Test Equipment for Internal Combustion Engines - Reprogrammable (STE/ICE-R) to perform the following:

- Tests to determine overall condition of vehicles or other equipment
- General measurements on vehicles and equipment
- Special tests on vehicle and equipment systems
- Diagnostic Connector Assembly (DCA) tests when the vehicle/equipment being tested has connector and transducer assemblies

This technical manual is organized so that the STE/ICE-R procedures required to perform these tasks are easily located. Take a few minutes to read through this part of the manual to learn how it is put together and how to find and use these test procedures.

A. BEFORE YOU START

1. Read and understand all of the warnings in the front of this manual.
2. Read Chapter 1 to learn more about STE/ICE-R and its purpose, capabilities and features.
3. Study Section I of Chapter 2 to become familiar with the controls and indicators, and with messages that the Vehicle Test Meter (VTM) can display.

B. CONTENTS OF MANUAL

1. This manual contains:
   a. Operating procedures 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/equipment information together with test data.
   c. Maintenance and fault isolation procedures to help you keep STE/ICE-R working properly.
2. This manual is made up of:
   a. Chapters. There are three chapters: Introduction, Operation, and Maintenance. Each chapter is divided into sections.

GO TO NEXT PAGE

HOW TO USE THIS MANUAL (cont)

(1) Chapter 1 has three sections: General Information, Equipment Description, and Data and Principles of Operation.

(2) Chapter 2 has four sections: Controls and Indicators, preventive Maintenance Checks and Services, Operation Under Usual Conditions, and Operation Under Unusual Conditions.

(3) Chapter 3 has four sections: Repair Parts and Special Tools, Fault Isolation, Maintenance Procedures, and Storage and Shipment.

b. Sections. Sections cover special information about the system. Each section begins with a list of paragraphs.

c. Paragraphs. Paragraphs make up sections. The paragraphs have the information needed to do the job properly.

d. Pages. Pages are number consecutively within each chapter Each Page number is prefixed with the chapter number. For example, page 3 of Chapter 2 is numbered 2-3.

e. Appendices. Appendices are found in the back of the manual. They provide refernce information required by the operator.

f. Index. The index is located in the back of the manual. It lists topics in alphabetical order, and it references the paragraph numbers where information on the topic can be found.

g. Glossary. The glossary is located in the back of the manual. It contains a listing of terms used in this manual and their explanation.

C. HOW TO FIND A TEST PROCEDURE

1. To perform a sequence of tests to determine the overall condition of your vehicle/equipment, use the vehicle/equipment TM and the general measurement section of this manual.

2. To perform a single measurement on a military vehicle/equipment:

a. Refer to the test selection guide, table 2-5, to determine if that type of measurement is listed.

b. If it is, go to the page number listed for that test to read the measurement description and the pre-test requirements.

c. If the measurement description fits your needs, proceed with the measurement.

3. To perform special tests on equipment subsystems of vehicle/equipment which have vehicle identification on numbers assigned:

GO TO NEXT PAGE

HOW TO USE THIS MANUAL (cont)

a. Refer to the test selection guide, table 2-5, to determine if that type of test is listed.

b. If it is, go to the page number listed for that test to read the test description and the pre-test requirements.

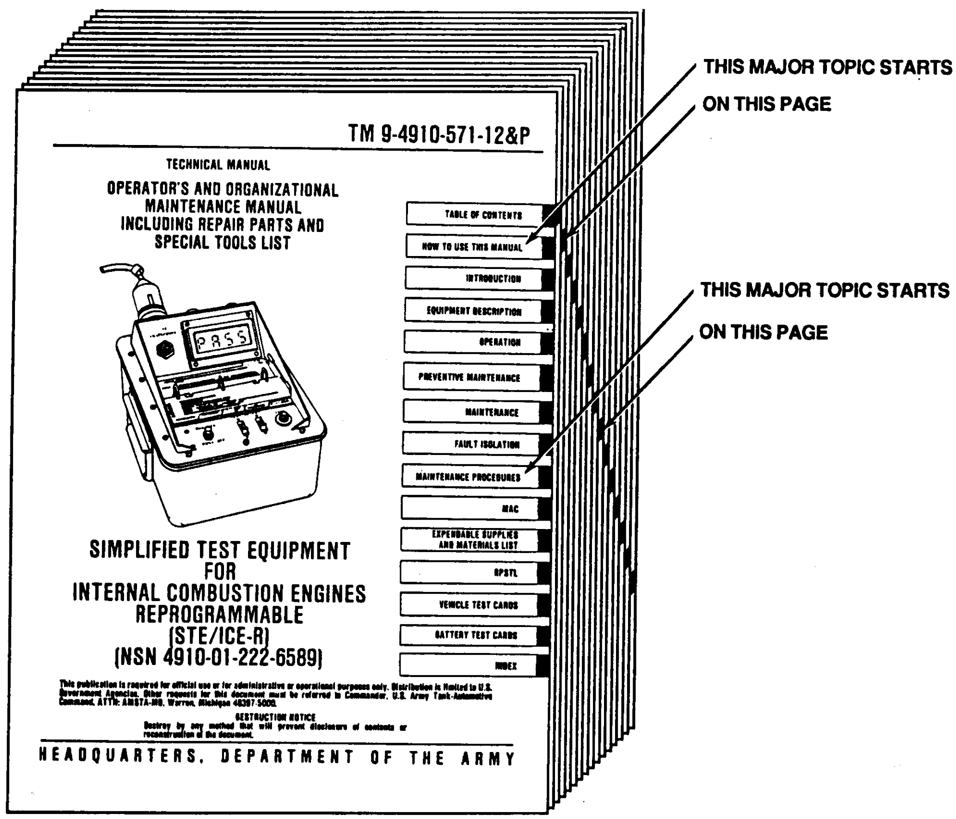
c. If the test description fits your needs, proceed with the test.

4. To perform a diagnostic connector assembly (DCA) test:

a. Refer to paragraph 2-3-54, DCA tests, to obtain background information on DCAS (what it is?, etc.).

b. Go to the vehicle/equipment TM for the description of the test and the procedure to run the test.

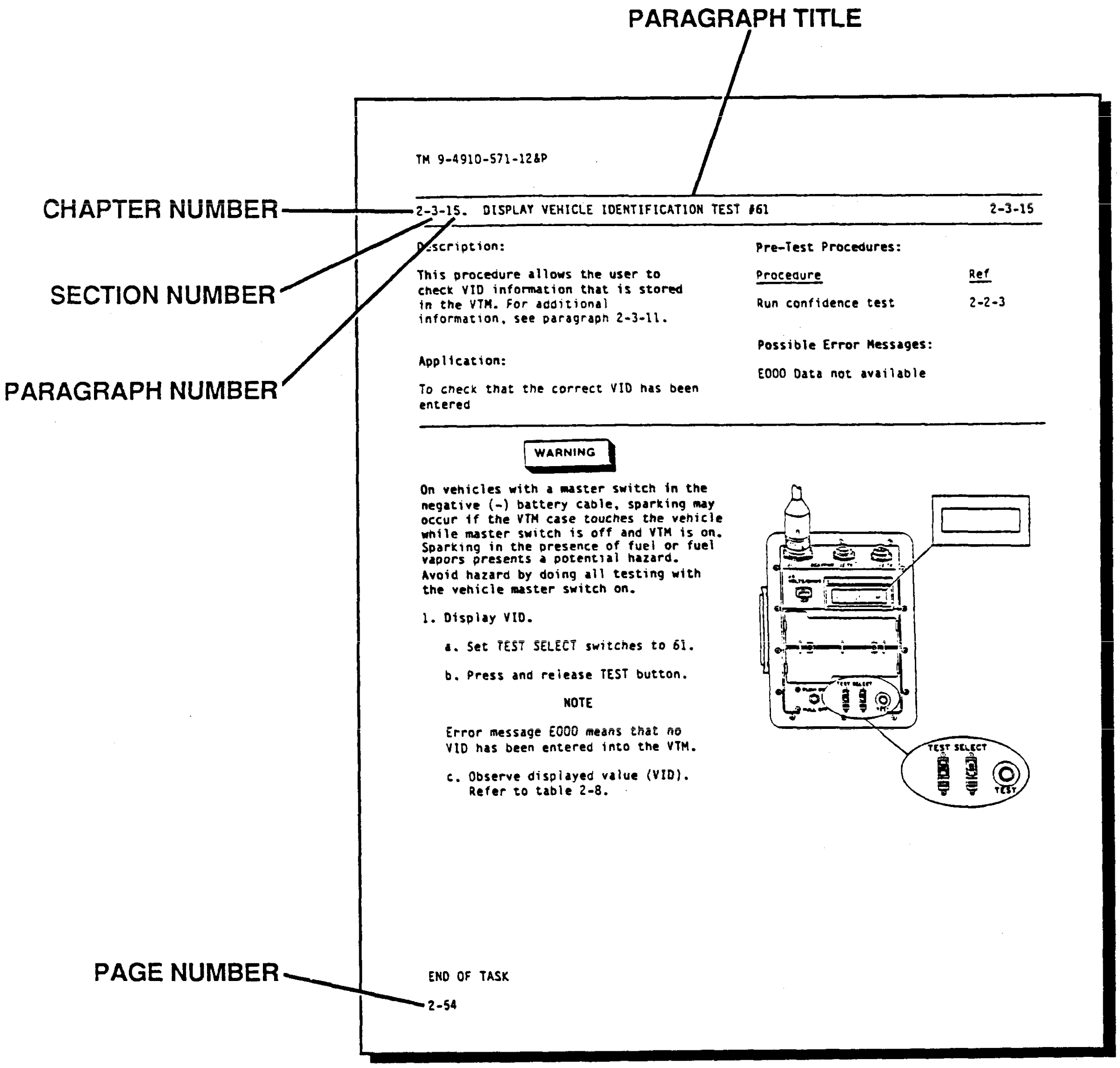
D. HOW TO FIND INFORMATION QUICKLY



1. Using Front Cover. The front cover of the manual has boxed titles for major topics. At the right side of each box is a blackened area. The blackened area matches black markings on the first page of that major topic in the manual. Fan the outer edge of the manual to find the topic material.

GO TO NEXT PAGE

HOW TO USE THIS MANUAL (cont)



2. Using Paragraph Numbers and Titles. Paragraph numbers include the chapter and section number. The paragraph number appears before the title and at the end of the paragraph title line. Paragraphs that are longer than one page will have the paragraph number and title continued at the top of each following page.

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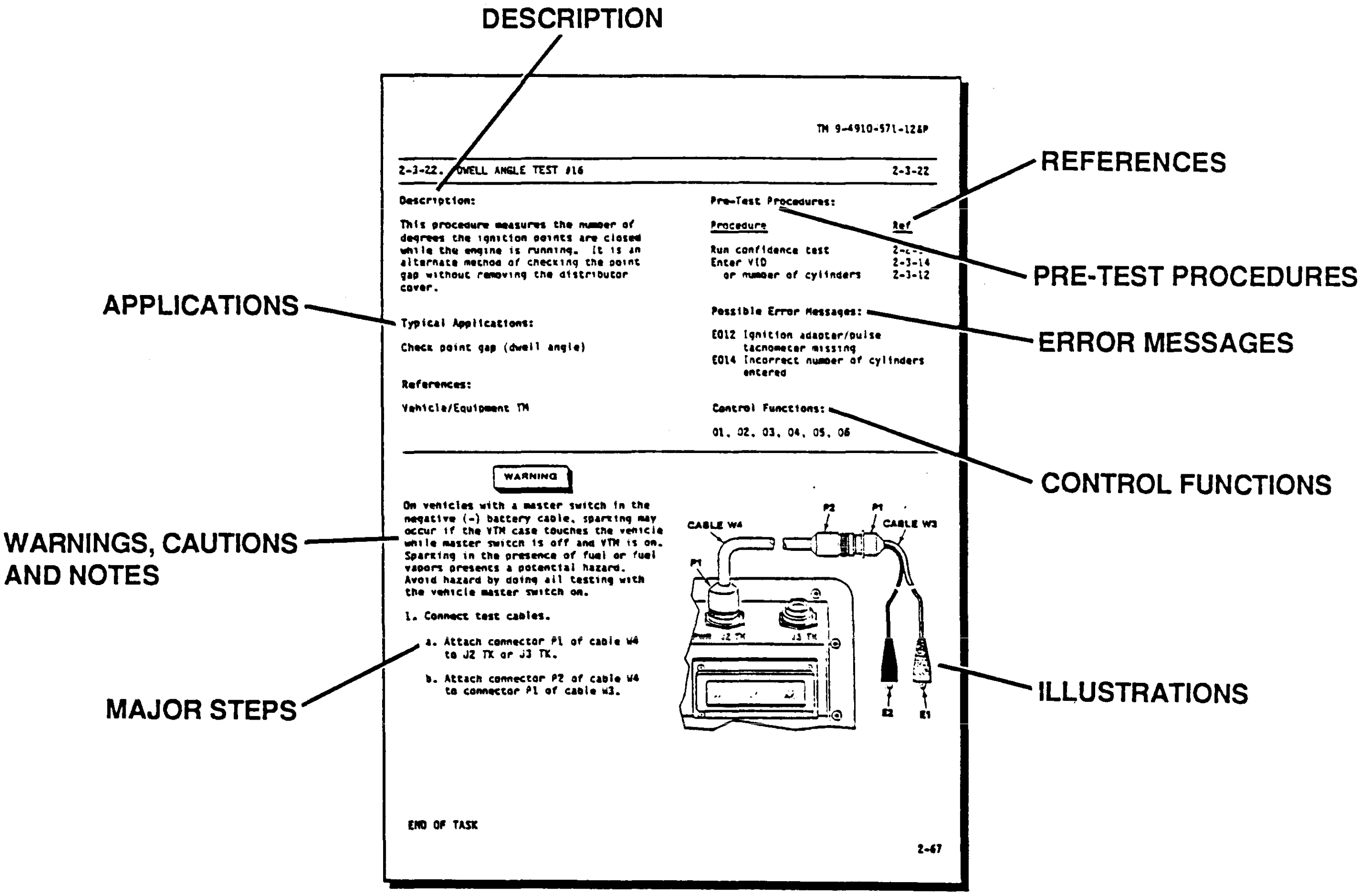
HOW TO USE THIS MANUAL (cont)



E. HOW TO USE A PROCEDURE

Each procedure consists of two parts, a setup table and measurement section.

The setup table contains the following parts:

Description - Describes the procedure.

Applications - Gives examples of how/where the procedure is used.

References - Shows where reference material can be found.

Pre-test Procedures - Refers to procedures that must be done before attempting this procedure.

Possible Error Messages - A list of error messages that might be encountered while performing the test.

Control Functions - A list of the control functions that could be used with this test if desired.

GO TO NEXT PAGE

HOW TO USE THIS MANUAL (cont)

The measurement section contains task steps printed in bold type followed by specific substeps. A supporting illustration is on the same page as referenced in text.

All warnings, cautions and notes are shown immediately before the steps in which they apply.

F. HOW TO USE THE REPAIR PARTS AND SPECIAL TOOLS LISTS

For information on how to use the RPSTL, refer to Appendix E, Repair Parts and Special Tools Lists.

END OF HOW TO USE THIS MANUAL

Chapter One - INTRODUCTION

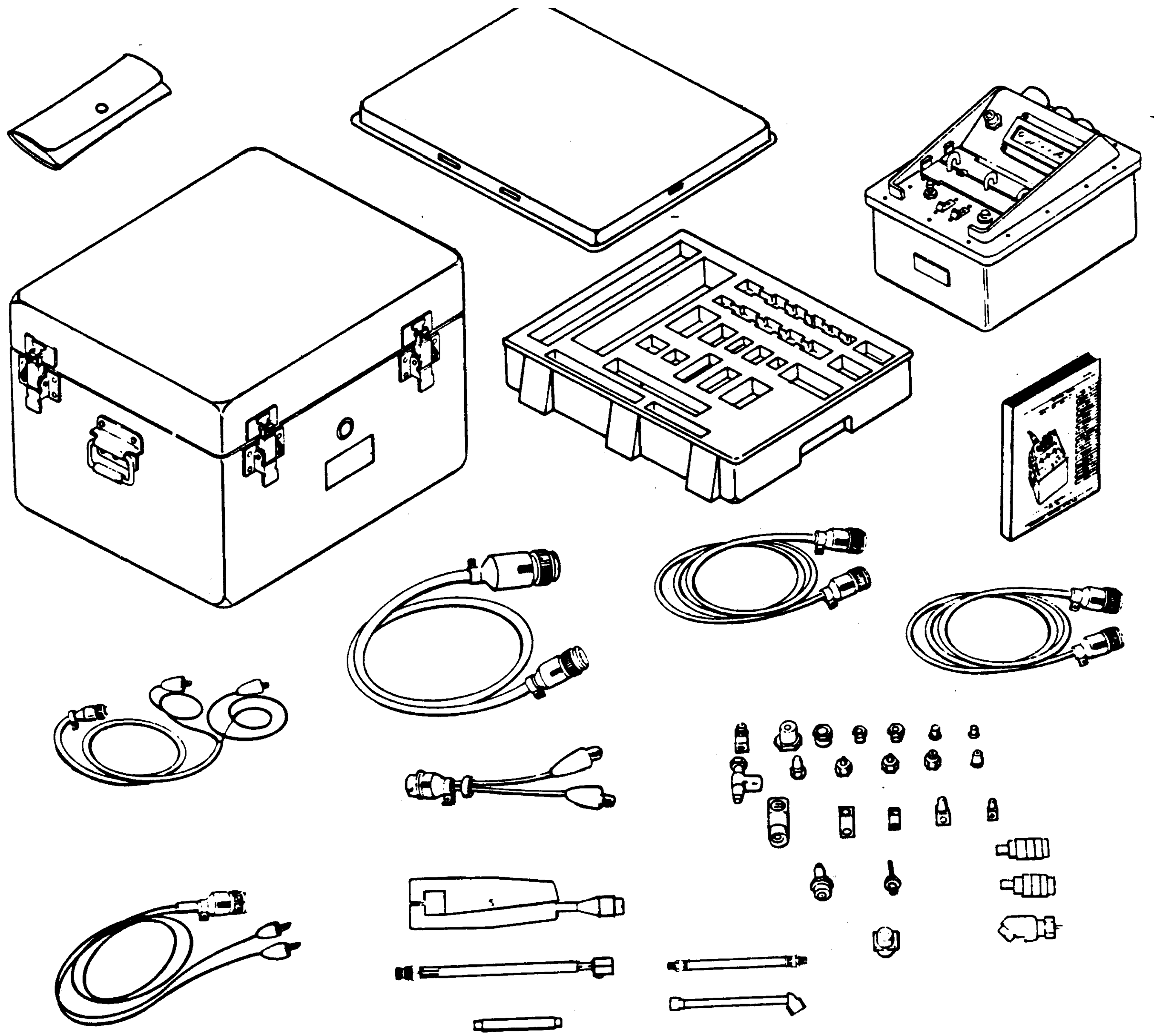
Chapter one is an introduction to the STE/ICE-R equipment. This chapter also includes information on forms and records and has the following sections:

Section I. GENERAL INFORMATION

Section I provides a general description of the STE/ICE-R equipment and what it is used for. This section also includes information on forms and records and has the following paragraphs:

1-1-1. INTRODUCTION

1-1-1



A. STE/ICE-R performs many tests and measurements on internal combustion engines as well as other equipment.

B. Engine power tests can be made on most engines without the need for other special test equipment.

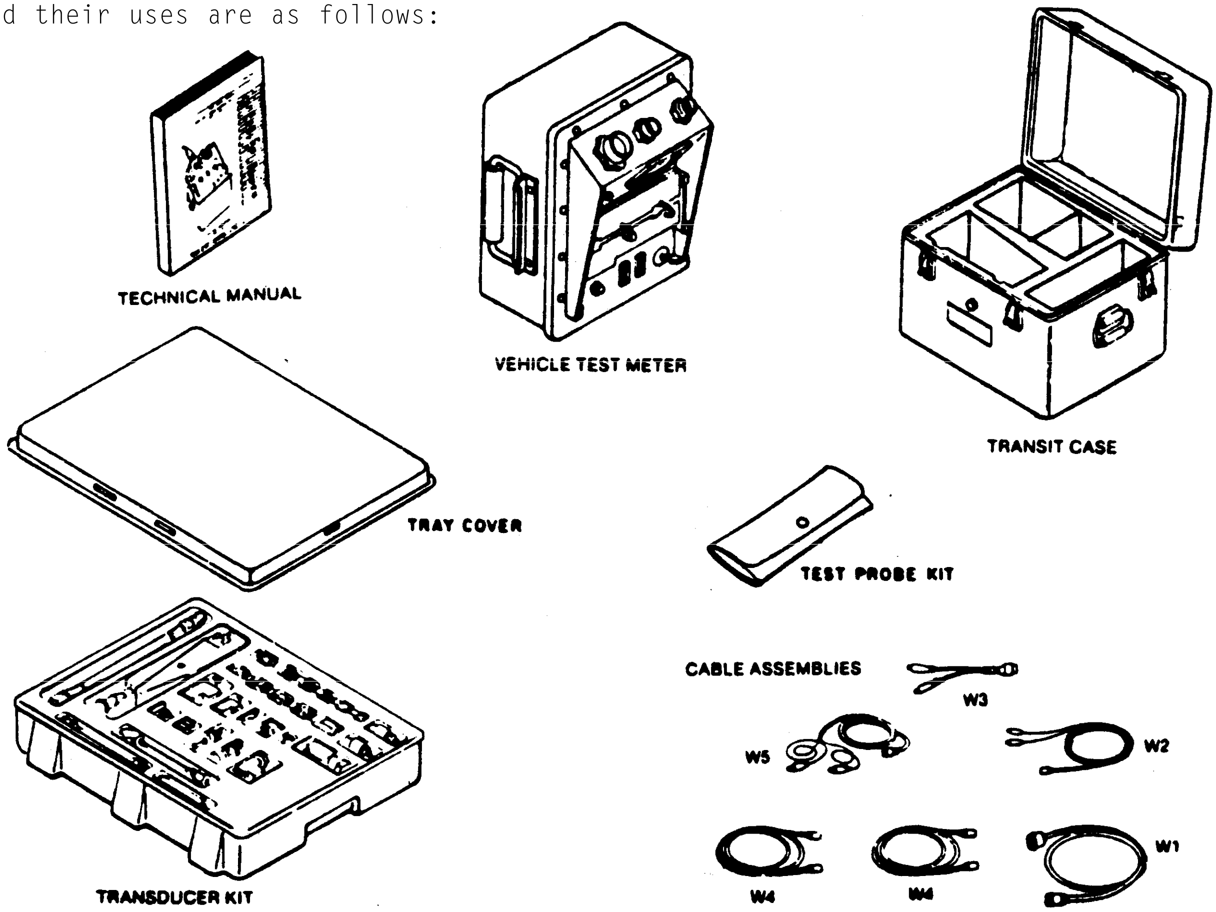
C. Special tests, such as compression unbalance tests and starter system evaluation tests, are performed on most engines by STE/ICE-R.

D. Test Measurement and Diagnostic Equipment (TMDE) functions can be performed with STE/ICE-R.

G. TO NEXT PAGE

1-1-1. INTRODUCTION (cont) 1-1-1

E. Major items of the STE/ICE-R and their uses are as follows:



1. Vehicle Test Meter (VTM)-used to test vehicle/eqipment components.

2. Transit Case - a fitted carrying case used to transport all items of the STE/ICE-R.

3. Cable Assemblies - used to supply operating power and test data to the VTM. Cable assemblies are referred to by the cable number and by a name which tells how the cable is used.

4. Transducer Kit - contains a cover, transducers, adapters, and current probe. Used to connect the VTM to the vehicle/equipment for testing.

5. Technical Manual - describes the operation and organizational maintenance of the STE/ICE-R system. Contains detailed operating procedures for general and special measurements.

6. Test Probe Kit - The test probe kit contains a variety of clips and probes which can be attached to the test probe cable W2. These clips and probes allow the user to make different types of measurements (e.g. cable continuity tests, battery tests, etc.) with greater ease.

END OF PARAGRAPH

1-1-2. SCOPE 1-1-2

This technical manual (TM) describes the operation and organizational maintenance of the Simplified Test Equipment for Internal Combustion Engines - Reprogranrnable (STE/ICE-R) system. It contains general measurement procedures which can be used on a variety of electrical and mechanical equipment such as electric generators, motors, and helicopters, as well as special tests for specific vehicles. Maintenance procedures for the STE/ICE-R set at the organizational level are also included.

STE/ICE-R can be used with this TM and with the vehicle/equipment TM to perform diagnostic measurements. After a faulty part or subsystem is identified, the user will use the vehicle/equipment TM for specific replacement or repair procedures.

1-1-3. MAINTENANCE FORMS, RECORDS AND REPORTS 1-1-3

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-1-4. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE 1-1-4

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2, Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

1-1-5. PREPARATION FOR STORAGE OR SHIPMENT 1-1-5

No special requirements are necessary to prepare the test equipment for storage or shipment.

1-1-6. OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS 1-1-6

This paragraph contains table 1-1 that shows official nomenclature of STE/ICE-R items and commonly used terms. In this manual, equipment is referred to by the common name. Common names of the equipment are listed in alphabetical order in the first column. The second column is official nomenclature as listed in Appendix E, Repair Parts and Special Tools List.

GO TO NEXT PAGE

1-1-6. OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS (cont) 1-1-6

Table 1-1 Nomenclature Cross-Reference List

COMMON NAME	OFFICIAL NOMENCLATURE
Black Clip	Clip, Electrical
Blue Striped Transducer, TK item 17	Transducer, Pressure 0 to 1000 PSIG Blue: TK 17
Current Probe, TK item 11	Prod. Test DC and AC Current: TK 11
Connector Adapter, TK item 29	Adapter, Connector: TK 29
DCA Cable W1	Cable Assembly, Power W1
Display	Indicator, Digital
Ignition Adapter, TK item 30	Adapter, Connector Primary Ckt: TK 30
Ignition Adapter Cable W3	Cable Assembly, Spec W3
Power Cable W5	Cable Assembly, Power W5
Pulse Tachometer, TK item 34	Tachometer, Pulse: TK 34
Red Clip	Clip, Electrical
Red Striped Transducer, TK item 22	Transducer, Pressure, Minus 30 inches HG to plus 25 PSIG Red: TK 22
Snubber, TK item 21	Dampener, Fluid Pres: TK 21
Test Probe Cable W2	Cable Assembly, W2
Test Probe Kit	Test Probe Kit
Transducer Cable W4	Cable Assembly, W4
Transducer Kit	Group 6715: Transducer Kit (TK) Components
Transit Case	Case, Test Set
VTM (Vehicle Test Meter)	Test Meter Assembly, STE/ICE-R

END OF PARAGRAPH

1-1-7. REPORTING OF EQUIPMENT IMPROVEMENT RECOMENDATIONS 1-1-7

If your STE/ICE-R needs improvement, let us know. Send us an EIR. You the user, are the only one who can tell us what you don't like about your equipment.Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at:

Commander
US Army Tank-Automotive Command
Attn: AMSTA-QRT
Warren, Michigan 48397-5000

We'll send you a reply.

1-1-8. ABBREVIATIONS 1-1-8

ABBREVIATION	DEFINITION
BTC	Battery Test Card
BTDC	Before Top Dead Center
Cl	Compression Ignition (Diesel)
DA	Department of the Army
DCA	Diagnostic Connector Assembly
DCA ID	DCA Identification Number
DIST	Distributor
DS	Direct Support
ECU	Electronic Control Unit
EIR	Equipment Improvement Recommendation
F	Fahrenheit

GO TO NEXT PAGE

1-1-8. ABBREVIATIONS (cont) 1-1-8

ABBREVIATION	DEFINITION
Hg	Mercury
Hz	Hertz (frequency)
ID	Identification Number
MAC	Maintenance Allocation Chart
PCV	Positive Crankcase Ventilation
PMCS	Preventive Maintenance Checks and Services
SI	Spark Ignition (Gasoline)
SMR	Source, Maintenance, and Recoverability Codes
STE/ICE-R	Simplified Test Equipment for Internal Combustion Engines - Reprogrammable
TAMMS	The Army Maintenance Management System
TK	Transducer Kit
TK ID	Transducer Identification Number
TMDE	Test, Measurement, and Diagnostic Equipment
U/M	Unit of Measure
VID	Vehicle Identification Number
VTC	Vehicle Test Cards
VTM	Vehicle Test Meter
#	number

END OF SECTION

Section II. EQUIPMENT DESCRIPTION AND DATA

Section II describes the STE/ICE-R equipment and has the following Paragraphs:

1-2-1. EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES 1-2-1

A. CHARACTERISTICS

STE/ICE-R is a versatile diagnostic tool for testing and taking measurements on vehicle engines as well as many other types of electrical and mechanical equipment. Housed in a protective transit case, it is easily transported-to a test site complete with all accessories.

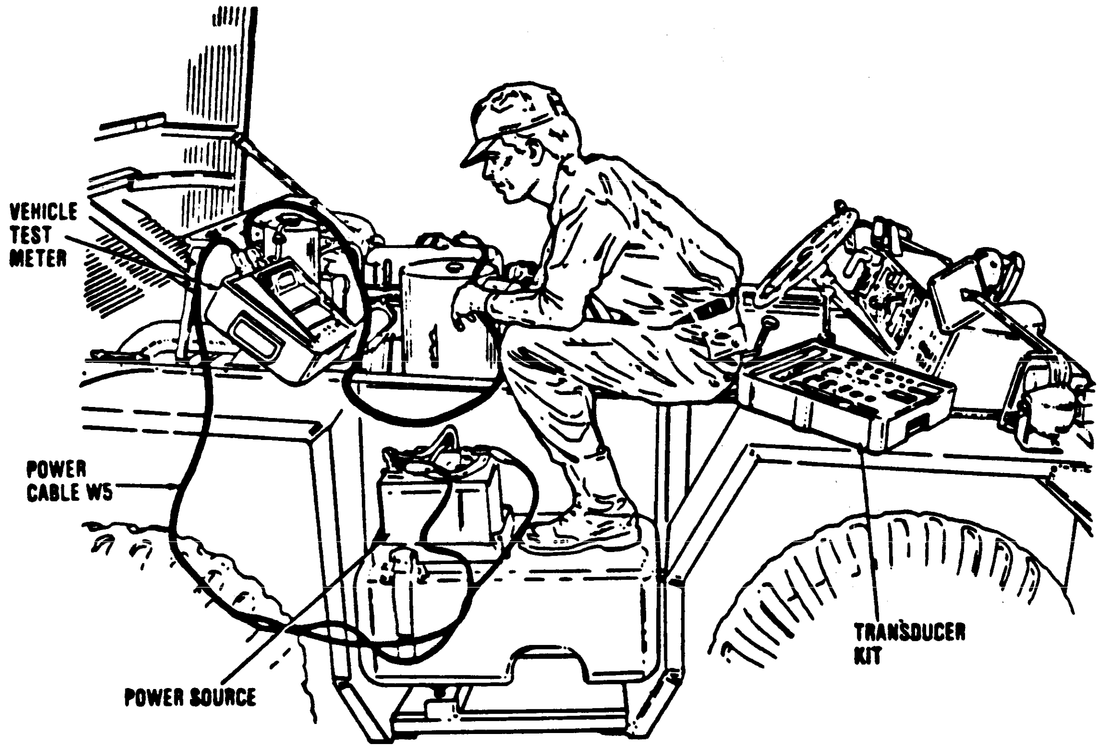
GO TO NEXT PAGE

1-2-1. EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES (cont) 1-2-1

B. CAPABILITIES

STE/ICE-R has three major measurement capabilities:

- General Measurements
- Special Tests
- Diagnostic Connector Assembly (DCA) Tests



Typical General Measurements and Special Tests Hookup

1. General Measurements. STE/ICE-R can be used to make standard voltage, current, resistance, pressure, and speed measurements without the need for specific vehicle or equipment information. In making general measurements, the vehicle test meter (VTM) receives power through power cable W5 or DCA cable W1. Test data may be received through various test probe cables and transducers.

2. Special Tests. STE/ICE-R can be used to test specific vehicles in the Army fleet. when a recognized vehicle identification (VID) number is entered in the VTM, STE/ICE-R will automatically use vehicle information stored in its memory together with test data received to give a result. In performing special tests, the VTM receives power from a battery through power cable W5 or DCA cable W1. Test data may be received through various test probe cables and transducers. In-addition, some special tests can be used without a vehicle identification number to make measurements on any vehicle/equipment.

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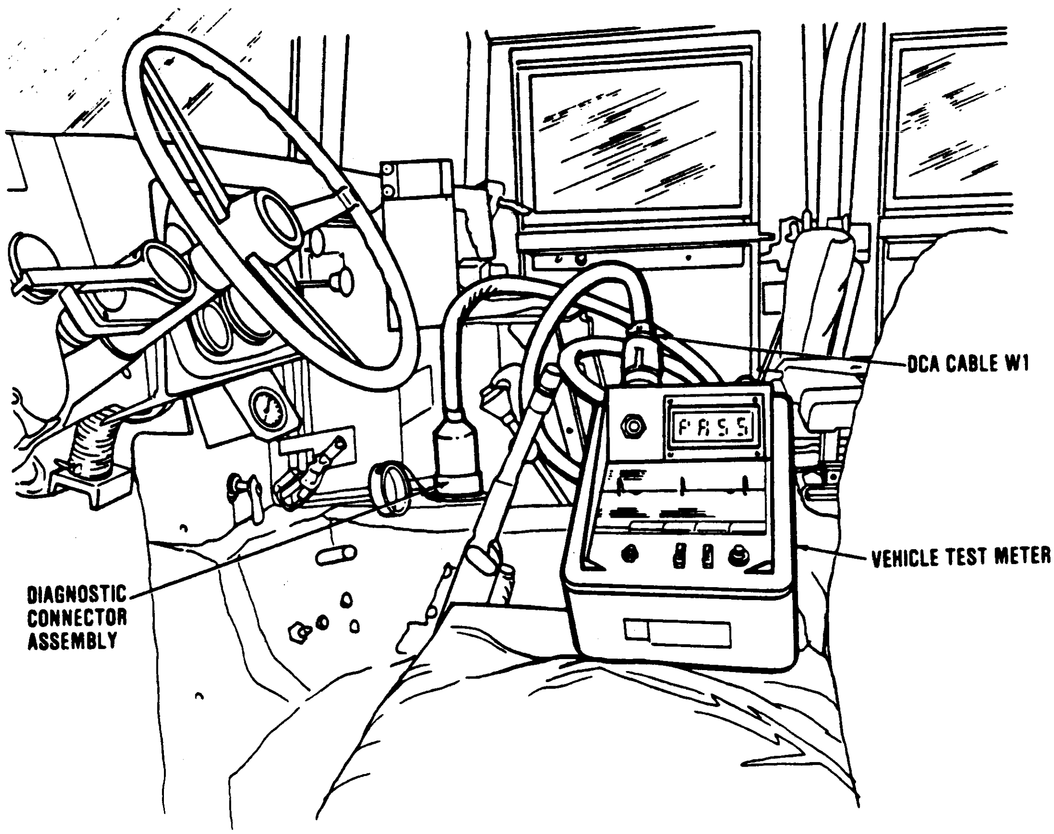
1-2-1. EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES (cont)



DCA Test Hookup

3. DCA Tests. If the vehicle or equipment to be tested has a permanently mounted diagnostic connector assembly (DCA) the VTM can receive both its power and test data through DCA cable W1. Wires from the DCA connect to test points and to the vehicle/equipment or power source. Additional transducers can be used at the same time for test points not connected to the DCA.

C. FEATURES

- Provides summary measurements of equipment condition
- Performs a broad range of tests, quickly and accurately
- Simple to set up, operate and interpret
- Portable
- . Built-in protection against common Operator errors
- Operates on 12 or 24-vOlt power supply

END OF PARAGRAPH

1-2-2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS 1-2-2

The STE/ICE-R set consists of:

A. Vehicle Test Meter (VTM)

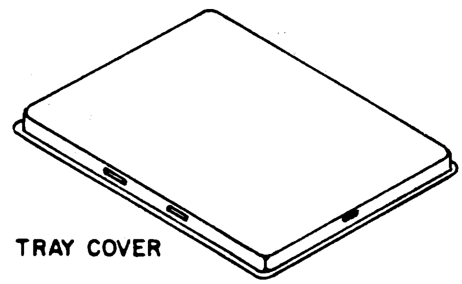
B. Transducer Kit (TK)

C. Cable Assemblies

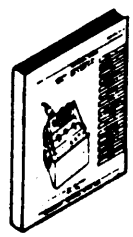
D. Transit Case

E. Test Probe Kit

F. Technical Manual



TRAY COVER



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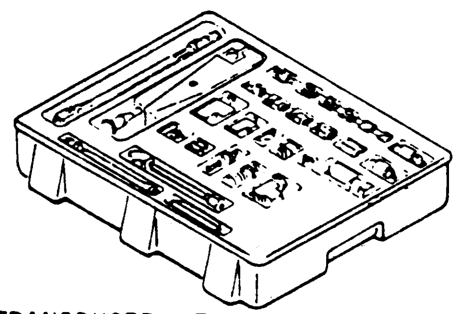
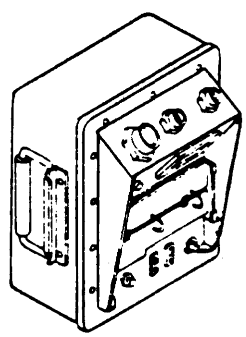
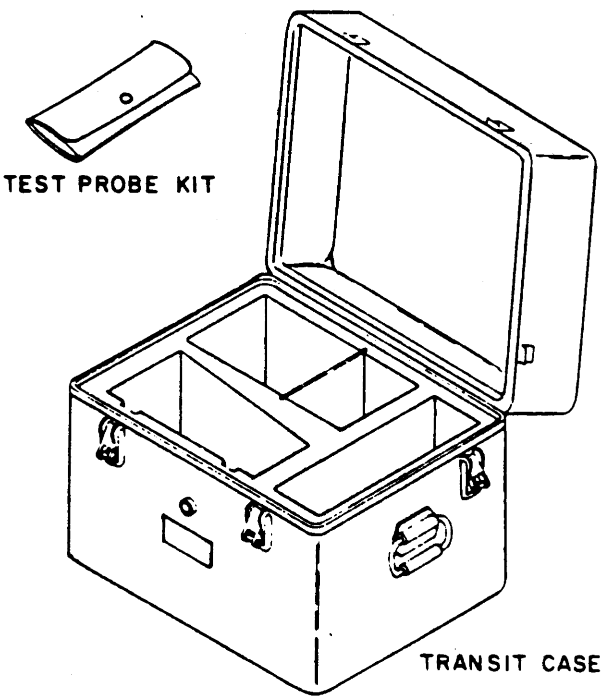


TRANSDUCER KIT

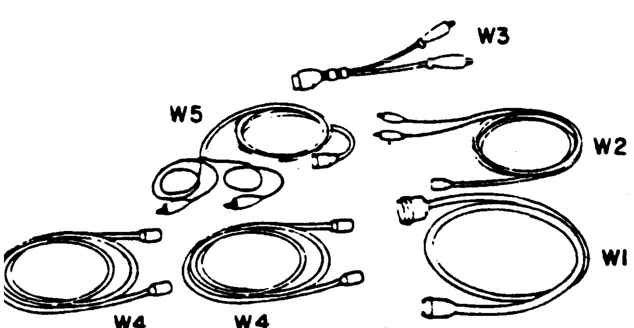


VEHICLE TEST METER

TEST PROBE KIT



TRANSIT CASE



CABLE ASSEMBLIES

GO TO NEXT PAGE

1-2-2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont)

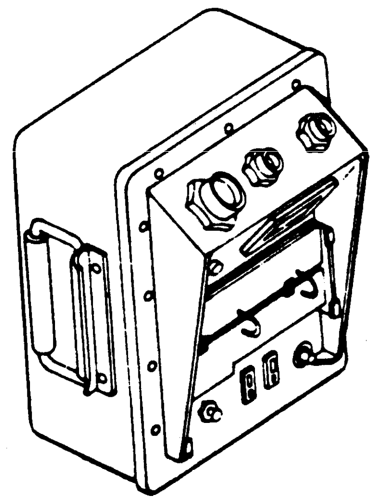
A. VEHICLE TEST METER

1. The Vehicle Test Meter (VTM) is a tool for testing electrical and mechanical components. Readings are either pass/fail or digital displays (psi, rpm, volts, etc.).

2. The VTM interfaces with the vehicle or equipment being tested by either a transducer from the transducer kit (TK) or by a Diagnostic Connector Assembly (DCA).

3. Power for the VTM is drawn from the vehicle/equipment batteries or from an alternate power source.

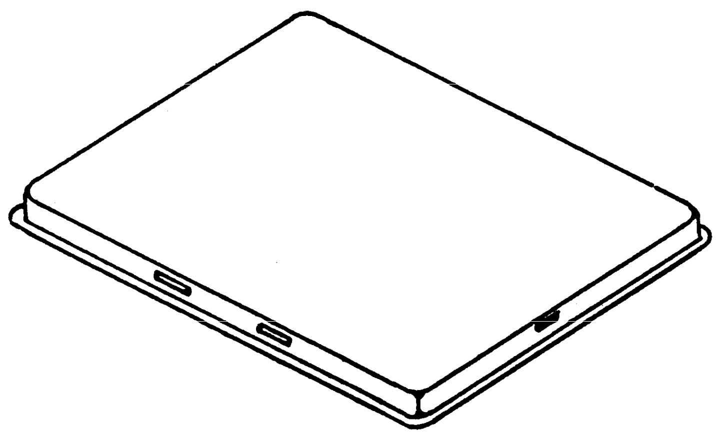
4. Refer to paragraph 1-2-5 for a description of the flip cards mounted on the VTM.

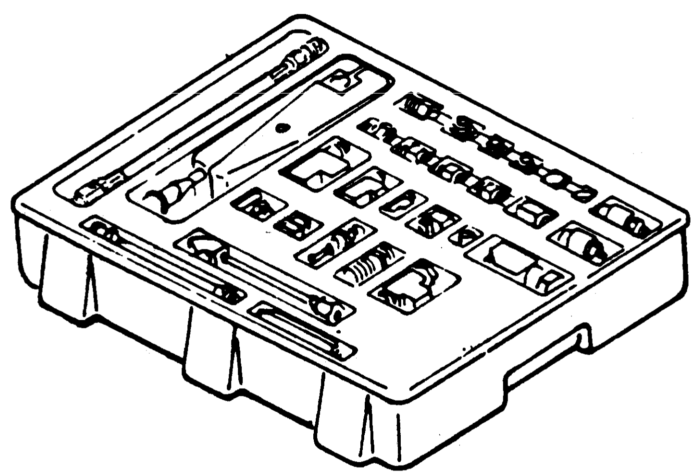


B. TRANSDUCER KIT

1. The transducer kit is a covered tray inside the transit case that contains transducers, fittings and connectors which are used during testing.

2. Refer to Paragraph 1-2-3 for location and description of transducer tray components.





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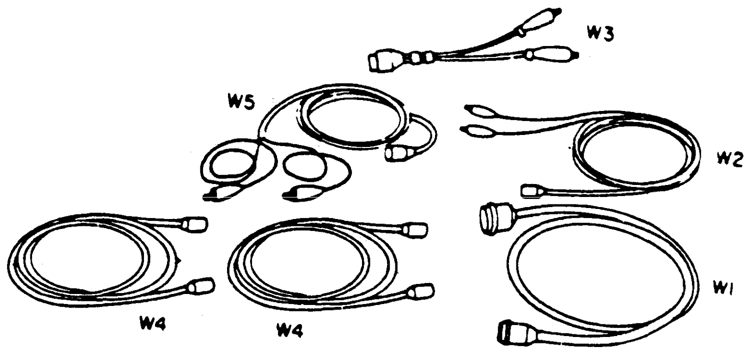
1-2-2. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (cont) 1-2-2

C. CABLE ASSEMBLIES

1. Cable assemblies are included for power supply and testing.

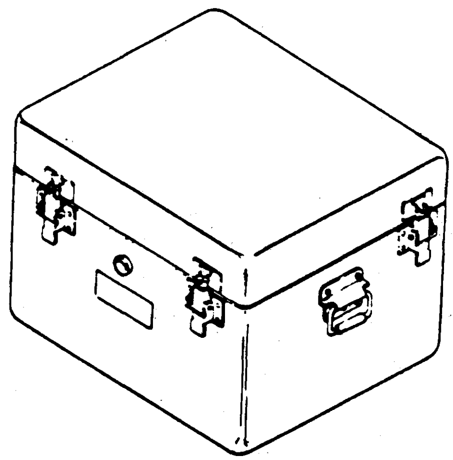
2. Refer to paragraph 1-2-6 for a description of the cable assemblies.



D. TRANSIT CASE

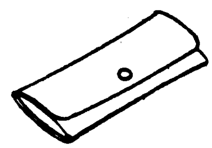
1. The STE/ICE-R is housed in a portable protective transit case which contains all of the necessary accessories.

2. A pressure relief valve located on the front of the case allows the operator to release any pressure or vacuum resulting from changes in climate during transit.



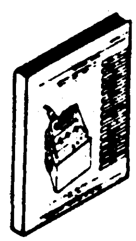
E. TEST PROBE KIT

The test probe kit allows the user to make different types of measurements (e.g. cable continuity, battery tests, etc.) with greater ease.



F. TECHNICAL MANUAL

The technical manual describes the operation and organizational maintenance of the STE/ICE-R system. It has detailed operating procedures for general and special measurements.

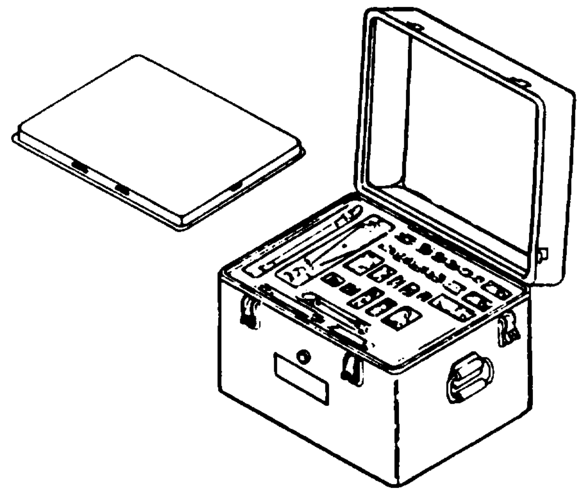


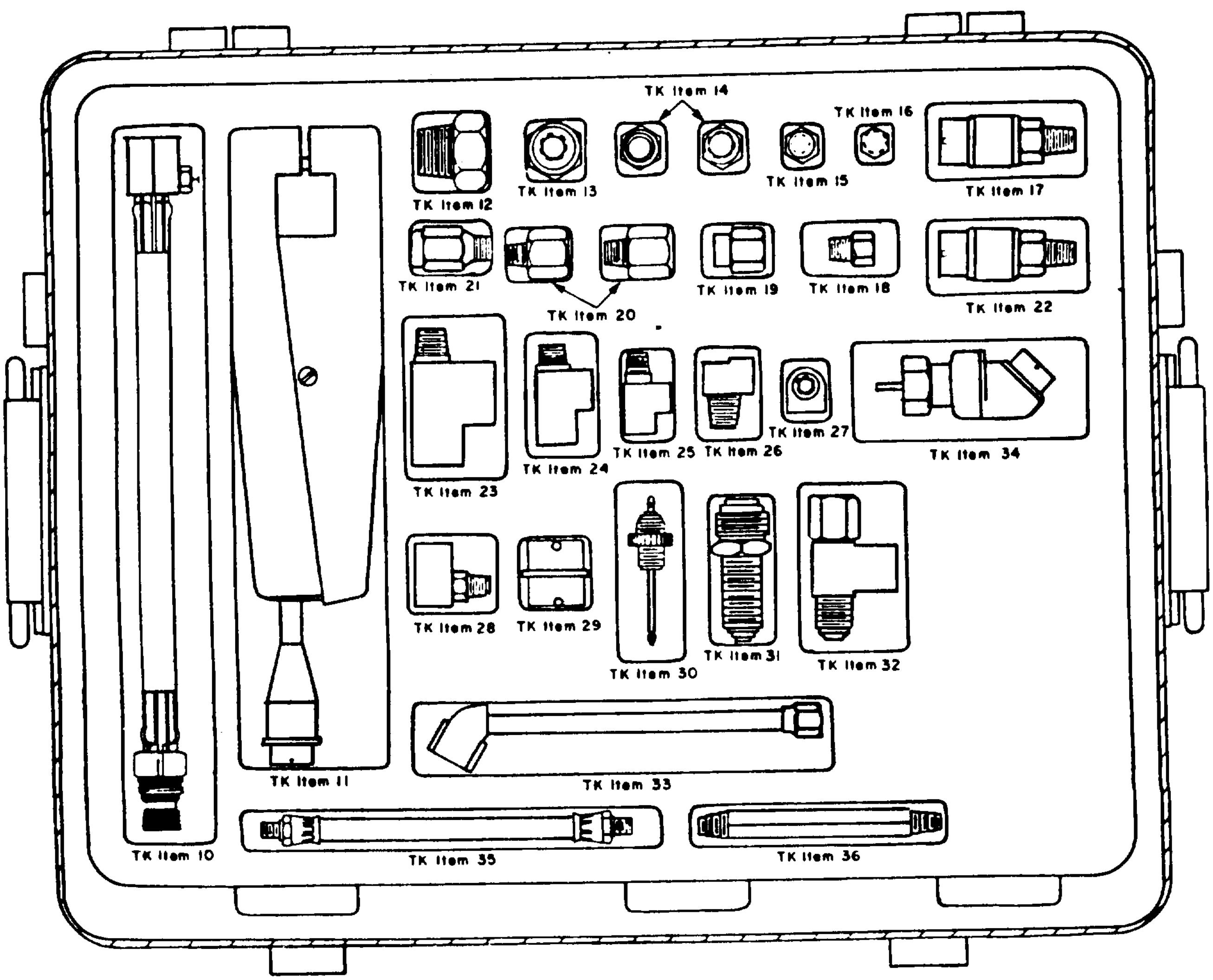
END OF PARAGRAPH

1-2-3. DESCRIPTION OF FITTINGS AND TRANSDUCERS 1-2-3

The transducer kit (TK) contains transducers, adapters and fittings. The TK is stored in a molded tray with a cover in the top of the transit case. The TK item numbers shown in the illustration are for reference only and do not appear on the tray.

Many of the fittings do not have part number markings on them, and are referred to by TK Item Number and name. In table 1-2, each fitting is identified by TK item number and part number. A brief description of each item's use is included.



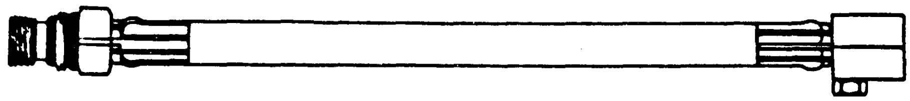


GO TO NEXT PAGE

1-2-3. DESCRIPTION OF FITTINGS AND TRANSDUCERS (cont) 1-2-3

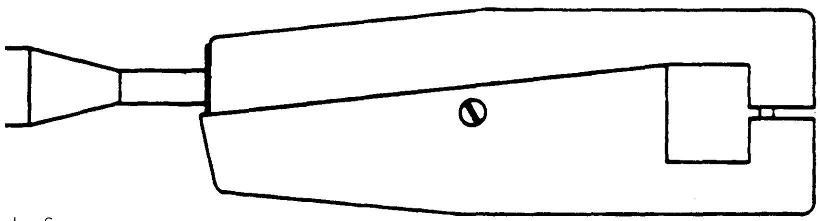
Table 1-2 Transducers and Fittings

TK Item 10 - Hose and Fitting Assembly
PN 11669227



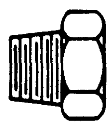
Used to measure cylinder compression pressure.

TK ITEM 11 Current Probe
PN 12258878



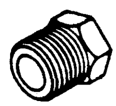
Used to measure current and frequency.

TK Item 12 - 3/4 Reducer
3/4 MPT to 1/4 FPT
PN 12258853-1



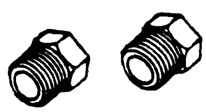
Used to reduce 3/4 inch threaded holes down to the 1/4 inch female pipe thread required for pressure transducers.

TK Item 13 - 1/2 Reducer
1/2 MPT to 1/4 FPT
PN 12258853-3



Used to reduce 1/2 inch threaded holes down to the 1/4 inch female pipe thread required for pressure transducers.

TK Item 14 - 3/8 Reducer (two)
3/8 MPT to 1/4 FPT
PN 12258853-2



Used to reduce 3/8 inch threaded holes down to the 1/4 inch female pipe thread required for pressure transducers.

GO TO NEXT PAGE

1-2-3. DESCRIPTION OF FITTINGS AND TRANSDUCERS (cont)

Table 1-2 Transducers and Fittings (cont)

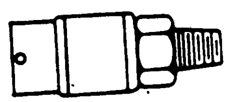
TK Item 15 - 1/4 Pipe Plug
1/4 MPT Hex Head
PN 444620

Used to plug female pipe threads of 1/4 inch pipe street tee to allow its use as an elbow or a straight fitting.

TK Item 16 - 1/8 Pipe Plug
1/8 MPT Hex Head
PN 5327970

Used to plug female pipe threads of 1/8 inch pipe street tee to allow its use as an elbow or a straight fitting.

TK Item17- Pressure Transducer
Blue Stripe
o-1000 PSIG
PN 12258876

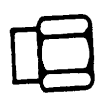


Used to measure cylinder compression, oil, fuel and other Pressures In excess of 25 psi.

TK Item 18 - 1/4 Male Connector
5/16 Tube to 1/4 MPT
PN 187343

Used to connect to 5/16 inverted flare fitting as found on gas lines.

TK Item19 - Pipe Reducer Coupling
1/4 FPT to 1/8 FpT
PN 444104



Adapts 1/8 male pipe thread to pressure transducer. Use with hose assemblys TK item 35, or with long hex pipe nipple, TK Item 36.

TK Item 20 - Adapter (two)
1/8 MPT to 1/4 FPT
PN 444012

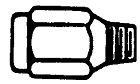
Used to adapt 1/8 female threaded hole to pressure transducer”

GO TO NEXT PAGE

1-2-3. DESCRIPTION OF FITTINGS AND TRANSDUCERS (cont) 1-2-3

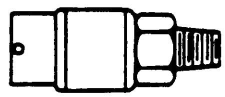
Table 1-2 Transducers and Fittings (cont)

TK Item 21 - Snubber
PN 12258881



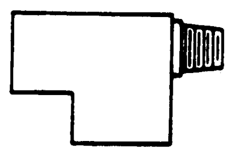
1/4 male pipe thread fitting with porous metal insert. Used with 25 psi transducer on intake manifold of S1 engines. Can be used on other measurements to reduce pulsations.

TK Item 22 - Pressure Transducer
Red Stripe
-15 to +25 PSIG
PN 12258877



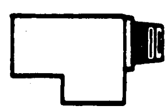
Used to measure manifold vacuum, air cleaner pressure drops, manifold pressure after turbochargers, air box pressures, fuel pressures on SI engines and other pressures. When measuring manifold vacuum on S1 engines, use snubber, TK item 21, to protect transducer from backfiring pressures.

TK Item 23 - 1/2 Street Tee
Pipe Thread
PN 444152



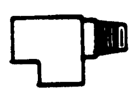
Used to tee a pressure transducer into a line where measurements are to be made under flow conditions. Use with adapters to provide thread compatibility with existing fittings.

TK Item 24 - 1/4 Street Tee
Pipe Thread
PN 8366166



Used to tee a pressure transducer into a line where measurements are to be made under flow conditions. Use with adapters to provide thread compatibility with existing fittings.

TK Item 25 - 1/8 Street Tee
Pipe Thread
PN 444550



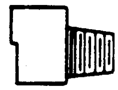
Used to tee a pressure transducer into a line where measurements are to be made under flow conditions. Use with adapters to provide thread compatibility with existing fittings.

GO TO NEXT PAGE

1-2-3. DESCRIPTION OF FITTINGS AND TRANSDUCERS (cont)

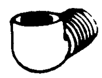
Table 1-2 Transducers and Fittings (cont)

TK Item 26 - 1/4 Street Elbow
pipe Thread
PN 12258879-2



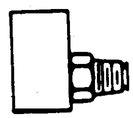
Used to adapt to pressure transducer in tight spaces or with other fittings.

TK Item 27 - 1/8 Street Elbow
pipe Thread
PN 12258879-1



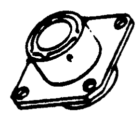
Used to adapt to pressure transducer in tight spaces or with other fittings

TK Item 28 - Inverted Flare Tee
PN 12258762



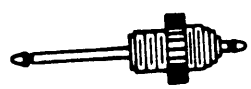
Used with 25 psi pressure transducer for M880 fuel pressure measurement.

TK Item 29 - Adapter Connector
(For W4 Cables)
PN MS3119E14-19pS



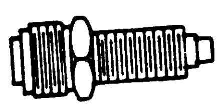
Used to connect two transducer cables together to extend reach of transducer.

TK Item 30 - Ignition Adapter
(Primary Circuit)
PN 7540877



Used with ignition adapter cable for M15A2 ignition System measurements*

TK Item 31 - Tachometer Drive Adapter
PN MS53099-2



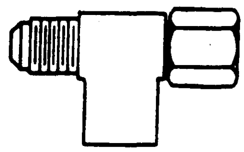
Used to adapt flexible drive shaft to pulse tachometer, TK item 34, for engine speed measurements. Attaches to instrument panel end of shaft.

GO TO NEXT PAGE

1-2-3. DESCRIPTION OF FITTINGS AND TRANSDUCERS (cont) 1-2-3

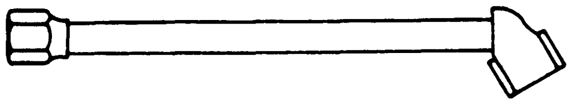
Table 1-2 Transducers and Fittings (cont)

TK Item 32 - Fuel Link Adapter
Swivel Nut Run Tee
PN 12258880



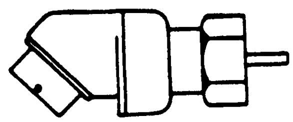
Used with 1,000 psi pressure transducer, TK item 17, to measure fuel pressure on M48A3/M60Al. Inserts in output side of fuel pump.

TK Item 33 - Air Chuck
PN 8840543



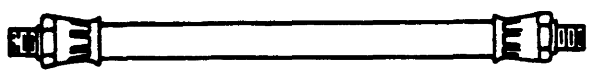
Used with 1,000 psi pressure transducer, TK item 17, to measure tire pressure.

TK Item 34 - Pulse Tachometer
PN 12258875



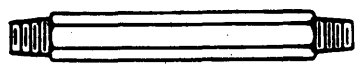
Used to sense speed on CI engines. When end of shaft is not accessible, use with tachometer drive adapter, TK item 31.

TK Item 35 - Flexible Hose Assembly
1/8 MPT
PN 11669236



Used for pressure measurements on M48A3/M60 transmission and for air box measurements on Detroit Diesels. Use with pipe reducer, TK item 19.

TK Item 36 - Long Hex Pipe Nipple
1/8 MPT
PN 12258852



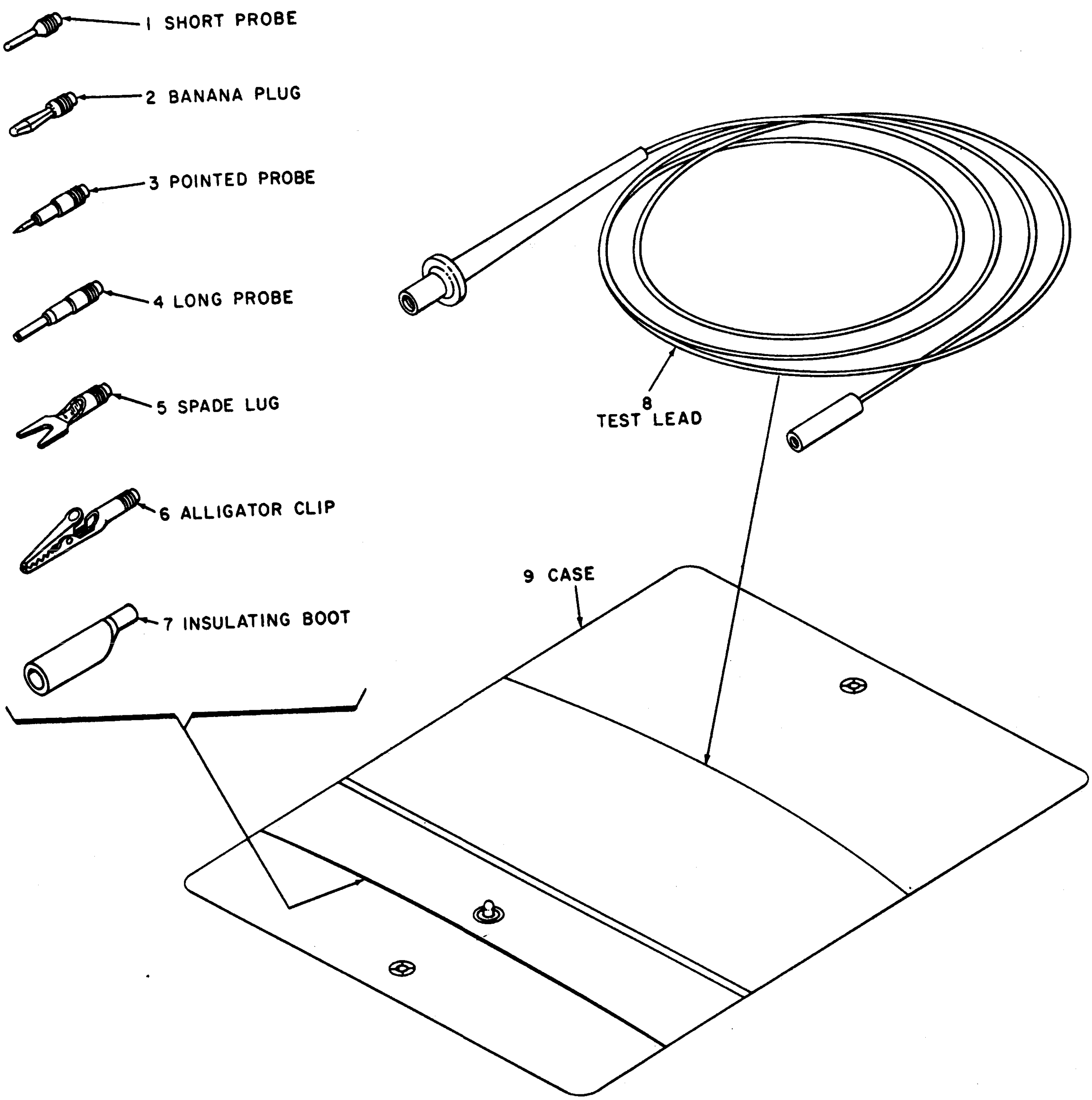
Used to adapt 1/8 pipe thread holes to pressure transducer.

END OF PARAGRAPH

1-2-4. DESCRIPTION OF TEST PROBE KIT

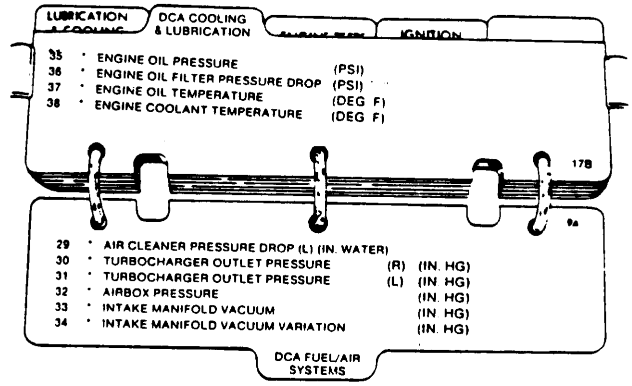
1-2-4

The test probe kit allows you to use a number of tips on the ends of your test leads when making measurements. The kit contains 6 pairs of clips 1 Pair of test leads and 1 pair of insulating boots. One of each type is shown in the illustration. The item numbers are for reference only. The clips and test leads attach to the test probe cable W2 through screw on connections. The procedure in paragraph 1-2-7 tells you how to change the tips on these test leads.



END OF PARAGRAPH

1-2-5. DESCRIPTION OF FLIP CARDS 1-2-5

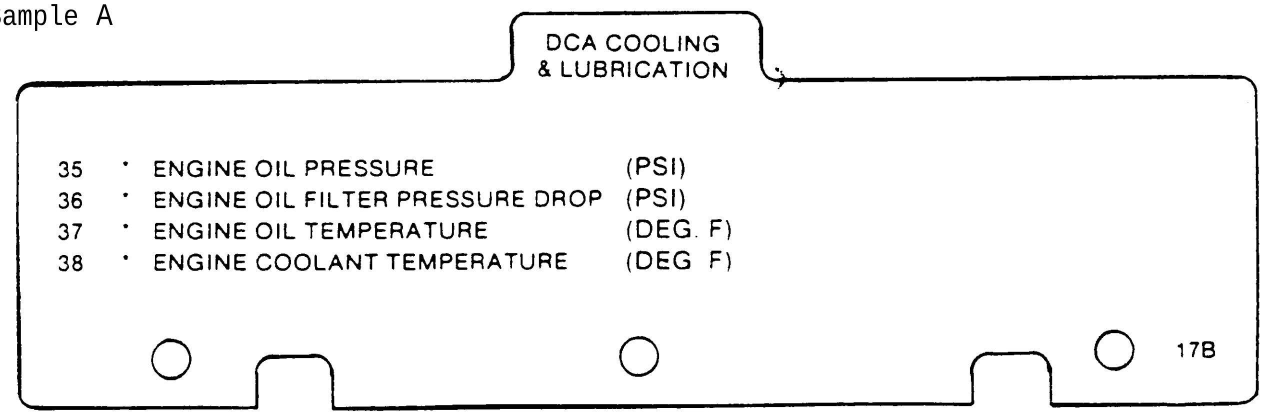


The flip cards are attached to the front of the VTM to provide a quick but limited re-

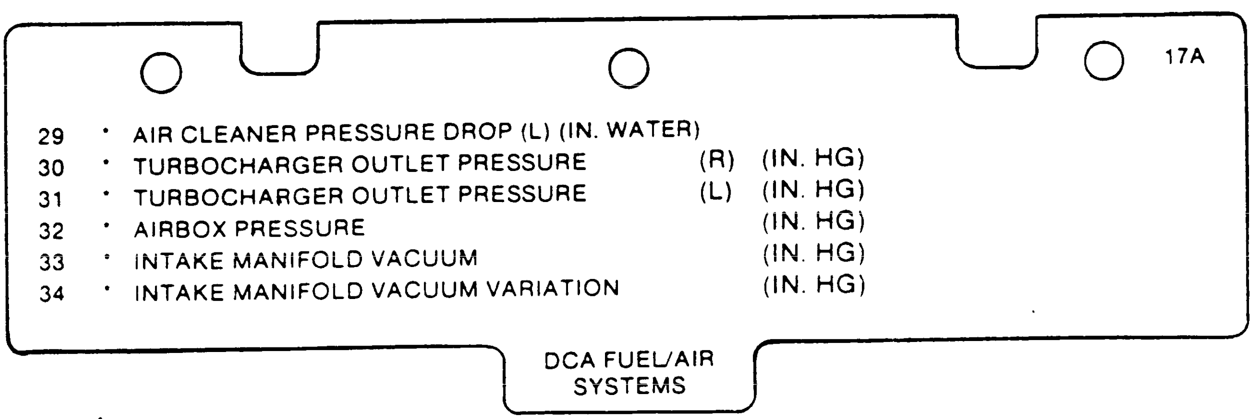
list test numbers; messages and some” procedures.

An example of the information contained on an operating instruction flip card is given in Sample A. Sample B shows test requirements for specific procedures.

Sample A



Sample B



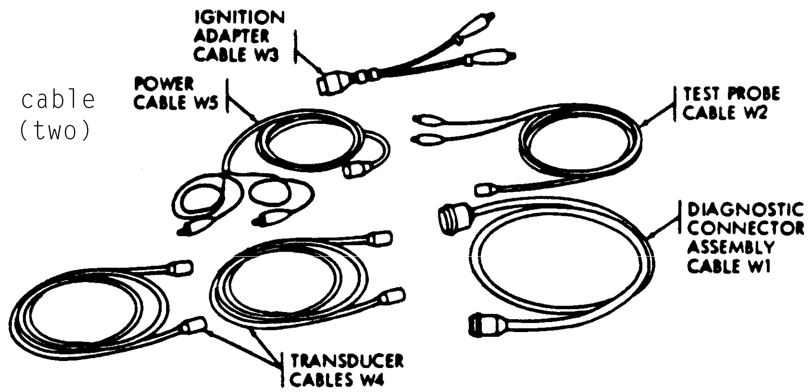
END OF PARAGRAPH

1-2-6. DESCRIPTION OF CABLES 1-2-6

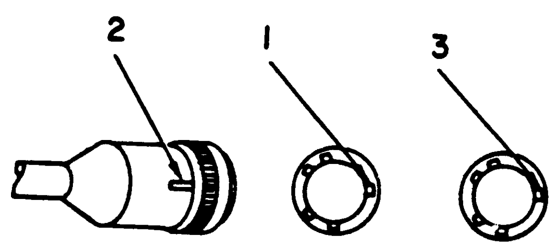
In procedures in this manual, the cable assemblies are referred to by a number for quick identification. Each cable also has a name which describes its use. A reference to Wl, for example, would indicate the DCA cable. Connectors on the cable are identified by a number preceeded by either a P or an E, such as P1 or E2.

The cable assemblies included in the STE/ICE-R are:

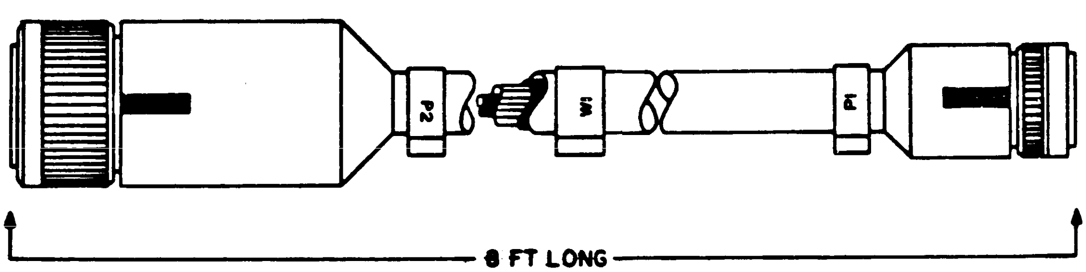
- WI - DCA cable
- W2 - test probe cable
- W3 - ignition adapter cable
- W4 - transducer cable (two)
- W5 - power cable



When cables are connected, the large key (1) located by the white stripe (2) on the cable connector mates with, large keyway (3) of connector on VTM or transducer.



A. DIAGNOSTIC CONNECTOR ASSEMBLY CABLE W1

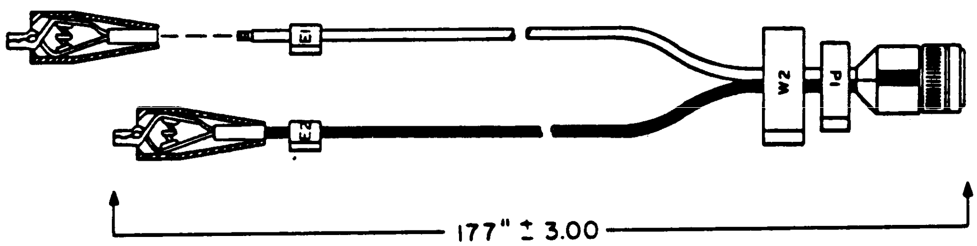


The DCA cable assembly W1 is used to power the VTM, and provides access to test points and sensors connected to the vehicle/equipment mounted DCA. When performing a DCA measurement, both the power and the measurement information are received through W1. For a measurement that is not DCA peculiar on equipment with a DCA, the VTM can receive power through W1, and use other cables to make measurements through the remaining connectors on the VTM.

GO TO NEXT PAGE

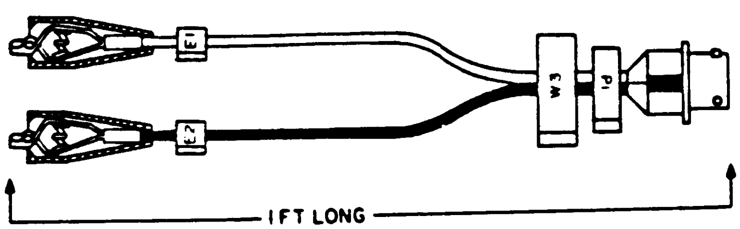
1-2-6. DESCRIPTION OF CABLES (cont) 1-2-6

B. TEST PROBE CABLE W2



The test probe cable W2 is used for both general and Special measurements. It is used for measuring voltages, frequency, resistance and continuity. It is also used the first peak series and compression unbalance tests. W2 IS divided into two color coded leads, red for E1 and black for E2. Test clips E1 and E2 of W2 attach to points on the equipment being tested. The test clips E1 and E2 are attached to the cable by screw on connections. They can be removed and replaced with other clips from the test probe kit (see paragraph 1-2-4).

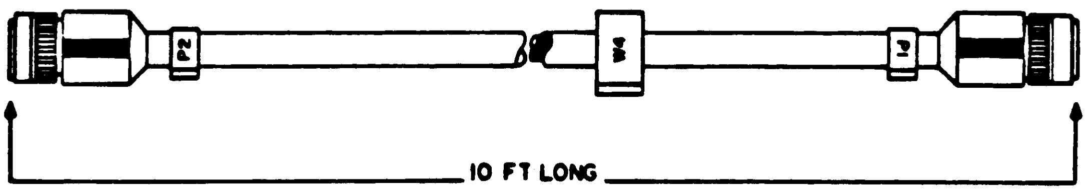
C. IGNITION ADAPTER CABLE W3



The ignition adapter cable W3 is used in measuring dwell angle; points voltage, engine rpm and power tests. W3 is divided into two color coded cads, red for E1 and black for E2.

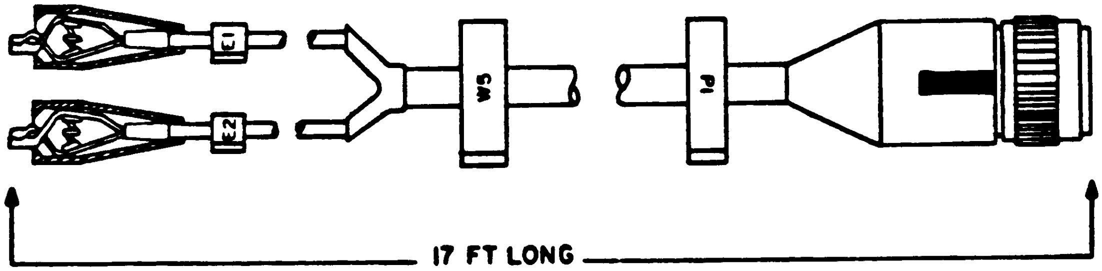
GO TO NEXT PAGE

D. TRANSDUCER CABLES W4



The transducer cables W4 are used as extensions to connect the VTM to a pressure transducer, pulse tachometer, current probe or ignition adapter cable. If necessary, two transducer cables can be joined using connector adapter, TK item 29.

E. POWER CABLE W5



The power cable W5 is used to power the VTM when cable W1 is not being used. Cable W5 is divided into two leads with color coded clips, red for E1 and black for E2. Battery clips E1 and E2 are attached to a vehicle/equipment battery or to a 9 to 32 volt 4A regulated power supply. Do not connect the VTM to a battery charger unless it is also connected to a battery. Damage to the VTM may result.

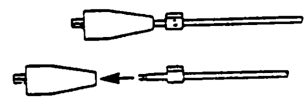
END OF PARAGRAPH

1-2-7. TEST PR0BE KIT USE

The following procedure tells you how to attach:

- the tips in your test probe kit to the test leads.
- the test leads to test probe cable W2.

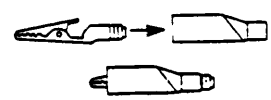
1. Remove (unscrew) alligator clips from both leads of test probe cable



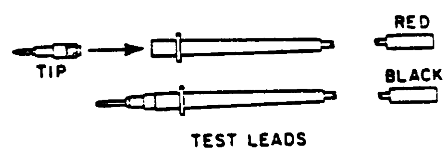
Select a pair of tips from the test probe kit.

- If you selected the alligator clip tip, go to step 3.
- If you selected any other tip, go to step 4.

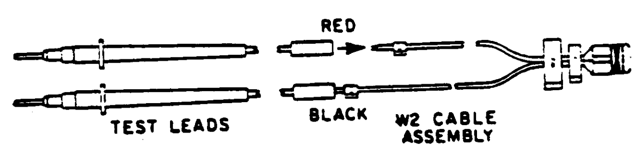
3. Slide the threaded end of each alligator clip tip into large end of each insulating boot until the threaded end comes through the small end of the boot.



4. Screw one of the tips into the longer end of the red test lead. Screw the other tip into the longer end of the black test lead.



5. Screw the shorter end of the red test lead onto the red lead of test probe cable W2. Screw the shorter end of the black test lead onto the black lead of the test probe cable.



6. Perform the desired measurements using test probe cable W2 with the new tips.

END OF PARAGRAPH

1-2-8. EQUIPMENT DATA 1-2-8

Table 1-3 System Characteristics

ITEM or FUNCTION	DESCRIPTION
Transit Case Dimensions	Height - 14.25 in. Length - 20.0 in. Width - 16.0 in.
Transit Case Weight	54 lbs.
VTM Dimensions	Height - 7.4 in. Width - 9.2 in. Length - 11.86 in.
Input Voltage Range (VTM)	9 to 32 Vdc

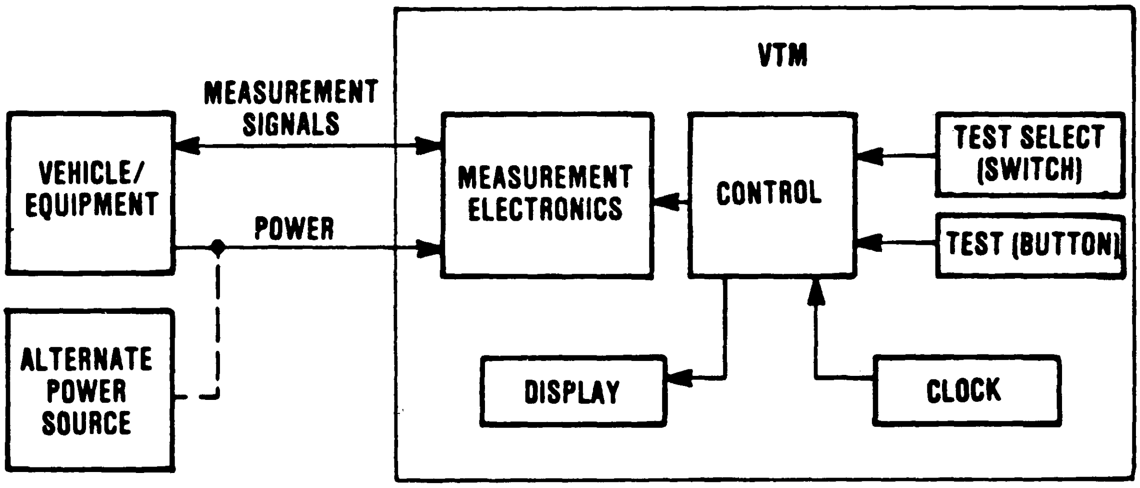
END OF SECTION

Section III. PRINCIPLES OF OPERATION

Section III describes the principles of operation for the STE/ICE-R VTM, cables and accessories. Block diagrams are used to show power, control and display functions.

This section contains the following paragraphs:

1-3-1 TECHNICAL PRINCIPLES OF OPERATION 1-3-1

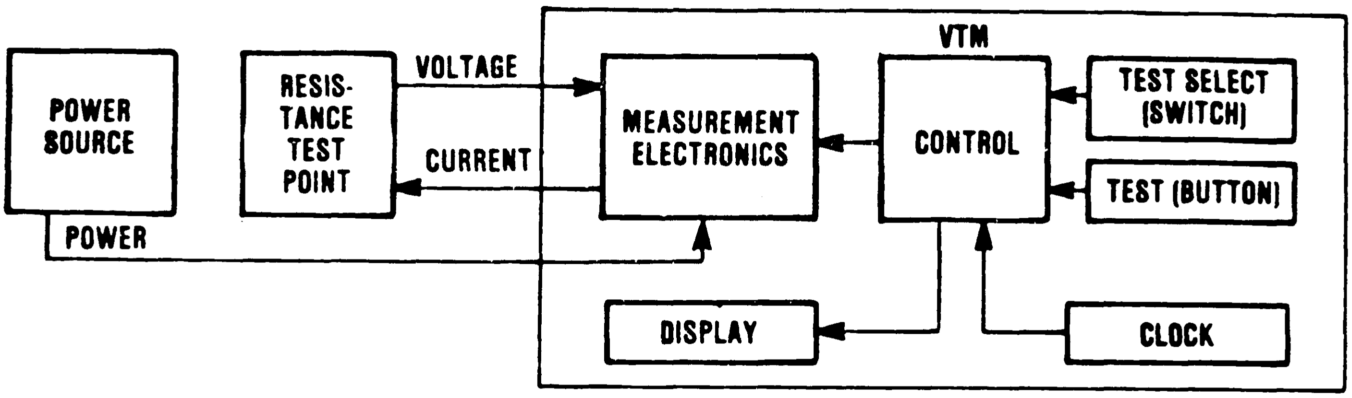


- Operating power is supplied to the VTM from the vehicle/equipment battery or from an alternate power source.
- Measurement information is sent to the VTM and is compared to values stored in its memory.
- Setting the TEST SELECT switches indicates to the VTM what measurement procedure to do when TEST button is pressed and released.
- Pressing and releasing the TEST button tells the VTM to perform the selected measurement procedure.
- The VTM display shows the results in the unit being measured (volts, RPM, PSI etc.) or as a PASS/FAIL message.

END OF PARAGRAPH

1-3-2. FUNCTIONAL DESCRIPTION 1-3-2

A. RESISTANCE MEASUREMENT

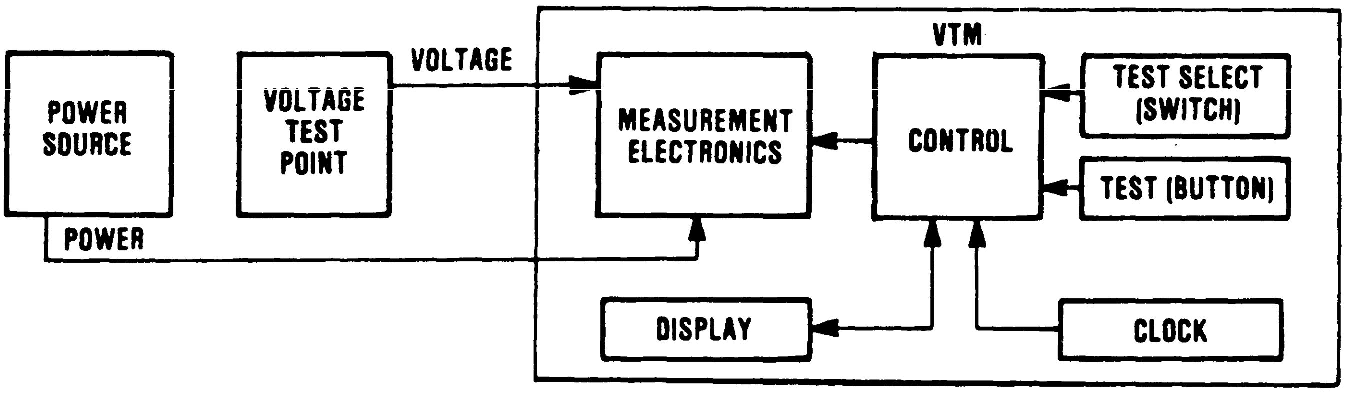


- Setting the TEST SELECT switches to the required test number tells the VTM to make a resistance measurement when the TEST button is pressed and released.
- The VTM supplies constant electrical current to the vehicle/equipment under test.
- Voltage across equipment under test is measured and resistance is calculated by the VTM.
- The VTM displays the resistance in ohms or Kohms.

GO TO NEXT PAGE

1-3-2. FUNCTIONAL DESCRIPTION (cont) 1-3-2

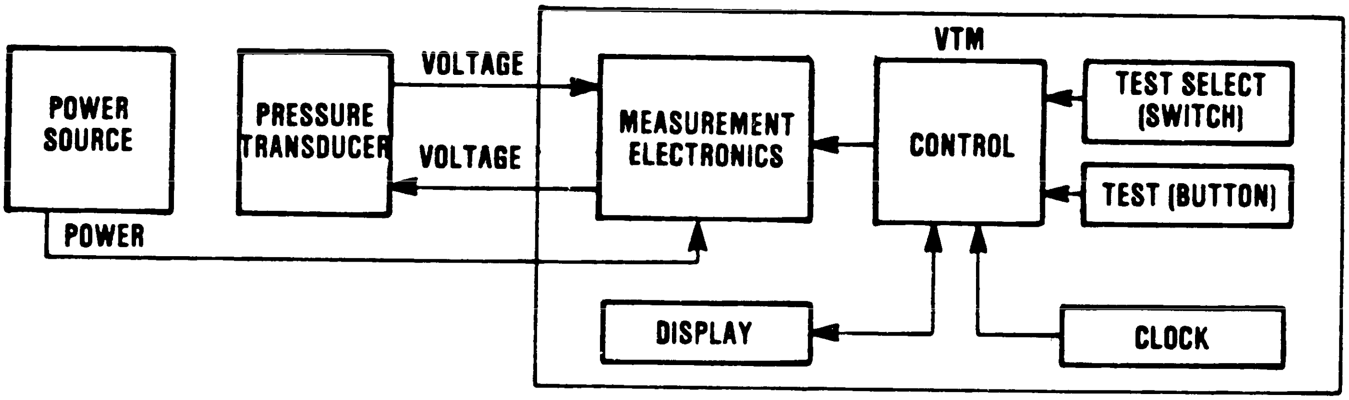
B. AC VOLTAGE MEASUREMENT



- Setting the TEST SELECT switches to the required test number tells the VTM to make the AC voltage measurement when the TEST button is pressed and released.
- The AC voltage value across vehicle/equipment under test is sent to the VTM.
- The VTM displays the average value of the signal in volts.

GO TO NEXT PAGE

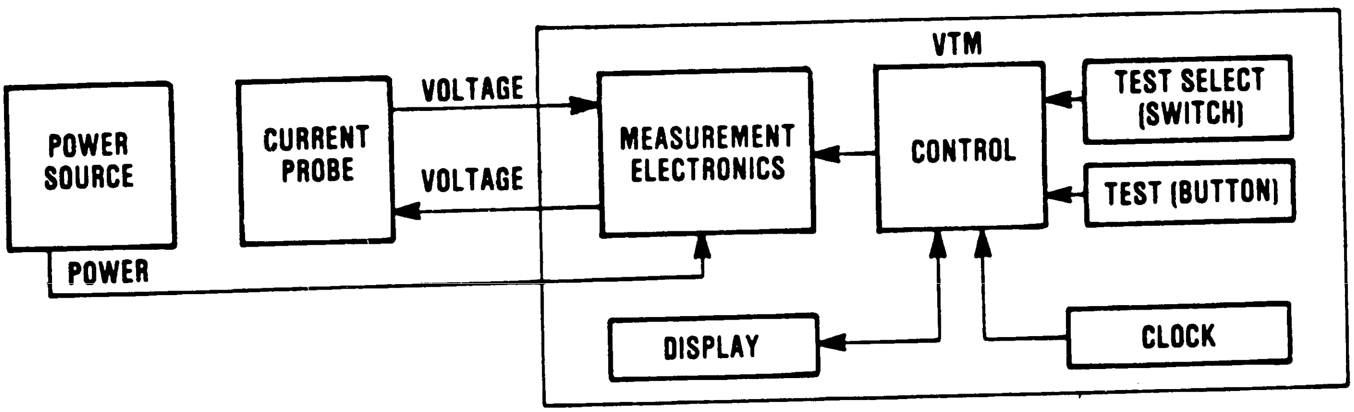
C. PRESSURE MEASUREMENT



- Setting the TEST SELECT switches to the required test number tells the VTM to make a pressure measurement when the TEST button is pressed and released.
- VTM supplies constant voltage to the pressure transducer.
- The pressure transducer returns a voltage in proportion to the pressure being measured.
- Voltage developed by the transducer is measured and converted to pressure by the VTM.
- The VTM displays the pressure in PSIG, inches of mercury or inches of water.

GO TO NEXT PAGE

D. CURRENT MEASUREMENT



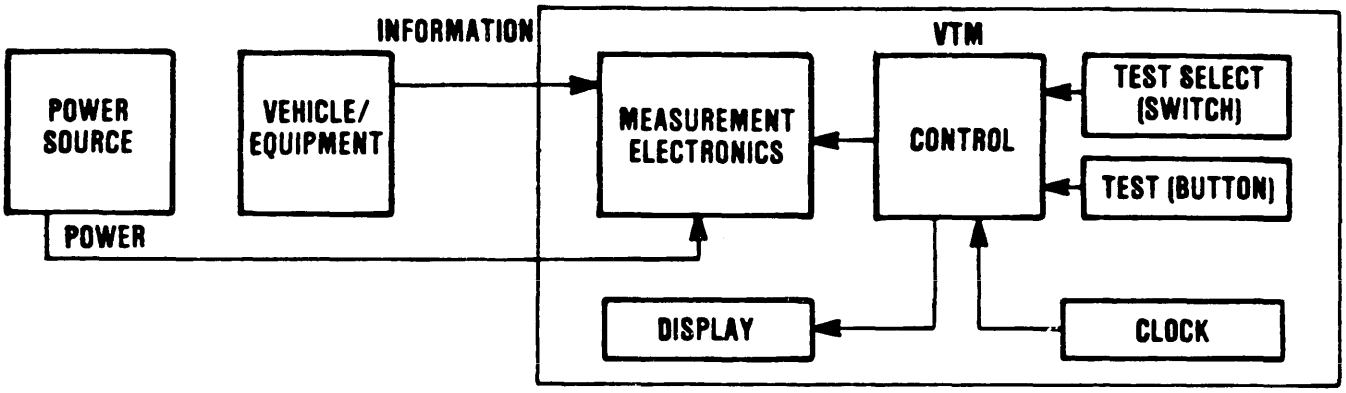
- Setting the TEST SELECT switches to the required test number tells the VTM to make a current measurement when the TEST button is Pressed and released.
- VTM supplies constant voltage to the current probe.
- The current probe returns a voltage in proportion to the current being measured.
- voltage developed by the current probe is measured and converted to current by the VTM.

The VTM displays the current in AMPS.

GO TO NEXT PAGE

1-3-2. FUNCTIONAL DESCRIPTION (cont) 1-3-2

E. RPM MEASUREMENT



Setting the TEST SELECT switches to the required test number tells the VTM to make an RPM measurement when the TEST button is pressed and released.

On CI engines, the VTM measures the time needed for an engine revolution.

On S1 engines, the VTM measures the time between cylinder firings.

The VTM uses an internal clock as a time reference to convert these measurements to RPM.

The VTM displays the engine speed in RPM.

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END OF CHAPTER

Chapter Two - OPERATION

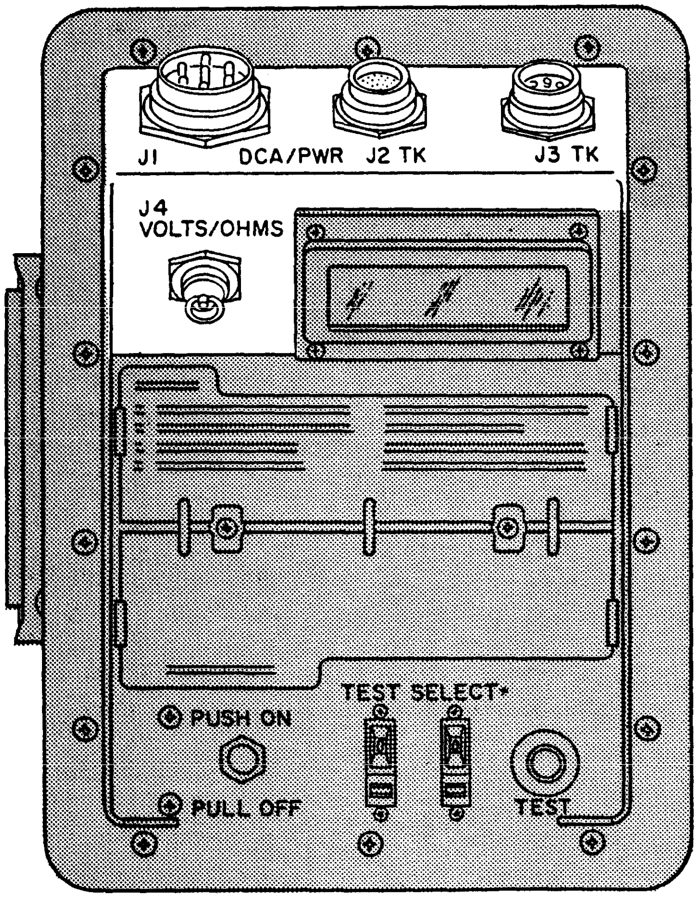
This chapter contains descriptions of VTM controls and indicators. A description of error and control messages is also included along with preventive maintenance checks and services. These are followed by operating procedures.

Section I. CONTROLS AND INDICATORS

Section I includes a description of the STE/ICE-R equipment controls and indicators and what they are used for. This section also includes information messages that are displayed by the vehicle test meter and has the following paragraphs:

2-1-1. OPERATOR'S CONTROLS AND INDICATORS 2-1-1

This paragraph describes STE/ICE controls and Indicators. All operator controls and indicators are located on the VTM. Each control and indicator is shown, and its function is briefly described.



A. DCA/PUR CONNECTOR J1

Used to connect VTM to either a vehicle diagnostic connector with the DCA cable W1 or to a DC power source with the power cable W5. The DC power source is usually the vehicle's batteries.

B. TRANSDUCER CABLE CONNECTORS J2 TK AND J3 TK

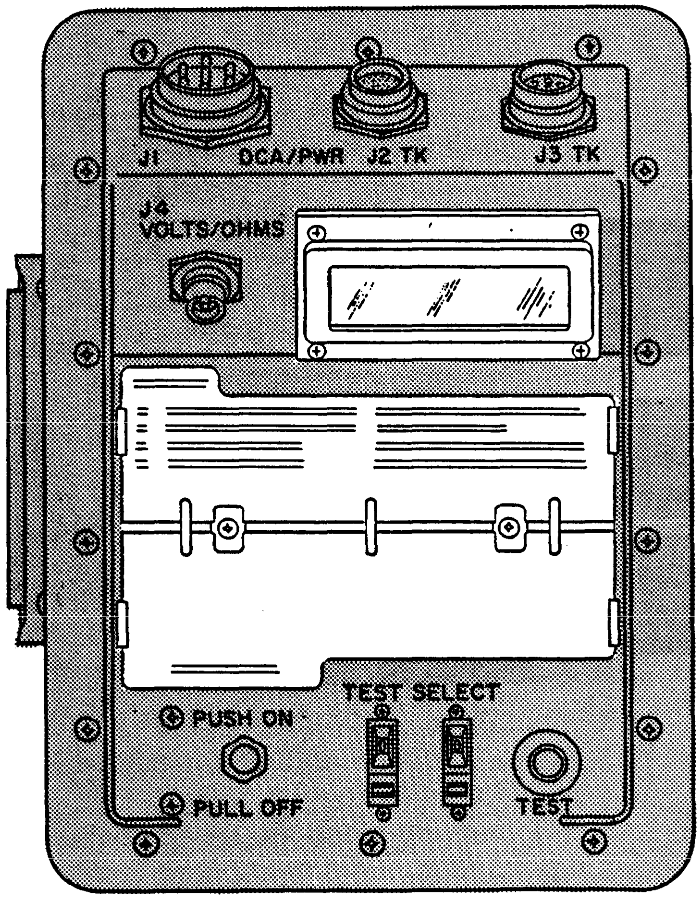
Used to connect transducer cables W4 to VTM when doing TK measurements. Power and signals are routed through these connectors. Both connectors may be used when a test requires two measurements to be made at the same time.

C. VOLTS/OHMS CONNECTOR J4

Used to connect test probe cable W2 to VTM for voltage and resistance tests.

GO TO NEXT PAGE

2-1-1. OPERATOR'S CONTROLS AND INDICATORS (cont) 2-1-1



D. READOUT DISPLAY

Displays different types of readouts during testing up to a maximum of 4 characters. Types of readouts are:

Status — Keeps operator informed of what is happening such as power applied, failed test, etc.

Numerical — Measurement results. Units of measurement (psi, RPM, Volts, etc.) are not displayed.

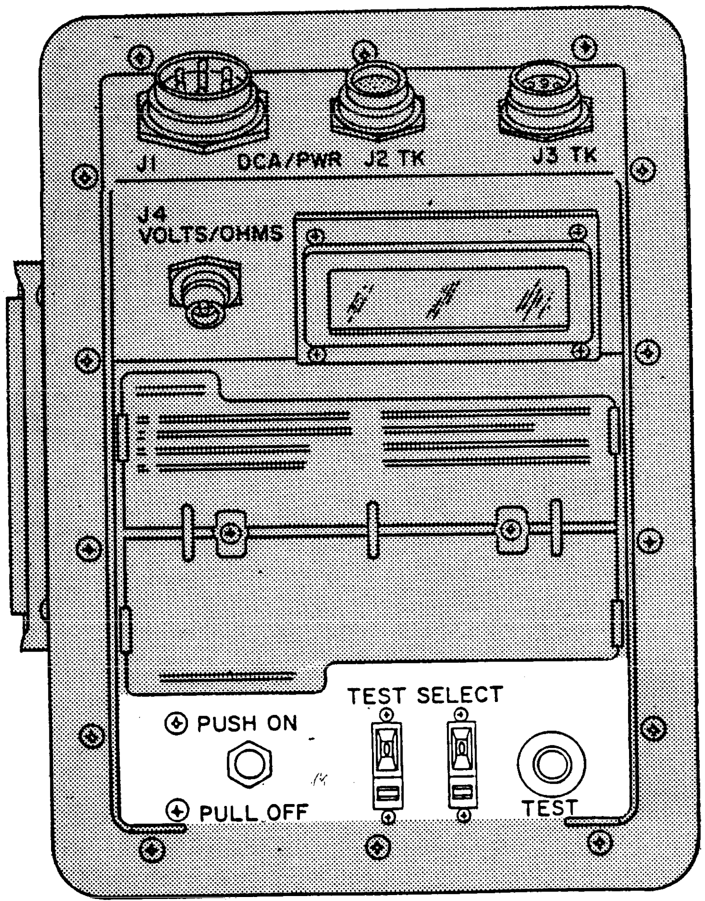
Error — Informs operator of an error (wrong test number entered, transducer not connected, VTM faulty, etc.).

E. FLIP CARDS

Used as an aid in testing. General discussion of test information.

GO TO NEXT PAGE

2-1-1. OPERATOR'S CONTROLS AND INDICATORS (cont)



F. **TEST BUTTON**

This push button switch has two functions:

Press and Release - causes selected test measurement to begin; or causes information on test select switches to be entered.

Press and Hold - initiates an offset test.

G. **TEST SELECT SWITCHES**

Two ten-position switches. Used to select the test to be performed by the VTM when the TEST button is pressed and released. These switches also are used to enter vehicle data during testing.

H. **PUSH ON/PULL OFF SWITCH**

Used to control power to the VTM from the power source. Switch contains a 4 amp circuit breaker to protect VTM internal circuitry.

END OF PARAGRAPH

2-1-2. ERROR MESSAGES 2-1-2

An error message indicates that the VTM needs additional or corrected information before testing can continue, or that additional procedures are required.

All error messages are displayed as an E followed by three numbers (for example, E003). To correct the problem, go to the error message fault isolation paragraph in Chapter 3, Section II, for the error shown on display.

Table 2-1 Error Message Displays

DISPLAY	MEANING
E000	VTM has been asked for information that it does not have. For example, you have requested the vehicle/equipment ID and it has not been entered.
E001	A test number which does not exist has been entered on the TEST SELECT switches.
E002	The required transducer is not connected.
E003	Test number wrong for DCA connected. This can occur if test selected does not apply to the class of vehicle/equipment under test or if the DCA harness does not have the required transducers.
E004	No longer used. If message appears, turn in test set.
E005	Required offset test was not performed.
E007	The VID number and number-of-cylinders information entered do not agree.
E008	VTM is not receiving required voltage signal for selected test. This message can occur on tests 14, 15 and 72 thru 79.
E009	VTM is not receiving engine speed signal. This applies only to engine power test and S1 full power simulation.
E010	A wrong VID number was entered. The VTM will only accept numbers between 01 and 99. If E010 is displayed when the VID entered was between 01 and 99, it means that the VID does not agree with the identity of DCA harness powering the VTM. Testing may continue.
E011	Throttle control was operated incorrectly. It was taking too long to accelerate or decelerate during power test.

GO TO NEXT PAGE

2-1-2. ERROR MESSAGES (cont) 2-1-2

Table 2-1 Error Message Displays (cont)

DISPLAY	MEANING
E012	The Sl ignition adapter, TK item 30, or CI pulse tachometer, TK item 34, is missing or is not connected to the VTM.
E013	VTM is unable to use data received.
E014	The wrong number of cylinders was entered.
E015	No longer used. If message appears, turn in test set.
E017	VTM is not receiving ignition information during dwell test.
E018	Test discontinued due to no information being detected by VTM. This will occur after several minutes of no-signal operation.
E020	No first peak information was detected by the VTM.
E021	VTM cannot calculate result. Current is over current probe's range, and VTM did not sample correct portion of data.
E022	External voltage was detected in the circuit under test while measuring resistance.
E023	VTM'S constant voltage source is not working.
E024	Test is not valid for VID entered.
E027	Error in entry of compression unbalance constants.
E028	Test just entered cannot be used with control function 06.
E030	VID entered conflicts with speed transducer attached.
E032	Vehicle's cranking speed is varying too much for a compression unbalance measurement.
E033	Error in entry of power test constants.
	NOTE: If any error message not listed above is displayed, return STE/ICE-R set to DS maintenance.

END OF PARAGRAPH

2-1-3. STATUS MESSAGES 2-1-3

A status message keeps the operator informed of what is happening. The status messages and their meanings are as follows:

Table 2-2 Status Message Displays

DISPLAY	MEANING
.8.8.8.8	There is power to the VTM and the display is working properly. This appears only for a short period after power is turned on and during confidence test.
.9.9.9.9	VTM is reading a test value beyond its range.
AUE	Numerical display is an average value.
Con	Accepted control function input.
FAIL	Unit under test has failed test.
LO	Engine speed is below 1600 RPM during S1 power test. Indicates the engine failed the power test.
PASS	Unit under test has passed test.
- - -	After power turn on, means VTM is ready for testing. During compression unbalance test and frequency measurement, means testing is in progress.
	VTM is busy.

2-1-4. PROMPTING MESSAGES 2-1-4

A prompting message indicates that the operator must do something. After the operator action is completed, testing will continue. The prompting messages and their meanings are as follows:

Table 2-3 Promting Message Displays

DISPLAY	MEANING
0066	Tells the operator to set TEST SELECT switches to 99 during confidence test.
CAL	Tells the operator to release the TEST button during an offset test.
CIP	Tells the operator to apply full throttle in a C1 power test.

GO TO NEXT PAGE

2-1-4. PROMPTING MESSAGES (cont) 2-1-4

Table 2-3 Prompting Message Displays (cont)

DISPLAY	MEANING
Cu-1	Enter 1st compression unbalance value.
CU-2	Enter 2nd compression unbalance value.
CU-3	Enter 3rd compression unbalance value.
CU-4	Enter 4th compression unbalance value.
CU-5	Enter 5th compression unbalance value.
CYCL	Test that displays this message is not valid in the STE/ICE-R set.
CYL	Tells the operator to enter the number-of-cylinders into the VTM.
GO	Tells the operator to crank engine.
OFF	Tells the operator to stop the operation being performed. In a compression unbalance test, this means stop cranking the engine. In a CI power test, it means to release the accelerator.
OP-1	Enter number of 1st test to be used with control function 06.
OP-2	Enter number of 2nd test to be used with control function 06.
Po-1	Enter 1st power test value.
PO-2	Enter 2nd power test value.
PO-3	Enter 3rd power test value.
SIP	Tells the operator to apply full throttle in a Sl power test.
UEH	Tells the operator to enter VID on the TEST SELECT switches.

2-1-5. CONFIDENCE TEST ERROR MESSAGES 2-1-5

Confidence test messages are displayed either as PASS or by a C followed by three numbers (#). A C### is an error message used by VTM repair personnel as an aid in troubleshooting.

If a C### message appears during confidence test or during normal operation, go to Confidence Test Fault Isolation; paragraph 3-2-4, for the necessary corrective action.

END OF SECTION

Section II. PREVENTIVE MAINTENANCE

Section II is a description of the preventive maintenance checks and services required to maintain STE/ICE-R in serviceable condition and has the following paragraphs:

2-2-1. PREVENTIVE MAINTENANCE 2-2-1

Preventive Maintenance is the systematic inspection and proper care of the STE/ICE-R to prevent the occurence of trouble, reduce downtime and maintain the equipment in serviceable condition.

2-2-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES 2-2-2

The preventive maintenance checks and services (PMCS) table includes information on what procedures are required at regular intervals to maintain STE/ICE-R in serviceable condition. It also describes any condition which would prevent STE/ICE-R from being ready and available for use.

When performing PMCS, always keep in mind the WARNINGS and CAUTIONS listed in the front of the TM. Fault isolation and replacement procedures which can be performed at the operator/organizational level are in chapter 3 of this manual.

Refer to DA PAM 738-750, The Army Maintenance Management System (TAMMS), for information on forms to be used for maintenance records and reports.

A. ITEM NUMBER COLUMN

Each major item of STE/ICE-R equipment is assigned a number. Use this number in the TM Number column on DA form 2404, Equipment Inspection and Worksheet, when recording results of PMCS.

2-2-2 PREVENTIVE MAINTENCE CHECKS AND SERVICES (cont) 2-2-2

B. INTERVAL COLUMN

Intervals for STE/ICE-R PMCS are before (B) and after (A) each use for all of the major items in the STE/ICE-R set. The Confidence Test #66 should be run before and after each use to insure accurate results.

C. ITEM TO BE INSPECTED AND PROCEDURERE COLUMN

The item to be checked will be referred to by its common name in bold type. This will be followed by the steps to be performed. Specific subassemblies that are to be inspected will be called out by key number on the illustration. Reference may be made to other paragraphs in this TM for procedures to repair or replace damaged equipment.

D. EQUIPMENT NOT READY/AVAILABLE COLUMN

Any condition which would prevent the full and effective use of the item being inspected will be listed in this column.

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2-2-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (cont) 2-2-2

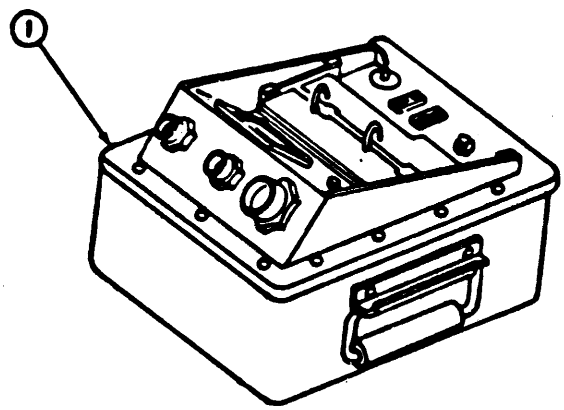

Table 2-4, Operator Preventive Maintenance Check and Services

B - Before A - After

ITEM NO.	INTERVAL B	INTERVAL A	ITEM TO BE CHECKED PROCEDURE	FOR READINESS REPORTING, EQUIPMENT IS NOT READY OR AVALABLE IF:
1	●	●	**Vehicle Test Meter VTM (1)** Run Confidence Test #66. Refer to Paragraph 2-2-3	VTM does not pass Confidence Test.

GO TO NEXT PAGE

2-2-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (cont)

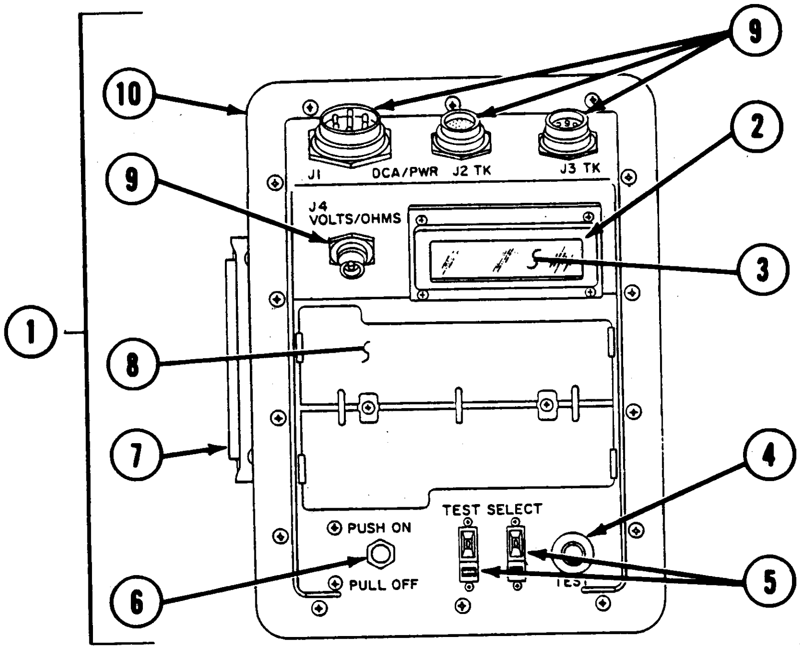

Table 2-4, operator Preventive Maintenance Check and services (cont.)

B - Before A - After

ITEM NO.	INTERVAL B	INTERVAL A	ITEM TO BE CHECKED PROCEDURE	FOR READINESS REPORTING, EQUIPMENT IS NOT READY OR AVAILABLE IF:
2	•		**VTM -** Check display assembly (2) for dents and cracked or broken window (3). Check TEST switch (4) to see that it is not loose and that you feel it click when you press it. Check TEST SELECT switches (5) to see that they are not loose and that you can dial in numbers. Check circuit breaker (6) to see that it is not loose and that you feel it click when you push it in or pull it out. Check handle (7) to see that it is not loose and that it springs back when you lift it. Check card set (8) to see that it not loose and that no cards are broken. Check panel connectors (9) for bent or missing pins or damaged threads. Check housing (10) for dents or. cracks in any place.	TEST SELECT switches will not turn or are loose. Circuit breaker does not click or is loose. Handle does not spring back or is loose. Cards are broken or missing. Connectors have bent or missing pins. Connectors have damaged threads. Housing is dented or cracked.

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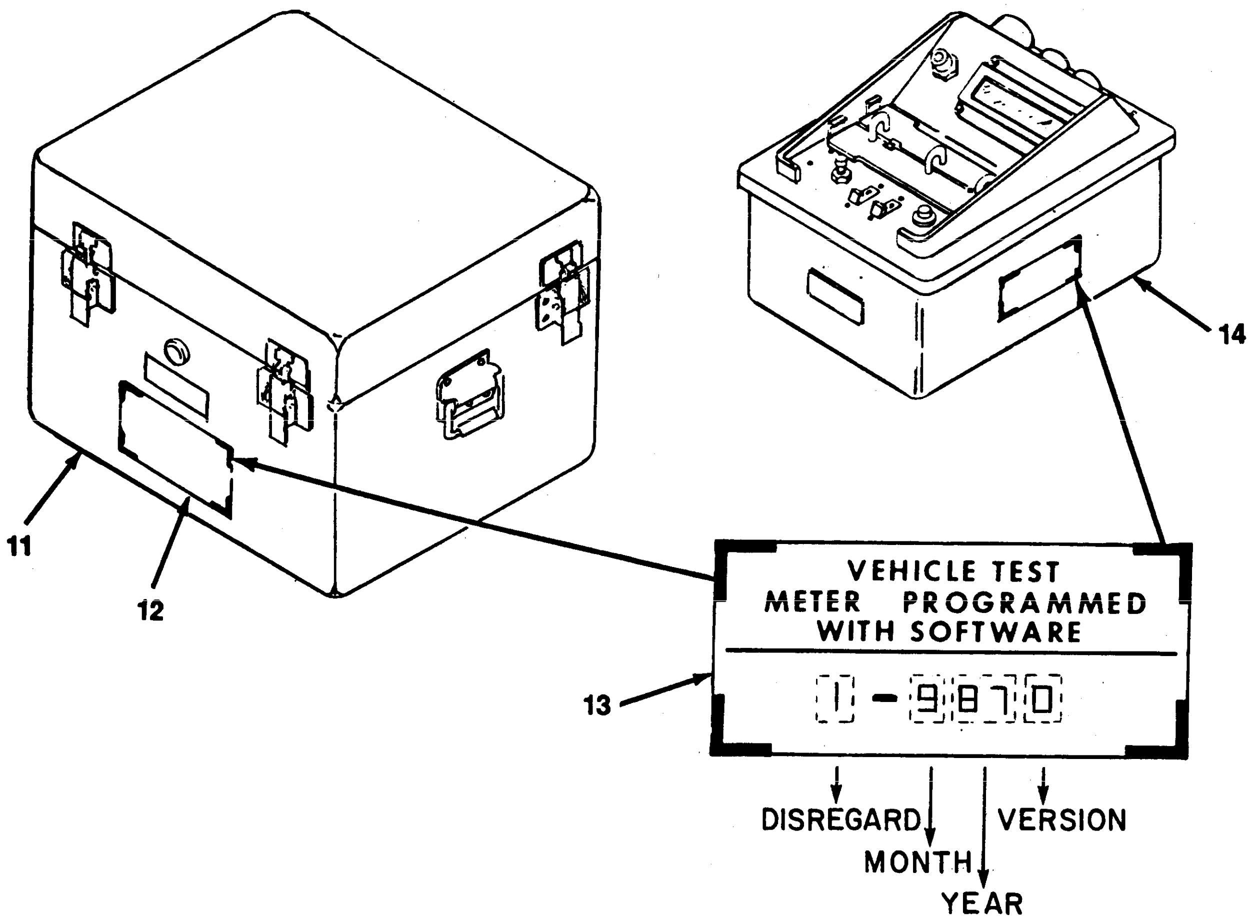


Table 2-4, Operator Preventive Maintenance Check and Services (cont.)

B - Before A - After

ITEM No.	INTERVAL B	INTERVAL A	ITEM TO BE CHECKED PROCEDURE	FOR READINESS REPORTING, EQUIPMENT IS NOT READY OR AVAILABLE IF:
3	•		**Transit Case** (11) - Check for major damage to transit case, cover, handles, latches, relief valve, identification plate (12). Check that software revision number label (13) on transit case matches software revision number label on VTM (14).	

GO TO NEXT PAGE

2-2-2. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (cont)

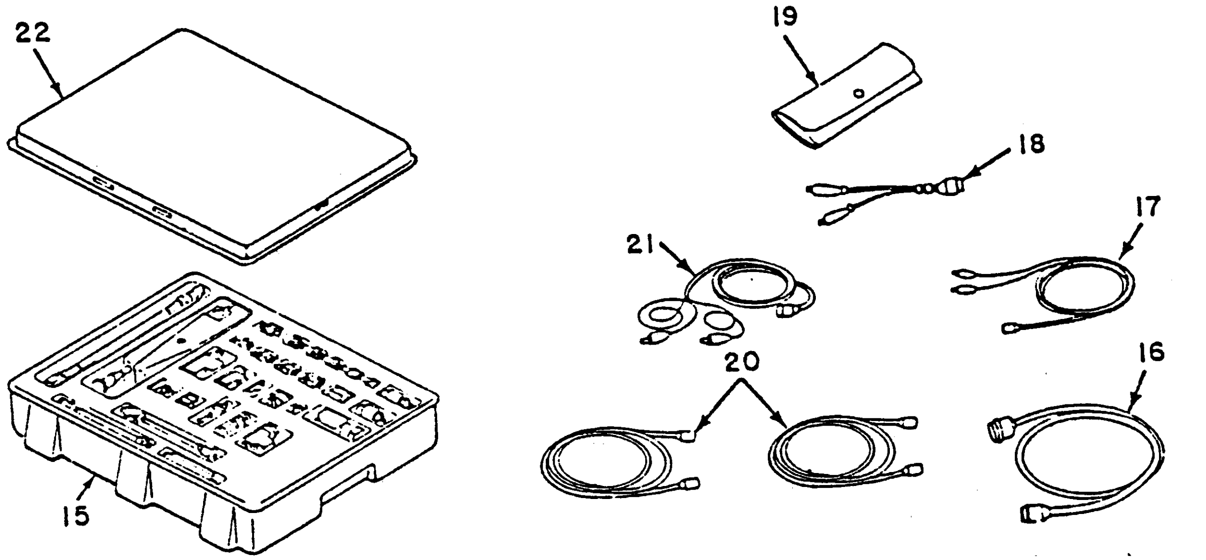


Table 2-4, Operator Preventive Maintenance Check and Services (cont.)

B - Before A - After

ITEM NO.	INTERVAL B	INTERVAL A	ITEM TO BE CHECKED PROCEDURE	FOR READINESS REPORTING, EQUIPMENT IS NOT READY OR AVAILABLE IF:
4	●		**Transducer Kit (15)** - Check tray (15) and tray cover (22) for damage If bad, replace. Check to see that no item are missing.	
5	●		**Test Probe Kit (19)** - Check test probe kit for missing, damaged or broken components.	
6	●		**Cable Assemblies W1 (16), W2 (17), W3 (18), M4 (20) and W5 (21):** Check for band marker stamped P1 for connector. (On cables W1 and W4 also check for band marker stamped P2.) Check for band marker W1 through w5, as applicable. Check for cuts or breaks in insulation. Check connectors for missing pins and damaged threads. As applicable: Check for damaged or missing alligator clips. Check for damaged or missing boots on clip ends.	W5 cable is missing alligator clips or has damaged pins and/ or connector assembly.

END OF PARAGRAPH

2-2-3. CONFIDENCE TEST #66 2-2-3

Description:

This procedure provides an overall check of the VTM and should be run before and after each use to assure accuracy of results.

Applications:

Checks on serviceability of VTM

Pre-Test Procedure:

Procedure	Ref
Power up VTM	2-3-3

NOTE

If VTM fails to display correct readouts, refer to Confidence Test Fault Isolation, paragraph 3-2-4.

1. Run confidence test.

   a. Set TEST SELECT switches to 66.

   b. Press and release TEST button.

   c. Wait for display to show 0066.

   d. Set TEST SELECT switches to 99.

   e. Press and release TEST button.

2. Observe displayed readouts.

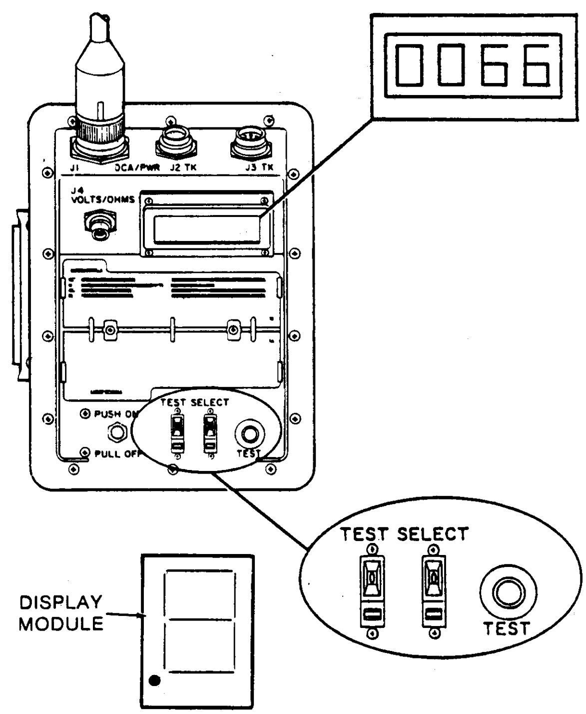
   a. Display shows 0099.

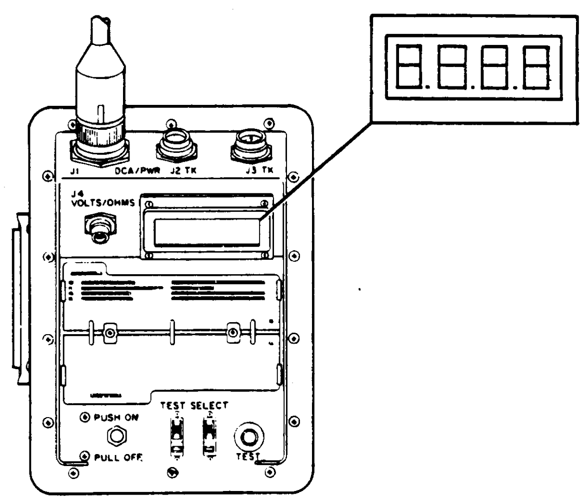
   b. Display blank.

N O T E

When performing step c, observe display and verify that all segments of display are on.

   c. Display shows .8.8.8.8. If any segments of display are not working, refer to Digital Display Modules Removal/Installation, paragraph 3-3-2.





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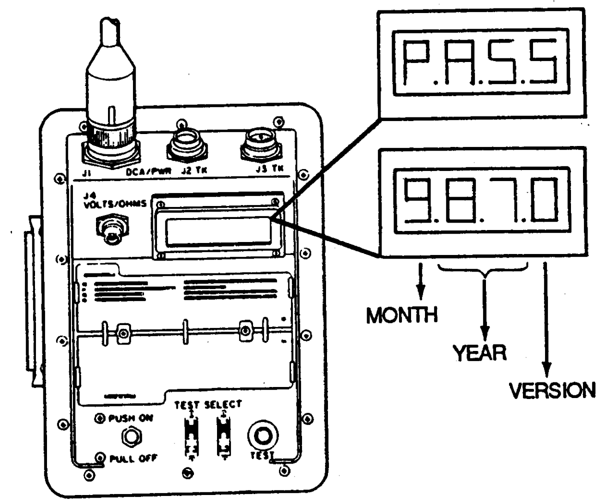
2-2-3. CONFIDENCE TEST #66 (cont)

d. Display blank.



NOTES

Intermediate test results are displayed indicating test in progress. The end result will alternately show the software revision number and the PASS message

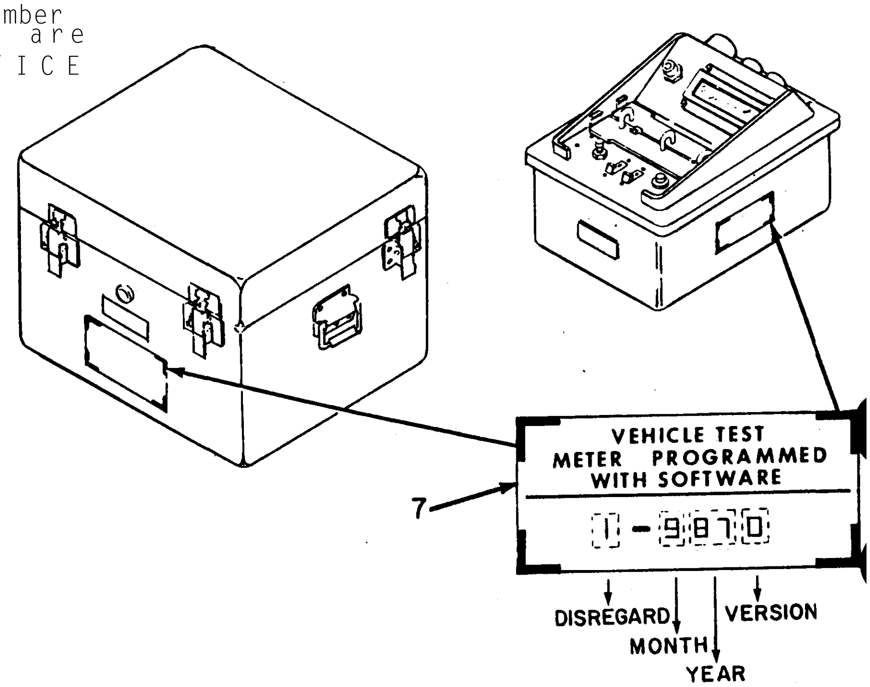
The displayed software revision number has a month (one digit), a year (two digits) and the version number which is always zero.

e. Wait for the alternate display of the revision number and the PASS message.

NOTE

The software revision number flashing on the display should match the portion of the label on the side of the VTM.

f. Compare the revision number displayed with the revision number on the VTM label. If they are different, return the STE/ICE set to DS maintenance.



END OF SECTION

Section III. OPERATION UNDER USUAL CONDITIONS

Section III describes the use of STE/ICE-R under usual conditions and has the following paragraphs:

GO TO NEXT PAGE

2-3-1. OPERATING PROCEDURES 2-3-1

This paragraph contains a test selection guide which lists the 99 test numbers that are used by the STE/ICE-R system.

The Test Selection Guide, table 2-5, has five columns. It is divided into sections according to the type of operation being performed. Each listing shows the following:

A. **TEST NUMBER**

This is the two digit number that the TEST SELECT switches are set to before running the test.

B. **TYPE OF TEST**

This shows how the test is categorized.

C. **OFFSET TEST REQUIRED**

A yes entry in this column will indicate that the test requires an offset test

D. **DESCRIPTION**

This will give a brief description of the test. Tests that are DCA only to the vehicle/equipment TM for a description.

E. **PARAGRAPH NUMBER**

This will show the paragraph number where the test procedure can be found.

GO TO NEXT PAGE

2-3-1. OPERATING PROCEDURES (cont) 2-3-1

Table 2-5 Test Selection Guide

Test Number	Type of Test	Offset Test Required	Description	Para Number
			CONTROL FUNCTIONS	
01	Control		Display RPM with next measurement	2-3-5
02	Control		Display minimum value of next measurement	2-3-6
03	Control		Display maximum value of next measurement	2-3-7
04	Control		Display peak to peak value of next measurement	2-3-8
05	Control		Sl full power simulation	2-3-9
06	Control		Display two measurements	2-3-10
07-09			Spares (not used in current STE/ICE-R)	
			ENGINE TESTS	
10	General		Engine RPM average	2-3-20
11	General		Engine RPM cranking	2-3-21
12	Special		Power (RPM/See)	2-3-42
13	Special		Power (percent)	2-3-43
14	Special		Compression unbalance-(power cable)	2-3-44
15	Special		Compression unbalance (test probe)	2-3-45
			IGNITION TESTS	
16	General		Dwell angle	2-3-22
17	General		Points voltage	2-3-23
18	DCA only		Refer to vehicle/equipment TM	
19			Spare	
20			RESERVED	
			FUEL/AIR SYSTEMS TESTS	
21	DCA only		Refer to vehicle/equipment TM	
22	DCA only		Refer to vehicle/equipment TM	
23	OCA only	yes	Refer to vehicle/equipment TM	
24	DCA only	yes	Refer to vehicle/equipment TM	
25	DCA only	yes	Refer to vehicle/equipment TM	
26	DCA only		Refer to vehicle/equipment TM	
27	DCA only		Refer to vehicle/equipment TM	
28	DCA only	yes	Refer to vehicle/equipment TM	
29	DCA only	yes	Refer to vehicle/equipment TM	
30	DCA only	yes	Refer to vehicle/equipment TM	
31	DCA only	yes	Refer to vehicle/equipment TM	

GO TO NEXT PAGE

1-3-1. OPERATING PROCEDURES (cont)

Table 2-5 Test Selection Guide (cont)

Test Number	Type of Test	Off set Test Required	Description	Para Number
			FUEL/AIR SYSTEMS TESTS (cont)	
32	DCA only	yes	Refer to vehicle/equipment TM	
33	DCA only	yes	Refer to vehicle/equipment TM	
34	DCA only	yes	Refer to vehicle/equipment TM	
			LUBRICATION/COOLING SYSTEMS TESTS	
35	DCA only	yes	Refer to vehicle/equipment TM	
36	DCA only	yes	Refer to vehicle/equipment TM	
37	DCA only	yes	Refer to vehicle/equipment TM	
38	DCA only	yes	Refer to vehicle/equipment TM	
			PRESSURE/TEMPERATURE TESTS	
39	DCA only	yes	Refer to vehicle/equipment TM	
40	DCA only	yes	Refer to vehicle/equiPment TM	
41	DCA only	yes	Refer to vehicle/equipment TM	
42	DCA only	yes	Refer to vehicle/equipment TM	
43	DCA only	yes	Refer to vehicle/equipment TM	
44	DCA ONLY	yes	Refer to vehicle/equipment TM	
45		yes	Vacuum 0 to 30 inch mercury	2-3-24
46	General	yes	Vacuum variation 0 to 30 inch mercury	2-3-25
47	General	yes	Pressure 0 to 50 inch Hg.	2-3-26
48	General	yes	Vacuum 0 to 150 inch water	2-3-27
49	General	yes	Pressure 0 to 25 psig	2-3-28
50	General	yes	Pressure 0 to 1000 psig	2-3-29
51	General	yes	Pressure 0 to 9999 psig	2-3-30
52-54			Reserved	
			DATA/ID ENTRY/DISPLAY FUNCTIONS	
55			spare	
56			Reserved	
57			Reserved	
58	Entry		Enter number of cylinders	2-3-12
59	Display		Display number of cylinders	2-3-13
60	Entry		Enter VID	2-3-14
61	Display		Display VID	2-3-15
62	Display		Display DCA ID number	2-3-16
63	Display		Display J2 TK transducer ID number	2-3-17
64	Display		Display J3 TK transducer ID number	2-3-18
65			Reserved	

GO TO NEXT PAGE

2-3-1. OPERATING PROCEDURES (cont) 2-3-1

Table 2-5 Test Selection Guide (cont)

Test Number	Type of Test	Offset Test Required	Description	Para Number
			CONFIDENCE TEST	
66	Self		Vehicle test meter confidence test	2-2-3
			STARTING/CHARGING SYSTEMS TESTS	
67	General		Battery voltage	2-3-31
68	DCA only		Refer to vehicle/equipment TM	
69	DCA only		Refer to vehicle/equipment TM	
70	DCA only		Refer to vehicle/equipment TM	
71	DCA only	yes	Refer to vehicle/equipment TM	
72	Special	yes	Current first peak (power cable)	2-3-46
73	Special	yes	Battery internal resistance (power cable	2-3-47
74	Special	yes	Starter circuit resistance (power cable)	2-3-48
75	Special	yes	Battery resistance change (power cable)	2-3-49
76	Special	yes	Current first peak (test probe)	2-3-50
77	Special	yes	Battery internal resistance (test probe)	2-3-51
78	Special	yes	Starter circuit resistance (test probe)	2-3-52
79	Special	yes	Battery resistance change (test probe)	2-3-53
80	DCA only	yes	Refer to vehicle/equipment TM	
81	DCA only		Refer to vehicle/equipment TM	
82	DCA only		Refer to vehicle/equipment TM	
83	DCA only		Refer to vehicle/equipment TM	
84	DCA only		Refer to vehicle/equipment TM	
85	DCA only		Refer to vehicle/equipment TM	
86	DCA only		Refer to vehicle/equipment TM	
87	DCA only		Refer to vehicle/equipment TM	
			ELECTRICAL TESTS	
88	General	yes	Live circuit resistance (low ohms)	2-3-32
89	General	yes	DC voltage 0 to 45 VDC	2-3-33
90	General	yes	DC current 0 to 1500 amps	2-3-34
91	General	yes	Resistance and continuity 0 to 4500 ohms	2-3-35
92	General	yes	Resistance 0 to 40 Kohms	2-3-36
93	General	yes	AC voltage 0 to 35 volts	2-3-37
94			Reserved	
95	General	yes	AC current test 0 to 700 amps	2-3-38
96	General		AC frequency 40 to 500 Hz (test probe)	2-3-39
97	General		AC frequency 40 to 500 Hz (current probe	2-3-40
98	DCA only		Refer to vehicle/equipment TM	
99	DCA only		Refer to vehicle/equipment TM	

END OF PARAGRAPH

2-3-2. ASSEMBLY AND PREPARATION FOR USE 2-3-2

It is the responsibility of the receiving organization to determine whether equipment has been properly prepared for service by the supplying unit. All new, used, or re-conditioned STE/ICE-R equipment should be inspected by the receiving organization to determine if the item is correctly assembled and stowed. A visual inspection should also be done to determine if there are any signs of damage due to shipping.

The STE/ICE-R should also be inventoried to determine if all of the parts are present. Check for worn identification plates, printed matter, and markings which are not easy to read, and replace as necessary.

Perform the PMCS tasks in table 2-4 to prepare the STE/ICE-R set for operation. Also check that the program revision decal on the transit case matches the program revision decal on the VTM.

2-3-3. VTM POWER UP 2-3-3

There are two power up procedures, one for TK mode, and one for DCA mode. Do procedure A if testing in TK mode, and procedure B for DCA mode testing.

A. POWER UP - TK MODE

In the TK mode, the VTM normally receives its power from power cable W5 connected to the batteries of the vehicle/equipment under test. If those batteries are dead, the VTM can receive power by connecting power cable W5 to the batteries of another adjacent vehicle/equipment other than the one under test. As a possible third source of power, the VTM can utilize a DCA cable plugged into any vehicle/equipment DCA connector. With the third source of power, no RPM measurement can be made on the vehicle/equipment under test.

GO TO NEXT PAGE

2-3-3. VTU POWER UP (cont) 2-3-3

A. POWER UP - TK MODE (cont)

WARNING

Do not connect V/TM to power source while VTM power switch is on. Battery explosion could occur.

CAUTION

Do not connect VTM to a battery charger unless charger is connected to a battery. Damage to VTM may result.

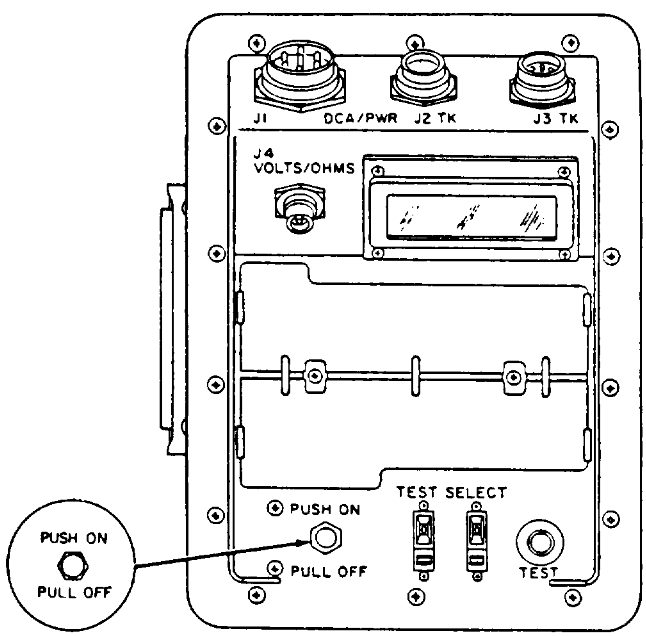
Connect P1 of power cable W5 to J1 DCA/PWR on VTM before connecting clips El and E2 to the power source. Damage to VTM may result.

Do not connect or disconnect VTM while vehicle/equipment is operating. Damage to connector may result.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTH is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. **Turn VTU off.** PULL OFF VTM power switch.



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2-3-3. VTM POWER UP (cont) 2-3-3

A. **POWER UP - TK MODE** (cont)

2. Connect power cable N5.

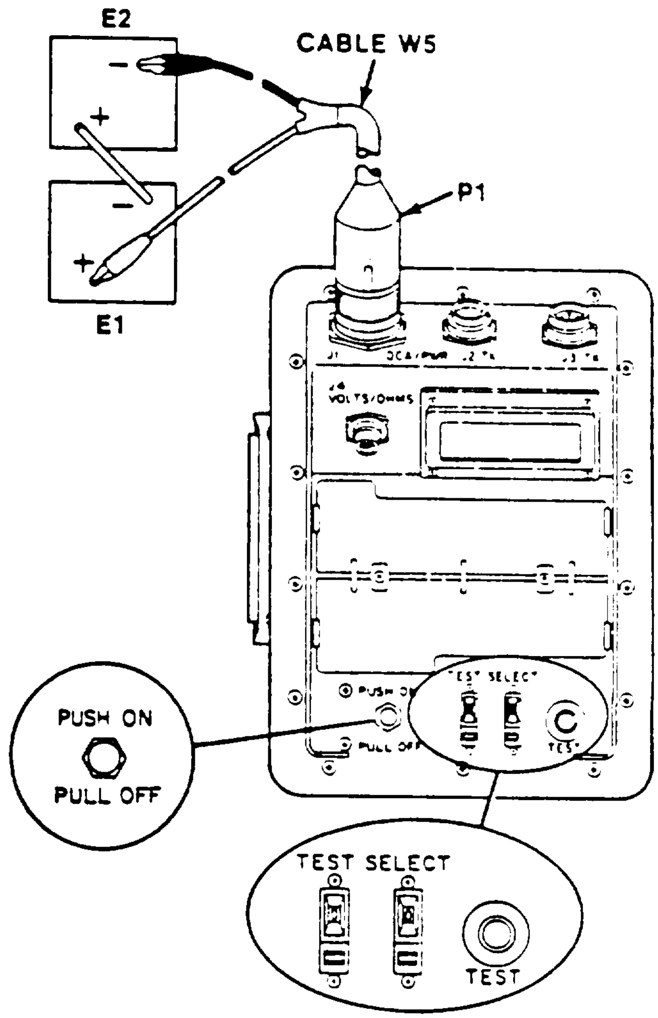
   a. Attach connector P1 of cable W5 to J1 DCA/PWR of VTM. Aline white mark on connector P1 with large slot in keyway of J1. Twist locking ring until it clicks.

NOTE

Cable W5 clips can be connected to batteries of vehicle/equipment under test. If these batteries are too weak to power VTM, then clips can be attached to batteries of an adjacent vehicle/equipment.

   b. Attach red clip El of cable W5 to positive (+) terminal of power source.

   c. Attach black clip E2 of cable W5 to negative (-) terminal of power source.



3. **Power up VTM.**

   a. PUSH ON VTM power switch.

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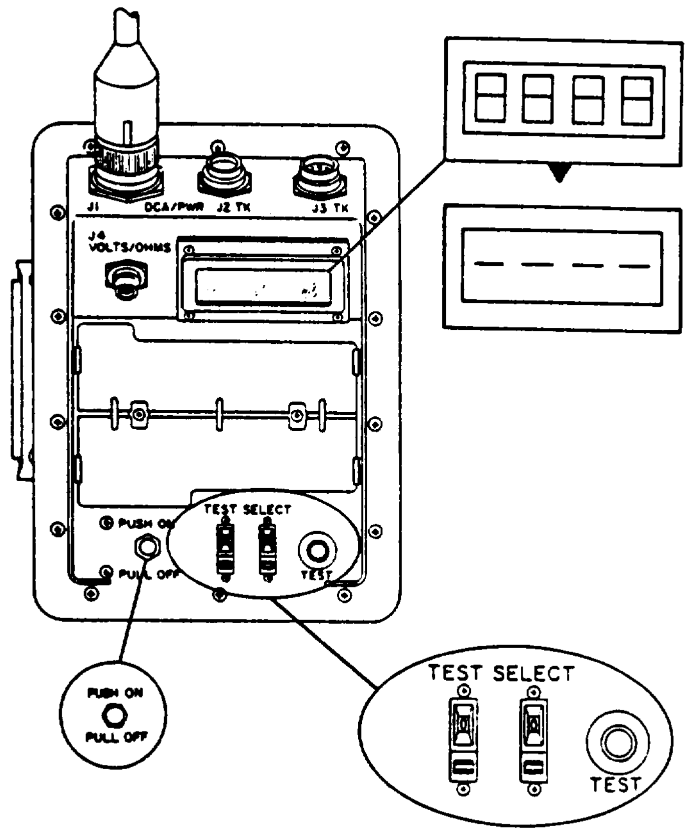
A. POWER UP - TK MODE (cont)

NOTES

If step 3.b requirements are not met, refer to Power Up Fault Isolation, paragraph 3-2-5.
If any display segments are not working, refer to digital display modules removal/installation, paragraph 3-3-2.

b. Verify that .8.8.8.8 displays for about 2 seconds, then becomes -----



4. **Run confidence test.** Refer to Confidence Test #66, paragraph 2-2-3.

5. **Check battery voltage.**

a. Set TEST SELECT switches to 67.
b. Press and release TEST button.

NOTE

Battery voltage must be between 9-32 vdc for VTM to operate properly (batteries may be too weak to run vehicle/equipment). If voltage is not between 9-32 volts, perform step 6.

c. Observe displayed value (volts).

6. **Correct low battery voltage.**

a. Check VTM connections.
b. Clean battery terminals.
c. Go to vehicle/equipment TM and check battery specific gravity.
d. Charge battery if necessary.
e. Go to Cable Fault Isolation, paragraph 3-2-3, to troubleshoot cable w5
f. Go to step 5.

-

GO TO NEXT PAGE

B. POWER UP - DCA MODE

In the DCA mode, the VTM receives its power from the W1 cable connected to the vehicle/equipment.

CAUTION

Do not connect VTM to diagnostic connector while VTM power switch is on. Damage to connectors may result.

Connect DCA cable W1 to J1 DCA/PWR on VTM before connecting to the vehicle/equipment diagnostic connector. Otherwise, damage to connector may result.

Do not connect or disconnect VTM while vehicle/equipment is operating. Damage to connector may result.

WARNING

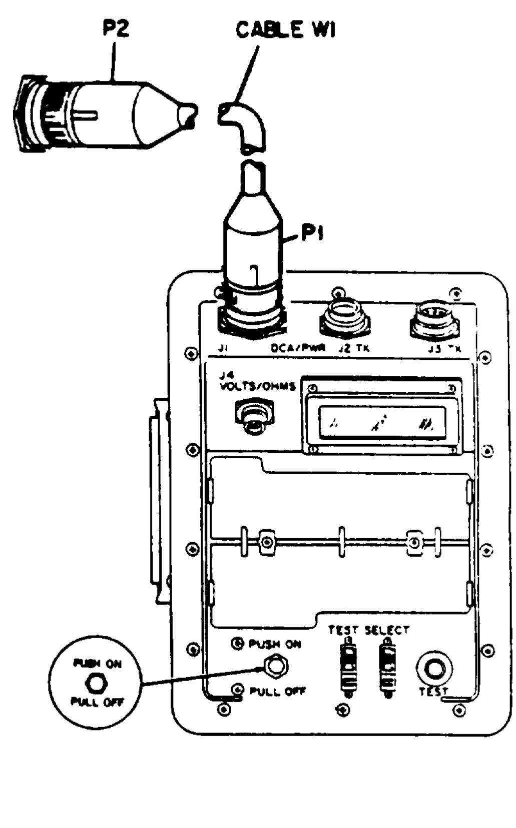
on vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. **Turn VTM off.** PULL OFF VTM power switch.

2. **Connect VTM to diagnostic connector.**

   a. Attach connector P1 of cable W1 to J1 DCA/PWR of VTM. Aline white mark on connector P1 with large slot in keyway of J1. Twist locking ring until it clicks.

   b. Attach connector P2 of cable W1 to vehicle/equipment diagnostic connector.



GO TO NEXT PAGE

2-3-3. VTM POWER UP (cont) 2-3-3

B. POWER UP - DCA MODE (cont)

3. Power up VTN.

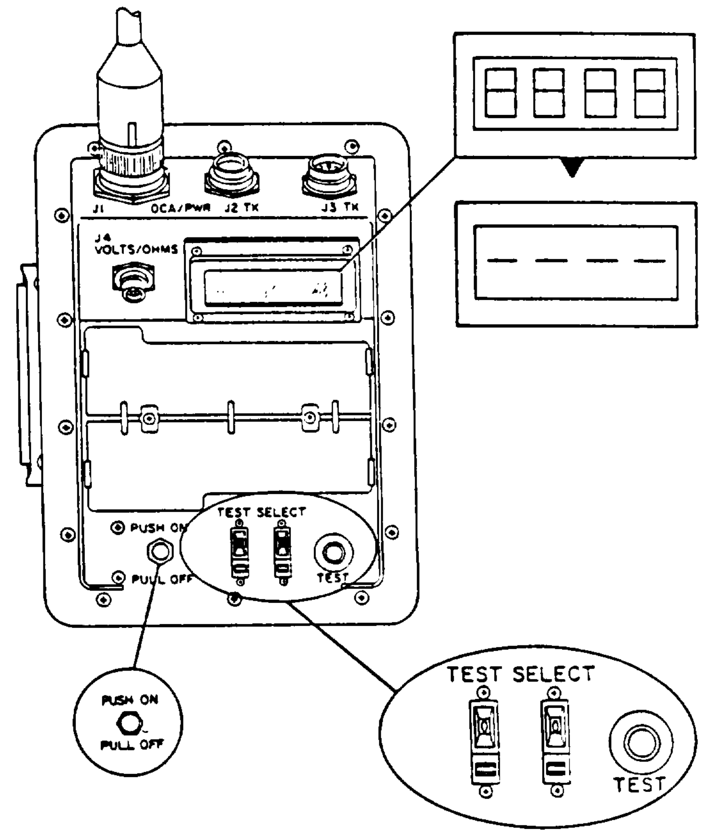
a. PUSH ON VTM power switch.

NOTES

If requirements of 3b are not met, refer to Power Up Fault Isolation, paragraph 3-2-5.

If any display segments are not working, refer to digital display modules removal/installation, paragraph 3-3-2.

b. Verify that .8.8.8.8 appears on display for approximately 2 seconds and then changes to ----.



4. Run confidence test. Refer to paragraph 2-2-3 and run confidence test.

END OF PARAGRAPH

2-3-4. CONTROL FUNCTIONS 2-3-4

A. USING CONTROL FUNCTIONS

Control functions change the way a measurement is displayed or run. There are six control functions.

01 Display RPM with next measurement.

02 Display minimum value of next measurement.

03 Display maximum value of next measurement.

04 Display peak-to-peak value of next measurement.

05 SI full power simulation.

06 Display two measurements.

The control functions available for each test are in table 2-6. Control functions can be used together except as indicated in the table.

By combining control functions, for example, you can display maximum battery voltage, alternating with speed under full power simulation. The control function test numbers can be entered in any order prior to entering the measurement test number. The exceptions are 02, 03, 04, and 06, of which, only the last one entered will be active.

The steps taken to use a control function are:

1. Check table 2-6 to see if control functions can be used for the measurement.

2. Perform offset test (if required).

3. Enter any control functions that are desired. VTM will display Con after each entry.

4. Perform desired measurement.

B. DISPLAY RPHUITH NEXT MEASUREMENT FUWTION #01

This function causes the VTM display to alternate between the test that was entered and a measurement of engine speed. This is useful when a measurement is to be made at a particular engine speed. If the VTM is not powered through a DCA, then it must have an ignition adapter cable or pulse tachometer attached.

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C. DISPLAY MINIMUN VALUE OF NEXT MEASUREMENT FUNCTION #02

This function causes the VTM to display the lowest value measured during a test. It is useful when the lowest value of a measurement is needed; for example, when looking for the lowest manifold vacuum on a spark ignition engine.

D. DISPLAY MAXIMUM VALUE OF NEXT MEASUREMENT FUNCTION #03

This function causes the VTM to display the highest value measured during a test. It is useful when the greatest value of a measurement is needed; for example, when measuring cylinder pressure.

E. DISPLAY PEAK-TO-PEAK VALUE OF NEXT MEASUREMENT FUNCTION #04

This function causes the VTM to display the difference between the highest value and the lowest value measured between display changes during a test. The peak-to-peak control function can be used with the dwell measurement to determine dwell difference between the cam lobes.

F. SPARK IGNITION FULL POWER SIMULATION FUNCTION #05

This function allows the user to simulate full power operation on spark ignition engines while making measurements (maximum fuel flow without maximum engine speed). The SI full power simulation will continue until the vehicle throttle is released.

G. DISPLAY TWO MEASUREMENTS FUNCTION #06

This function allows the user to make two general measurements at the same time. The control function causes the VTM display to alternate between the results of the first measurement and the results of the second measurement. Table 2-6 shows those tests that can be used with control function 06. As an example, this control function can be used to measure pressure versus current to adjust by-pass valves and main pumps on motor generators and cranes. It can also be used to determine the proper operation of charging systems by measuring battery voltage versus battery current.

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2-3-4. CONTROL FUNCTIONS (cont) 2-3-4

Table 2-6 STE/ICE-R Control Function Applications

Test	Description	Control Functions					
			Use only one.				
		#01	#02	#03	#04	#05	#06
10	Engine RPM (Average)					X	
11	Engine RPM (Cranking)						
12	Power Test (rpm/sec)						
13	Power Test (% power)						
14	Compression Unbalance (W1 or W5)						
15	Compression Unbalance (W2)						
16	Dwell Angle	X			X	X	X
17	Points Voltage	X	X	X	X	X	X
18	DCA Only	X	X	X	X	1	X
21	DCA Only	X	X	X	X		X
22	DCA Only	X	X	X	X		X
23	DCA Only	X	X	X	X		X
24	DCA Only	X	X	X	X	1	X
25	DCA Only	X	X	X	X	1	X
26	OCA Only					1	X
27	DCA Only	X	X	X	X		X
28	DCA Only	X	X	X	X		X
29	DCA Only	X	X	X	X		X
30	OCA Only	X	X	X	X		X
31	DCA Only	X	X	X	X		X
32	DCA Only	X	X	X	X		X
33	DCA Only	X	X	X	X	1	X
34	DCA Only	X				1	
35	DCA Only	X	X	X	X		X
36	DCA Only	X	X	X	X		X
37	DCA Only	X	X	X	X		X
38	DCA Only	X	X	X	X	1	X
39	llCA Only	X	X	X	X		X
40	DCA Only	X	X	X	X		X
41	DCA Only	X	X	X	X		X
42	DCA Only	X	X	X	X		X
43	DCA Only	X	X	X	X		X
44	DCA Only	X	X	X	X		X
45	Vacuum 0 to 30 in. Mercury	X	X	X	X	X	X
46	Vac Variation 0 to 30 in. Mercury	X				X	
47	Pressure 0 to 50 in. Mercury	X	X	X	X	X	X
48	Vacuum 0 to 150 in. Water	X	X	X	X	X	X
49	Pressure 0 to 25 psig	X	X	X		X	X
50	Pressure 0 to 1000 psig	X	X	X	X	X	X
51	Pressure 0 to 9999 psig	X	X	X	X	X	X

Note: 1 Applies to DCA 10 only,

GO TO NEXT PAGE

Table 2-6 STE/ICE-R Control Function Applications (cont)

Test	Description	Control Functions					
			Use only one.				
		#01	#02	#03	#04	#05	#06
58	Enter Number of Cylinders						
59	Display Number of Cylinders						
60	Enter VID						
61	Display VID						
62	Display DCA ID						
63	Display J2 TK ID						
64	Display J3 TK ID						
66	Confidence Test						
67	Battery Voltage	X	X	X	X	X	X
68	DCA Only	X	X	X	X	1	X
69	DCA Only	X	X	X	X	1	X
70	DCA Only	X	X	X	X	1	X
71	DCA Only	X	X	X	X		X
72	Current First Peak						
73	Battery Internal Resistance						
74	Starter Circuit Resistance						
75	Battery Resistance Change						
76	Current First Peak						
77	Battery Internal Resistance						
78	Starter Circuit Resistance						
79	Battery Resistance Change						
80	DCA Only	X	X	X	X	1	X
81	DCA Only					1	
82	DCA Only	X	X	X	X	1	X
83	DCA Only	X	X	X	X	1	X
84	OCA Only	X	X	X	X	1	X
85	DCA Only	X		X			X
86	DCA Only	X	:	X			X
87	DCA Only						
88	Live Circuit Resistance (Low Ohms]	X					X
89	DC Voltage 0 to 45 Volts DC	X	X	X	X	X	X
90	DC Current 0 to 1500 Amps DC	X	X	X	X	X	X
91	Resistance and Continuity 0 to 4500 Ohms	X	X	X	X	X	X
92	Resistance 0 to 40 Kohms	X	X	X	X	X	X
93	AC Voltage 0 to 35 Volts AC	X	X	X		X	X
95	AC Current 0 to 700 Amps AC	X	X	X		X	X
96	AC Frequency (Test Probe) 40 to 500 Hz						
97	AC Frequency (Current Probe) 40 to 500 Hz Frequency						
98	DCA Only	X	X	X	X		X
99	DCA Only	X	X	X			X

Note: 1 Applies to DCA 10 only.

END OF PARAGRAPH

2-3-5. DISPLAY RPM WITH NEXT MEASUREMENT TEST #01 2-3-5

Description:

This procedure causes the VTM to display engine rpm while performing another measurement. The display will alternate between the rpm value and the measurement value. Enterinq test 01 into the VTM causes this function to be applied to the next test entered. For additional information, see paragraph 2-3-4.

Typical Applications:

Check alternator/generator output at a prescribed RPM.

Check fuel pressure at a prescribed RPM.

Pre-Test Procedures:

Procedure	REF
Run confidence test	2-2-3
Perform offset tests	2-3-1
Enter VID (SI engine only) or	2-3-14
Enter number of cylinders (SI engine only)	2-3-12

Possible Error Messages:

E012 Ignition adapter or pulse tach missing
E014 incorrect number of cylinder entered

Control Functions:

02, 03, 04, 05

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTN is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

NOTE

Go to test procedure for measurement that is to be done, and perform all hookup and offset test steps before starting this procedure. Offset limits may al so be found in Table 3-2.

If testing SI engine, do procedure A.
If testing Ci engine, do procedure B.

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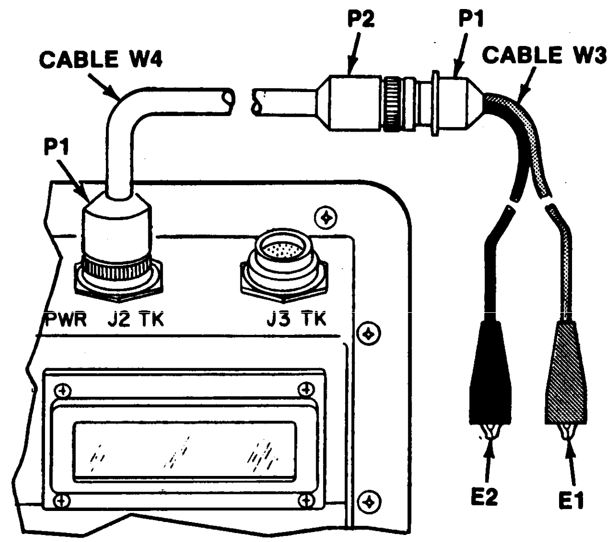
2-3-5. DISPLAY RPM WITH NEXT MEASUREMENT TEST #01 (cont) 2-3-5

A. SI HOOKUP AND TEST PROCEDURE

1. Connect cables.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Attach connector P2 of cable W4 to connector P1 of cable W3.



WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

2. Connect cable W3 to test point.

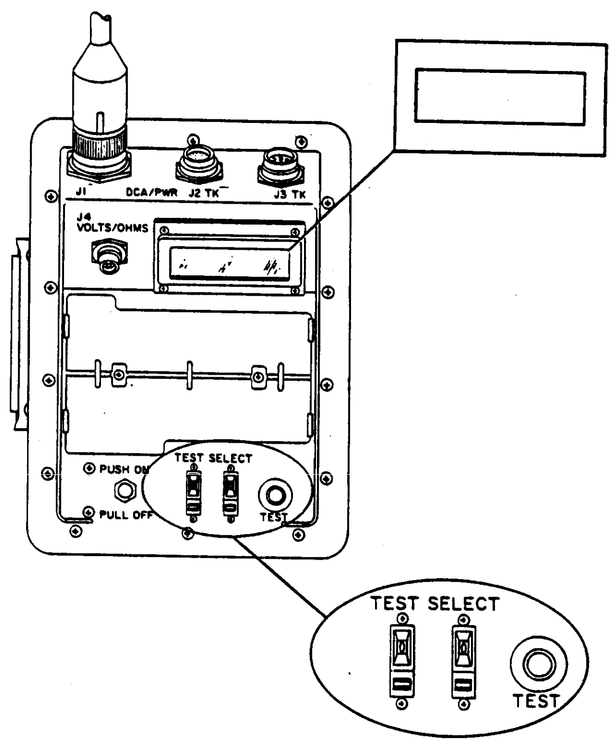
N O T E

Locate vehicle/equipment test points where measurement is to be made.

   a. Install adapter, TK item 30, or locate the distributor terminal of the coil primary.

   b. Attach red clip E1 of cable W3 to adapter, TK 30, or distributor terminal of coil primary.

   c. Attach black clip E2 of cable W3 to vehicle/equipment ground.



3. Enter control function.

   a. Set TEST SELECT switches to 01.

   b. Press and release TEST button.

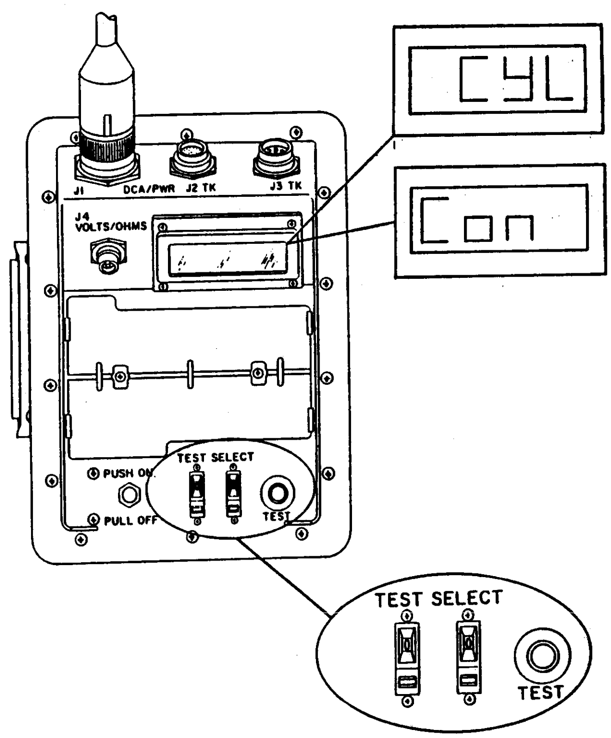
GO TO NEXT PAGE

2-3-5. DISPLAY RPM WITH NEXT MEASUREMENT TEST #01 (cont) 2-3-5

A. SI HOOK UP AND TEST PROCEDURE (cont)

NOTE

If a prompting message CYL appears on the display, refer to the vehicle/ equipment TM for the number of cylinders or cylinder pairs to enter in step d. If no CYL prompting message appears on the display, skip steps c thru f.



c. Wait for prompting message CYL to appear on display.

d. Set TEST SELECT switches to number of cylinders/cylinder pairs.

NOTE

The number of cylinders display will remain only a few seconds.

e. Press and release TEST button

f. Wait for VTM to display number of cylinders entered.

g. Wait for VTM to display Con.

4. Perform measurement.

NOTE

Hook up and offset steps should already have been completed. Do not repeat.

a. Go to desired measurement procedure. Follow those procedures.

b. VTM will alternately display engine sped and desired measurement. (The first number displayed will be the rpm.)

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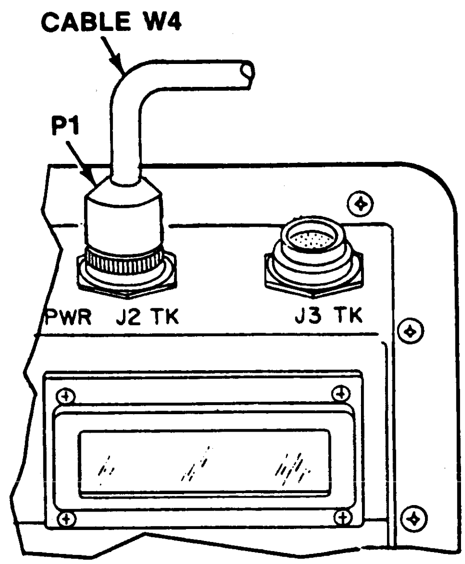
2-3-5. DISPLAY RPM WITH NEXT MEASUREMENT TEST #01 (cont) 2-3-5

B. CI HOOKUP AND TEST PROCEDURE

1. **Connect test cable.** Attach connector P1 of cable W4 to TK J2 or TK J3.



WARNING

To prevent damage to equipment or injury to personnel turn engine off before installing pulse tachometer.

CAUTION

Clean all mounting surfaces before installing pulse tachometer to prevent the entry of foreign substances that may damage the engine or transducer.

NOTE

If vehicle/equipment is equipped with a DCA, go to vehicle/equipment TM for correct procedure.

2. **Locate and disconnect vehicle/equipment tachometer cable.**

GO TO NEXT PAGE

2-3-5. DISPLAY RPM WITH NEXT MEASUREMENT TEST #01 (cont) 2-3-5

B. **CI HOOKUP AND TEST PROCEDURE** (cont)

NOTE

On vehicle/equipment with a tachometer on the instrument panel, it may be possible to disconnect drive cable from back of tachometer and connect STE/ICE-R pulse tachometer to it using adapter, TK item 31. If erratic readings occur, or if no measurement is detected, drive cable may be faulty. Connect pulse tachometer directly to engine, or right angle drive on engine. Locate point on vehicle/equipment for pulse tachometer installation.

3. **Install pulse tachometer, TK item 34, in place of the disconnected engine tachometer cable.**

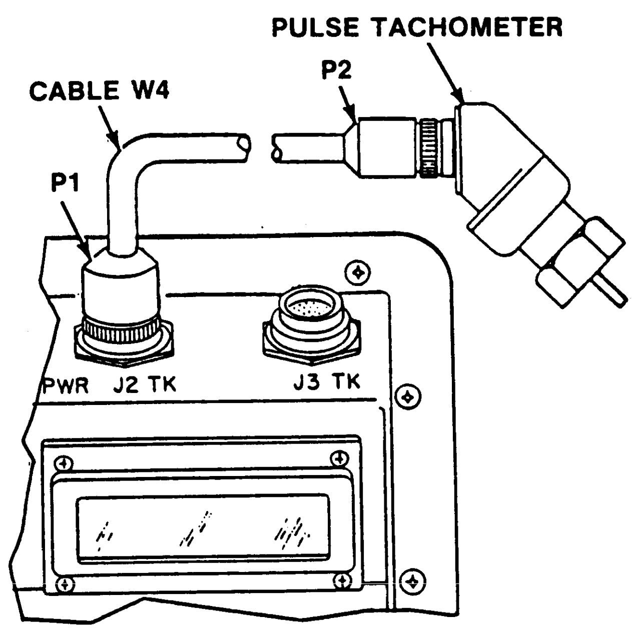
CAUTION

To prevent damage, make sure cable is clear of belts and fan blade.

NOTE

Make sure that take off point rotates at one half engine speed. Refer to vehicle/equipment TM before connecting tachometer.

4. **Connect tachometer.** Attach connector P2 of cable W4 to pulse tachometer, TK item 34.



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2-3-5. DISPLAY RPM WITH NEXT MEASUREMENT TEST #01 (cont) 2-3-5

5. Enter control function.

   a. Set TEST SELECT switches to 01.

   b. Press and release TEST button.

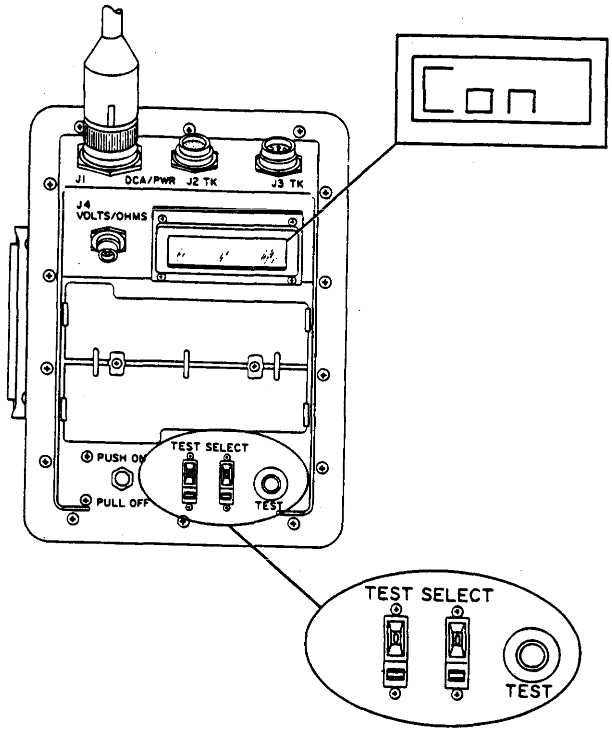
   c. Wait for VTM to display Con.

6. Perform measurement.

NOTE

Hookup and offset steps should already have been completed. Do not repeat.

Go to desired measurement procedure. Follow that procedure. VTM will alternately display the engine speed and the desired measurement. (The first number displayed will be rpm.)



END OF TASK

2-3-6. DISPLAY MINIMUM VALUE OF NEXT MEASSUREMENT TEST #02 2-3-6

Description:

This procedure causes VTM to display
• lowest value measured during a test.
Entering test 02 Into the VTM causes this function to be applied to the next test entered. For additional information, see paragraph 2-3-4.

Typical Applications:

Measure lowest manifold vacuum on SI engine.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Perform offset tests	2-3-1

Control Functions:

Compatible with 01, 05

Overrides 03, 04, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

NOTE

Go to test procedure for measurement to be performed with this control function. Do all hookup and offset steps before starting this procedure.

1. Enter control function.

   a. Set TEST SELECT switches to 02.

   b. Press and release TEST button.

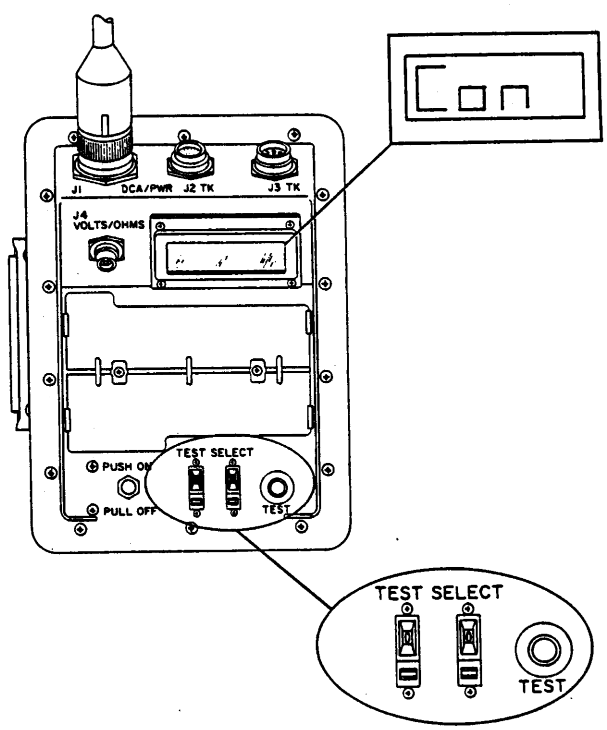
   c. Wait for VTM to display Con.

2. Continue controlled test.

   a. Go to test procedure for measurement to be performed with this control function.

   b. Continue with test procedure. Hookup and offset tests have been completed. Do not repeat.

   c. VTM will display lowest value measured since test was started.



END OF TASK

2-3-7. DISPLAY MAXIMUM VALUE OF NEXT MEASUREMENT TEST #03 2-3-7

Description:

This procedure causes VTM to display highest value measured during a test. Entering test 03 into the VTM causes this function to be applied to the next test entered. For additional information, see paragraph 2-3-4.

Typical Applications:

Measure maximum cylinder pressure.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Perform offset tests	2-3-1

Control Functions:

Compatible with 01, 05

Overrides 02, 04, 06

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. **Enter control function.**

   a. Set TEST SELECT switches to 03.

   b. Press and release TEST button.

   c. Wait for VTM to display Con.

2. **Continue controlled test.**

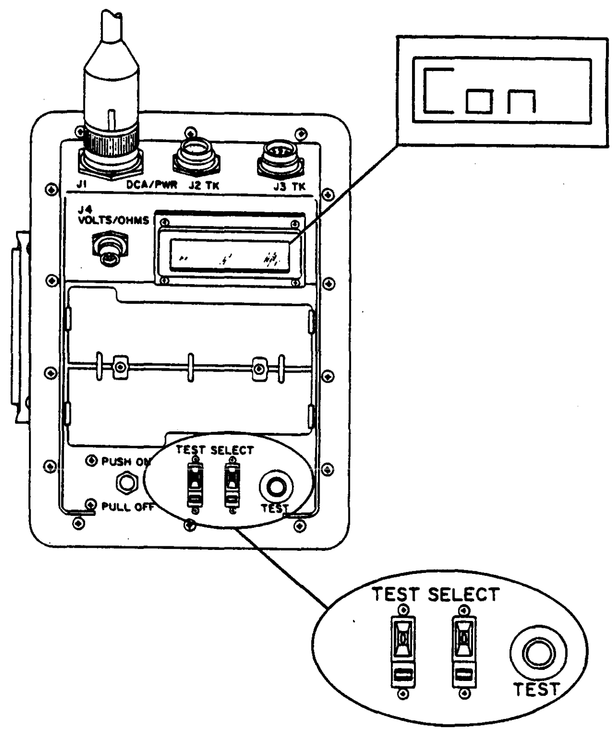
   a. Go to test procedure for measurement to be performed with this control function.

   b. Continue with test procedure. Hookup and offset tests have been completed. Do not repeat.

   c. VTM will display highest value measured since test was started.

NOTE

Go to test procedure for measurement to be performed with this control function. Do all hookup and offset steps before starting this procedure.



END OF TASK

2-3-8. DISPLAY PEAK TO PEAK VALUE OF NEXT MEASUREMENT TEST #04

2-3-8

Description:

This procedure causes VTM to display the difference between highest value and lowest value measured during a test. Entering test 04 into the VTM causes this function to be applied to the next test entered. For additional information, see paragraph 2-3-4.

Typical Applications:

Measure dwell variation of cam lobes.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Perform offset tests	2-3-1

Control Functions:

Compatible with 01, 05

Overrides 02, 03, 06

WARNING

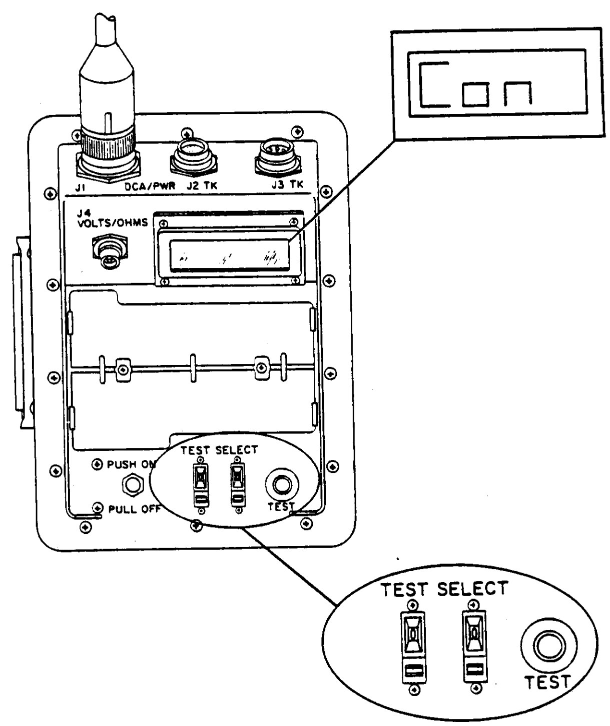
On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

NOTE

Go to test procedure for measurement to be performed with this control function. Do all hookup and offset steps before starting this procedure.

1. **Enter control function.**
   a. Set TEST SELECT switches to 04.
   b. Press and release TEST button.
   c. Wait for VTM to display Con.

2. **Continue controlled test.**
   a. Go to test procedure for measurement to be performed with this control function.
   b. Continue with test procedure. Hookup and offset tests have been completed. Do not repeat.
   c. VTM will display peak to peak value measured between display updates.



END OF TASK

2-3-9. SI FULL POWER SIMULATION TEST #05 2-3-9

Description:

This procedure allows VTM to perform tests in S1 full power simulation mode. This mode allows an SI engine to operate under maximum fuel and air flow at less than maximum speed. For additional information, see paragraph 2-3-4.

Typical Applications:

Test VTM interrupter circuits

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Perform offset tests	2-3-1
Enter VID	2-3-14
Enter number of cylinders	2-3-12

Possible Error Messages:

E009 Engine not running
E012 Ignition adapter missing
E014 Incorrect number of cylinders entered

Control Functions:

01, 02, 03, 04, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Do not perform test #05 on vehicles equipped with a catalytic converter. Damage to catalytic converter may result.

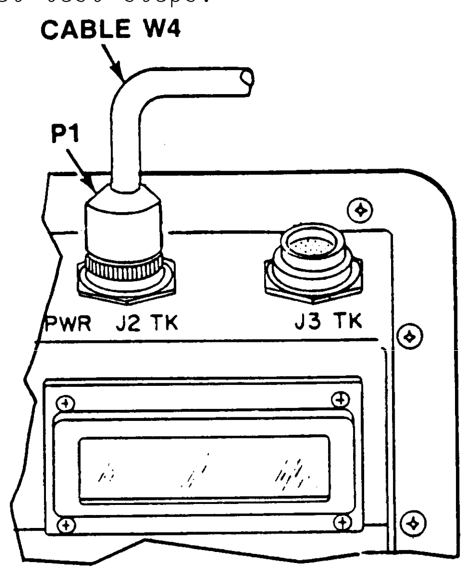
1. **Connect test cable.**

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

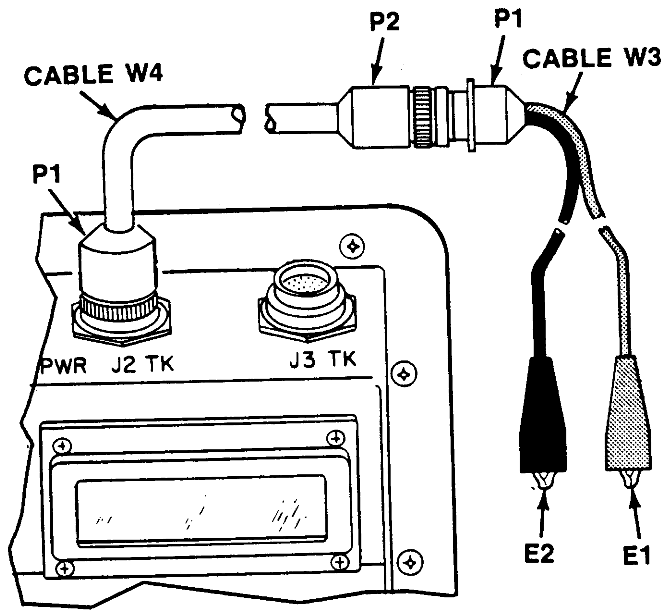
GO TO NEXT PAGE

NOTE

Before starting this procedure, go to test procedure for measurement that is to be performed under SI full power simulation and Perform all hookup and offset test steps.



2-3-9. SI FULL POWER SIMULATION TEST #05 (cont)



b. Attach connector P2 of cable W4 to connector P1 of cable W3.

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

NOTE

Locate vehicle/equipment test points where measurement is to be made.

2. Make cable connections.

a. Install ignition adapter, TK item 30, or locate the distributor terminal of coil primary.

b. Attach red clip E1 of cable W3 to ignition adapter, TK item 30, or distributor terminal of coil primary.

c. Attach black clip E2 of cable W3 to vehicle/equipment ground.

CAUTION

To prevent engine damage, engine governor speed must be checked before performing power simulation. If governor speed is not within limits specified for the vehicle/equipment, go to vehicle/equipment TM to adjust governor. Do not run power simulation if governor speed is not within specified limits.

GO TO NEXT PAGE

2-3-9. SI ULL POWER SIMULATION TEST #05 (cont) 2-3-9

CAUTION

To prevent engine damage do not run power simulation if idle speed cannot be properly adjusted.

NOTE

Engine idle speed must be checked before performing power simulation. If idle speed is not within limits specified for vehicle/equipment, adjust idle speed to be within proper limits.

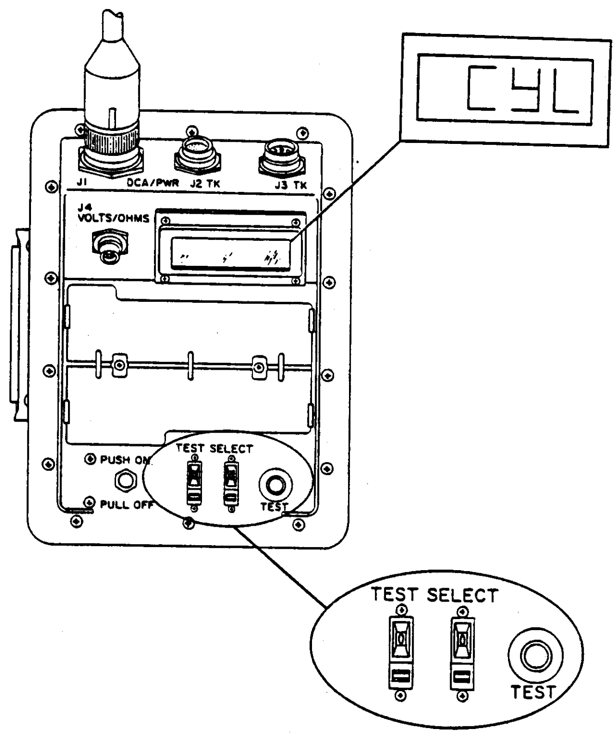
3. **Start and idle engine.**

   a. Set TEST SELECT switches to 10.

   b. Press and release TEST button.

NOTE

If a prompting message CYL appears on the display, refer to the vehicle/ equipment TM for the number of cylinders or cylinder pairs to enter in step d. If no CYL prompting message appears on the display, skip steps c thru f.



   c. Wait for prompting message CYL to appear on display.

   d. Set TEST SELECT switches to number of cylinders/cylinder pairs.

NOTE

The number of cylinders display will remain only a few seconds.

   e. Press and release TEST button

   f. Wait for VTM to display number of cylinders entered.

   g. Check idle speed. Adjust if necessary.

   h. Check high speed, but do not exceed vehicle rpm restrictions.

GO TO NEXT PAGE

2-3-9. SI FULL POWER SIMULATION TEST #05 (cont)

CAUTION

To prevent engine damage, operation of VTM interrupt circuit must be checked before proceeding.

4. Check interrupt circuitry.

   a. Press and release TEST button.

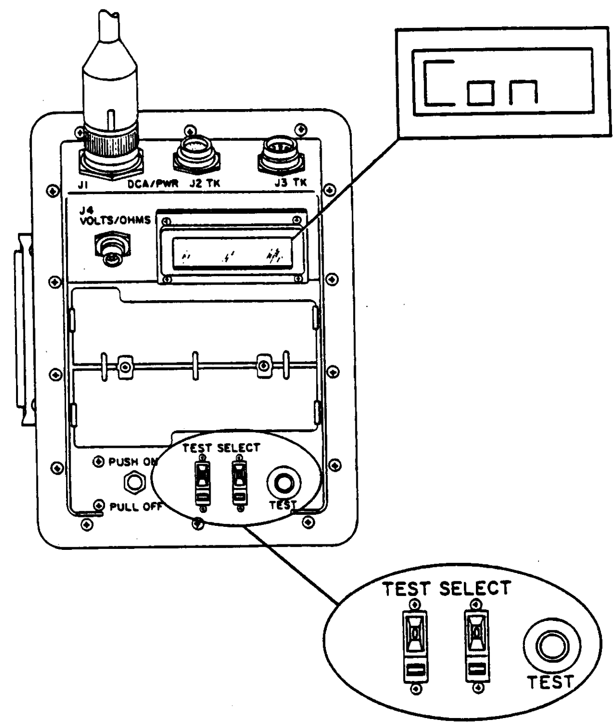
   b. Set TEST SELECT switches to 05.

CAUTION

To prevent engine damage, do not overspeed engine while doing step 4. Interrupt should occur at about 3500 rpm.

   c. Increase engine speed to slightly above 3500 rpm as shown on display. Hold speed constant.

   d. Press and release TEST button. If engine misses and VTM displays Con, release accelerator and proceed to step 5. If VTM does not display Con or does not begin missing, release accelerator and check all VTM connections and repeat step 4. If VTM still fails to display Con or does not begin missing, stop testing and go to Cable Fault Isolation, paragraph 3-2-3 to troubleshoot ignition adapter cable W3 and transducer cable W4. If no cable fault is found, then VTM cannot perform SI full power simulation. Continue other testing. When finished, return STE/ICE-R set to DS maintenance for repair.



GO TO NEXT PAGE

2-3-9. SI FULL POWER SIMULATION TEST #05 (cont) 2-3-9

CAUTION

To prevent engine damage, allow vehicle/equipment to idle for at least five minutes after performing SI full power simulation.

Discontinue simulation if engine temperature is above normal. Damage to vehicle/equipment may result.

NOTE

Do not proceed to step 5 until engine has reached normal operating temperature.

5. Initiate SI full power simulation.

CAUTION

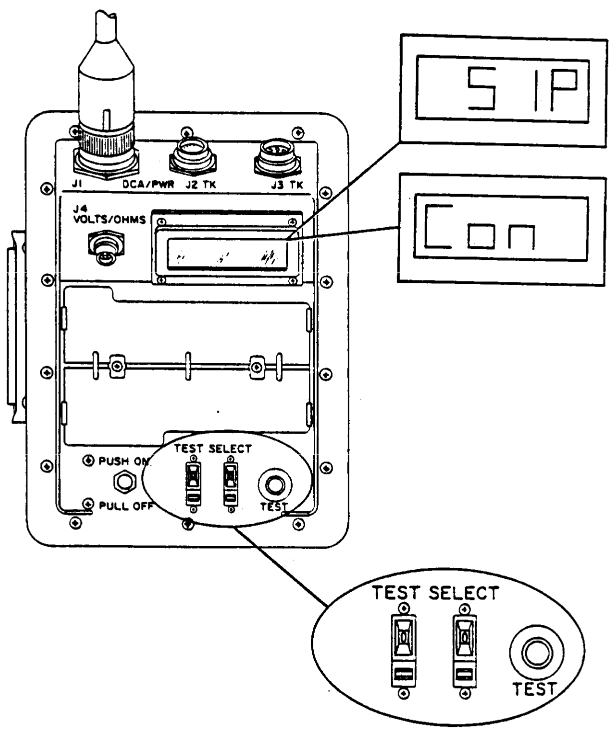
If engine sounds like it is overspeeding, release accelerator immediately. To prevent engine damage, check connections and repeat steps 4 and 5.

NOTE

The engine will run rough and may backfire. This is normal.

a. Press and release TEST button.

b. When SIP appears on display, press accelerator sharply and hold it to floor until Con appears on display.



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2-3-9. SI FULL POWER SIMULATION TEST #05 (cont) 2-3-9

NOTE

SI full power simulation will end i speed drops below 1600 RPM.

6. Continue controlled test.

CAUTION

When testing is complete, release accelerator to end simulation. Allow engine to idle 5 minutes.

Go to procedure for measurement to which this control function is to be applied. Continue with test procedure. Hookup and offset steps have been completed. Do not repeat.

END OF TASK

2-3-10. DISPLAY TWO MEASUREMENTS TEST #06

Description:

This procedure causes VTM to display alternate measurements. The display will alternate between the value of the first measurement and the value of the second measurement. For additional information, see paragraph 2-3-4.

Typical Applications:

Adjust by-pass valves and main pumps on motor generators and cranes.

Determine proper operation of charging system.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Perform offset tests	2-3-1

Possible Error Messages:

E028 Test just entered cannot be used with control function 06.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing al 1 testing with the vehicle master switch on.

NOTE

Go to test procedure for measurement to be performed with this control function. Do all hookup and offset steps before starting this procedure.

1. Enter control function.

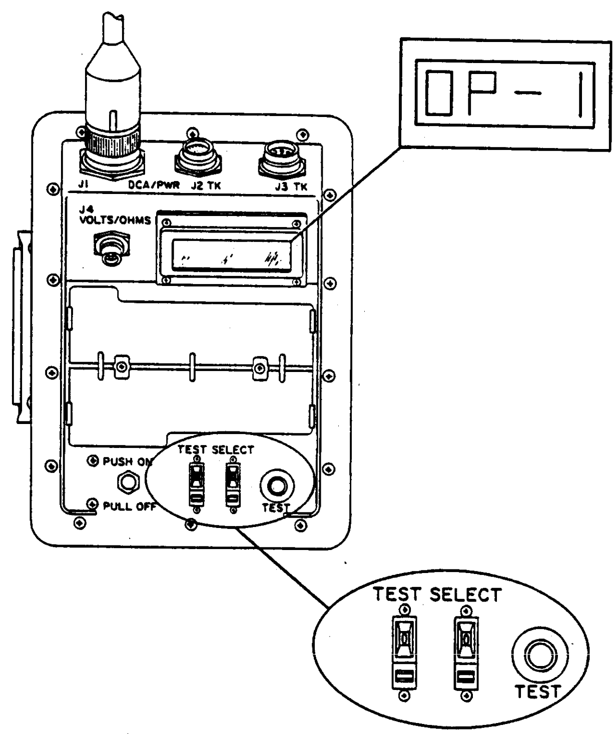
   a. Set TEST SELECT switches to 06.

   b. Press and release TEST button.

   c. Wait for VTM to display OP-1.

   d. Set TEST SELECT switches to the number of the first desired measurement.

   e. Press and release TEST button.



GO TO NEXT PAGE

2-3-10. DISPLAY TWO MEASUREMENTS TEST #06 (Cont)

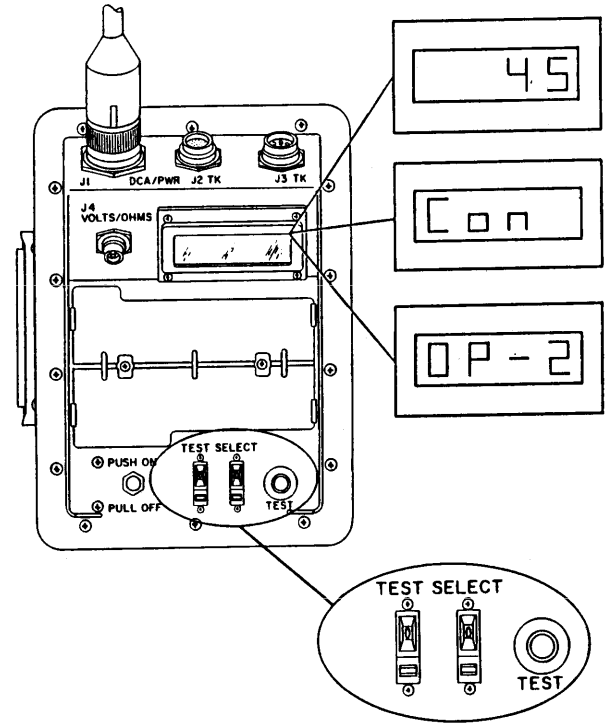
NOTE

The VTM will display the number just entered, then the Con message, and finally the OP-2 message. A typical sequence of these displays is shown in the illustration for test #45.

f. Wait for VTM to Display OP-2.

g. Set TEST SELECT switches to the number of the second desired measurement.

h. Press and release TEST button.



NOTE

The VTM will display the number just entered, then the Con message, then continuously display in the following order - both test numbers, the value of the first measurement, and the value of the second measurement. A typical sequence of these displays is shown in the illustration for test #89.

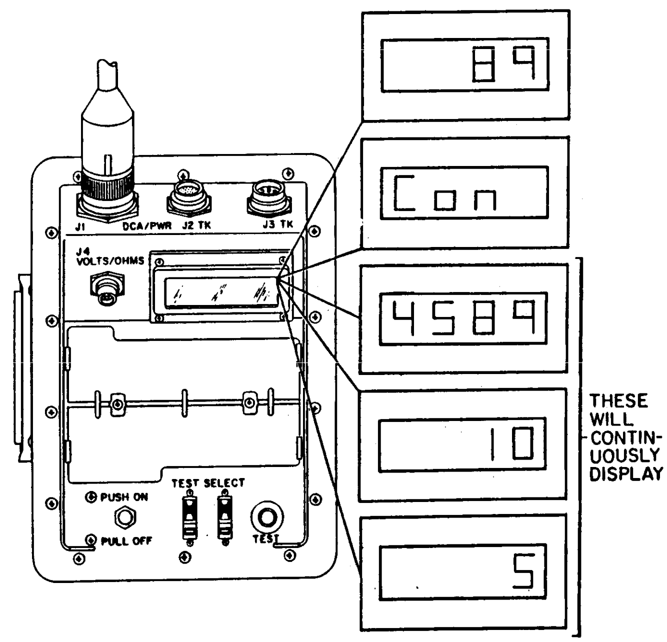
2. **Perform measurements.**

NOTE

Hookup and offset steps should already have been completed. Do not repeat.

a. Go to desired measurement procedures. Follow those procedures.

b. VTM will alternately display both test numbers and the values of the two measurements.



END OF TASK

2-3-11. DATA/ID ENTRY/DISPLAY FUNCTIONS 2-3-11

A. DATA ENTRY TESTS #58, #60

It is sometimes necessary to enter vehicle information into the VTM in order to run a test. Certain tests require that a VID or the number of cylinders be entered. The set-up table of a procedure will list any required entries as a pre-test procedure. Tests #01, #05, #10, #11, #12 and #16 on SI engines require number of cylinders information. Special tests #13, #14, and #15 require a VID. In addition, to run properly, some other tests may require a VID.

1. Test #58 is used to enter the number of cylinders or cylinder pairs into the VTM. This information remains in the VTM until test #58 is repeated, or another test enters new information, or the VTM is turned off. If the vehicle/equipment has a VID assigned, then test #60 should be used. Refer to table 2-8 or to the vehicle/ equipment TM to determine if a VID has been assigned. Refer to paragraph 2-3-12 to perform test #58. Error message E007 will occur if the number-of-cylinders information being entered conflicts with the number-of-cylinders information stored from a previous test #60. The new cylinder information will be accepted by the VTM.

2. Test #60 is used to enter the vehicle identification number into the WM. This VID remains in the VTM until another VID is entered (tests 13, 14, 15, or 60) or the VTM is turned off. Test #60 will accept VID numbers 01 through 99. Some of these VID numbers have been programmed with particular information (see Table 2-8). If one of these VID numbers is entered with test #60, then the number-of-cylinders information will automatically be entered during test #60. Otherwise, the test requiring the number-of-cylinders information will use the prompt message CYL to request the data. Refer to paragraph 2-3-14 to perform test #60. Refer to vehicle/equipment TM or table 2-8 to see if a VID has been assigned. When connected to a DCA, an E010 error message may occur if the VID entered conflicts with the type of DCA information stored in the VTM.

B. DATA DISPLAY TESTS #59, #61, #62, #63, #64

Data display tests are used to display data previously stored in the VTM or to read the type of transducer or DCA harness that the VTM is connected to. Stored data can result from data entry tests or prompt messages.

1. Test #59 displays the number-of-cylinders information stored in the VTM by test #58, test #60, or as a result of a CYL prompt message during a test. Refer to Appendix G, Vehicle Test Cards, or to the vehicle/equipment TM to compare this value with the listed value. Refer to paragraph 2-3-13 to perform test #59.

2. Test #61 displays the VID stored in the VTM by test #60, or as a result of a UEH prompt message during a test. Refer to table- 2-8 or to the vetiicle/equipment TM to compare this value with the listed value. Refer to paragraph 2-3-15 to perform test #61.

GO TO NEXT PAGE

2-3-11. DATA/ID ENTRY/DISPLAY FUNCTIONS (cont)

3. Test #62 displays the ID for the type of DCA installed in the vehicle/equiPrnent under test. Refer to table 2-9 or to the vehicle/equipment TM to compare this value with the listed value. Refer to paragraph 2-3-16 to perform test #62.

4. Test #63 displays the ID for the transducer connected to J2 of the VTMO Refer to table 2-7 to compare this value with the listed value. Refer to paragraph 2-3-17 to perform test #63.

5. Test #64 displays the ID for the transducer connected to J3 of the VTMO Refer to table 2-7 to compare this value with the listed valueo Refer to Paragraph 2-3-18 to perform test #64.

Table 2-7 Transducer ID Numbers

TRANSDUCER	TK ID	TK ITEM NUMBER
Pressure -15 to +25 psig (red stripe)	4	22
Pressure 0 to 1000 psig (blue stripe)	7	17
Pressure 0 to 10,000 psig (see Appendix C)	9	None
Ignition Adapter Cable W3	1	None
Pulse Tachometer	10	34
Current Probe	13	11

NOTE: TK ID numbers are not the same as TK item numbers

Table 2-8 Partial list of VID numbers

VEHICLE	VID
M2/M3/MLRS	16
M35/44	02
M48/M60	04
M107/M110/M578	10
M109	11
M113	03
M123	07
M151	01
M520	08
M551	12
M561	09
M809/M813	06

VEHICLE	V I D
M880	05
M915	15
M939	19
M977	18
M992	11
M998	21
M1008	23
M9ACE	24
LAV	29
LVTP7	14
LTVP7A1	13

Table 2-9 Partial list of DC ID numbers

VEHICLE	DCA ID
M2/M3/MLRS	3, 13
M35/M44	1
M48/M60	5
M107/M109	6
M110/M578/M977	6
M113/M561	2
M123	8
M520	9
M551	1
M809	3
M915	8
M939	3
M998	8
M1008	4
M9ACE	3
LAV	3
LTVP7A1	3, 13

END OF PARAGRAPH

2-3-12. ENTER NUMBER OF CYLINDERS TEST #58 2-3-12

Description:

This procedure allows user to enter the number of cylinders or cylinder pairs into the VTM. Entering the number of cylinders allows VTM to measure engine speed, cranking speed, power in RPM/SEC, and dwell angle, on an SI engine if VID is not known. If a VID is known, use VID entry, test #60. For additional information, see paragraph 2-3-11.

Application:

Enter number of cylinders for SI engine when a VID is unknown. The VTM will only accept entries 2, 3, 4, 5, 6, 8, or 10 cylinders.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

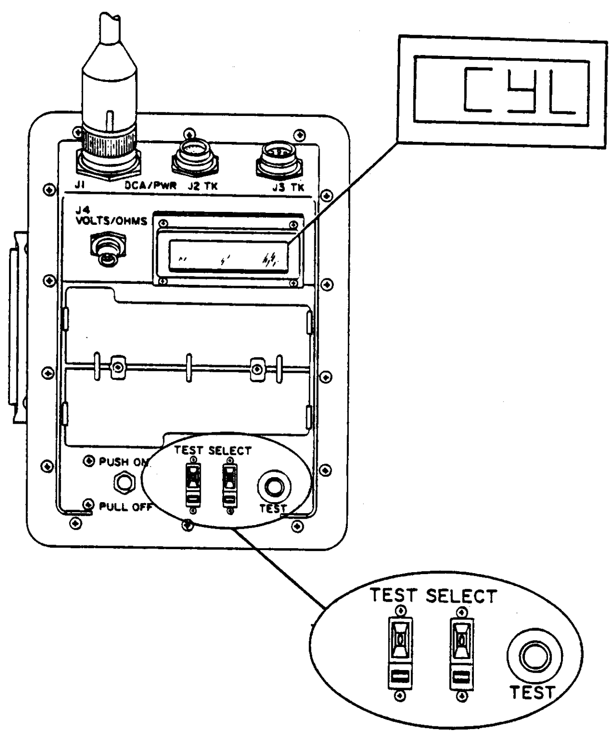
Possible Error Messages:

E007 Number of cylinders entered does not agree with previously entered VID

E014 Number of cylinders entered is not 2, 3, 4, 5, 6, 8, or 10.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.



1. **Enter number of cylinders.**

   a. Set TEST SELECT switches to 58.

   b. Press and release TEST button.

   c. Wait for prompting message CYL to appear on display.

   d. Set TEST SELECT switches to number of cyliriders.

   e. Press and release TEST button.

   f. Wait for VTM to display number of cyliriders entered.

END OF TASK

2-3-13 DISPLAY NUMBER OF CYLINDERS TEST #59

Description:

This procedure allows the user to check the number of cylinders information that is stored in the VTM. For additional information, see paragraph 2-3-11.

Application:

To check that the correct number of cylinders has been entered.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E000 Data not available

WARNING

On vehicles with a master switch in the negative (-) battery cables sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Display number of cylinders.

   a. Set TEST SELECT switches to 59.

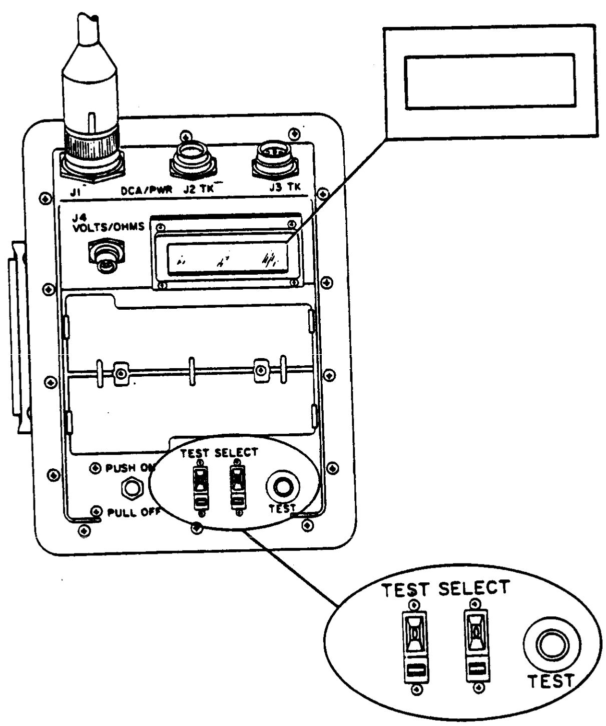
   b. Press and release TEST button.

   NOTES

   Error message E000 means that number of cyliniders information has not been entered into VTM.

   When the number of cyliniders is from a VID entry, the correct displayed value is sometimes the number of cylinder pairs (one-half the number of cylinders).

   c. Observe displayed value (number of cylinders or cylinder pairs).



END OF TASK

2-3-14. ENTER VEHICLE IDENTIFICATION TEST #60 2-3-14

Description:

This procedure allows a user to enter a VID into VTM. The VTM has been programmed to recognize a particular VID. Entering the VID allows the VTM to perform special vehicle dependent tests. For additional information, see paragraph 2-3-11.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E010 VID does not agree with attached DCA class

VID entered is out of range (i.e., VID = 0).

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Enter VID.

   a. Set TEST SELECT switches to 60.

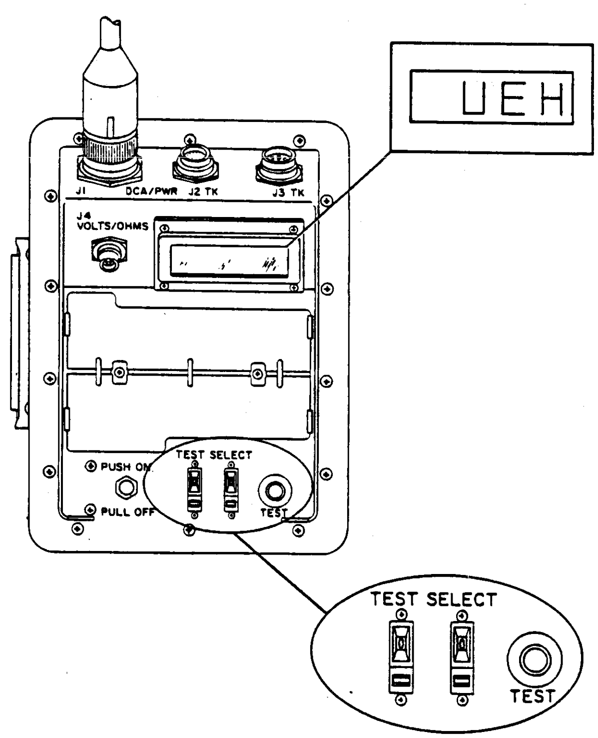
   b. Press and release TEST button.

   c. Wait for prompting message UEH to appear on display.

   d. Set TEST SELECT switches to VID for vehicle being tested.

   e. Press and release TEST button.

   f. Wait for VTM to display and hold VID number.



END OF TASK

2-3-15. DISPLAY VEHICLE IDENTIFIMTION TEST #61

Description:

This procedure allows the user to check VID information that is stored in the VTM. For additional information, see paragraph 2-3-11.

Application:

To check that the correct VID has been entered

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E000 Data not available

WARNING

On vehicles with a master switch in the negative (-) battery cables sparking may occur if the VIM case touches the vehicle while master switch is off and VIM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Display VID.

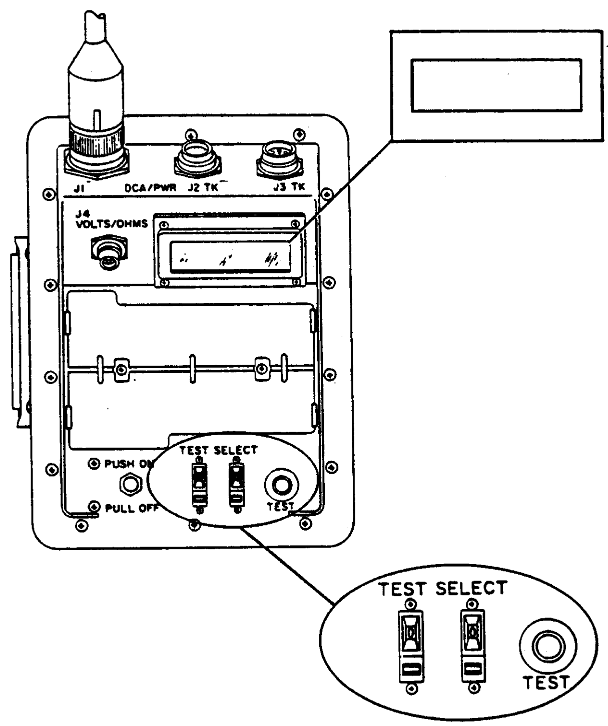
   a. Set TEST SELECT switches to 61.

   b. Press and release TEST button.

   NOTE

   Error message E000 means that no VID has been entered into the VTM.

   c. Observe displayed value (VID). Refer to table 2-8.



END OF TASK

2-3-16. DISPLAY DCA IDENTIFICATION TEST #62

Description:

This procedure allows the user to check the DCA ID when the VTM is powered through the DCA cable W1. For additional information, see paragraph 2-3-11.

Application:

To verify the generic DCA class of harness to which VTM is attached.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E000 Data not available

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTK is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Display generic DCA ID class.

   a. Set TEST SELECT switches to 62.

   b. Press and release TEST button.

   NOTE

   Error message E000 means that VTM is not connected to a DCA.

   c. Observe displayed value (DCA ID number) . Refer to table 2-9.

END OF TASK

2-3-18. DISPLAY J2 TK TRANSDUCER ID TEST #63 2-3-18

Description:

This procedure allows the user to check TK ID of the transducer attached to VTM connector J2 TK. For additional information, see paragraph 2-3-11.

Application:

To check that correct transducer is attached

Pre-Test Procedures:

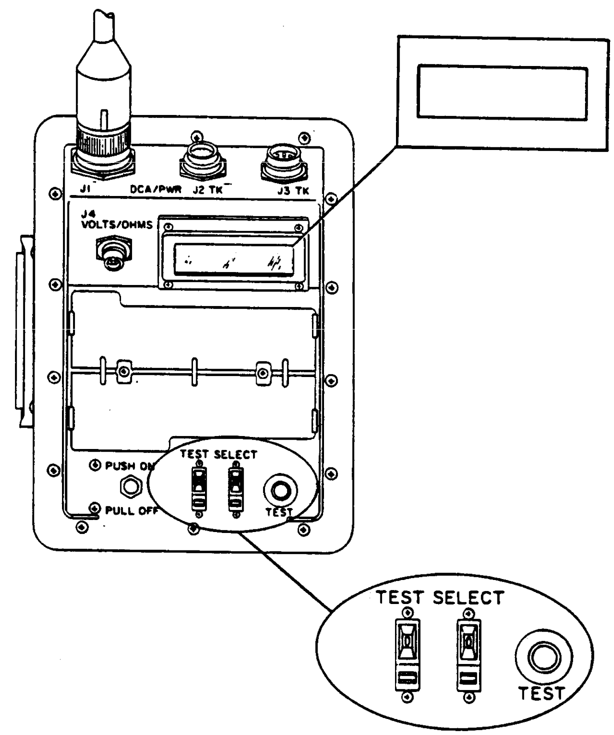
Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E000 Data not available

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.



1. Display J2 TK ID.

   a. Set TEST SELECT switches to 63.

   b. Press and release TEST button.

   NOTES

   TK ID numbers are rot the same as TK item numbers.

   Error message E000 means that no transducer is attached to VTM connector J2 TK.

   c. Observe displayed value (TK ID number). Refer to table 2-7.

END OF TASK

2-3-19. GENERAL MEASUREMENTS 2-3-19

General measurements are those for which the VTM does not require a vehicle identification number in order to conduct the measurement. These include voltage, pressure, current, resistance etc. These measurements are useful in troubleshooting equipment such as air conditioners, electric generators, vehicles etc.

This part of the manual includes a procedure for each of the measurements. Each procedure consists of two parts, a set-up table and the sequence of steps required to perform the measurement. The How-To-Use section in the front of this manual describes both of these parts in detail.

Some general measurements can also be made through a diagnostic connector assembly mounted in a vehicle (DCA mode). The procedures for making the measurements are the same once the hookups are established.

The following table lists the STE/ICE-R general measurements. Also refer to tab 2-5, Test Selection Guide, for a listing-of all tests.

Table 2-10 General Measurement Tests

TEST NO.	MEASUREMENT NAME	PARAGRAPH
* 10	Engine RPM (average)	2-3-20
* 11	Engine RPM (cranking)	2-3-21
* 16	Dwell angle	2-3-22
* 17	Points voltage	2-3-23
45	Vacuum 0 to 30 inch mercury	2-3-24
46	Vacuum Variation 0 to 30 inch mercury	2-3-25
47	Pressure 0 to 50 inch mercury	2-3-26
48	Vacuum 0 to 150 inch water	2-3-27
49	Pressure 0 to 25 psig	2-3-28
50	Pressure 0 to 1000 psig	2-3-29
51	Pressure 0 to 9999 psig (optional transducer req'd)	2-3-30
* 67	Battery voltage	2-3-31
88	Live circuit resistance (Low Ohms)	2-3-32
89	DC voltage 0 to 45 VDC	2-3-33
90	DC current 0 to 1500 amps	2-3-34
91	Resistance and continuity 0 to 4500 ohms	2-3-35
92	Resistance 0 to 40 Kohms	2-3-36
93	AC voltage 0 to 35 volts	2-3-37
95	AC current 0 to 700 amps	2-3-38
96	AC frequency 40 to 500 hz (Test Probe)	2-3-39
97	AC frequency 40 to 500 hz (Current Probe)	2-3-40

* General measurements which can be performed in both DCA and TK modes.

END OF PARAGRAPH

2-3-20. ENGINE RPM (AVERAGE) TEST #10 2-3-20

Description:

This procedure measures engine speed in the range of 50 to 5000 rpm for most SI and most CI engines. The test methods for SI and CI engines are different.

For SI engines, the VTM measures the speed of the opening and closing of the ignition points or the on-off switching of electronic ignitions. The number of cylinders or VID must be entered into the VTM. This test may be used on 2, 3, 4, 5, 6, 8 or 10 cylinder SI engines.

For CI engines, the pulse tachometer, TK item 34, is used to measure engine speed. No VID or number of cylinders information is required.

At speeds below 50 RPM, the VTM will display 0. At speeds above 5,000 RPM, the display may give a false reading.

Typical Applications:

Check engine speed on SI or CI engines.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Enter VID (SI engine only)	2-3-14
or number of cylinders (SI engine only)	2-3-12

Possible Error Messages:

E014 Incorrect # of cylinders entered

Control Functions:

05

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

NOTE

If testing SI engine, do procedure A.
If testing CI engine, do procedure B.

GO TO NEXT PAGE

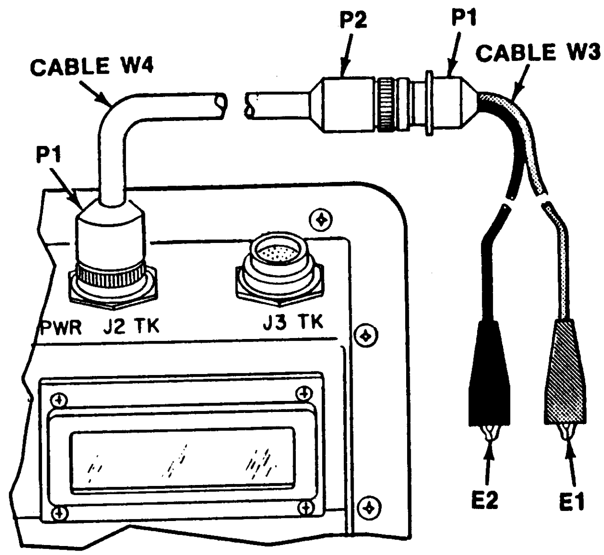
2-3-20. ENGINE RPM (AVERAGE) TEST #10 (cont) 2-3-20

A. SI HOOKUP AND TEST PROCEDURE

1. Connect cables.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK of VTM.

   b. Attach connector P2 of cable W4 to connector PI of cable W3.



WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition adapter cable or ignition adapter to vehicle.

NOTE

Locate vehicle/equipment test points where measurement is to be made.

2. Connect cable W3 to test point.

   a. Install adapter, TK item so, or locate the distributor terminal of the coil primary.

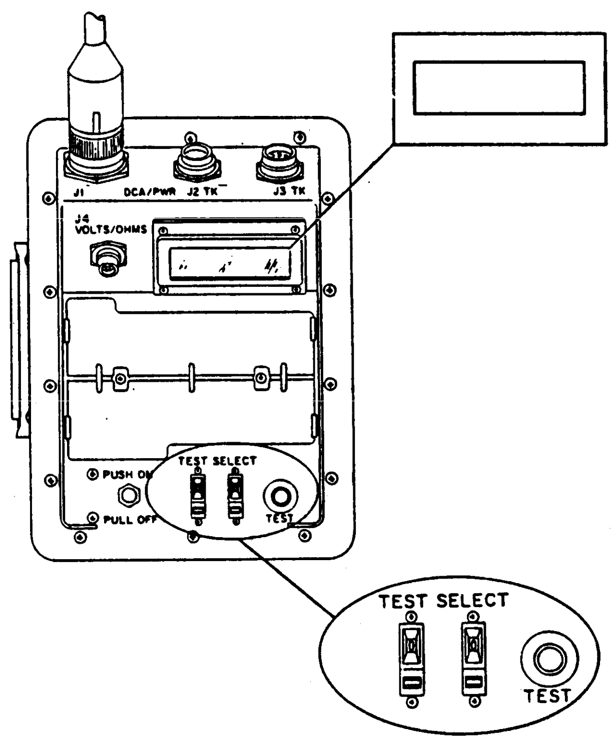
   b. Attach red clip E1 of cable W3 to adapter, TK 30, or distributor terminal of coil primary.

   c. Attach black clip E2 of cable W3 to vehicle/equipment ground.

3. Check engine speed.

   a. Set TEST SELECT switches to 10.

   b. Press and release TEST button.



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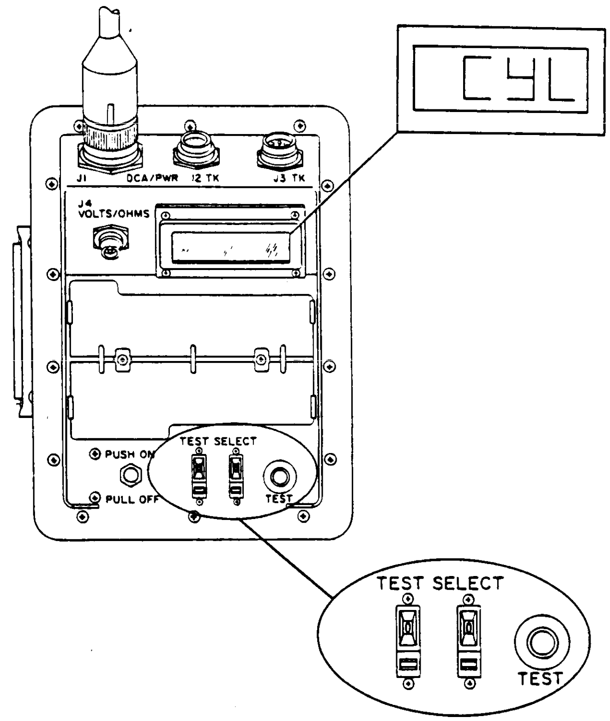
2-3-20. ENGINE RPM (AVERAGE) TEST #10 (cont) 2-3-20

A. SI HOOK UP AND TEST PROCEDURE (cont)

NOTE

If a prompting message CYL appears on the display, refer to the vehicle/equipment TM for the value of cylinders or cylinder pairs to enter in step d. If no CYL prompting message appears on the display, skip steps c to f.



c. Wait for prompting message CYL to appear on display.

d. Set TEST SELECT switches to number of cylinders/cylinder pairs.

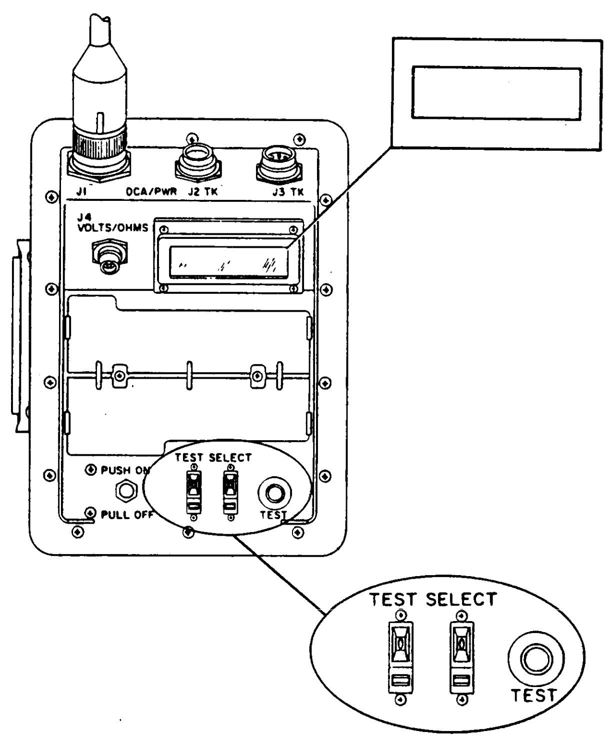
NOTE

The cylinders display value will remain on the display only a few seconds.

e. press and release TEST button

f. Wait for VTM to display number of cylinders entered.

g. Turn on ignition switch.



CAUTION

Do not overspeed the engine while performing test #10. Engine damage can result.

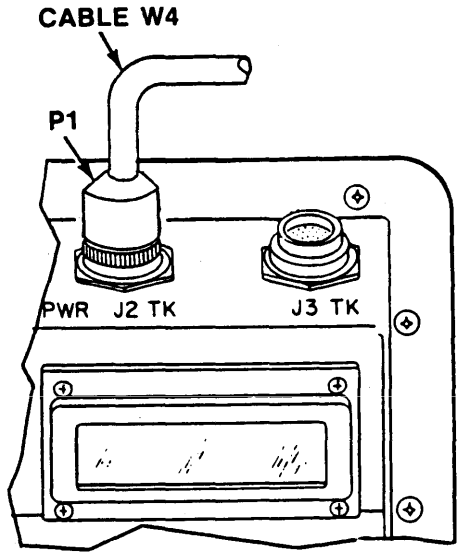
d. Start engine.

e. Observe displayed value (RPM).

GO TO NEXT PAGE

B. CI HOOKUP AND TEST PROCEDURE

1. Connect test cable. Attach connector PI of cable W4 to J2 TK or J3 TK.



NOTES

If vehicle is equipped with a DCA, go to vehicle/equipment TM for correct procedure.

On vehicle/equipment with tachometer on instrument panel, it may be possible to disconnect the drive cable from back of tachometer and connect pulse tachometer, TK item 34, using adapter, TK item 31. If erratic readings occur, or no measurement is detected, drive cable may be faulty. Connect pulse tachometer directly to engine (or right angle drive on engine). Locate test point on vehicle/equipment for installation.

2. Disconnect vehicle/equipment tachometer cable.

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before installing pulse tachometer.

CAUTION

Clean all mounting surfaces before installing pulse tachometer to prevent the entry of foreign substances that may damage the engine or transducer.

3. Install pulse tachometer, TK item 34, in place of disconnected engine tachometer cable.

GO TO NEXT PAGE

2-3-20. ENGINE RPM (AVERAGE) TEST #10 (cont) 2-3-20

B. CI HOOKUP AND TEST PROCEDURE (cont)

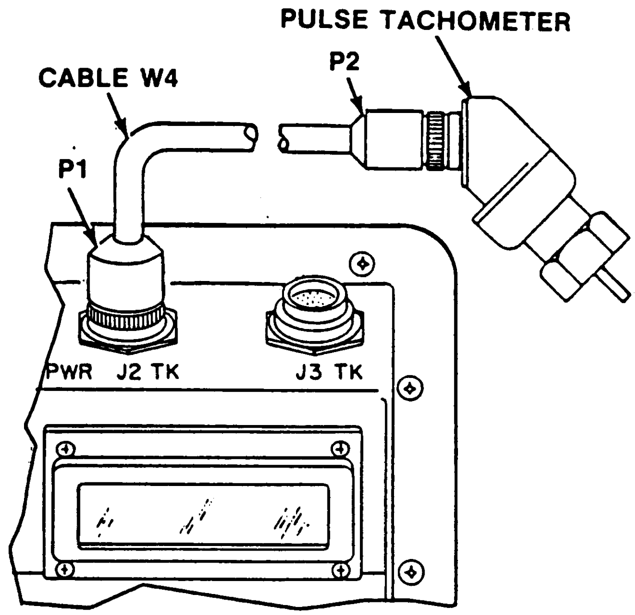
CAUTION

To prevent cable damage, make sure cable is clear of belts and fan blade.

NOTE

Check that take off point rotates at one half engine speed. Refer to vehicle/equipment TM before connecting tachometer.

4. **Connect tachometer.** Attach connector P2 of cable W4 to pulse tachometer, TK item 34.



5. **Check engine speed.**

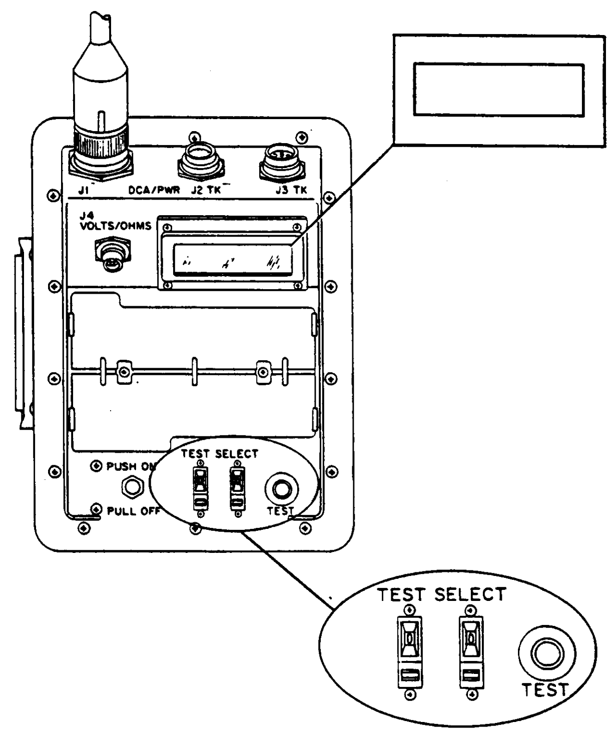
a. Set TEST SELECT switches to 10.

b. Press and release TEST button.

c. Turn on master switch.

d. Start engine.

e. Observe displayed value (RPM).



END OF TASK

2-3-21. ENGINE RPM (CRANKING) TEST #11

2-3-21

Description:

This procedure measures SI engine cranking speed in the range of 50 to 250 RPM. The VTM prevents spark plug firing and permits the engine to be operated without starting. This test requires that the number of cylinders or VID be entered into the VTM to obtain test results. At speeds below 50 rpm, the VTM will display 0. At speeds above 250 rpm, the VTM may give a false reading.

Typical Applications:

SI engine cranking speed

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Enter VID	2-3-14
or number of cylinders	2-3-12

Possible Error Messages:

E012 Ignition adapter/pulse tachometer missing
E014 Incorrect number of cylinders entered
E018 Test discontinued

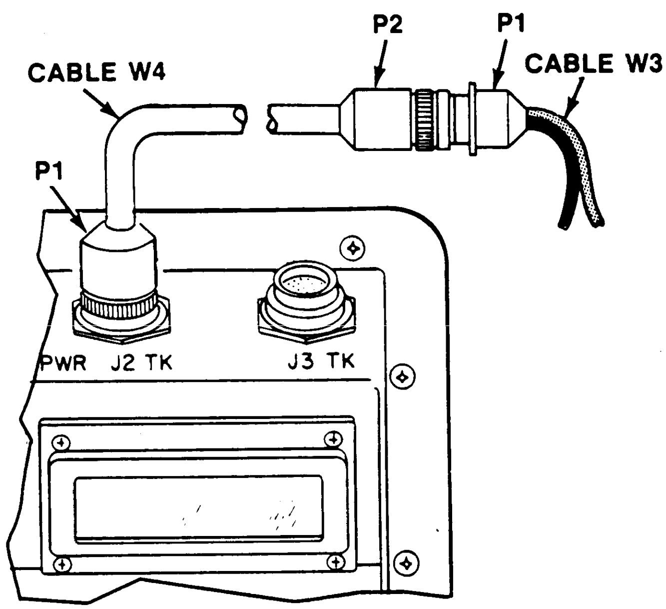
WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Connect test cables.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Attach connector P2 of cable W4 to connector P1 of cable W3.



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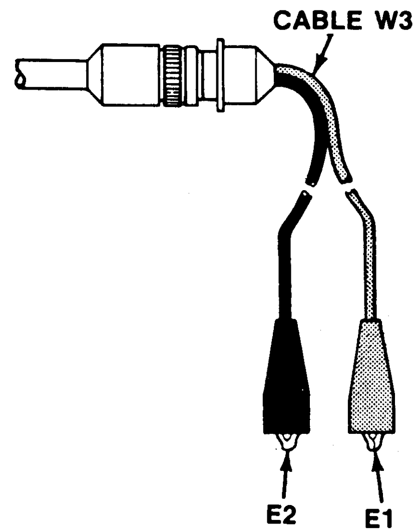
2-3-21. ENGINE RPM (CRANKING) TEST #11 (cont) 2-3-21

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

NOTE

Locate vehicle/equipment test points where measurement is to be made.



2. Make cable connections.

   a. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.

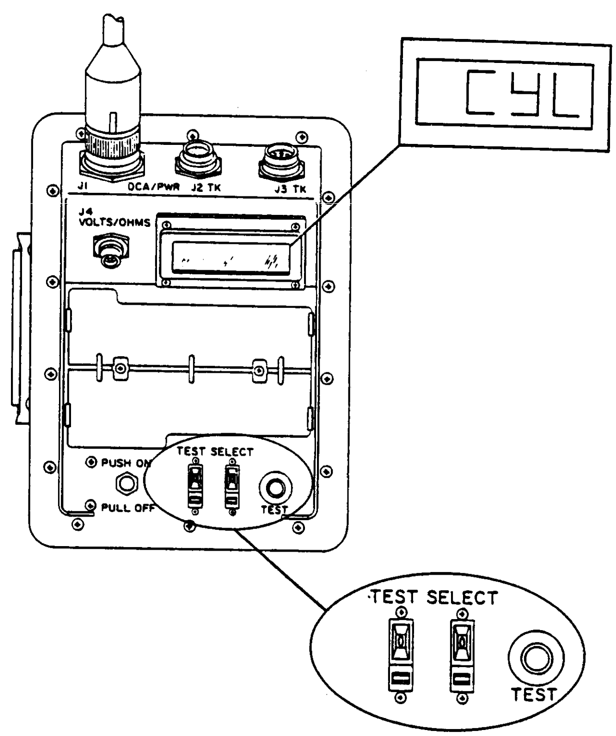
   b. Attach red clip E1 of cable W3 to ignition adapter, TK item 30, or distributor terminal of coil primary.

   c. Attach black clip E2 of cable W3 to vehicle/equipment ground.

3. Check engine speed.

   a. Set TEST SELECT switches to 11.

   b. Press and release TEST button.



NOTE

If a prompting message CYL appears on the display, refer to the vehicle/equipment TM for the value of cylinders or cylinder pairs to enter in step d. If no CYL prompting message appears on the display, skip steps c to f.

   c. Wait for prompting message CYL to appear on display.

   d. Set TEST SELECT switches to number of cylinders/cylinder pairs.

GO TO NEXT PAGE

2-3-21. ENGINE RPM (CRANKING) TEST #11 (cont)

NOTE

The cylinders display value will remain on the display only a few seconds.

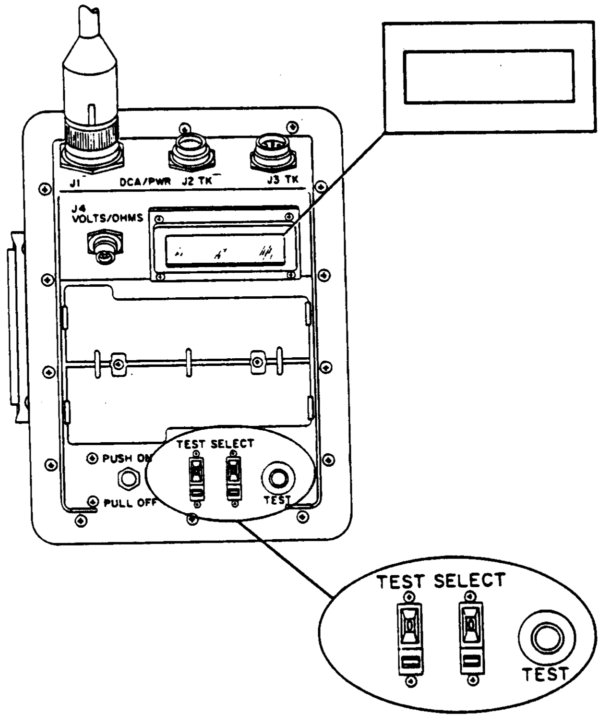
e. Press and release TEST button

f. Wait for VTM to display number of cylinders entered.

g. Turn on ignition switch.

h. Engage starter switch to turn engine over long enough to obtain reading.

i. Observe displayed value (RPM).



END OF TASK

2-3-22. DWELL ANGLE TEST #16 2-3-22

Description:

This procedure measures the number of degrees the ignition points are closed while the engine is running. It is an alternate method of checking the point gap without removing the distributor cover.

Typical Applications:

Check point gap (dwell angle)

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Enter VID	2-3-14
or number of cylinders	2-3-12

Possible Error Messages:

E012 Ignition adapter/pulse tachometer missing
E014 Incorrect number of cylinders entered

Control Functions:

01, 02, 03, 04, 05, 06

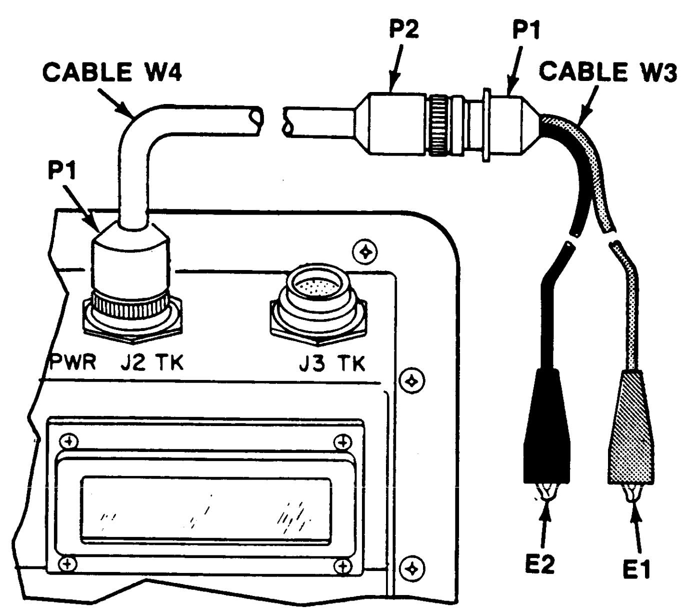
WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Connect test cables.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Attach connector P2 of cable W4 to connector P1 of cable W3.

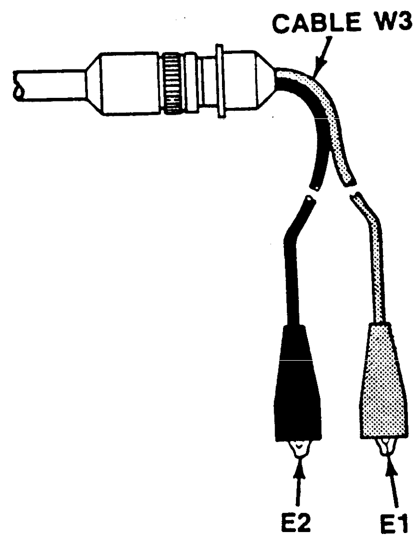


END OF TASK

2-3-22. DWELL ANGLE TEST #16 (cont)

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.



NOTE

Locate vehicle/equipment test points where measurement is to be made.

2. Make cable connections.

   a. Install ignition adapter, TK item 30, or locate distributor terminal of the coil primary.

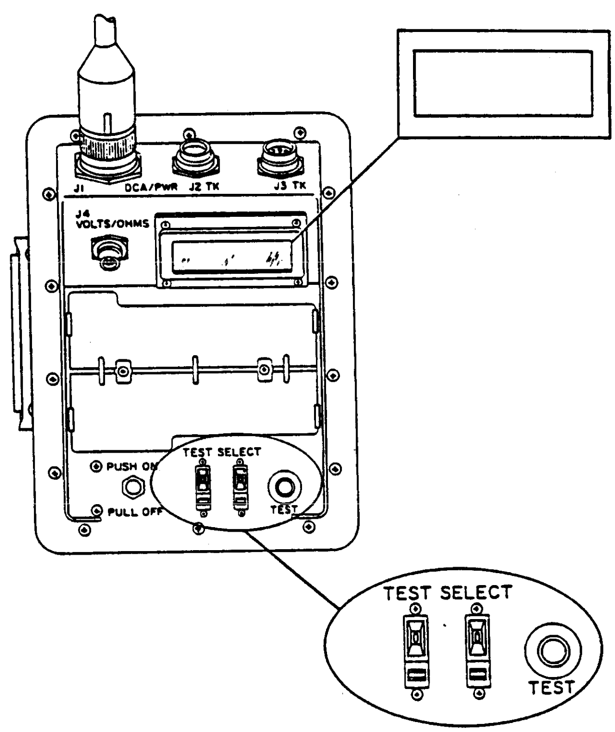
   b. Attach red clip E1 of cable W3 to ignition adapter, TK item 30, or distributor terminal of coil primary.

   c. Attach black clip E2 of cable W3 to vehicle/equipment ground.

3. Measure dwell angle.

   a. Start engine and set idle.

   b. Set TEST SELECT switches to 16.



NOTE

Dwell test gives best results at low idle RPM. Unless otherwise specified by vehicle/equipment TM, set engine speed at idle RPM.

   c. Press and release TEST button.

END OF TASK

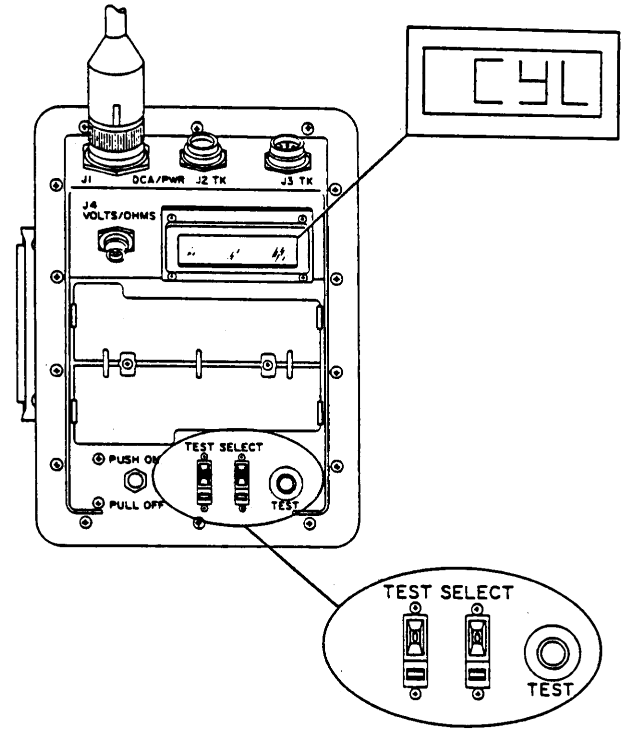
2-3-22. DWELL ANGLE TEST #16 (cont) 2-3-22

NOTE

If a prompting message CYL appears on the display, refer to the vehicle/ equipment TM for the value of cylinders or cylinder pairs to enter in step e. If no CYL prompting message appears on the display, skip steps d to g.

d. Wait for prompting message CYL to appear on display.

e. Set TEST SELECT switches to number of cylinders/cylinder pairs.



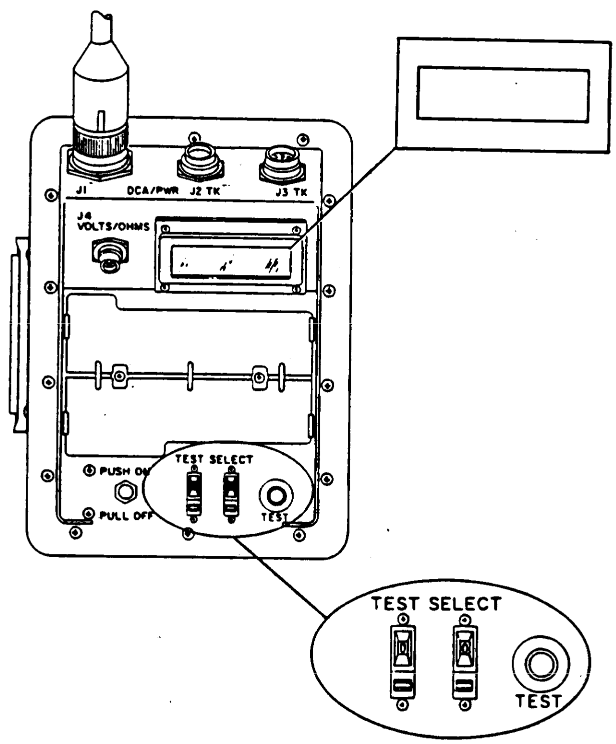
NOTE

The cylinders display value will remain on the display only a few seconds.

f. Press and release TEST button

g. Wait for VTM to display number of cylinders entered.

h. Observe displayed value (degrees).



END OF TASK

2-3-23. POINTS VOLTAGE TEST #17 2-3-23

Description:

This procedure measures the DC voltage drop across the points in the range of 0.0 to 2.0 volts. It indicates the condition of the points. A voltage (usually greater than 0.2 volts) drop with the points closed indicates burned or pitted points, while a small voltage drop shows good point contact.

This test must be done with the engine off and the points closed. If a measurement results in a display of .9.9.9.9, it indicates that the points are open, and must be closed for satisfactory completion of the test.

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E012 Ignition adapter/pulse tachometer missing

Control Functions:

01, 02, 03, 04, 05, 06

Typical Applications:

Check condition of points

References:

Vehicle/Equipment TM

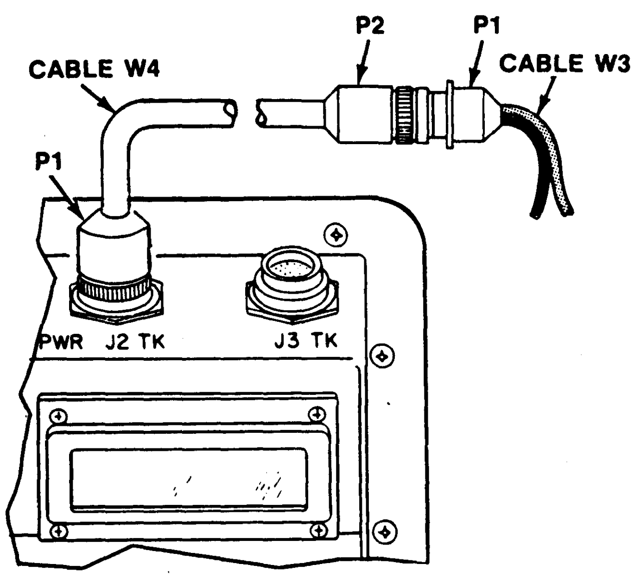
WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking My occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Connect test cables.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Attach connector P2 of cable W4 to connector P1 of cable W3.



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2-3-23. POINTS VOLTAGE TEST #17 (cont) 2-3-23

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

NOTE

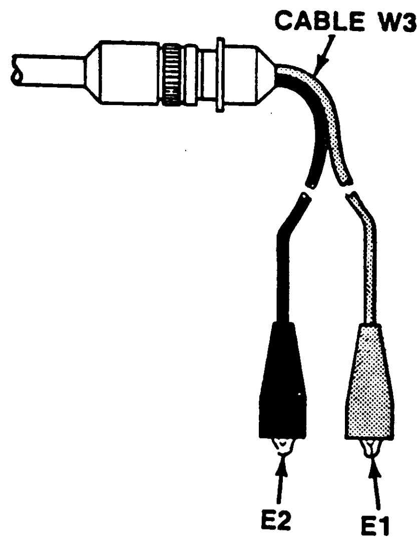
Locate vehicle/equipment test points where measurement is to be made.

2. **Make cable connections.**

   a. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.

   b. Attach red clip E1 of cable W3 to ignition adapter, TK item 30, or distributor terminal of coil primary.

   c. Attach black clip E2 of cable W3 to equipment ground



3. **Measure points voltage.**

   a. Turn ignition switch on.

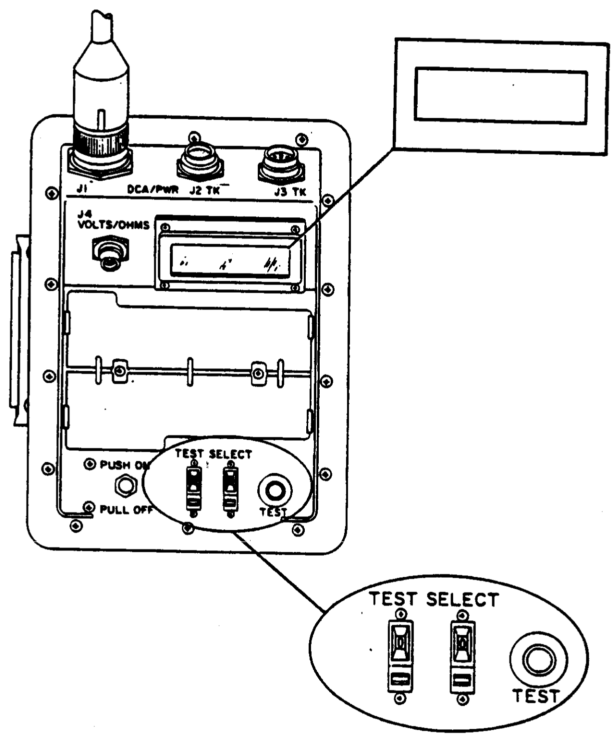
   b. Set TEST SELECT switches to 17.

   c. Press and release TEST button.

NOTE

If .9.9.9.9 is displayed, it indicates that the points are open. To close the points, bump starter to turn engine briefly until another value appears on display. A voltage drop (usually greater than 0.2 volts) with the points closed indicates burned or pitted points, while a small voltage drop shows good point contact.

   e. Observe displayed value (volts).



END OF TASK

2-3-24. VACUUM O TO 30 INCH MERCURY TEST #45

Description:

This procedure measures vacuum in the range of O to 30 inches mercury. If measuring intake manifold vacuum on an SI engine, use snubber, TK item 21.

Typical Applications:

Engine manifold vacuum
Vacuum pumps or motors
Fuel pump intake vacuum
Fuel pump suction

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

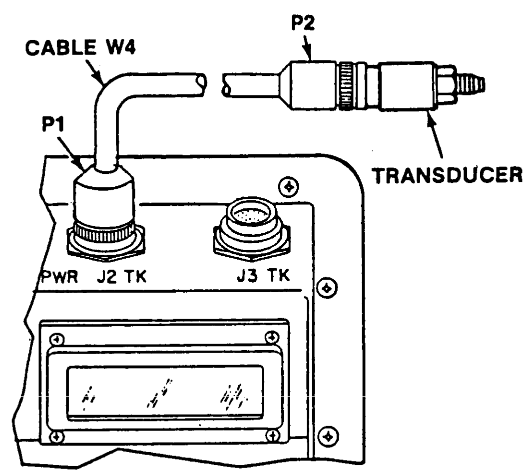
01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cables sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Do not use compressed air when cleaning transducer. Transducer damage may result.



1. Connect transducer.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Install red striped pressure transducer, TK item 22, where pressure is to be measured.

   c. Attach connector P2 of cable W4 to transducer.

GO TO NEXT PAGE

2-3-24. VACUUM O TO 30 INCH MERCURY TEST #45 (cont) 2-3-24

2. **Do offset test.**

   a. Set TEST SELECT switches to 45.

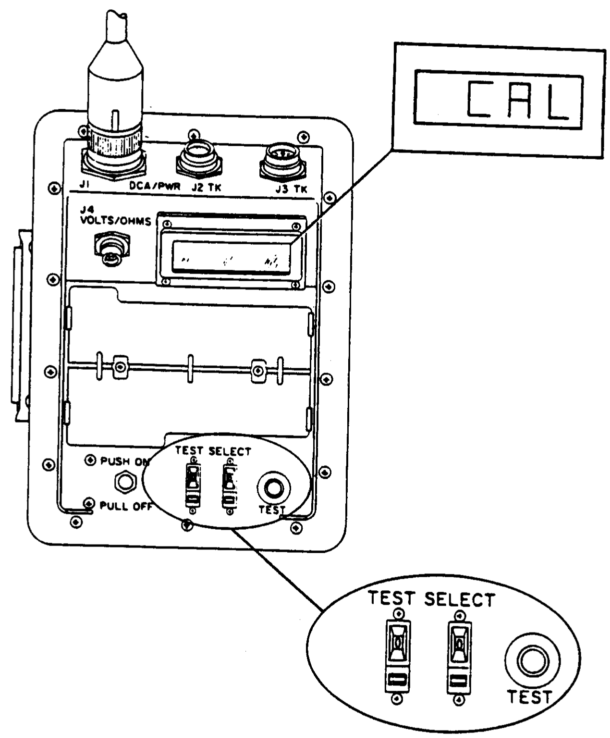
NOTE

When doing offset test, vacuum source must be off and system being measured must be de-pressurized.

   b. Turn off vehicle/equipment or vacuum source.

   c. Press and hold TEST button until CAL appears on display.

   d. Release TEST button; wait for offset value to appear on display. If offset is within -4.5 to +4.5, proceed to Step 3. If offset is not within -4.5 to +4.5, refer to Offset Fault Isolation, paragraph 3-2-2.



3. **Pleasure Vacuum.**

CAUTION

If measuring intake manifold vacuum, install snubber, TK item 21. Where vacuum is to be measured, install red-striped transducer, TK item 22, in snubber.

   a. Press and release TEST button.

   b. Start vehicle engine or vacuum source.

NOTE

If display is negative (-), the transducer is sensing pressure rather than vacuum. Use pressure test for best results.

   c. Observe displayed value (inches of mercury).

END OF TASK

2-3-25. VACUUM VARIATION O TO 30 INCH MERCURY TEST #46 2-3-25

Description:

This procedure measures vacuum variation and serves the same function as a vacuum gauge. The engine must be running with a steady throttle; otherwise, the engine speed-variations will be reflected in the displayed test results. Test results are displayed in one of two ways. Average value will be displayed and alternated with the AUE status message if variation is less than 1 inch mercury. The maximum and minimum value will be alternately displayed if the variation is greater than 1 inch mercury.

Typical Applications:

Engine manifold vacuum variations

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

01, 05

WARNING

On vehicles with a master switch In the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

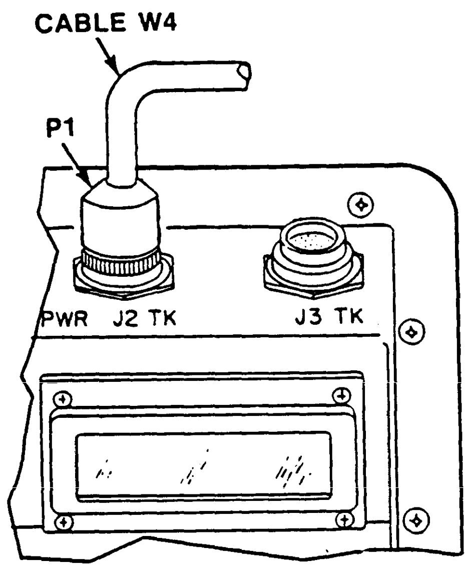
CAUTION

Do not use compressed air when cleaning transducer. Transducer damage may result.

Excessive pressure can damage transducer. Pressure being measured should not exceed 50 inches mercury.

1. Connect transducer.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.



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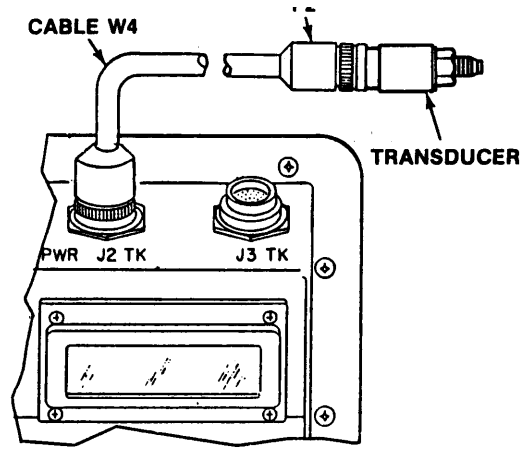
2-3-25. VACUUM VARIATION 0 TO 30 INCH MERCURY TEST #46 (cont) 2-3-25

b. Install snubber, TK item 21, where vacuum is to be measured. Use fitting adapter if required.

c. Install red striped pressure transducer, TK item 22, on snubber.

d. Attach connector P2 of cable W4 to transducer.



2. **Do offset test.**

a. Set TEST SELECT switches to 46.

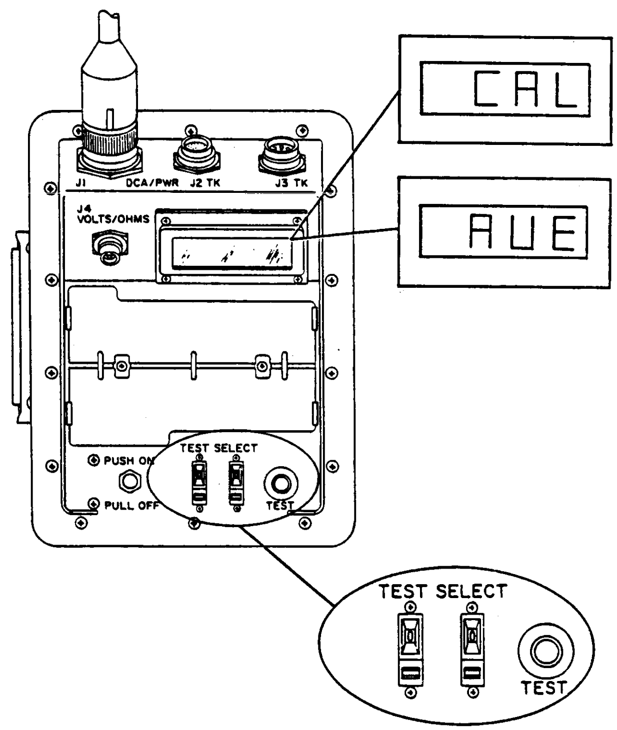
NOTE

When doing offset test, vacuum source must be off and system de-pressurized.

b. Turn off vehicle/equipment or vacuum source.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for AUE and then offset value to appear on display. If offset is within -4.5 to +4.5, proceed to Step 3. If offset is not within -4.5 to +4.5, refer to Offset Fault Isolation paragraph 3-2-2.



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2-3-25. VACUUM VARIATION 0 To 30 INCH MERCURY TEST #46 (CONT)

3. **Measure Vacuum.**

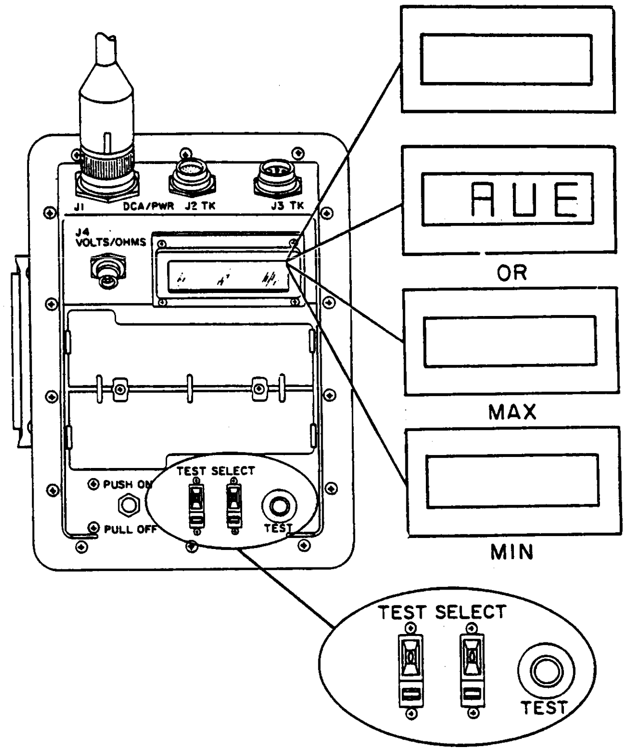
   a. Start vehicle engine or vacuum source.

   b. Press and release TEST button.

NOTE

If vacuum variation is greater than 1 inch mercury, the maximum and minimum values are alternately displayed. If the variation is less than 1 inch mercury, the average vacuum and AUE are alternately displayed.

   c. Observe displayed value (inches of mercury).



END OF TASK

2-3-26. PRESSURE O TO 50 INCH MERCURY TEST #47 2-3-26

Description:

This procedure measures pressure in the range of O to 50 inches mercury.

Typical Applications:

Turbocharger output pressure
Air box pressure

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Excessive pressure can damage transducer. Pressure being measured should not exceed 50 inches mercury.

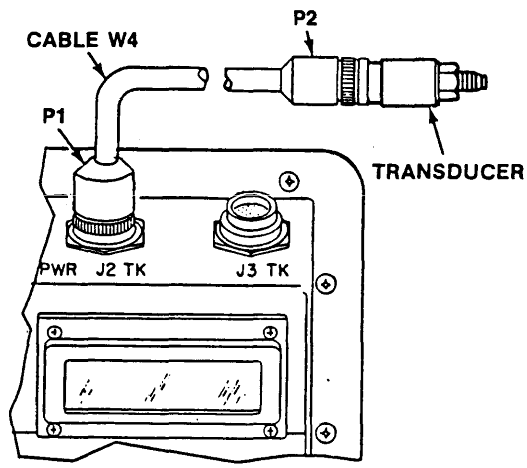
Do not use compressed air when cleaning transducer. Damage to transducer may result.

1. **Connect transducer.**

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Install red striped pressure transducer, TK item 22, where pressure is to be measured. Use fitting adapter if required.

   c. Attach connector P2 of cable W4 to transducer.



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2-3-26. PRESSURE O TO 50 INCH MERCURY TEST #47 (cont)

2. **Do offset test.**

   a. Set TEST SELECT switches to 47.

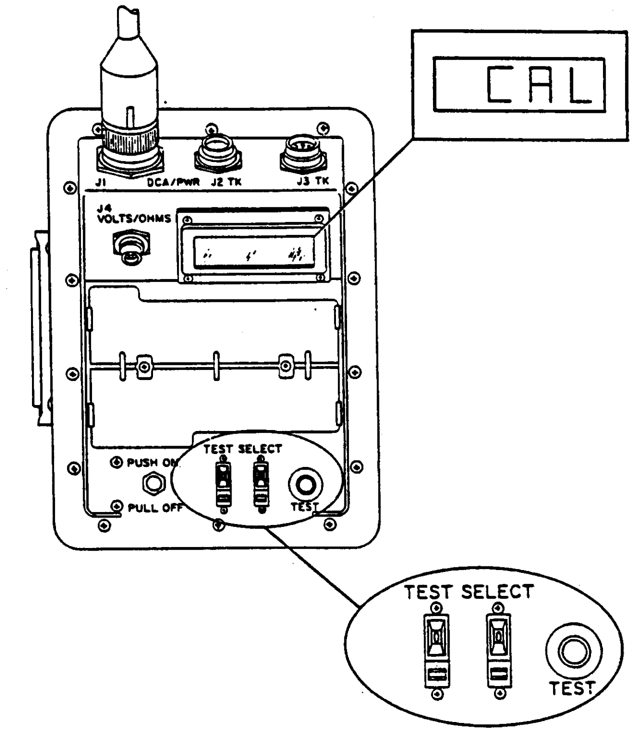
   NOTE

   When doing offset test, pressure source must be off and system being measured de-pressurized.

   b. Turn off vehicle/equipment or pressure source.

   c. Press and hold TEST button until CAL appears on display.

   d. Release TEST button: wait for offset value to appear on display. If offset is within -7.5 to +7.5, proceed to Step 3. If offset is not within -7.5 to +7.5, refer to Offset Fault Isolation paragraph 3-2-2.



3. **Measure pressure.**

   a. Press and release TEST button.

   b. Start engine or pressure source.

   NOTES

   If the display is negative (-), the transducer is sensing vacuum rather than pressure. Use appropriate vacuum test.

   If .9.9.9.9 is displayed, use blue striped transducer, TK item 17, and perform test #50, paragraph 2-3-29.

   c. Observe displayed value (inches mercury).

END OF TASK

2-3-27. VACUUM O TO 150 INCH MATER TEST #48 2-3-27

Description:

This procedure measures vacuum in the range of O to 150 inches water.

Typical Applications:

Air cleaner pressure drop
Intake filter pressure drop

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Excessive pressure can damage transducer. Pressure being measured should not exceed 150 inches water.

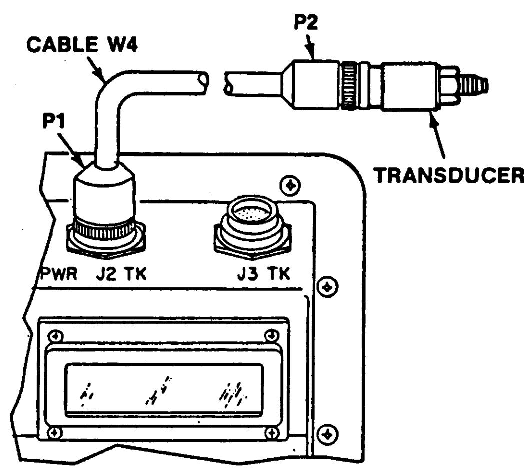
Do not use compressed air when cleaning transducer. Damage to transducer may result.

1. Connect transducer.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Install red striped pressure transducer, TK item 22, where pressure is to be measured. Use fitting adapter if required.

   c. Attach connector P2 of cable W4 to transducer.



GO TO NEXT PAGE

2-3-27. VACUUM O TO 150 INCH WATER TEST #48 (cont)

2. **Do offset test.**

   a. Set TEST SELECT switches to 48.

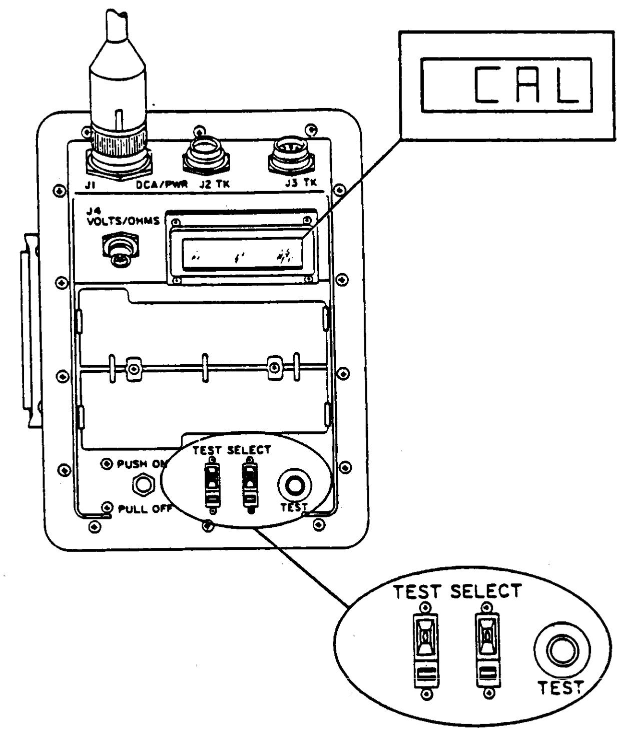
NOTE

When doing offset test, pressure source must be off and the system being measured de-pressurized.

   b. Turn off vehicle/equipment or pressure source.

   c. Press and hold TEST button until CAL appears on display.

   d. Release TEST button; wait for offset value to appear on display. If offset is within -90 to +90, proceed to Step 3. If offset is not within -90 to +90, refer to Offset Fault Isolation paragraph 3-2-2.



3. **Measure pressure.**

   a. Press and release TEST button.

   b. Start engine or pressure source.

NOTES

If the display is negative (-), the transducer is sensing pressure rather than vacuum. Use appropriate pressure test.

If .9.9.9.9 is displayed, the pressure is not within the test range and cannot be measured with STE/ICE-R.

   c. Observe displayed value (inches water).

END OF TASK

2-3-28. PRESSURE O TO 25 PSIG TEST #49 — 2-3-28

Description:

This procedure measures pressure in the range of -15 to +25 psig. The pressure transducer is installed where the vacuum/pressure is to be measured.

Typical Applications:

Fuel supply pressure on SI engines
Vacuum

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Excessive pressure can damage transducer. Pressure being measured should not exceed -15 to +25 psig.

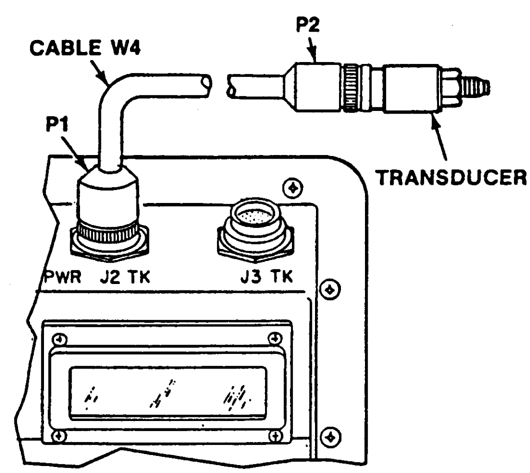
Do not use compressed air when cleaninq transducer. damage to transducer may result.

1. Connect transducer.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Install red striped pressure transducer, TK item 22, where pressure is to be measured. Use fitting adapter if required.

   c. Attach connector P2 of cable W4 to transducer.



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2-3-28. PRESSURE 0 TO 25 PSIG TEST #49 (cont)

2. **Do offset test.**

   a. Turn off vehicle/equipment or vacuum/pressure source.

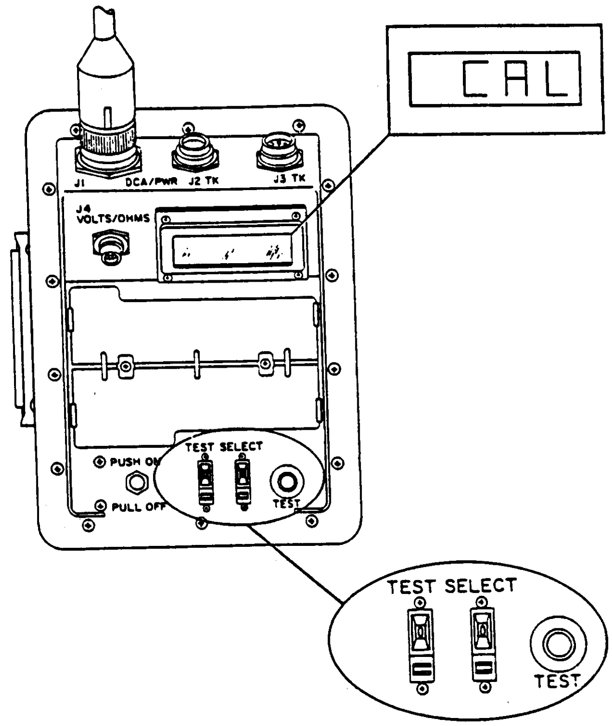
   NOTE

   During offset test, system being measured must be de-pressurized.

   b. Set TEST SELECT switches to 49.

   c. Press and hold TEST button until CAL appears on display.

   d. Release TEST button; wait for offset value to appear on display. If offset is within -4.0 to +4.0, proceed to step 3. If offset is not within -4.0 to +4.0, refer to Offset Fault Isolation paragraph 3-2-2.



3. **Measure vacuum/pressure.**

   a. Press and release TEST button.

   b. Turn on vacuum/pressure source.

   NOTE

   If .9.9.9.9 is displayed, use the blue striped transducer, TK item 19, and perform test #50, paragraph 2-3-29. A negative (-) display indicates vacuum. A positive display indicates pressure.

   c. Observe displayed value (psig).

END OF TASK

2-3-29. PRESSURE O TO 1000 PSIG TEST #50 2-3-29

Description:

This procedure measures pressure in the range of O to 1000 psig.

Typical Applications:

Lubrication pressure
Fuel pressure
Compressed air pressure
Power steering pressure
Automatic transmission pressure
Engine compression test

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Excessive pressure can damage transducer. Pressure being measured should not exceed 1000 psig.

Do not use compressed air when cleaning trannsducer. Damage to transducer may result

1. Connect transducer.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Install blue striped pressure transducer, TK item 17, where pressure is to be measured. Use fitting adapter if required.

   c. Attach connector P2 of cable W4 to transducer.

GO TO NEXT PAGE

2-3-29. PRESSURE 0 TO 1000 PSIG TEST #50 (cont)

2. **Do offset test.**

   a. Set TEST SELECT switches to 50.

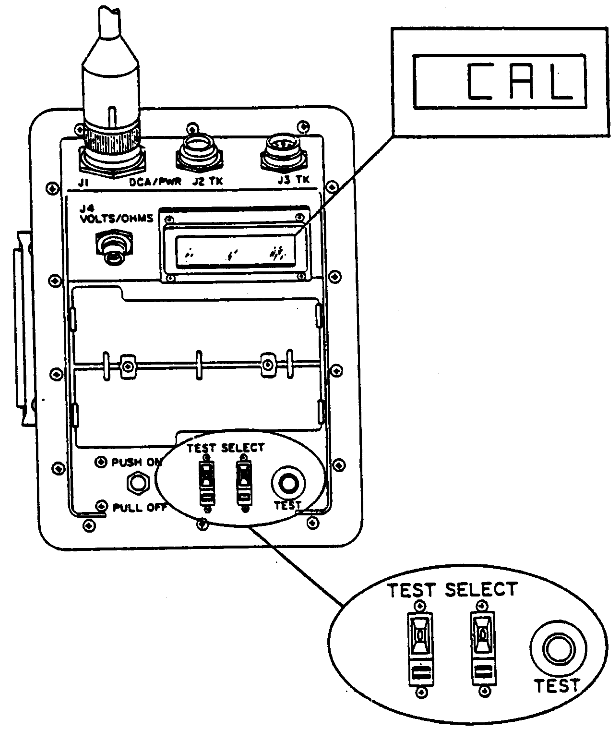
NOTE

During offset test, system being measured must be de-pressurized.

   b. Turn off vehicle/equipment or pressure source.

   c. Press and hold TEST button until CAL appears on display.

   d. Release TEST button; wait for offset value to appear on display. If offset is within -150 to +150, proceed to step 3. If offset is not within -150 to +150, refer to Offset Fault Isolation paragraph 3-2-2.



3. **Measure pressure.**

   a. Press and release TEST button.

NOTE

If .9.9.9.9 is displayed, the pressure is not within the test range and cannot be measured with this test. See Test #51, paragraph 2-3-30.

   b. Observe displayed value (psig).

END OF TASK

2-3-30. PRESSURE 0 TO 9999 PSIG TEST #51 2-3-30

Description:

This procedure measures high pressures in the range of 0 to 9999 psig. The 10,000 psi pressure transducer used for this test is not supplied with the STE/ICE-R set. Refer to the Additional Authorization List, Appendix C.

Typical Applications:

Hydraulic systems pressure

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Excessive pressure can damage transducer. Pressure being measured should not exceed 10,000 psi g.

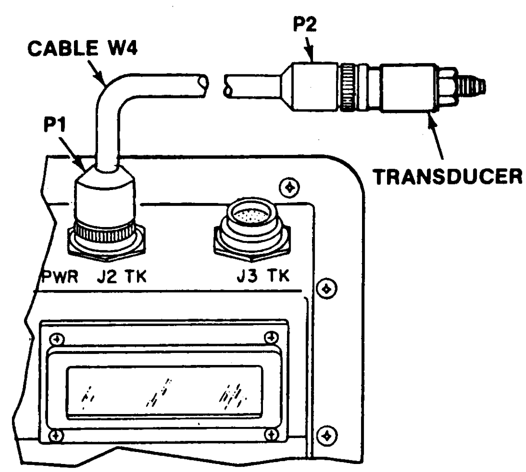
Do not use compressed air when cleaning transducer. Damage to transducer may result.

1. **Connect transducer.**

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Install 10,000 psig pressure transducer where pressure is to be measured. Use fitting adapter if required.

   c. Attach connector P2 of cable W4 to transducer.



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2-3-30. PRESSURE O TO 9999 PSIG TEST #51 (cont)

2. **Do offset test.**

   a. Set TEST SELECT switches to 51.

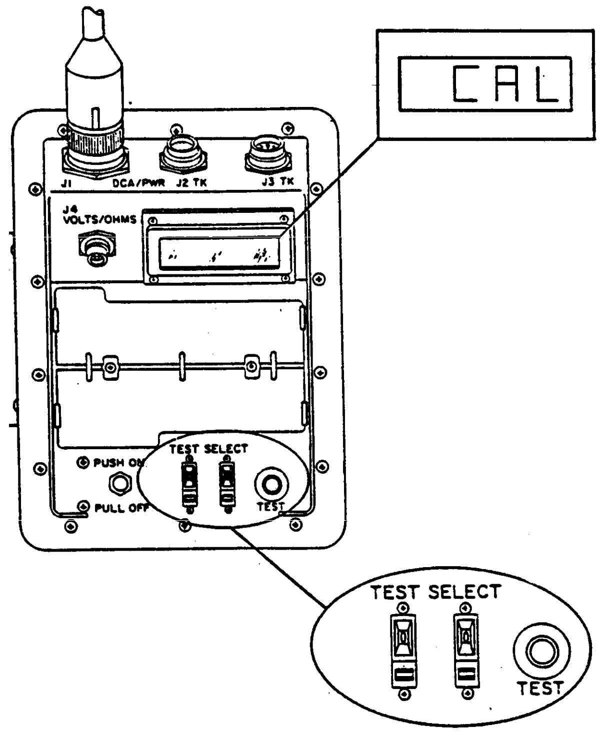
NOTE

During offset test, system being measured must be de-pressurized.

   b. Turn off pressure source.

   c. Press and hold TEST button until CAL appears on display.

   d. Release TEST button; wait for offset value to appear on display. If offset is within -450 to +450, proceed to step 3. If offset is not within -450 to +4!j0, refer to Offset Fault Isolation paragraph 3-2-2.



3. **Measure pressure.**

   a. Turn on pressure source.

   b. Press and release TEST button.

NOTE

If .9.9.9.9 is displayed, pressure is outside the test range and cannot be measured with STE/ICE-R.

   c. Observe displayed value (psig).

END OF TASK

2-3-31. BATTERY VOLTAGE TEST #67 2-3-31

Description:

This procedure measures battery voltage in the range of from 9 to 32 volts. The voltage is measured directly at the power source of the VTM, and may be done with the vehicle/ equipment operating or shut down.

Typical Applications:

Check battery voltage

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Control Functions:

01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. **Measure voltage.**

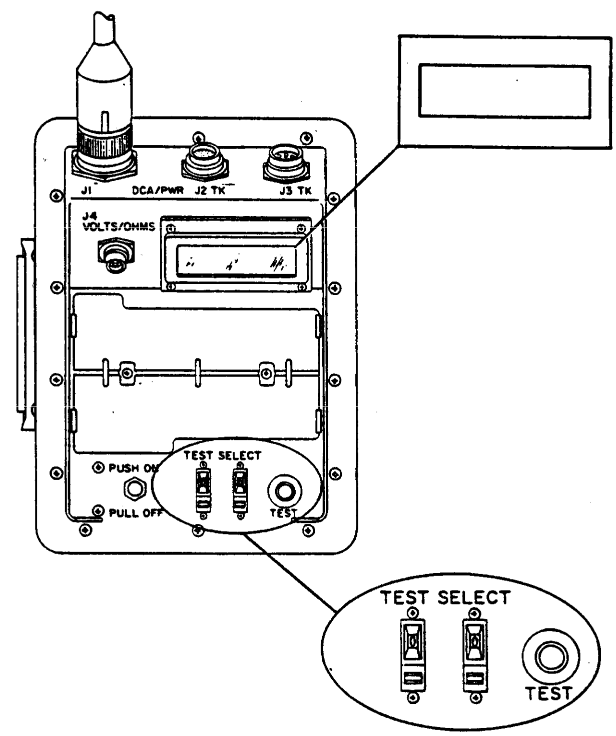
   a. Set TEST SELECT switches to 67.

   b. Press and release TEST button.

   NOTE

   If .9.9.9.9 is displayed, voltage is not within test range. Use Test #89, paragraph 2-3-33.

   c. Observe displayed value (volts).



END OF TASK

2-3-32. LIVE CIRCUIT RESISTANCE (LOW OHMS) TEST #88 2-3-32

Description:

This procedure measures resistance in the range of 0 to 10 ohms in a live circuit with high current. (For the best accuracy, the current in the circuit should be larger than 10 amps.) The VTM is used as a voltmeter and an ammeter at the same time. Test results are displayed in ohms with the decimal point always in the correct position.

Typical Applications:

Field circuit in a charging system
Low resistance/high current circuits

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

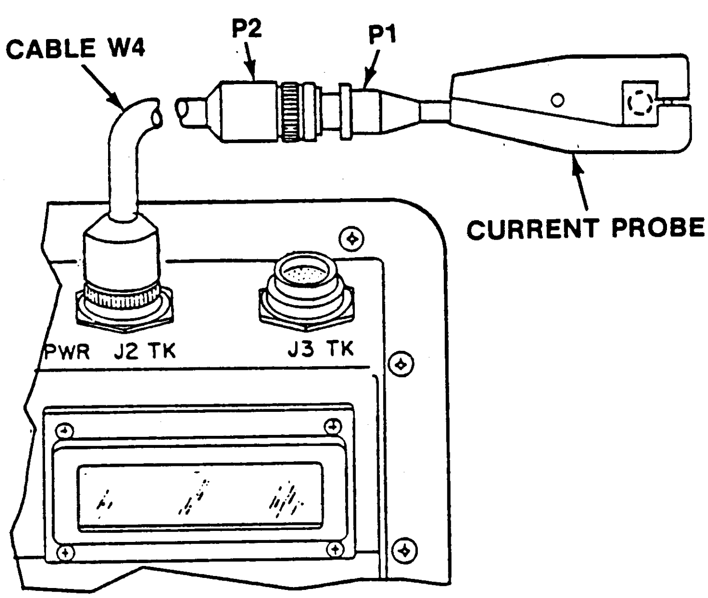
E005 Offset not performed

Control Functions:

01, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.



1. Connect current probe.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

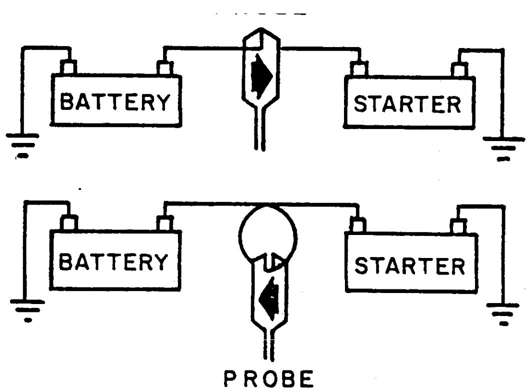
   b. Attach connector P2 of cable W4 to current probe, TK item 11.

GO TO NEXT PAGE

2-3-32. LIVE CIRCUIT RESISTANCE (LOW OHMS) TEST #88 (cont) 2-3-32

NOTE

If current probe, TK item 11, is below room temperature, then wait at least 5 minutes after connecting probe to VTM before doing offset test, or perform offset within 30 seconds of starting each measurement.



2. Condition current probe.

NOTE

Locate a high current load. On vehicles with electric starters, use positive (+) battery cable or positive (+) starter cable.

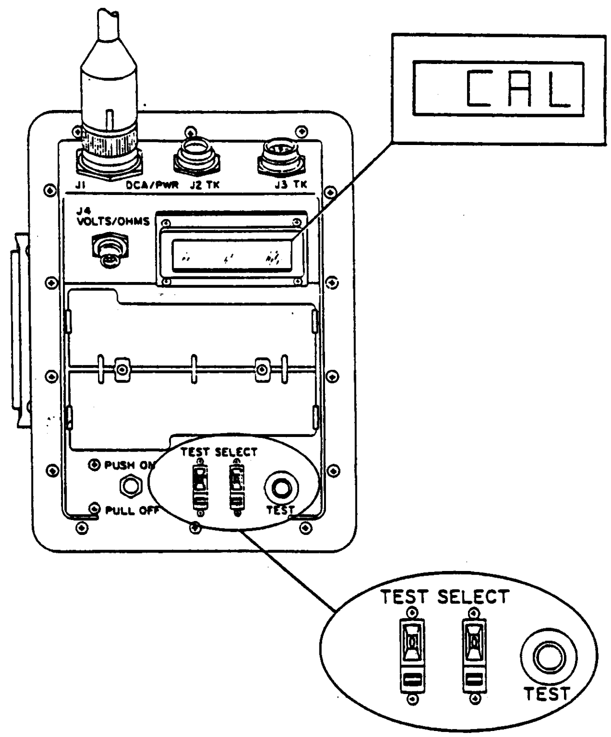
a. Turn off all electrical components.

b. Clamp current probe around wire or cable with arrow pointing in direction of current flow. If current probe is clamped around positive battery cable, arrow must point away from battery

c. Set TEST SELECT switches to 90.

d. Press and hold TEST button until CAL appears on display.

e. Release TEST button; wait for value to appear on display. If value is within -225 to +225, proceed to step f. If value is not within -225 to +225, refer to Offset Fault Isolation, paragraph 3-2-2.



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2-3-32. LIVE CIRCUIT RESISTANCE (LOW OHMS) TEST #88 (cont) 2-3-32

f. Press and release TEST button.

g. Turn on circuit used to condition current probe. If starter is used to condition probe, energize starter long enough to obtain a reading. Do not allow engine to start.

h. Note polarity sign of conditioning current. If readout is negative (-), reverse current probe, and repeat steps 2a through 2h.

i. Turn off circuit used to condition probe.

3. Do offset test for current probe.

NOTES

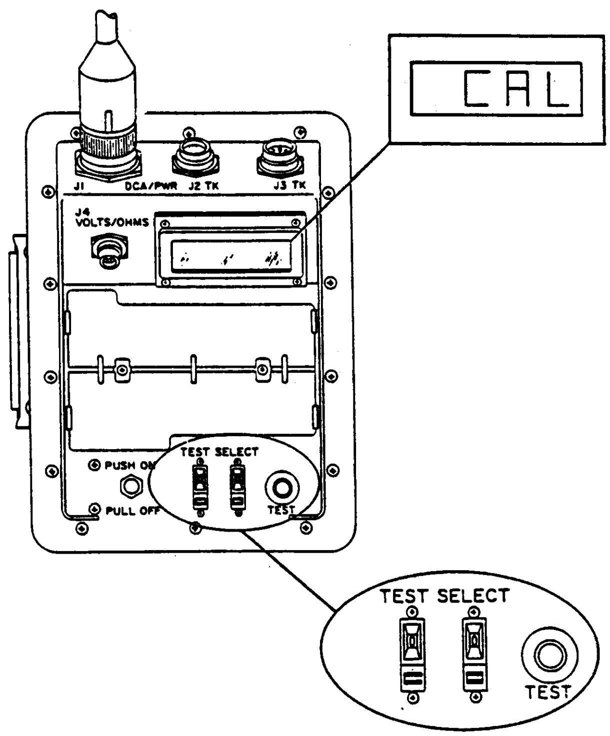
Stray magnetic fields can affect the current reading. Such fields may exist within a foot or so of operating vehicle generators and alternators, motor generators under load, and electric motors. Keep current probe at least one foot away from any operating generators, alternators or electric motors.

During offset test, the component being tested must be off, and the circuit must be deenergized.

a. Turn off component to be tested.

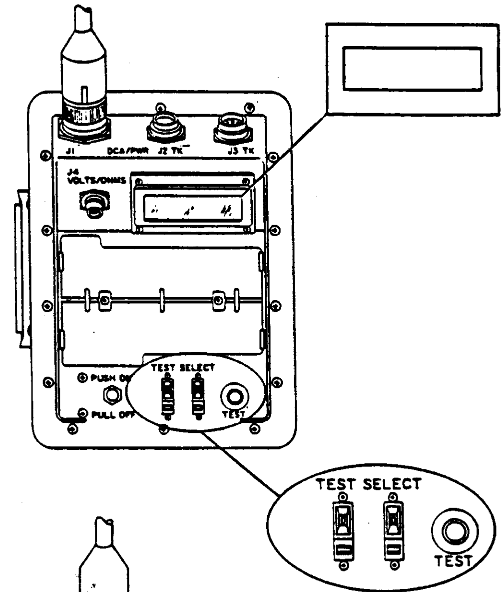
b. Install current probe where current is to be measured.

c. Press and hold TEST button until CAL appears on display.



2-3-32. LIVE CIRCUIT RESISTANCE (LOW OHMS) TEST #88 (cont) 2-3-32

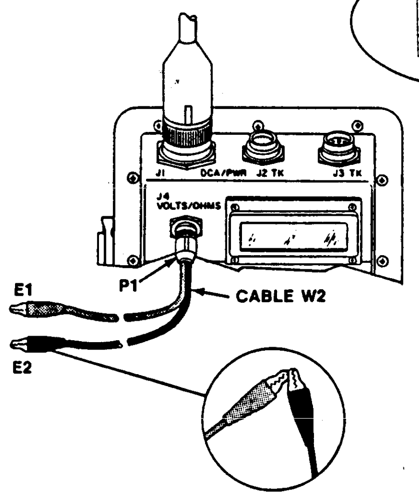
d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 4. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



NOTE

Alligator clips E1 and E2 on the test probe cable W2 can be replaced with other probe clips contained in the test probe kit. See paragraph 1-2-4.

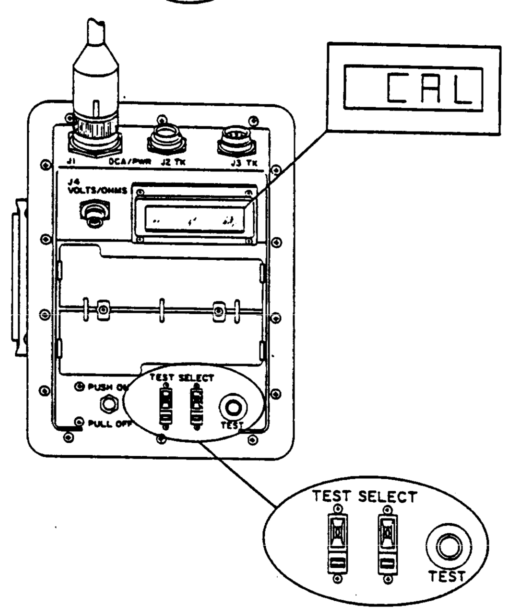
4. **Connect test probe cable W2.** Attach connector P1 of cable W2 to VOLTS/OHMS J4.



5. **Do offset test for test probe cable W2.**

   a. Attach red clip E1 to black clip E2.

   b. Set TEST SELECT switches to 89.



   c. Press and hold TEST button until CAL appears on display.

   d. Release TEST button; wait for offset value to appear on display. If offset is within -6.8 to +6.8, proceed to step 6. If offset is not within -6.8 to +6.8, refer to Offset Fault Isolation paragraph 3-2-2.

GO TO NEXT PAGE

2-3-32. LIVE CIRCUIT RESISTANCE (LOW OHMS) TEST #88 (cont)

6. Measure resistance in a live circuit.

NOTE

If the component being tested is grounded, the black clip E2 must be connected to the grounded side of the component.

a. Attach red clip E1 and black clip E2 across component to be tested.

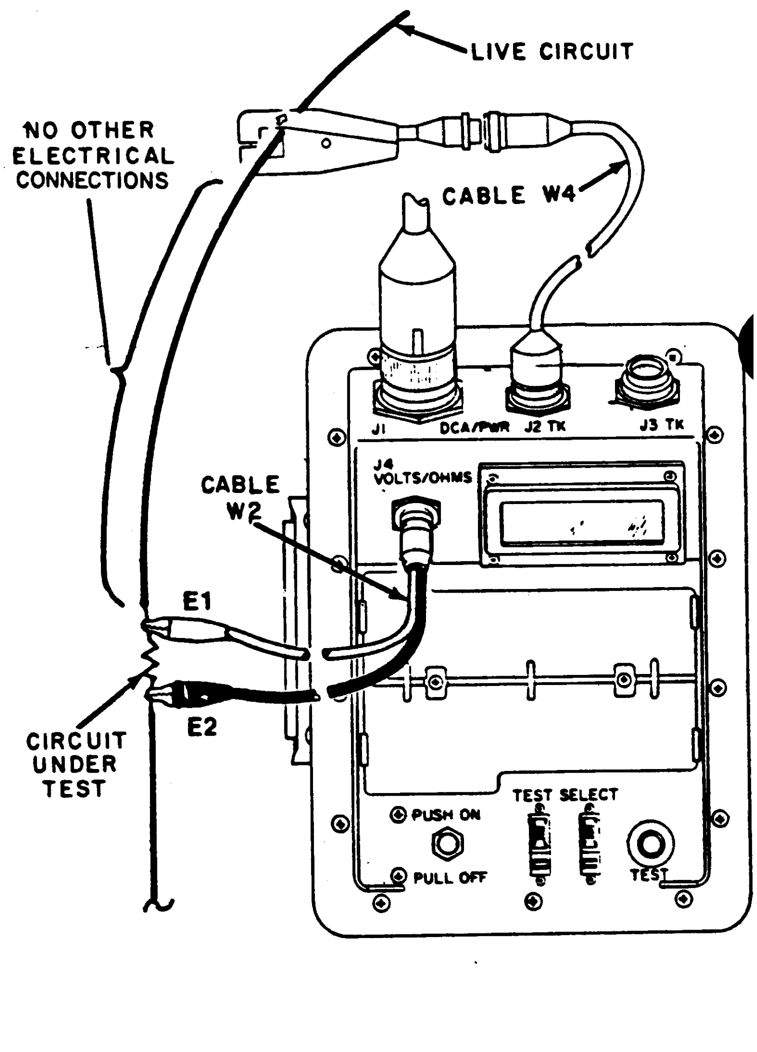
b. Connect current probe around wire attached to the resistor.

c. Turn the power on the circuit which has the resistor.

d. Set TEST SELECT switches to 88.

e. Press and release TEST button.

f. Observe displayed value (ohms).



END OF TASK

2-3-33. OC VOLTAGE O TO 45 VDC TEST #89 2-3-33

Description:

This procedure measures voltage in the range of -45 to +45 volts. The VTM is used as a DC voltmeter with the decimal point in the correct position. This test must be done with the component being tested turned on.

Typical Applications:

Battery	Coil Primary
Fuel Solenoid	Starter Motor
Starter Solenoid	Starter Cable Drop
Alt/Gen Output	
Alt/Gen Negative Cable Drop	
Any DC voltages within -45 to +45	

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E005 Offset not performed

Control Functions:

01, 02, 03, 04, 05, 06

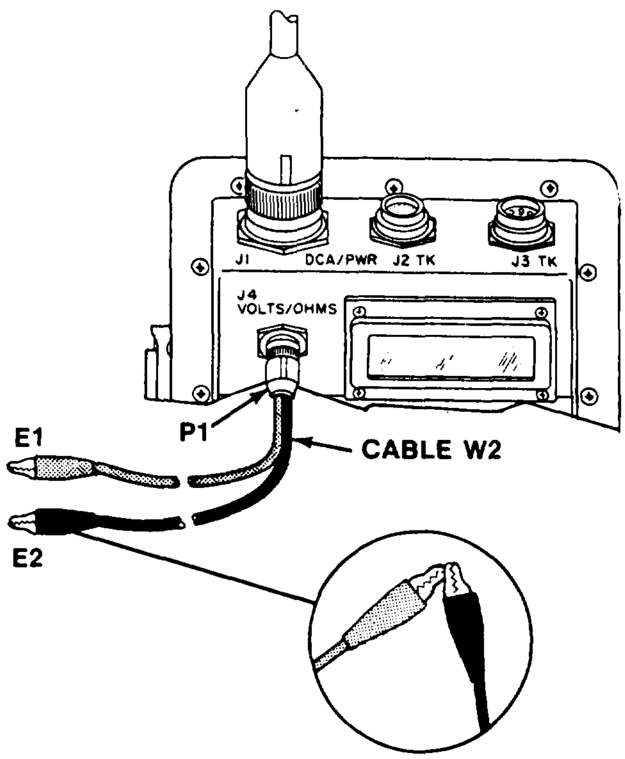
WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Connect test probe cable W2. Attach connector P1 of cable W2 to VOLTS/OHMS J4.

2. Do offset test.

   a. Attach red clip E1 of cable W2 to black clip E2 of cable W2.



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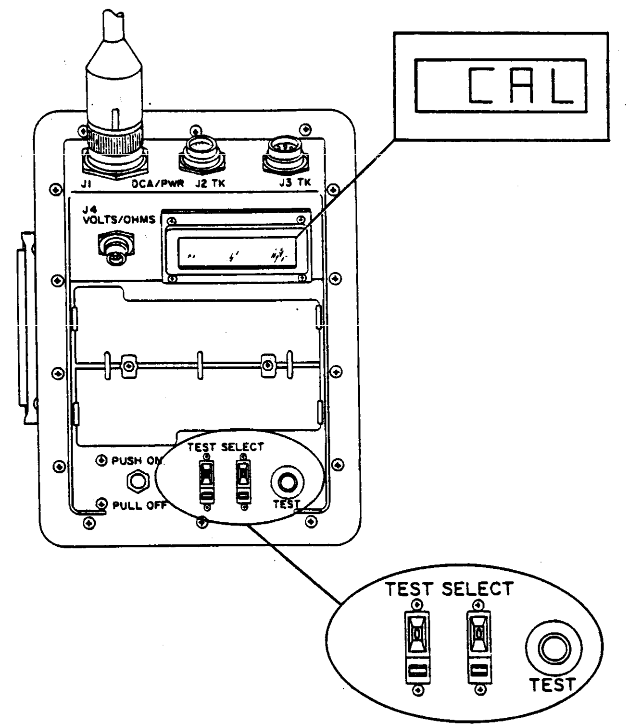
2-3-33. DC VOLTAGE 0 TO 45 VDC TEST #89 (cont)

b. Set TEST SELECT switches to 89.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -6.8 to +6.8, proceed to step 3. If offset is not within -6.8 to +6.8, refer to Offset Fault Isolation paragraph 3-2-2.



WARNING

Electrical shock hazard. Insure circuit is off before attaching leads. Failure to heed warning could cause shock, injury or death. If electrical shock occurs, administer first aid and seek medical assistance inunediately.

NOTE

Always attach red clip E1 to positive (+) side and black clip E2 to negative (-) side of item being measured. Otherwise, a negative number may be displayed.

3. **Connect leads.** Attach clips (E1 and E2) across circuit where voltage is to be measured.

4. **Measure voltage.**

a. Turn on circuit to be tested.

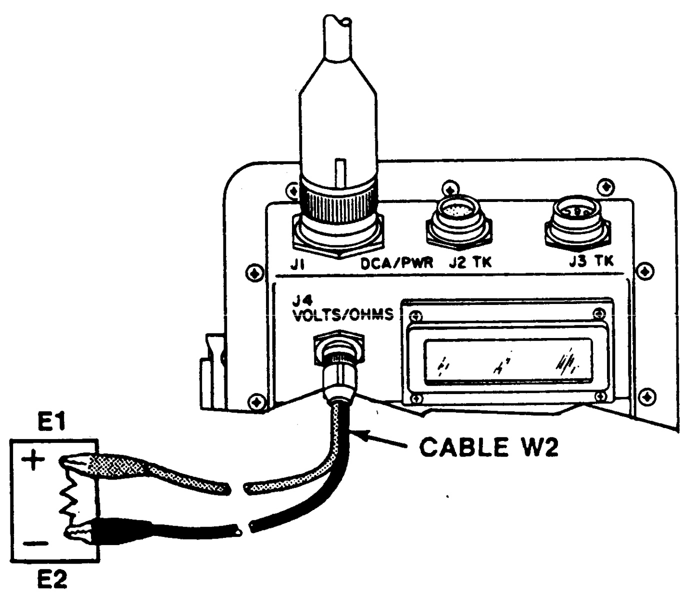
b. Press and release TEST button.

NOTE

If .9.9.9.9 is displayed, voltage is not within -45 to +45 volts, and cannot be measured on VTM. If negative (-) number is displayed, then a negative voltage is being measured.

c. Observe displayed value (volts).

END OF TASK



2-3-34. DC CURRENT O TO 1500 AMPS DC TEST #90 2-3-34

Description:

This procedure measures DC current in the range of O to 1500 anps. The VTM is used as an ammeter with the decimal point in the correct position. This test may be done with the vehicle/equipment operating.

Typical Applications:

Alternator output
Generator output
Average starter current
Field winding current
Accessory current
Battery charging current
Any current from O to 1500 Amps DC
Locating shorts

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E002 Transducer not connected
E005 Offset not performed

Control Functions:

01, 02, 03, 04, 05, 06

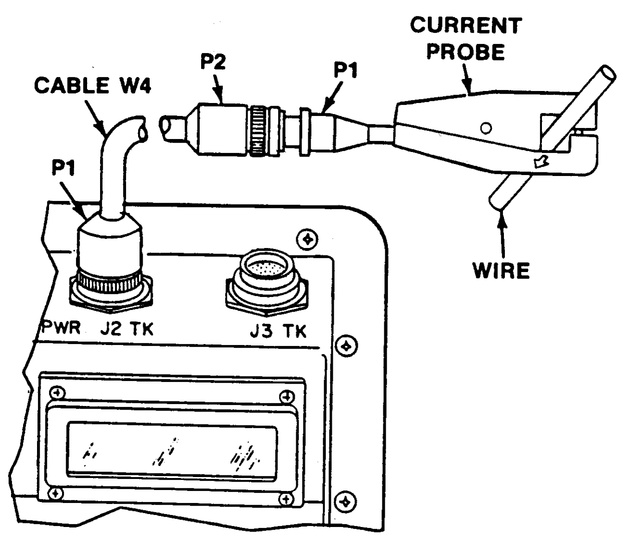
WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Connect current probe.

   a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

   b. Attach connector P2 of cable W4 to current probe, TK item 11.



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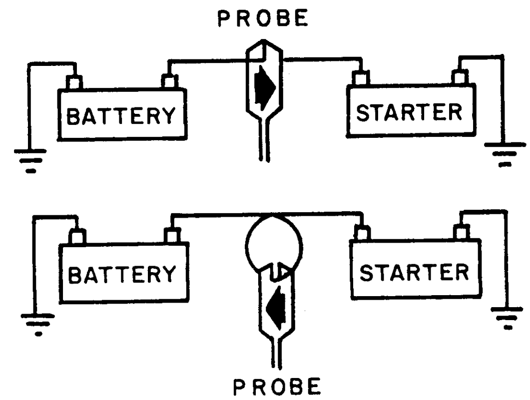
2-3-34. DC CURRENT 0 TO 1500 AMPS DC TEST #90 (cont) 2-3-34

NOTE

If current probe, TK item 11, is below room temperature, then wait at least 5 minutes after connecting probe to VTM before doing offset test, or perform offset within 30 seconds of starting each measurement.



2. Condition current probe.

NOTE

Locate a high current load. On vehicles with electric starters, use positive (+) battery cable or positive (+) starter cable.

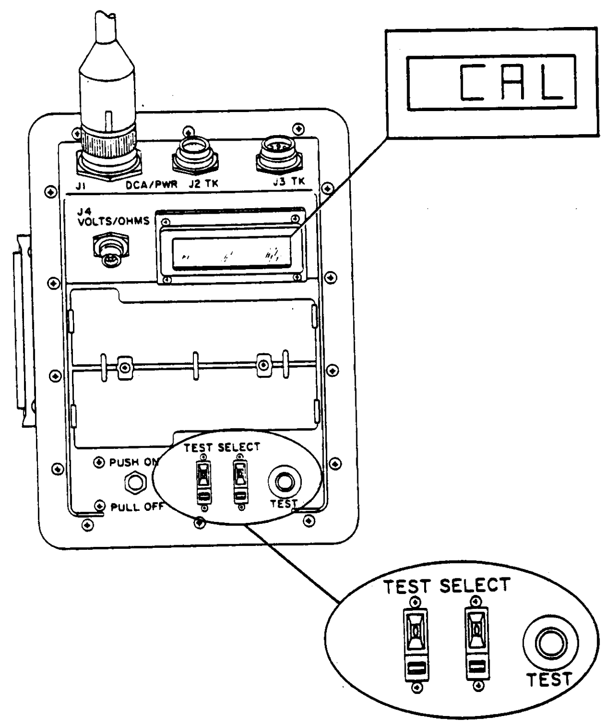
a. Turn off all electrical components.

b. Clamp current probe around wire or cable with arrow pointing in direction of current flow. If current probe is clamped around positive battery cable, arrow must point away from battery

c. Set TEST SELECT switches to 90.

d. Press and hold TEST button until CAL appears on display.

e. Release TEST button; wait for value to appear on display. If value is within -225 to +225, proceed to step f. If value is not within -225 to +225, refer to Offset Fault Isolation, paragraph 3-2-2.



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2-3-34. DC CURRENT O TO 1500 AMPS DC TEST 490 (cont) 2-3-34

f. Press and release TEST button.

g. Turn on circuit used to condition current probe. If starter is used to condition probe, energize starter long enough to obtain a reading. Do not allow engine to start.

h. Note polarity sign of conditioning current. If readout is negative (-), reverse current probe, and repeat steps 2a through 2h.

i. Turn off circuit used to condition probe.

3. Do offset test.

NOTES

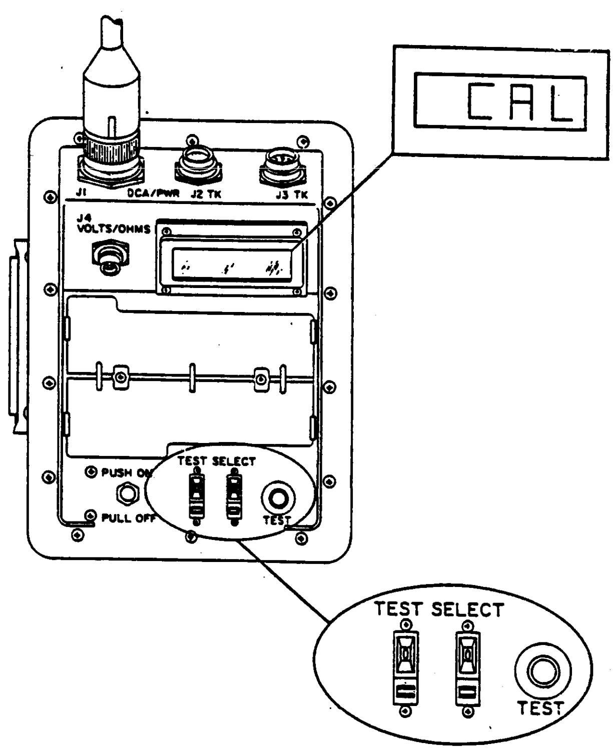
Stray magnetic fields can affect the current reading. Such fields may exist within a foot or so of operating vehicle generators and alternators, motor generators under load, and electric motors. Keep current probe at least one foot away from any operating generators, alternators or electric motors.

During offset test, the component being tested must be off, and the circuit must be deenergized.

a. Turn off component to be tested.

b. Install current probe where current is to be measured.

c. Press and hold TEST button until CAL appears on display.



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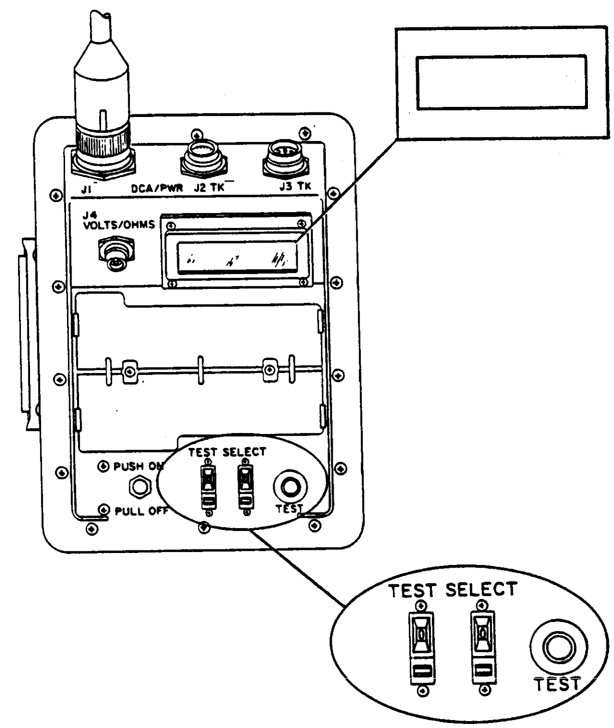
2-3-34. DC CURRENT 0 TO 1500 AMPS DC TEST #90 (cont)

d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 4. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



4. **Measure current.**

a. Press and release TEST button.

b. Turn on component to be tested.

NOTES

If .9.9.9.9 appears on display, the test current is greater than 1500 amps, and cannot-be measured with STE/ICE-R.

If display reads a value with a minus sign, current probe has been installed backwards. Repeat steps 2a through 4c. Be careful not to reinstall current probe backwards.

e. Observe displayed value (amps DC).

END OF TASK

2-3-35. RESISTANCE AND CONTINUITY O TO 4500 OIMS TEST #91 2-3-35

Description:

This procedure measures resistance in the range of O to 4500 ohms. The VTM is used as an ohmmeter, and test results are displayed in ohms with the decimal point always in the correct position. This test must be done with the component being tested turned off. DC voltage test #89, paragraph 2-3-33, may be used to assure that no voltage is present across the component. If any voltage is present, the results of this test will be in error. The resistance test will give best results if the component being tested is disconnected from its circuit. If this cannot be accomplished, then the black clip of the test probe cable must be attached to a grounded test point of component being tested. If the black clip is attached to a part of the circuit that is not grounded, then the results of the test may be in error. If a voltage greater than 5 or less than -5 is detected on the probes, then E022 will be displayed;

Typical Applications:

Continuity checks Shorts
O to 4500 ohms Switches
Relays, Cables, Windinqs

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Hessages:

E005 Offset not performed
E022 External voltage detected while measuring resistance

Control Functions:

01, 02, 03, 04, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and Vlll is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. **Connect test probe cable W2.** Attach connector P1 of cable W2 to VOLTS/OHMS J4.

2. **Do offset test.**

   a. Attach red clip E1 of cable W2 to black clip E2 of cable W2.

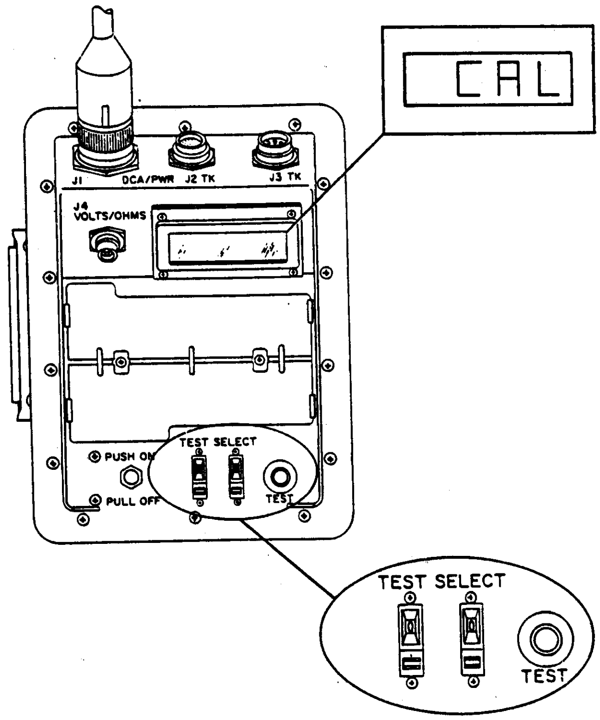
GO TO NEXT PAGE

2-3-35. RESISTANCE AND CONTINUITY 0 TO 4500 TEST #91 (cont)

b. Set TEST SELECT switches to 91.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button and wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 3. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



CAUTION

Do not attempt to measure resistance on an SI engine ignition system while engine is running. Damage to VTM may result.

NOTES

If .9.9.9.9 is displayed, measurement is not within the test range. Use test #92, paragraph 2-3-36.

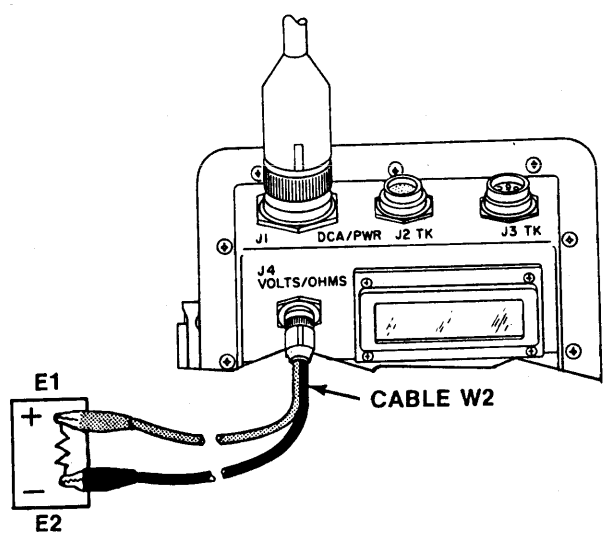
To avoid an incorrect result, turn off component to be tested. Use voltage test #89, paragraph 2-3-33, to assure that no voltage is present on component.

If possible, remove component to be tested from circuit.

If the component being tested is grounded, the black clip E2 must be connected to the ground side of the component.

3. **Measure resistance or check continuity.**

   a. Attach red clip E1 and black clip E2 across component to be tested.



   b. Press.and release TEST button.

   c. Observe displayed value (ohms).

END OF TASK

2-3-36. RESISTANCE O TO 40 KOHMS TEST #92 2-3-36

Description:

This procedure measures resistance in the range of O to 40 Kohms. The VTM is used as an ohmmeter, and test results are displayed in K ohms with the decimal point always in-the correct position. This test must be done with the component being tested turned off. The DC voltage test #89, paragraph 2-3-33, can be used to assure that no voltage is present a-cross the component. If any voltage is pres-ent, then the test results will be in error. This test will give best results if the com-ponent being tested is disconnected from the circuit. If this cannot be accomplished, then the black clip of the test probe cable must be attached to a grounded test point of the component being tested. If the black clip is attached to a part of the circuit that is not grounded, then the results of the test may be in error. If a voltage greater than 5 or less than -5 is detected on the probes, then E022 will be displayed.

Typical Applications:

O to 40 Kohm measurements

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E005 Offset not performed
E022 External voltage detected while measuring resistance

Control Functions:

01, 02, 03, 04, 05, 06

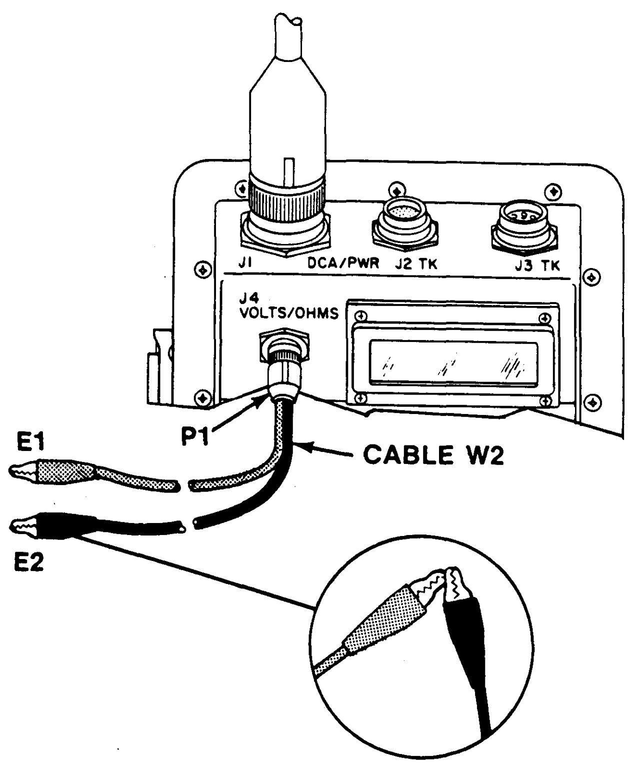
WARNING

On vehicles with a master switch in the nega-tive (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. **Connect test probe cable W2.** Attach con-nector P1 of cable W2 to VOLTS/OHMS J4.

2. **Do offset test.**

   a. Attach red clip E1 of cable W2 to black clip E2 of cable W2.



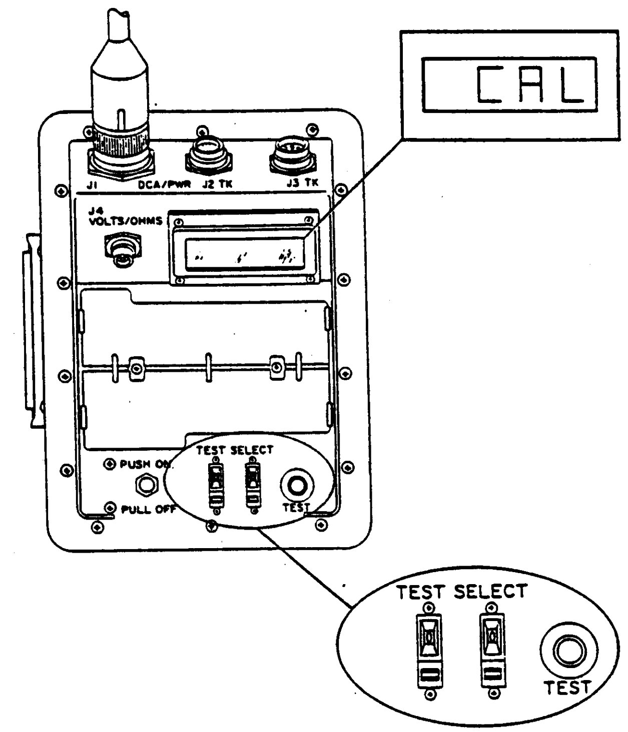
GO TO NEXT PAGE

2-3-36. RESISTANCE O TO 40 KOHMS TEST #92 (cont)

b. Set TEST SELECT switches to 92.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -6.0 to +6.0, proceed to step 3. If offset is not within -6.0 to +6.0, refer to Offset Fault Isolation paragraph 3-2-2.



CAUTION

Do not attempt to measure resistance on an SI engine ignition system while engine is running. Damage to VTM may result.

NOTES

To avoid an incorrect result, turn off component to be tested. Use voltage test #89, paragraph 2-3-33, to assure that no voltage is present on component.

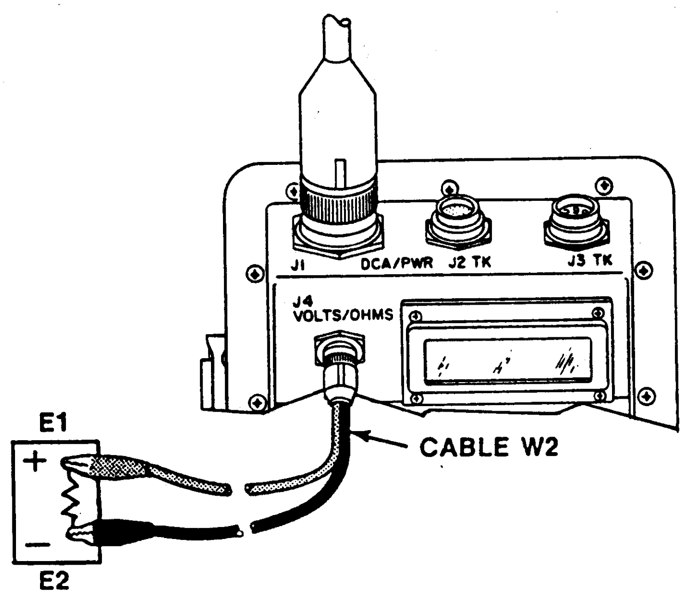
If possible, remove component to be tested from circuit.

If the component being tested is grounded, the black clip E2 must be connected to the ground side of the component.

3. **Measure resistance.**

a. Attach red clip E1 and black clip E2 across component to be tested.

b. Press and release TEST button.



NOTES

If .9.9.9.9 is displayed, result is not within the test range and cannot be measured with STE/ICE-RO

c. Observe displayed value (Kohms).

END OF TASK

2-3-37. AC VOLTAGE O TO 35 VOLTS TEST #93

Description:

This procedure measures AC voltage in the range of O to +35 volts. The VTM is used as an AC voltmeter with the decimal point in the correct position. This test mav be done with the vehicle/equipment operating.

Typical Applications:

Unrectified alternator output

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E005 Offset not performed

Control Functions:

01, 02, 03, 05, 06

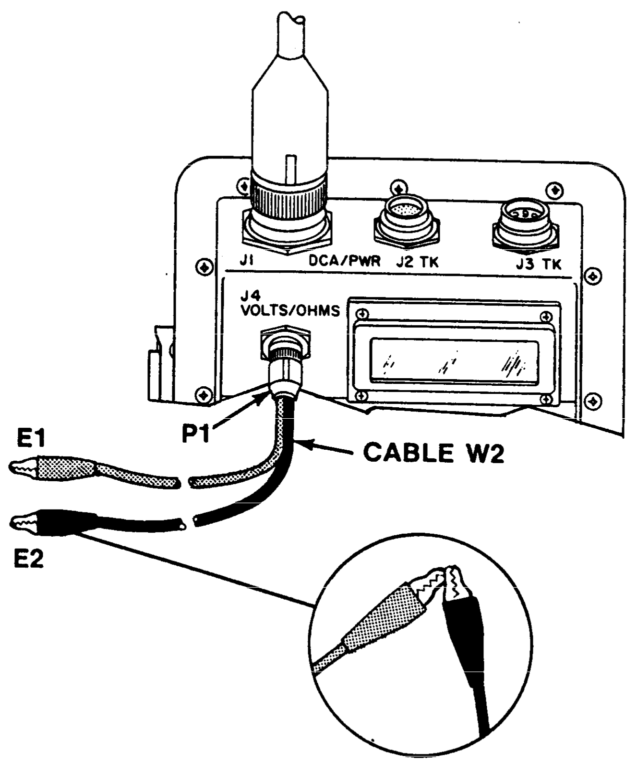
WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VIN case touches the vehicle while master switch is off and Vl14 is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Voltage being measured must not exceed 35 VAC. Damage to VTM may result. Line VOltage does exceed 35 VAC and will damage VTM.

1. **Connect test probe cable W2.** Attach connector P1 of cable W2 to VOLTS/OHMS J4.



GO TO NEXT PAGE

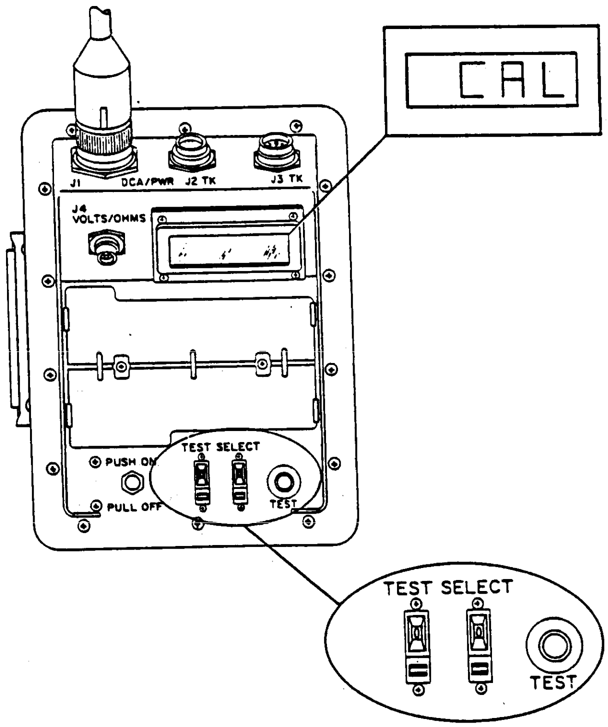
2. Do offset test.

a. Attach red clip El of cable W2 to black clip E2 of cable W2.

b. Set TEST SELECT switches to 93.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -6.8 to +6.8, proceed to step 3. If offset is not within -6.8 to +6.8. refer to Offset Fault Isolation paragraph 3-2-2.



3. Connect leads. Attach clips and E2) across circuit where voltage is to be measured.

4. Measure voltage.

a. Turn on component to be tested.

b. Press and release TEST button.

NOTE

If .9.9.9.9 is displayed, the voltage being measured is beyond the test range and cannot be measured with STE/ICE-R.

c. Observe displayed value (volts AC RMS).

END OF TASK

2-3-38. AC CURRENT O TO 700 AMPS TEST #95 2-3-38

Description:

This procedure measures AC current in the range of O to 700 AMPS. The VTM is used as an AC ammeter with the decimal point in the correct position. This test may be done with the vehicle/equipment operating.

Typical Applications:

o - 700 Amps AC measurements
Unrectified alternator output
AC reference output

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

EO05 Offset not performed

Control Functions:

01, 02, 03, 05, 06

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Connect current probe.

a. Attach connector PI of cable W4 to J2 TK or J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.

c. Clamp current probe around wire or cable to be measured.

GO TO NEXT PAGE

NOTE

If current probe is below room temperature, wait at least five minutes after connecting current probe to VTM to perform offset test, or perform offset test within thirty seconds of starting each measurement.

2. Do offset test.

a. Set TEST SELECT switches to 95.

NOTE

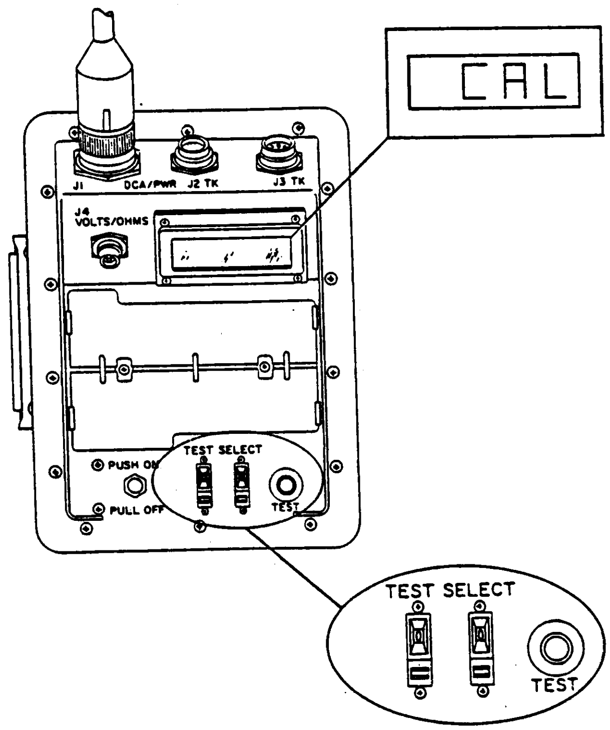
When doing offset test, Component to be tested must be off.

b. Turn off component to be tested.

c. Install current probe where current is to be measured.

d. Press and hold TEST button until CAL appears on display.

e. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 3. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



3. Measure current.

a. Press and release TEST button.

b. Turn on component to be tested.

NOTE

If .9.9.9.9 is displayed, the current is outside the test range and cannot be measured with STE/ICE-R.

c. Observe displayed value (Amps AC RMS).

END OF TASK

2-3-39. AC FREQUENCY 40 T0500 Hz (TEST PROBE) TEST #96 2-3-39

Description:

This procedure measures frequencies in the range of 40 to 500 Hz. The VTM is used as a frequency meter with the decimal point in the correct position. This test must be done with the equipment operating.

Typical Applications:

40 to 500 Hz measurements

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

E018 Test automatically terminated to protect the VTM

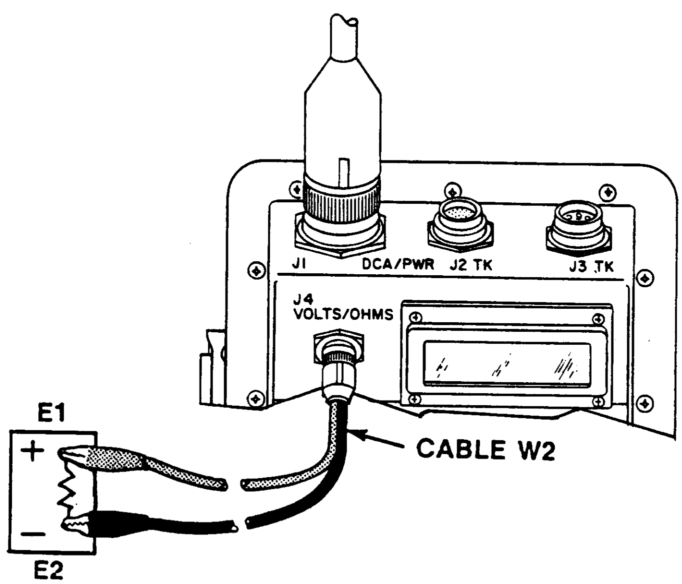
WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VIM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

CAUTION

Voltage must not exceed 35 VAC. Damage to VTM will result. Line voltage does exceed 35 VAC and will damage VTM.

1. **Connect test probe cable W2.** Attach connector P1 of cable W2 to VOLTS/OHMS J4.



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2-3-39. AC FREQUENCY 40 TO 500 HZ (TEST PROBE) TEST #96 (cont)

2. **Measure Frequency.**

a. Attach red clip El and black clip E2 of cable W2 across circuit where frequency is to be measured.

b. Turn on component to be tested.

c. Set TEST SELECT switches to 96.

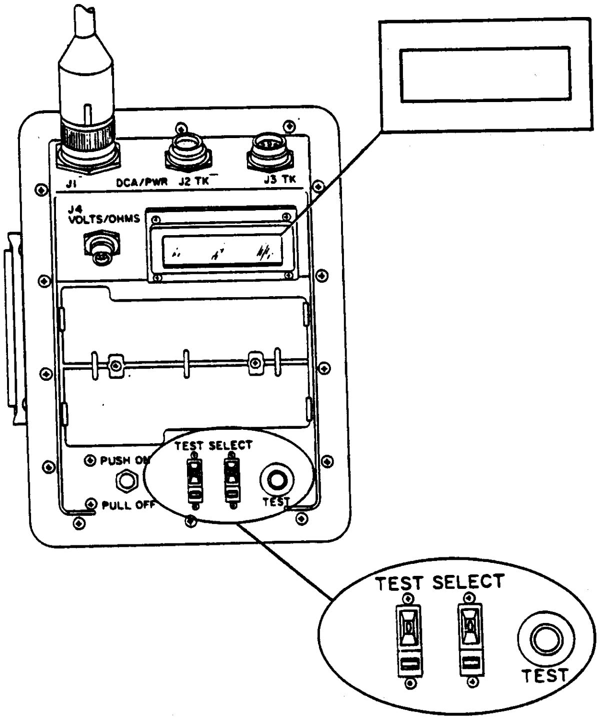
d. Press and release TEST button.

NOTES

If 0.0 is displayed, frequency is less than 40 Hz.

If .9.9.9.9 is displayed, frequency measured is beyond test range and cannot be measured with STE/ICE-R.

e. observe displayed value (Hz).



END OF TASK

2-3-40. AC FREQUENCY 40 TO 500 HZ (CURRENT PROBE) TEST #97 2-3-40

Description:

This procedure allows frequencies in the range of 40 to 500 Hz to be measured using the current probe. The VTM is used as a frequency meter with the decimal point in the correct position. This test must be done with the equipment operating.

Typical Applications:

40 to 500 Hz measurements

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3

Possible Error Messages:

EO02 Transducer not connected
E018 Test automatically terminated to protect the VTM

WARNING

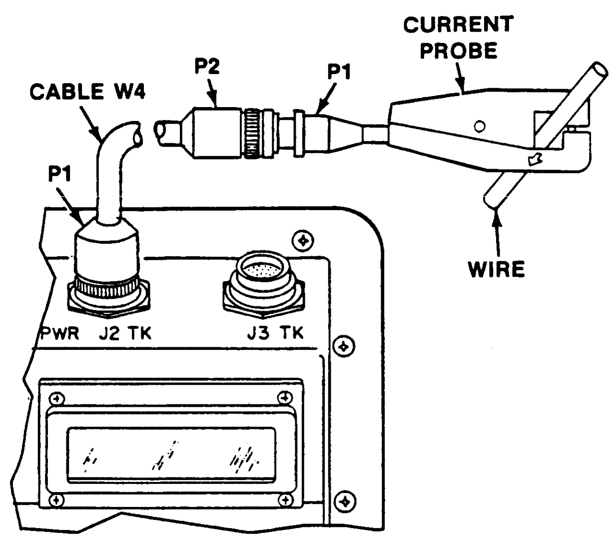
On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

1. Connect current probe.

a. Attach connector P1 of cable W4 to J2 TK or J3 TK on VTM.

b. Attach connector P2 of cable W4 to current probe, TK item 11.

c. Cl amp current probe around wire or cable to be measured.



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2-3-40. AC FREQUENCY 40 TO 500 HZ (CURRENT PROBE) TEST #97 (cont)

2. **Pleasure current frequency.**

a. Set TEST SELECT switches to 97.

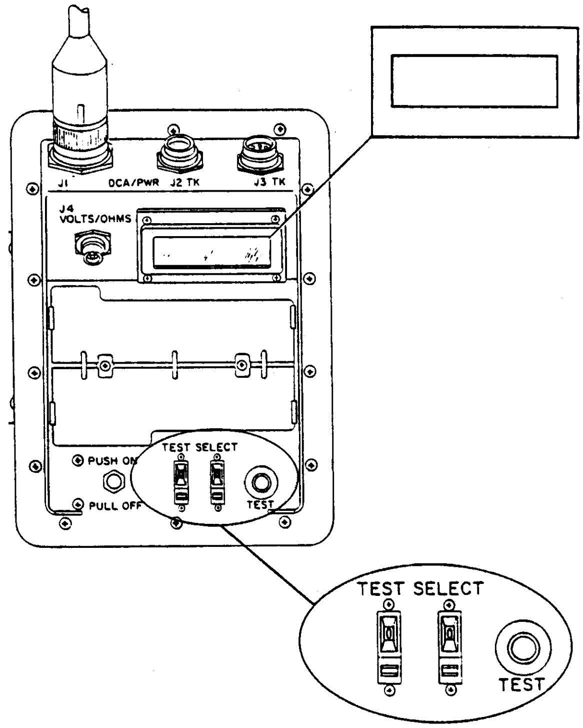
b. Turn on component to be tested.

c. Press and release TEST button.

NOTE

If .9.9.9.9 Is displayed, frequency is outside the test range and cannot be measured with STE/ICE-RC

d. Observe displayed value (Hz).



END OF TASK

2-3-41. SPECIAL TESTS 2-3-41

Special tests can be divided into two types, those that require specific vehicle/equipment information to conduct a measurement, and those that require uncommon procedural steps to accomplish a measurement. Tests 13, 14 and 15 fall into the first type and tests 72 thru 79, and 12 fall into the second type.

Tests that require specific vehicle/equipment information usually have that information stored in the VTM. The user must enter the VID to tell the VTM which vehicle's information to use. If the required information is not in the VTM for the particular VID entered, then the test will display prompt messages which will allow the user to enter the required information through the test select switches. Even tests that normally do not require a VID (tests 72 thru 79, and 12) may require a VID on special vehicle/equipment types (e.g. M151 and M880) to arrive at accurate measurement results. The VID, the test hookup, and any additional required information can be found in the vehicle/equipment TM or in Appendix G, Vehicle Test Cards. Test #60, paragraph 2-3-14, can be used to enter the VID, and test #61, paragraph 2-3-15, can be used to display the VID.

This part of the manual includes a procedure for each special test. The procedure for each of the special tests consists of two parts, a set-up table and the sequence of steps required to perform the measurement. The How To Use section in the front of this manual describes both of these parts in detail.

Some special tests can also be made through a diagnostic connector assembly mounted in a vehicle (DCA mode). The procedures for making the measurements are the same once the hookups are established.

Appendix J, Background Information for Tests, contains a detailed discussion on the theory of each test. The background discussion is optional reading material and is not needed to perform any test.

The following table lists the STE/ICE special tests. AIso refer to Table 2-5, Test Selection Guide, for a listing of all tests.

Table 2-11 Special Tests

TEST NO.	MEASUREMENT NAME	PARAGRAPH
* 12	Power Test (rpm/sec)	2-3-42
* 13	Power Test (percent)	2-3-43
* 14	Compression Unbalance (Power Cable)	2-3-44
15	Compression Unbalance (Test Probe)	2-3-45
* 72	Current First Peak (Power Cable)	2-3-46
* 73	Battery Internal Resistance (Power Cable)	2-3-47
* 74	Starter Circuit Resistance (Power Cable)	2-3-48
* 75	Battery Resistance Change (Power Cable)	2-3-49
76	Current First Peak (Test Probe)	2-3-50
77	Battery Internal Resistance (Test Probe)	2-3-51
78	Starter Circuit Resistance (Test Probe)	2-3-52
79	Battery Resistance Change (Test Probe)	2-3-53

* Special tests which can be performed in both DCA and TK modes.

END OF PARAGRAPH

2-3-42. POWER (RPM/SEC) TEST #12

Description:

This procedure measures an engine's power producing potential in units of RPM/SEC. For additional information, see Background Information for Tests, Appendix J.

Typical Applications:

Check enqine Power in units of RPM/SEC. May-be used for most CI or SI engines.

References:

Vehicle/EquiPment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (SI engine only)	2-3-14
or number of cylinders (SI engine only)	2-3-12

Possible Error Messages:

EO09 Engine not running at start of test
EO1l Throttle control operated incorrectly
E012 Ignition adapter/pulse tachometer missing
E014 Incorrect number of cylinders entry
E033 Error in entry of power test constants

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

A. CI HOOKUP AND TEST PROCEDURE

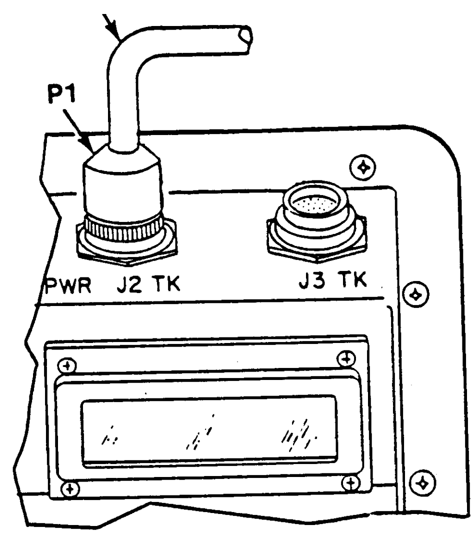
NOTE

CI power test will perform differently on engines with turbochargers and/or fuel limiting devices. See Vehicle/ Equipment TM for specific procedure.

1. **Connect test cable.** Attach connector P1 of cable W4 to J2 TK or J3 TK.

NOTE

For CI engine, do procedure A.
For SI engine, do procedure B.



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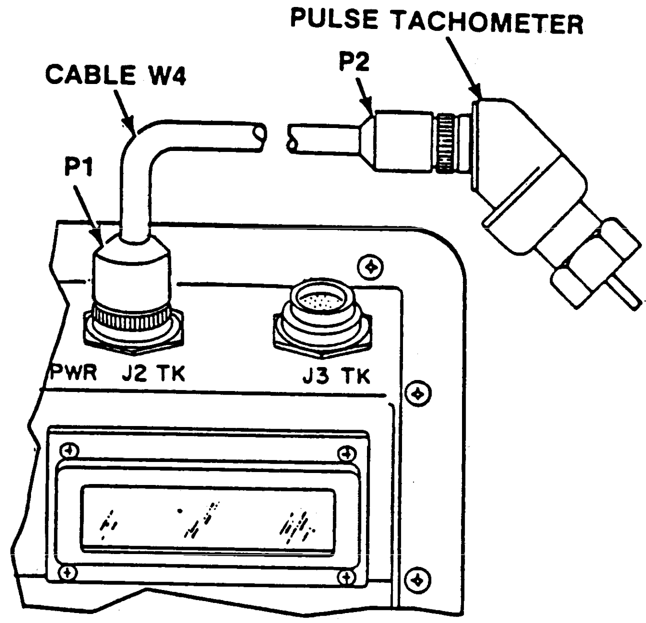
A. CI HOOKUP AND TEST PROCEDURE (cont)



WARNING

To prevent damage to equipment or injury to personnel, turn engine off before installing pulse tachometer.

CAUTION

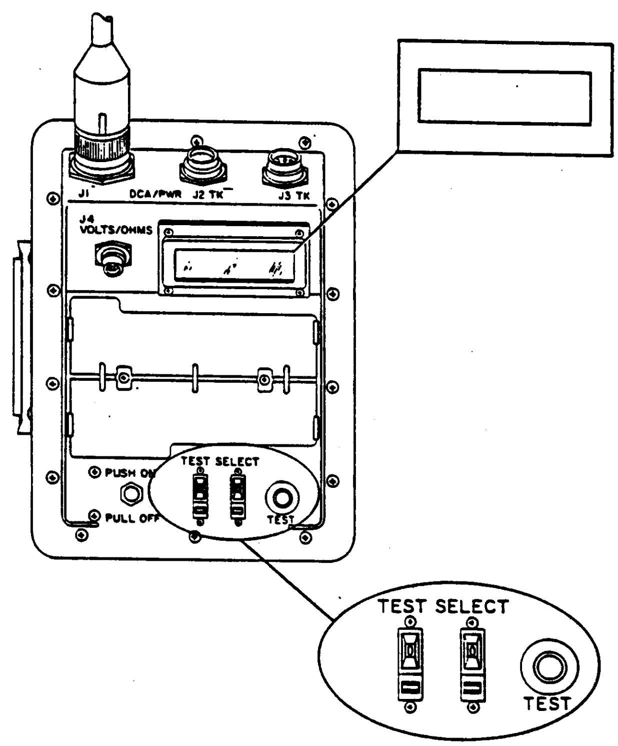
Clean all mounting surfaces before installing pulse tachometer to prevent the entry of foreign substances that may damage the engine or transducer.

NOTE

Locate vehicle/equipment test points where measurement is to be made.

2. Install pulse tachometer, TK item 34.

3. Connect tachometer. Attach connector P2 of cable W4 to pulse tachometer, TK item 34.



4. Start and idle engine.

   a. Set TEST SELECT switches to 10.

   b. Press and release TEST button.

NOTES

Engine idle speed must be checked before performing power test. If idle speed is not within limits specified for vehicle/equipment, adjust idle speed to be within proper limits.

Do not run power test if idle speed cannot be properly adjusted.

   c. Observe displayed value (rpm) to adjust idle speed if necessary.

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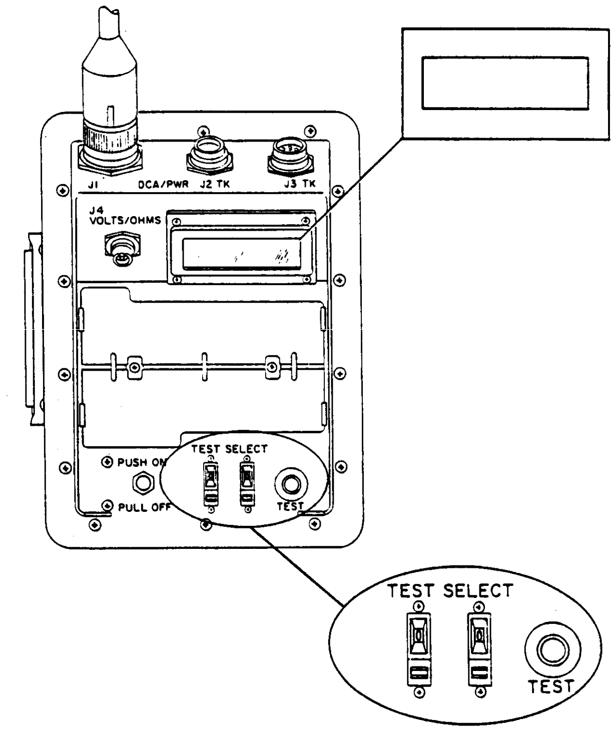
2-3-42. POWER (RPM/SEC) TEST #12 (Cont)

A. CI **HOOKUP AND TEST PROCEDURE** (cont)



CAUTION

Engine governor speed must be checked before performing power test. If governor speed is not within limits specified for vehicle/equipment, go to vehicle/equipment TM to adjust governor. Do not run power test if governor speed is not within specified limits Damage to vehicle/equipment may result.

d. Observe displayed value (rpm) to adjust governor speed if necessary

CAUTION

Look at engine temperature gage. Do not proceed to step 5 if engine temperature is above normal. Damage to vehicle/equipment may result.

NOTES

Do not proceed to step 5 until engine has been warmed up.

If specific governor speed is less than 2100 rpm or idle speed is greater than 900 rpm, measurement results may be in error. If specific governor speed is less than 2100 rpm, or idle speed is greater than 900 rpm, use test 60, paragraph 2-3-14, to enter the VID before proceeding to step 5. The VID value can be found in the vehicle/equipment TM.

5. Perform power test.

a. Set TEST SELECT switches to 12.

GO TO NEXT PAGE

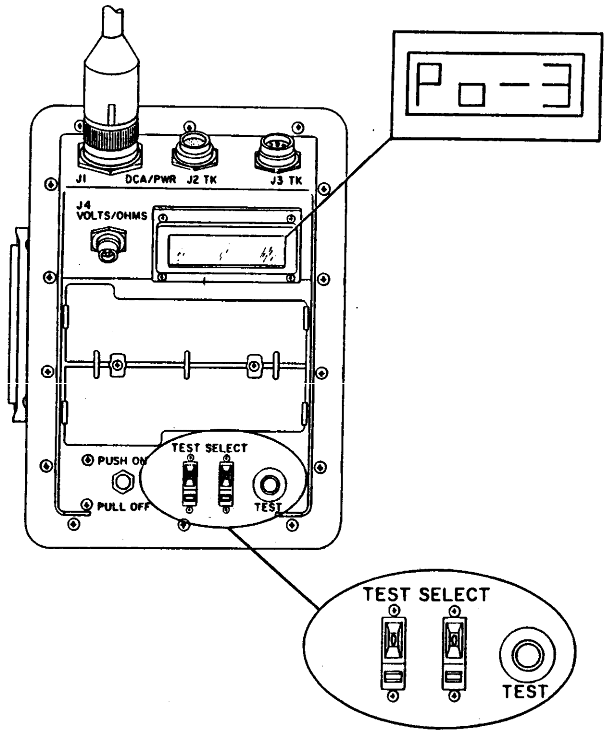
2-3-42. POWER (RPM/SEC) TEST #12 (cont) 2-3-42

A. **CI HOOKUP AND TEST PROCEDURE** (cont)

b. Press and release TEST button.

NOTE

If a prompting message Po-3 appears on the display, refer to the vehicle/equipment TM for the value to enter in step d. This value, which relates to engine speed, must be 1, 2, 3, or 4. If no Po-3 prompting message appears on the display, skip steps c to f.



c. Wait for prompting message Po-3 to appear on display.

d. Set TEST SELECT switches to Po-3 value.

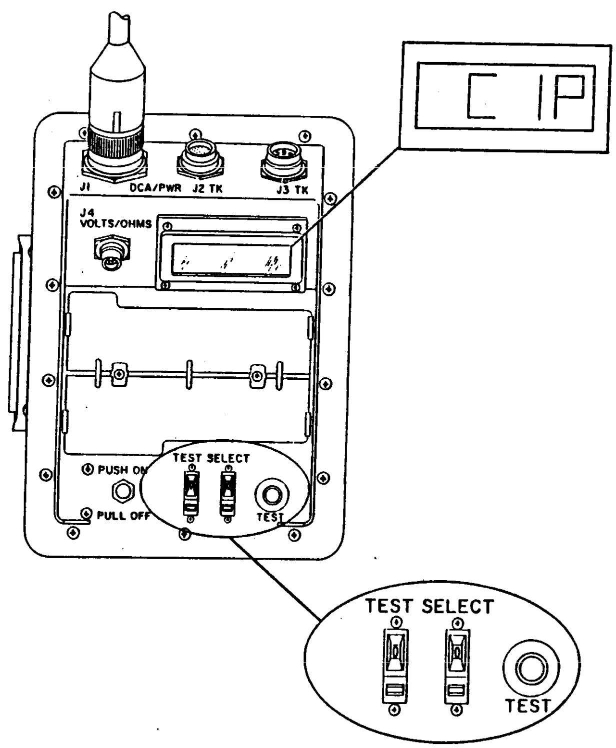
e. Press and release TEST button.

NOTE

The Po-3 value will remain on the display only a few seconds.

f. Wait for the VTM to display the Po-3 value.

g. When CIP appears on display, press down sharply on engine accelerator and hold it to the floor. When VTM displays a number, release accelerator.



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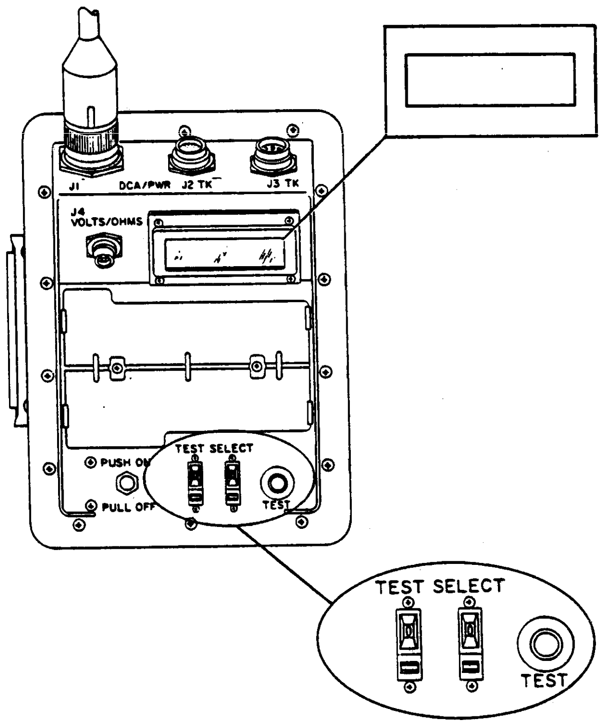
A. CI **HOOKUP AND TEST PROCEDURE** (cont)



CAUTION

Allow engine to idle for at least 2 minutes after running power test to prevent damage to vehicle/equipment.

NOTE

Two numbers will be displayed. First number is acceleration rate. This number will go away after a few seconds. The second number is the test resulte This number will remain on the display.

h. Observe displayed value (rpm/sec).

B. SI **HOOKUP AND TEST PROCEDURE**

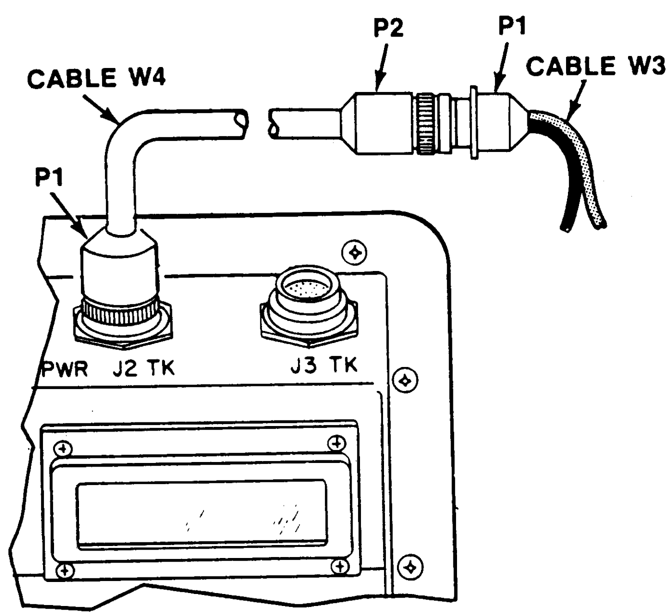
CAUTION

Do not perform SI power test on vehicles equipped with a catalytic converter. Damage to vehicle may result.

1. **Connect test cables.**

a. Attach connector P1 of cable W4 to J2 TK or J3 TK.

b. Attach connector P2 of cable W4 to connector P1 of cable W3.



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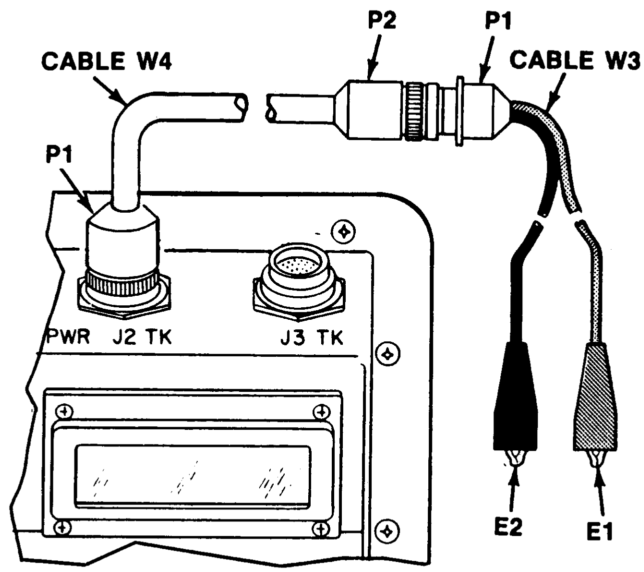
2-3-42. POWER (RPM/SEC) TEST #12 (cont) 2-3-42

B. SI **HOOKUP AND TEST PROCEDURE** (cont.),



WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

NOTE

Locate vehicle/equipment test points where measurement is to be made.

2. **Make cable connections for measurement.**

   a. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.

   b. Attach red clip El of cable W3 to ignition adapter, TK item 30, or distributor terminal of coil primary.

   c. Attach black clip E2 of cable W3 to vehicle/equipment ground.

CAUTION

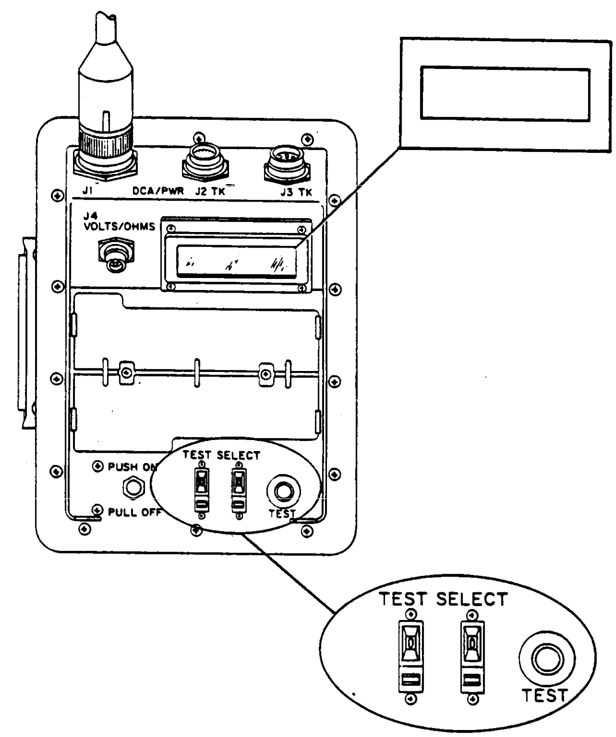
Do not operate engine over 4000 rpm, Engine damage may result.

NOTE

A VID or the number of cylinders must be entered.

3. Start and idle **engine.**

   a. Set TEST SELECT switches to 10.



GO TO NEXT PAGE

B. SI HOOKUP AND TEST PROCEDURE (cont)

b. Press and release TEST button.

NOTE

If a prompting message CYL appears on the display, refer to the vehicle/ equipment TM for the value of cylinders or cylinder pairs to enter in step d. If no CYL prompting message appears on the display, skip steps c to f.

c. Wait for prompting message CYL to appear on display.

d. Set TEST SELECT switches to number of cylimders/cylinder pairs.

NOTE

The cylinders display value will remain on the display only a few seconds.

e. Press and release TEST button

f. Wait for VTM to display number of cylinders entered.

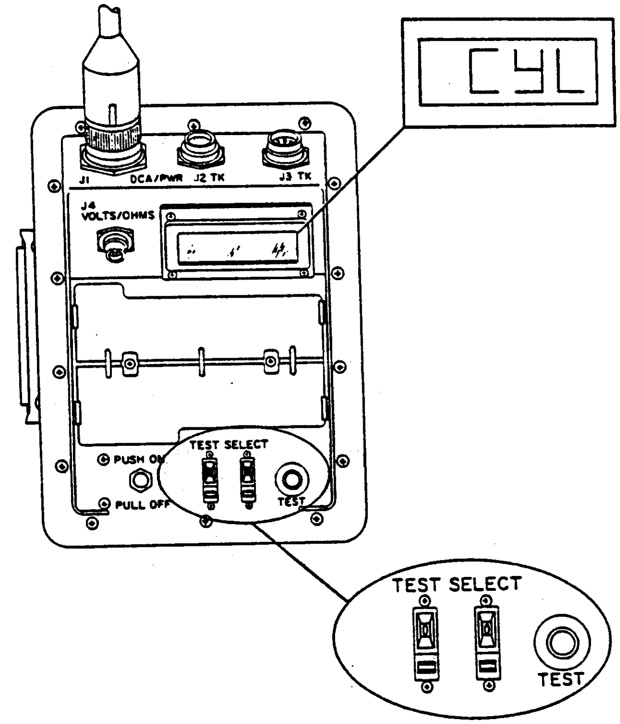
WARNING

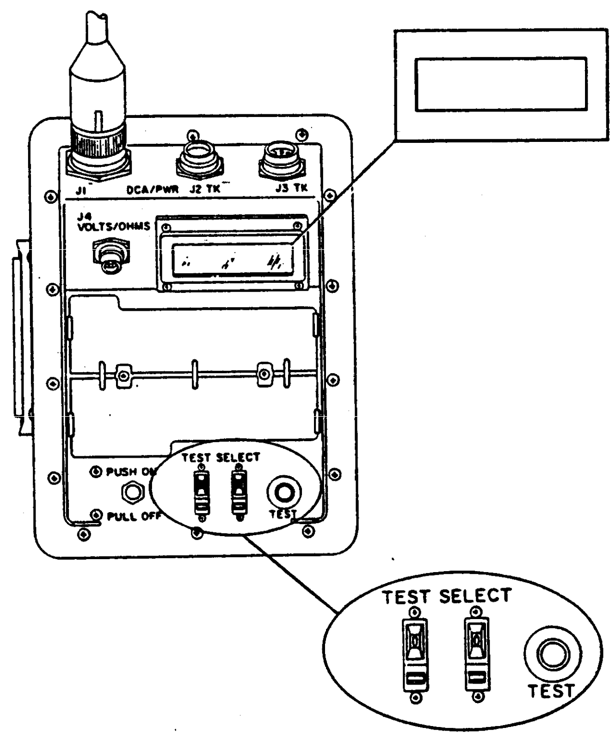
Do not run power test if idle speed cannot be properly adjusted.

NOTE

Engine idle speed must be checked before performing power test. If idle speed is not within limits specified for vehicle/equipment, adjust idle speed to be within proper limits.

g. Observe displayed value (rpm) to adjust idle speed if necessary.





GO TO NEXT PAGE

2-3-42. POWER (RPM/SEC) TEST #12 (cont) 2-3-42

B. SI HOOKUP AND TEST PROCEDURE (cont)

CAUTION

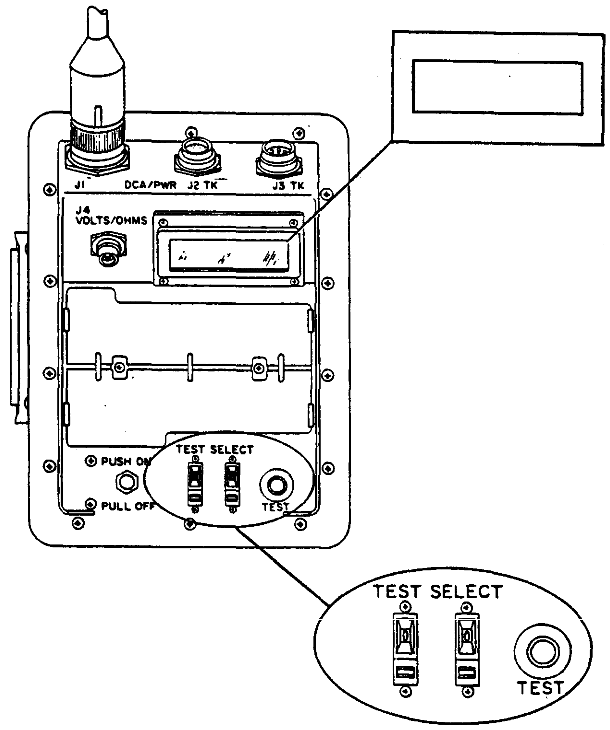
To prevent vehicle/equipment damage operation of VTM interrupt circuit must be checked before proceeding.

4. **Check interrupt circuitry.**

   a. Set TEST SELECT switches to 10.

   b. Press and release TEST button.

   c. Set TEST SELECT switches to 05.



GO TO NEXT PAGE

2-3-42. POWER (RPM/SEC) TEST #12 (cont)

B. **SI HOOKUP AND TEST PROCEDURE** (cont)

CAUTION

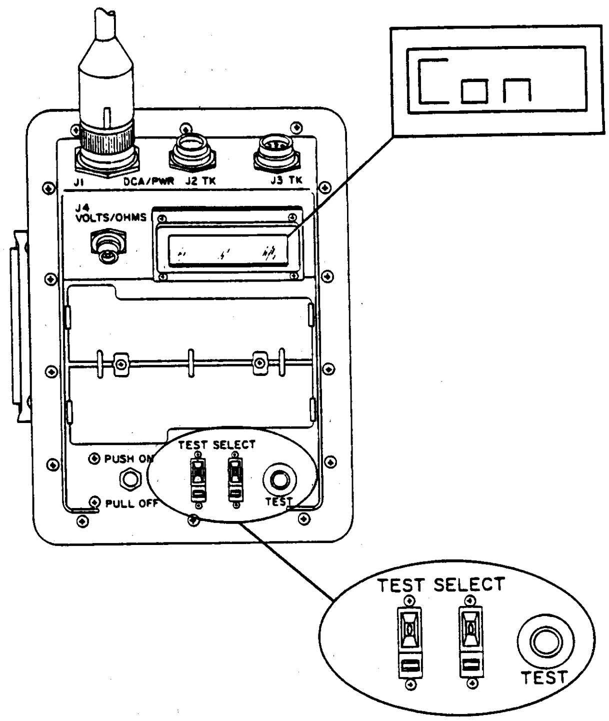
Do not overspeed the engine, damage to vehicle/equipment may result.

NOTE

Interrupt should occur at about 3500 rpm.

d. Increase engine speed to slightly above 3500 rpm as shown on display. Hold speed constant.

e. Press and release TEST button. If engine misses and VTM displays Con, release accelerator and proceed to step 5. If VTM does not display Con or does not begin missing, release accelerator and check all VTM connections and repeat step 4. If VTM still fails to display Con or does not begin missing, stop testing and go to Cable Fault Isolation, paragraph 3-2-3, to troubleshoot ignition adapter cable W3 and transducer cable W4. If no cable fault is found, then VTM cannot perform SI power test. Continue other testing. When finished, return STE/ICE-R set to DS maintenance for repair.



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CAUTION

Do not perform more than two power tests in succession. Damage to vehicle/equipment may resfilt. Allow vehicle/equipment to idle for at least five minutes after performing two power tests.

Check engine temperature gage. Do not proceed to step 5 if the engine temperature is above normal. Damage to the vehicle may result.

If engine sounds like it is overspeeding, release accelerator immediately to prevent damage to vehicle/equipment. Check connections, and repeat steps 4, and 5.

NOTE

Do not proceed to step 5 until engine reaches normal operating temperature.

5. **Perform power test.**

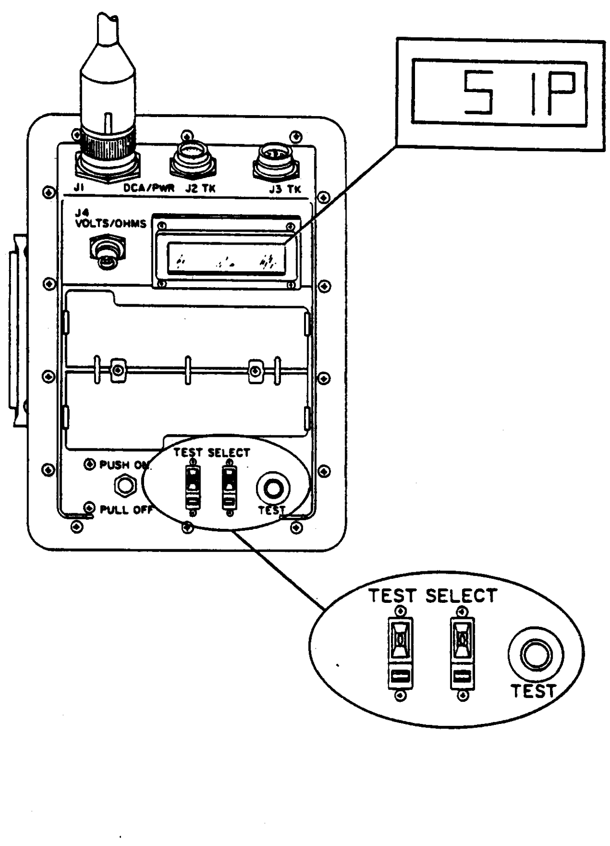
a. Set TEST SELECT switches to 12.

NOTE

About 40 seconds after starting test, engine will accelerate slightly and then stop. The engine will run rough and may backfire. This is normal.

b. Press and release TEST button.

C. When SIP appears on display, press accelerator sharply and hold it to floor until engine stops. When engine stops, release accelerator. This should happen in approximately 40 sec.



GO TO NEXT PAGE

2-3-42. POWER (RPM/SEC) TEST #12 (cont) 2-3-42

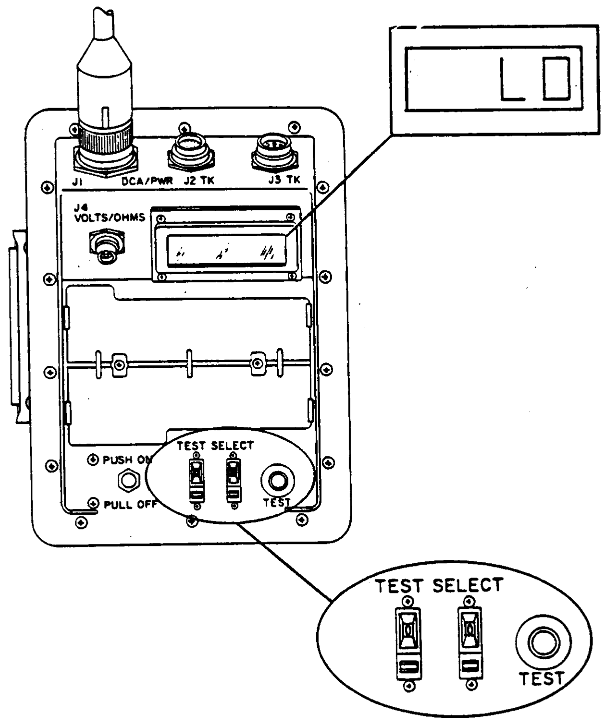
B. SI HOOKUP AND TEST PROCEDURE (cont)

NOTES

If LO message appears on VTM display, then vehicle has failed power test. This message appears when the vehicle cannot maintain a sufficient power level long enough to complete the test.

Two numbers will appear on the VTM display. These are the test results. The first number is the interrupt speed in RPM. This number will go away after a few seconds. The second number is the coast down deceleration in RPM/SEC. This number will remain on the display.

d. Observe displayed value (RPM/SEC).



NOTE

After testing is complete, run engine at high idle for approximately one minute before shutting engine down.

END OF TASK

2-3-43. POWER (PERCENT) TEST #13 2-3-43

Description:

This procedure measures the percentage of the engine's power producing potential as compared to a good engine. For additional information, see Background Information for Tests, Appendix J.

Typical Applications:

Check engine power.
May be used for several CI engines.
It may also be used on SI engines with a VIDof 1 or 5.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID	2-3-14

Possible Error Messages:

EO09 Engine not running at start of test
E011 Throttle control operated incorrectly
E012 Ignition adapter/pulse tachometer missing
E024 Test not valid for VID entered

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

A. CI HOOKUP AND TEST PROCEDURE

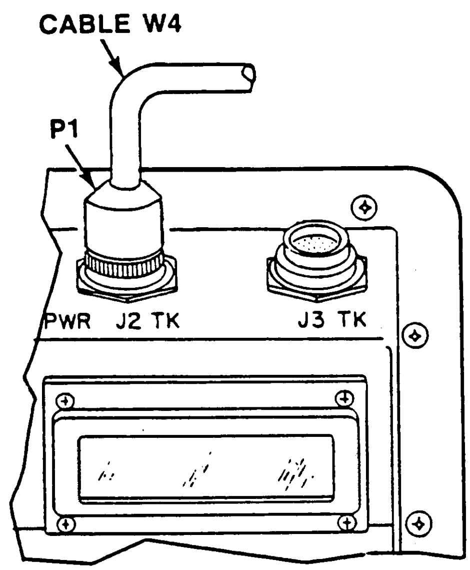
NOTE

CI power test will perform differently on engines with turbochargers and/or fuel 1 imiting devices. See Vehicle/ Equipment TM for specific procedure.

1. **Connect test cable.** Attach connector PI of cable W4 to J2 TK or J3 TK.

NOTE

For CI engine, do procedure A.
For SI engine, do procedure B.



GO TO NEXT PAGE

2-3-43. POWER (PERCENT) TEST #13 (cont) 2-3-43

A. **CI HOOKUP AND TEST PROCEDURE** (cont)

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before installing pulse tachometer.

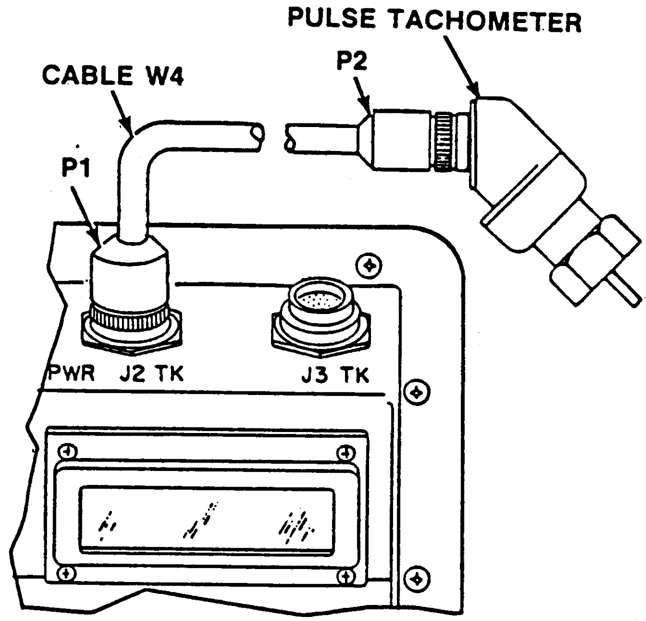
CAUTION

Clean all mounting surfaces before installing pulse tachometer to prevent the entry of foreign substances that may damage the engine or transducer.

NOTE

Locate vehicle/equipment test points where measurement is to be made.

2. **Install pulse tachometer, TK item 34.**



3. Connect pulse tachometer. Attach connector P2 of cable W4 to tachometer.

4. **Start and idle engine.**

   a. Set TEST SELECT switches to 10.

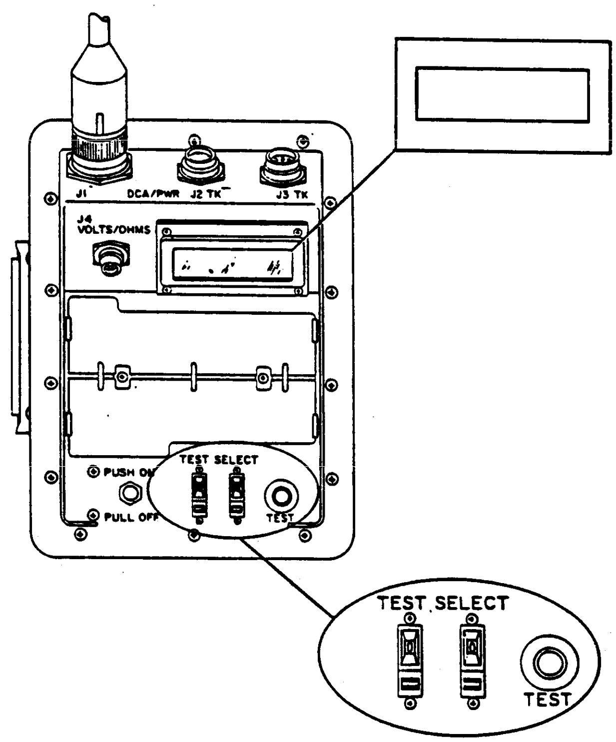
   b. Press and release TEST button.

NOTES

Engine idle speed must be checked before performing power test. If idle speed is not within limits specified for vehicle/equipment, adjust idle speed to be within proper limits.

Do not run power test if idle speed cannot be properly adjusted.

   c. Observe displayed value (rpm) to adjust idle speed if necessary.



GO TO NEXT PAGE

2-3-43. POWER (PERCENT) TEST #13 (cont) 2-3-43

A. **CI HOOKUP AND TEST PROCEDURE** (cont)

CAUTION

Engine governor speed must be checked before performing power test. If governor speed is not within limits specified for vehicle/equipment, go to vehicle/equipment TM to adjust governor. Do not run power test if governor speed is not within specified limits. Damage to vehicle/equipment may result.

d. Observe displayed value (rpm) to adjust governor speed if necessary.

CAUTION

Look at engine temperature gage. Do not proceed to step 5 if engine temperature is above normal. Damage to vehicle/equipment may result.

NOTES

Do not proceed to step 5 until engine has been warmed up.

5. Perform power test.

a. Set TEST SELECT switches to 13.

b. Press and release TEST button.

GO TO NEXT PAGE

2-3-43. POWER (PERCENT) TEST #13 (cont) 2-3-43

A. CI HOOKUP AND TEST PROCEDURE (cont)

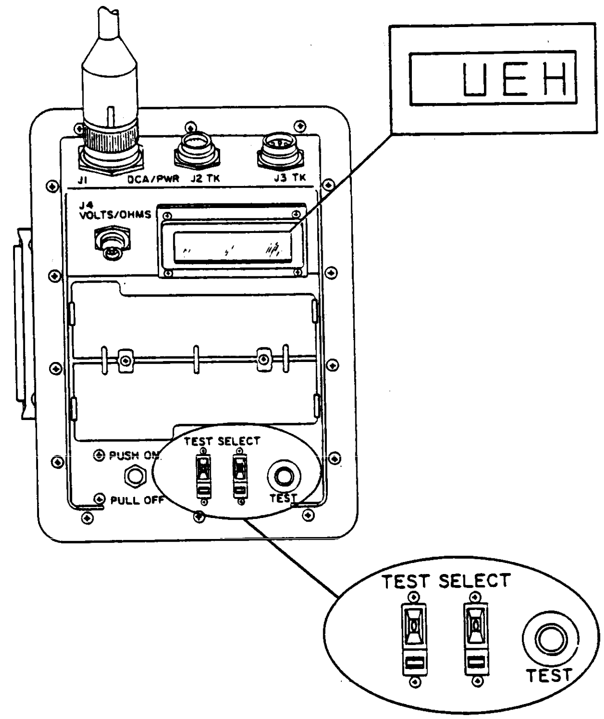
NOTE

If a prompting message UEH appears on the display, refer to the vehicle/ equipment TM for the value to enter in step d. If no UEH prompting message appears on the display, skip steps c to f.

c. Wait for prompting message UEH to appear on display.

d. Set TEST SELECT switches to VID value.

e. Press and release TEST button.



NOTE

The number just entered will remain on the display only a few seconds.

f. Wait for the VTM to display the VID just entered.

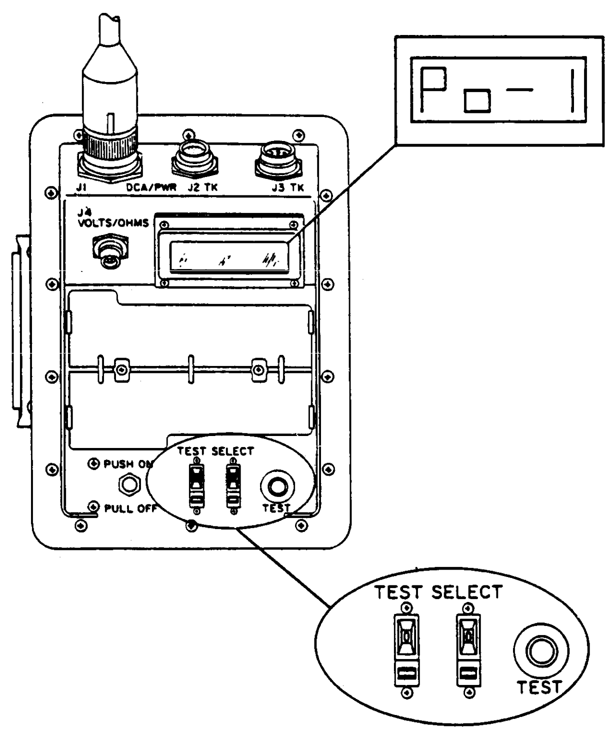
NOTE

If a prompting message Po-1 appears on the display, refer to the vehicle/ equipment TM for the values of Po-I and Po-2. If no Po-1 prompting message appears on the display, skip steps g to m.

g. Wait for prompting message Po-1 to appear on display.

h. Set TEST SELECT switches to Po-1 value.

j. Press and release TEST button.



GO TO NEXT PAGE

A. CI HOOKUP AND TEST PROCEDURE (cont)

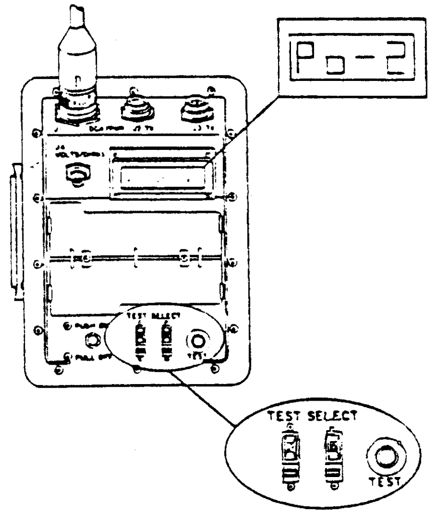
NOTE

The number just entered will remain on the display only a few seconds. It will be followed by a Po-2 prompting message.

k. Wait for prompting message Po-2 to appear on display.

1. Set TEST SELECT switches to Po-2 value.

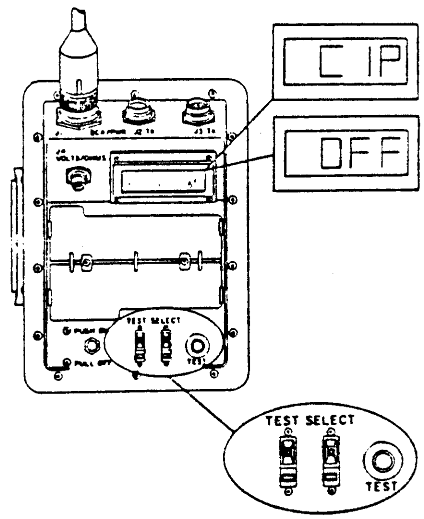
m. Press and release TEST button.



NOTE

The number just entered will remain on the display only a few seconds. It will be followed by the CIP prompting message.

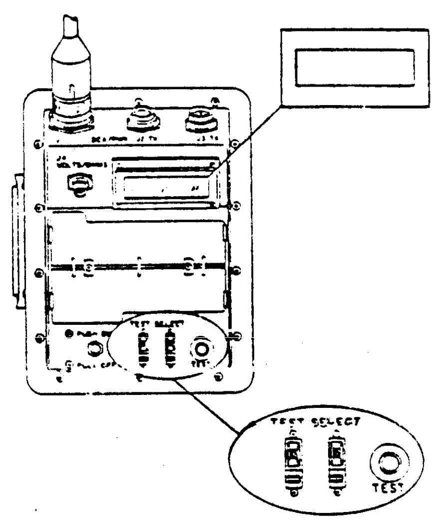
n. When CIP is displayed, sharply depress accelerator. Hold it to the floor. When VTM displays OFF, release accelerator.



CAUTION

To prevent damage to equipment, allow engine to idle for at least two minutes after running power test.

o. A number will be displayed after engine has returned to idie speed. This number is the test result in units of per cent of nominal rated power.



% POWER: MINIMUM TEST LIMIT			
Vehicie	Altituoe		
	0 to 2000 ft.	2000 to 4000 ft.	Above 4000 ft.
M35 TURBO	60%	51%	45%
ALL OTHER VEHICLES	75%	68%	60%

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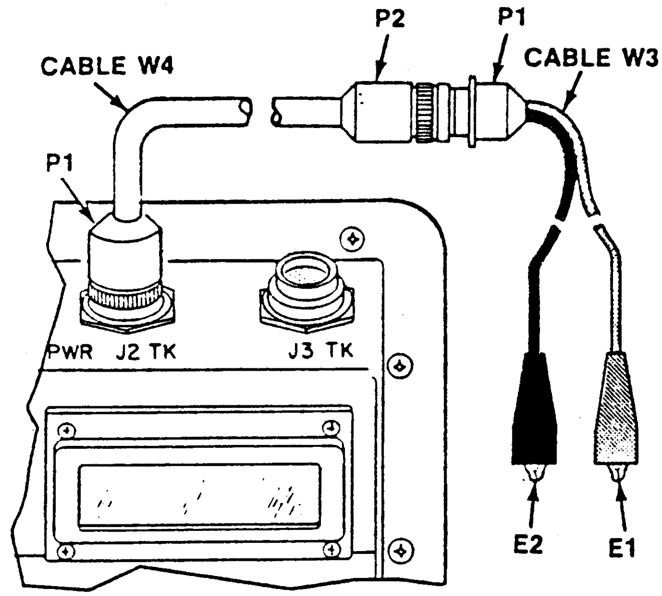
2-3-43. POWER (PERCERT) TEST #13 (cont) 2-3-43

R. SI HOOKUP AND **TEST PROCEDURE**



CAUTION

Do not perform SI power test on vehicles equipped with a catalytic converter. Damage to vehicle may result.

NOTE

This procedure cannot be used on vehicle/equipment with VIDS other than 1 or 5$_0$ The VID must be entered.

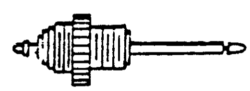
1. **Connect** test **cables.**

   a. Attach connector PI of cable W4 to J2 TK or J3 TK.

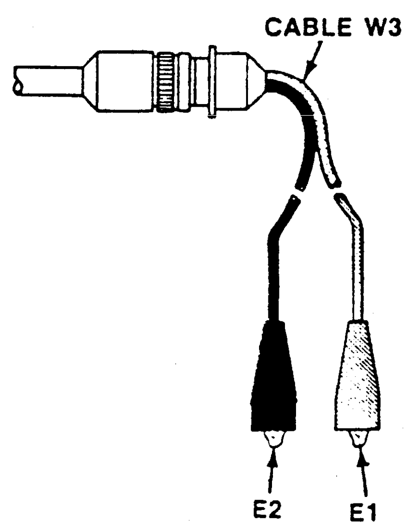
   b. Attach connector P2 of cable W4 to connector P1 of cable W3.

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.



IGNITION ADAPTER



NOTE

Locate vehicle/equipment test points where measurement is to be made.

2. Make cable connections for measurement.

   a. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.

   b. Attach red clip E1 of cable W3 to ignition adapter or distributor terminal of coil primary.

   c. Attach black clip E2 of cable W3 to vehicle/equipment ground.

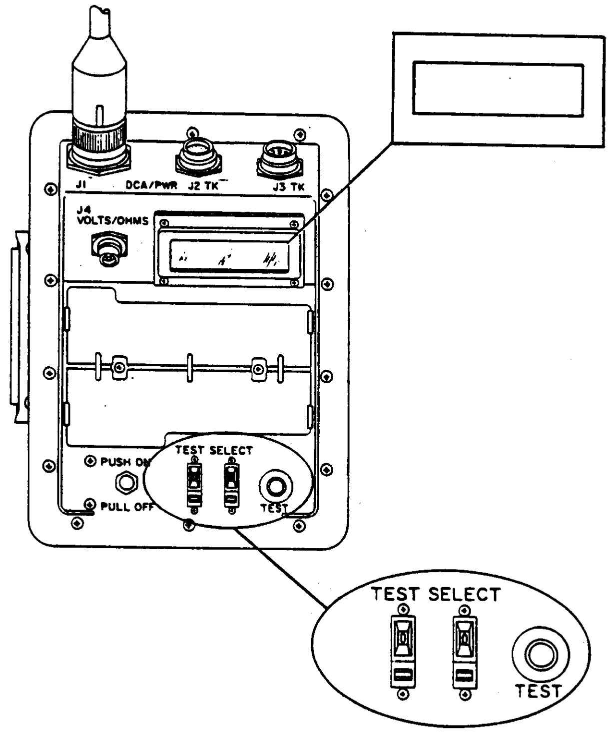
GO TO NEXT PAGE

2-3-43. POWER (PERCENT) #13 (Cont) 2-3-43

B. SI HOOKUP AND TEST PROCEDURE (cont)

CAUTION

Do not exceed vehicle engine rpm limitations. Engine damage may result.



NOTES

Engine idle speed must be checked before performing power test. If idle speed is not within limits specified in vehicle/equipment TM, adjust idle speed to be within proper limits.

Do not run power test if idle speed cannot be properly adjusted.

A VID must be entered.

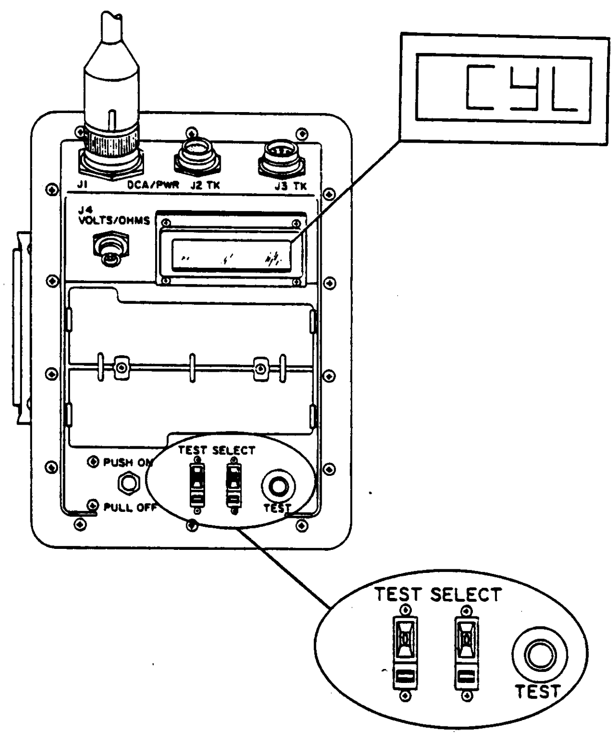
3. Start and idle engine.

a. Set TEST SELECT switches to 10.

b. Press and release TEST button.

NOTE

If a prompting message CYL appears on the display, refer to the vehicle/ equipment TM for the value of cylinders or cylinder pairs to enter in step d. If no CYL prompting message appears on the display, skip steps c to f.



c. Wait for prompting message CYL to appear on display.

d. Set TEST SELECT switches to number of cylinders/cylinder pairs.

NOTE

The cylinders display value will remain on the display only a few seconds. .

e. Press and release TEST button

GO TO NEXT PAGE

B. SI HOOKUP AND TEST PROCEDURE (cont)

f. Wait for VTM to display number of cylinders entered.

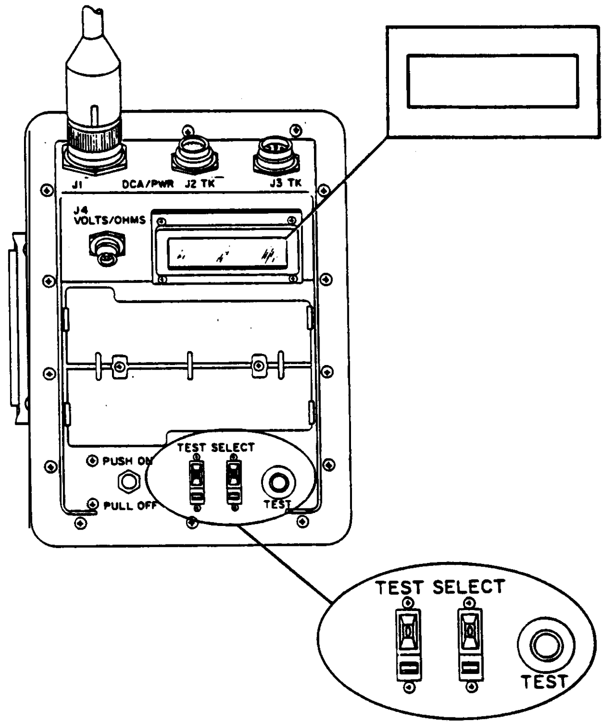
CAUTION

Do not run power test if idle speed cannot be properly adjusted.

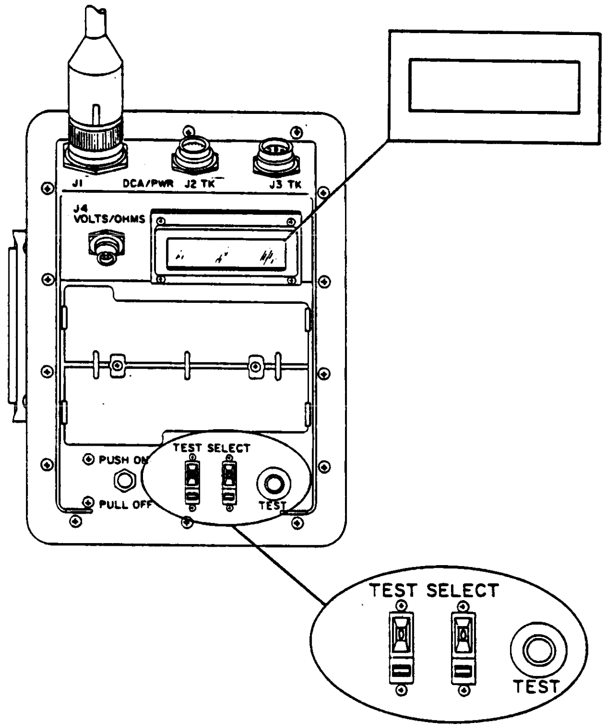
NOTE

Engine idle speed must be checked before performing power test. If idle speed is not within limits specified for vehicle/equipment, adjust idle speed to be within proper limits.

g. Observe displayed value (rpm) to adjust idle speed if necessary.



B. SI HOOKUP AND TEST PROCEDURE (cont)



CAUTION

Do not exceed vehcle engine rpm limitations.

To prevent possible damage to vehicle/equipment, operation of VTM interrupt circuit must be checked before proceeding to step 5.

4. **Check interrupt circuitry.**

a. Set TEST SELECT switches to 10.

b. Press and release TEST button.

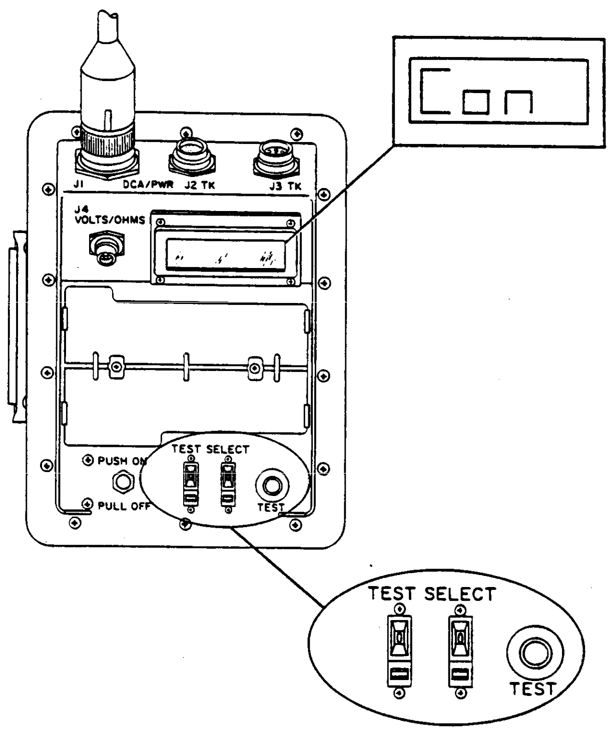
c. Set TEST SELECT switches to 05.

CAUTION

Do not overspeed the engine. Damage to vehicle/equipment may result.

NOTE

Interrupt should occur at about 3500 rpm.

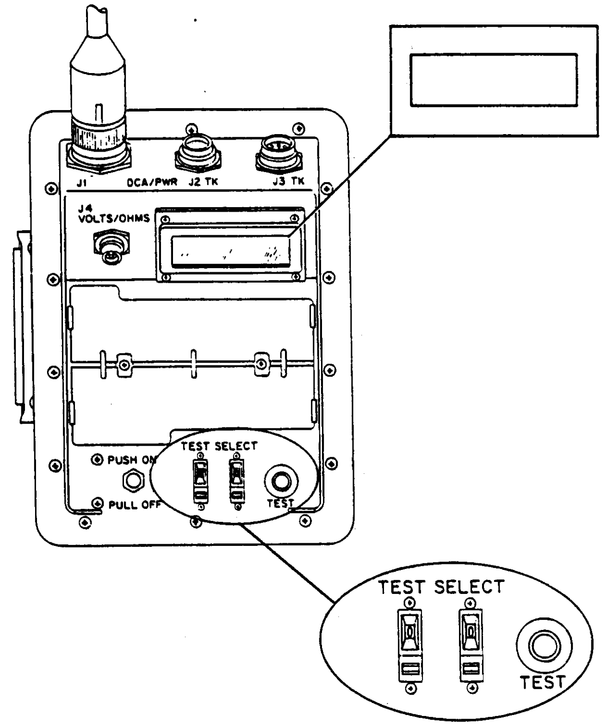


d. Increase engine speed to slightly above 3500 rpm. This speed will show on display. Hold speed constant.

e. Press and release TEST button. If engine misses and VTM displays Con, release accelerator and proceed to step 5. If VTM does not display Con or does not begin missing, release accelerator; check all VTM connections, and repeat step 4. If VTM still fails to display Con or does not begin missing, stop testing, and refer to Cable Fault Isolation, paragraph 3-2-3, to troubleshoot ignition adapter cable W3 and transducer cable W4. If no cable fault is found, then the VTM cannot perform SI power test. Continue other testing. When finished, return STE/ICE-R set to DS maintenance for repair.

GO TO NEXT PAGE

B. **SI HOOKUP AND TEST PROCEDURE** (cont)



CAUTION

Do not perform more than two power tests in succession. Damage to vehicle/equipment may result. Allow vehicle/equipment to idle for at least 5 minutes after performing two power tests.

Do not proceed to step 5 if engine temperature is above normal. Damage to vehicle/equipment may result.

NOTE

Do not proceed to step 5 until engine reaches normal operating temperature.

5. Perform power test.

a. Set TEST SELECT switches to 13.

CAUTION

If engine sounds like it is overspending, release accelerator immediately to prevent possible engine damage. Check connections, and repeat steps 4 and 5.

NOTE

About 40 seconds after starting test, engine will accelerate slightly and then stop The engine will run rough and may backfire. This is normal.

b. Press and release TEST button.

GO TO NEXT PAGE

B. SI HOOKUP AND TEST PROCEDURE (cont)

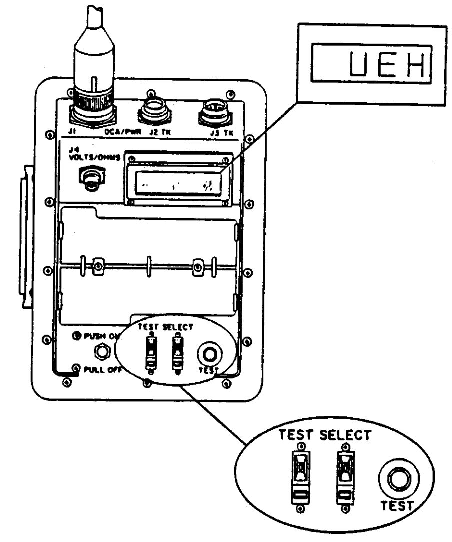
NOTE

If a prompting message UEH appears on the display, refer to the vehicle/ equipment TM for the value to enter in step d. If no UEH prompting message appears on the display, skip steps c to f.

c. Wait for prompting message UEH to appear on display.

d. Set TEST SELECT switches to VID value.

e. Press and release TEST button.

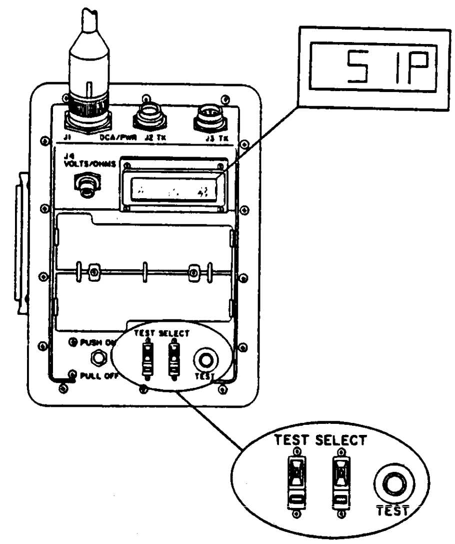


NOTE

The number just entered will remain on the display only a few seconds.

f. Wait for the VTM to display the VID just entered.

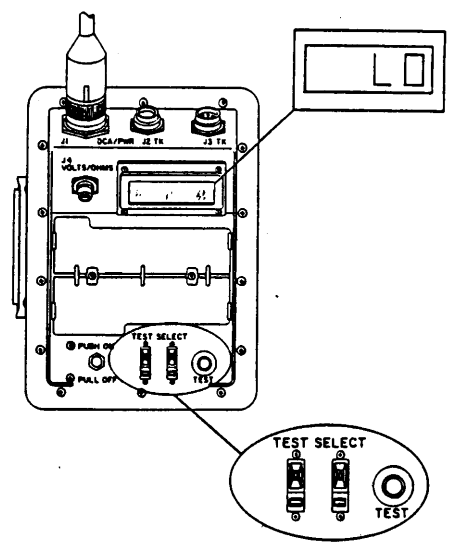
g. When SIP appears on display, press accelerator sharply and hold it to floor until engine stops. When engine stops, release accelerator. This should happen in approximately 40 sec.



NOTE

If LO message appears on VTM display, then vehicle has failed power test. This message appears when the engine cannot maintain a sufficient power level long enough to complete the test.

h. After engine stops, observe displayed value (percent of rated power).



END OF TASK

2-3-44. COMPRESSION UNBALANCE (POWER CABLE) TEST #14 2-3-44

Description:

This test compares the compression between the highest and lowest cylinders and displays the unbalance in percent. This is a cranking test. For additional information, see Background Information for Tests, Appendix J.

Typical Applications:

Check compression unbalance on CI and SI engines with VTM powered from battery of vehicle being tested

References:

Vehicle/Equipment TM

Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Run first-peak series	
Test #72	2-3-46
Test #73	2-3-47
Test #74	2-3-48
Test #75	2-3-49
Enter VID	2-3-14

Possible Error Messages:

EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E027 Error in entry of compression unbalance constants.
E032 Vehicle's cranking speed is varying too much for a compression unbalance measurement.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing al 1 testing with the vehicle master switch on.

NOTE

Be sure batteries are at full charge. Do not do more than two compression unbalance tests in a row because vehicle batteries may discharge.

NOTES

While cranking engine with bad or discharged batteries, VTM may lose power and come on again after the cranking has stopped, displaying ----- If this occurs, clean battery posts and clamps and try again. If VTM still loses power, do Compression Unbalance Test #15, paragraph 2-3-45.

If possible, engine should be at operating temperature when performing compression unbalance test. When engine is warmed, run engine at low idle for 2 minutes before stopping.

Do not have a battery charger connected when performing this test.

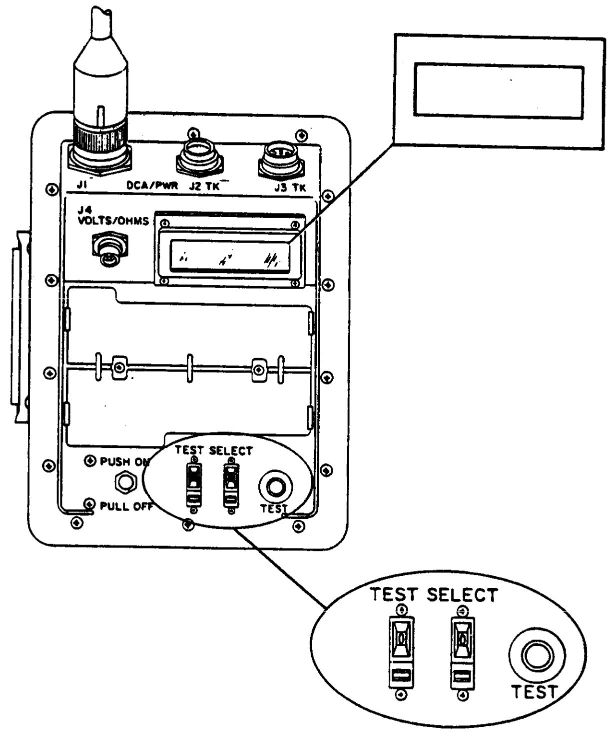
GO TO NEXT PAGE

1. Set up engine to prevent starting. Stop engine. Shut off fuel before cranking. Crank engine without fuel for 5 seconds to clear fuel from cylinders.

NOTES

Do not run more than two compression unbalance tests in a row. Idle engine between pairs of compression unbalance tests.

On M113 vehicles, disengage transfer case before performing test.



2. Perform test.

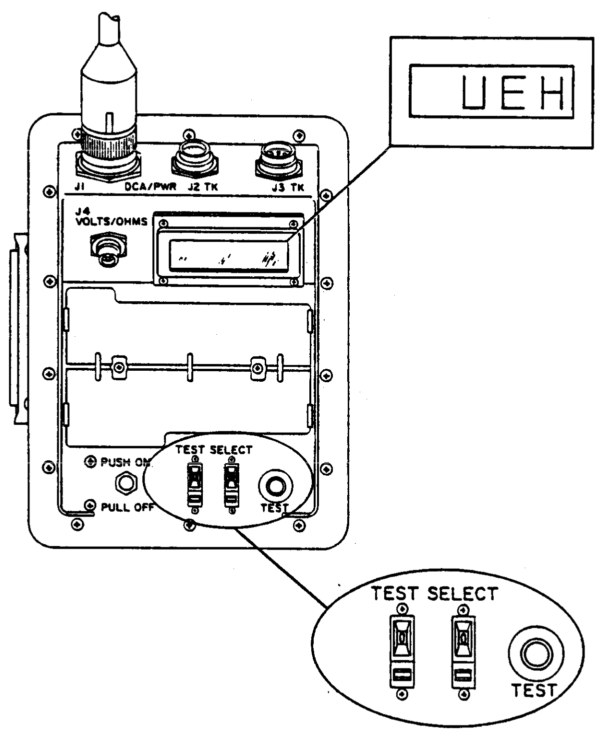
a. Set TEST SELECT switches to 14.

b. Press and release TEST button.

NOTE

If a prompting message UEH appears on the display, refer to the vehicle/ equipment TM for the value to enter in step d. If no UEH prompting message appears on the display, skip steps c to g.

c. Wait for prompting message UEH to appear on display.



d. Set TEST SELECT switches to VID value.

e. Press and release TEST button.

NOTE

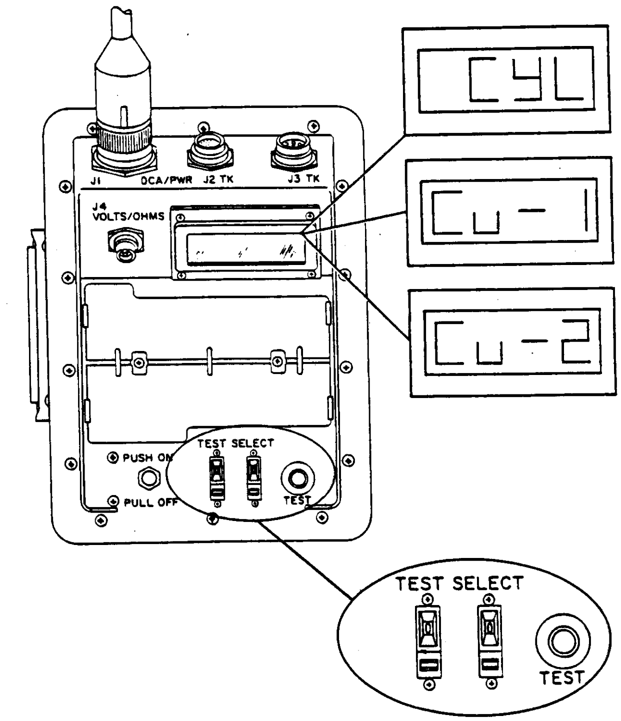
The number just entered will remain on the display only a few seconds.

f. Wait for the VTM to display the VID just entered.

GO TO NEXT PAGE

NOTE

If a prompting message CYL appears on the display, refer to the vehicle/equipment TM for the value of cylinders or cylinder pairs to enter in step h. The vehicle/equipment TM will also provide the values for compression unbalance constants Cu-1 to CU-5. If no CYL prompting message appears on the display, skip steps g thru y.



g. Wait for prompting message CYL to appear on display.

h. Set TEST SELECT switches to number of cylinders/cylinder pairs.

NOTE

The cylinders display value will remain on the display only a few seconds. This will be followed by the Cu-1 prompting message.

j. Press and release TEST button.

k. Wait for VTM to display the Cu-1 prompting message.

NOTE

All values entered in the following steps will remain on the display only a few seconds. Then the display will change to the next prompting message.

l. Set TEST SELECT switches to the value of the Cu-1 constant.

m. Press and release TEST button.

n. Wait for VTM to display the CU-2 prompting message.

o. Set TEST SELECT switches to the value of the CU-2 constant.

GO TO NEXT PAGE

2-3-44. COMPRESSION UNBALANCE (POWER CABLE) TEST #14 (cont) 2-3-44

p. Press and release TEST button.

q. Wait for VTM to display the CU-3 prompting message.

r. Set TEST SELECT switches to the value of the CU-3 constant.

s. Press and release TEST button.

t. Wait for VTM to display the CU-4 prompting message.

u, Set TEST SELECT switches to the value of the CU-4 constant.

v. Press and release TEST button.

w. Wait for VTM to display the CU-5 prompting message.

x. Set TEST SELECT switches to the value of the CU-5 constant.

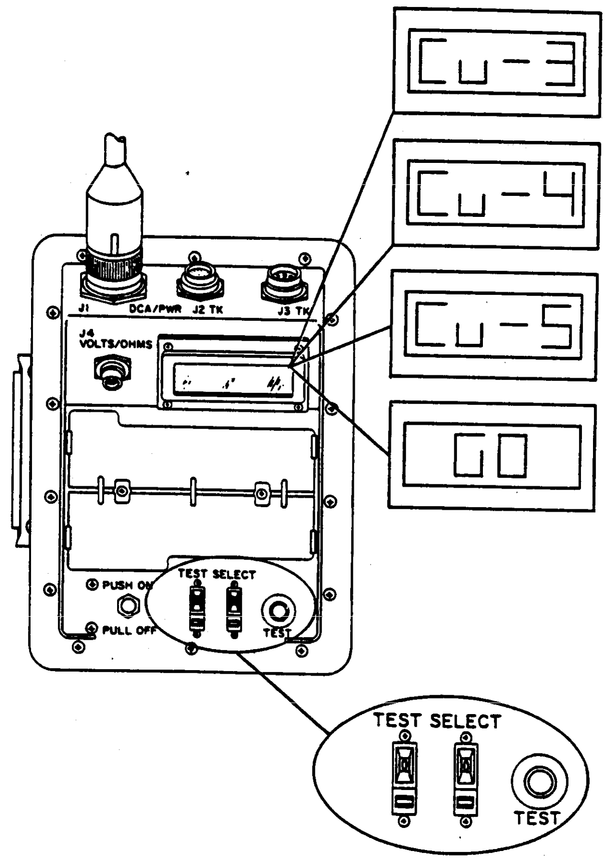
NOTE

An E027 error message will be displayed after the next step if the Cu-1 to CU-5 constants are entered incorrectly. Otherwise, the GO prompt message will be displayed.

y. Press and release TEST button.

z. Wait until GO appears on display before proceeding to step aa.

aa. When GO appears, crank engine. Display will change to ---- while engine is turning.



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2-3-44. COMPRESSION UNBALANCE POWER CABLE) TEST #14 (cont)

NOTE

If E013 appears, test data cannot be analyzed because of weak batteries, or interrupted cranking during test. Correct problem and repeat step 2. If E013 message persists after two compression unbalance measurements, go to the vehicle/equipment TM for alternate procedures for measuring compression.

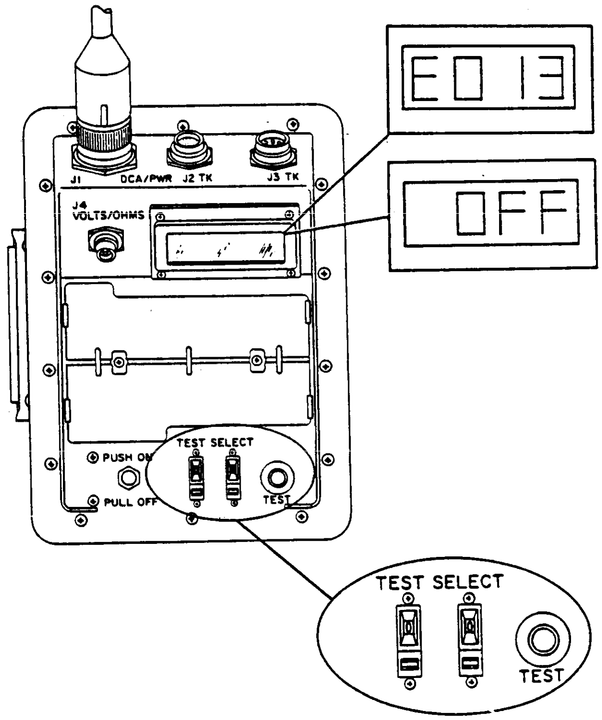
ab. When OFF or E013 appears, stop cranking.

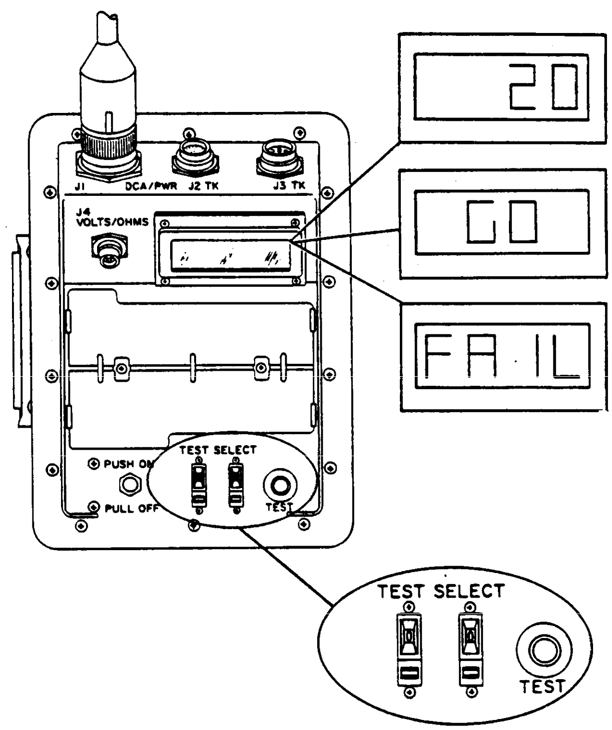
ac. If OFF appears, wait for message to appear.

(1) If a number is displayed, refer to the vehicle/equipment TM or the vehicle test card for its meaning.

(2) If GO appears, go back to step aa.

(3) A FAIL message usually means compression is too far unbalanced to measure with STE/ICE-R. Occasionally, a FAIL message may be caused by vehicle/equipment accessories that are activated during cranking or by imperfections in the starting system.





END OF TASK

2-3-45. COMPRESSION UNBALANCE (TEST PROBE) TEST #15 2-3-45

Description:

This test compares the compression between the highest and lowest cylinders and displays the unbalance in percent. This is a cranking test. For additionall information, see Background Information for Tests, Appendix J.

Typical Applications:

Check compression unbalance on CI and S1 engines with VTM not powered from battery of vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Run first-peak series	
Test #76	2-3-50
Test #77	2-3-51
Test #78	2-3-52
Test #79	2-3-53
Enter VID	2-3-14

Possible Error Messages:

EO08 VTM does not detect battery voltage.
E013 VTM cannot use data as received
E027 Error in entry of compression unbalance constants.
E032 Vehicle’s cranking speed is varying too much for a compression. unbalance measurement.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTH is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

NOTES

Be sure batteries are at full charge. Do not have a battery charger connected when performing this test.

Connect cable W2 to battery source used to crank engine.

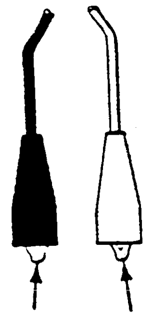
1. Connect test probe cable W2.

   a. Attach connector PI of cable W2 to J4 VOLTS/OHMS.

GO TO NEXT PAGE

b. Attach red clip El to positive (+) battery terminal that is connected to the starter.

c. Attach black clip E2 to negative (-) battery terminal that is connected to vehicle/equipment ground.



NOTE

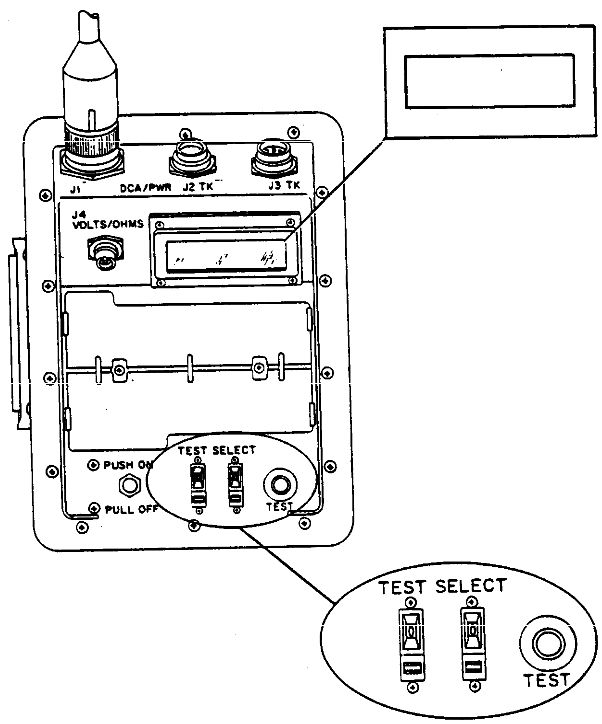
If possible, engine should be at operating temperature when performing compression unbalance test. When engine is warmed, run engine at low idle for 2 minutes before stopping.

2. Set up engine to prevent starting. Stop engine. Shut off fuel before cranking. Crank engine without fuel for 5 seconds to clear fuel from cylinders.

NOTES

Do not run more than two compression unbalance tests in a row. Idle engine between pairs of compression unbalance tests.

On M113 vehicles, disengage the transfer case before performing test.



3. Perform test.

a. Set TEST SELECT switches to 15.

b. Press and release TEST button.

2-3-45. COMPRESSION UNBALANCE (TEST PROBE) TEST #15 (cont) 2-3-45

NOTE

If a prompting message UEH appears on the display, refer to the vehicle/ equipment TM for the value to enter,in step d. If no UEH prompting message appears on the display, skip steps c to g.

c. Wait for prompting message UEH to appear on display.

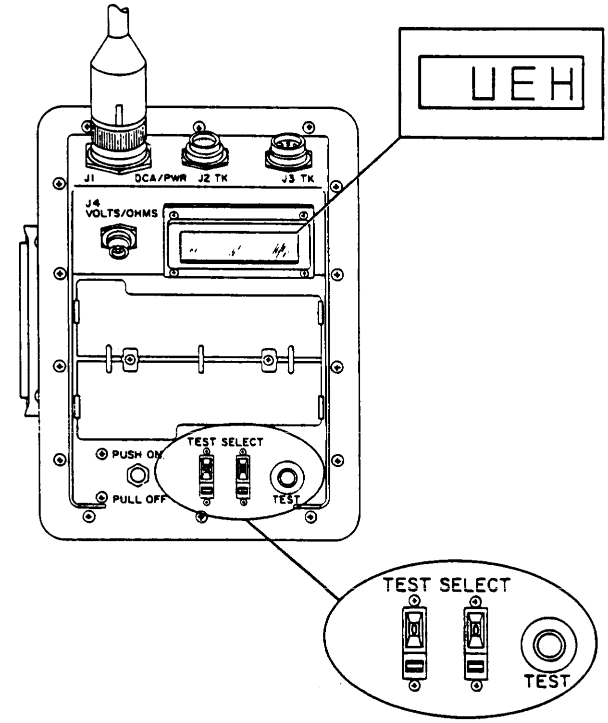
d. Set TEST SELECT switches to VID value.

e. Press and release TEST button.

NOTE

The number just entered will remain on the display only a few seconds.

f. Wait for the VTM to display the VID just entered.

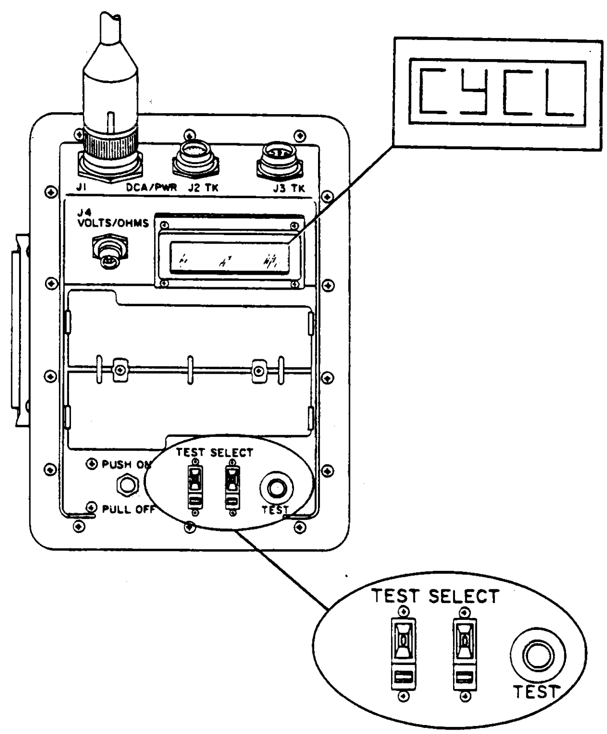


NOTE

If a prompting message CYL appears on the display, refer to the vehicle/ equipment TM for the value of cylinders or cylinder pairs to enter in step h. The vehicle/equipment TM will also provide the values for compression unbalance constants Cu-1 to CU-5. If no CYL prompting message appears on the display, skip steps g thru y.

g. Wait for prompting message CYL to appear on display.

h. Set TEST SELECT switches to number of cylinders/cylinder pairs.



GO TO NEXT PAGE

2-3-45. COMPRESSION UNBALANCE (TEST PROBE) TEST #15 (cont)

NOTE

The cylinders display value will remain on the display only a few seconds. This will be followed by the Cu-1 prompting message.

j. Press and release TEST button.

k. Wait for VTM to display the Cu-1 prompting message.

NOTE

All values entered in the following steps will remain on the display only a few seconds. Then the display will change to the next prompting message.

1. Set TEST SELECT switches to the value of the Cu-1 constant.

m. Press and release TEST button.

n. Wait for VTM to display the CU-Z prompting message.

o. Set TEST SELECT switches to the value of the CU-2 constant.

p. Press and release TEST button.

q. Wait for VTM to display the CU-3 prompting message.

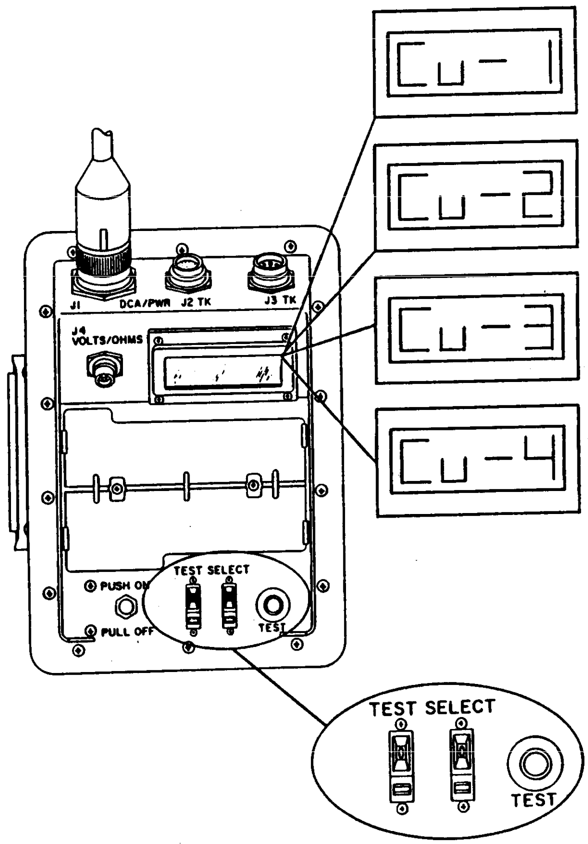
r. Set TEST SELECT switches to the value of the CU-3 constant.

s. Press and release TEST button.

t. Wait for VTM to display the CU-4 prompting message.

u. Set TEST SELECT switches to the value of the CU-4 constant.

v. Press-and release TEST button.

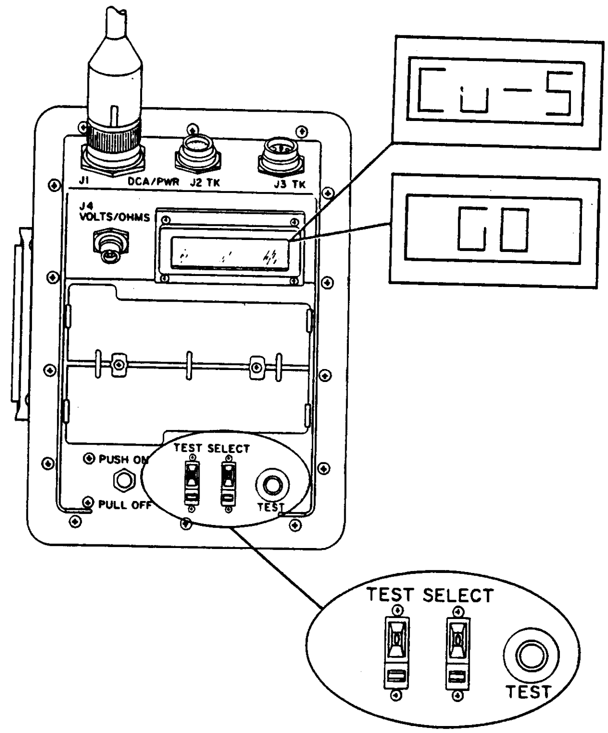


GO TO NEXT PAGE

2-3-45. COMPRESSION UNBALANCE (TEST PROBE) TEST #15 (cont) 2-3-45

w. Wait for VTM to display the CU-5 prompting message.

x. Set TEST SELECT switches to the value of the CU-5 constant.



NOTE

An E027 error message will be displayed after the next step if the Cu-1 to CU-5 constants are entered incorrectly. Otherwise, the GO prompt message will be displayed.

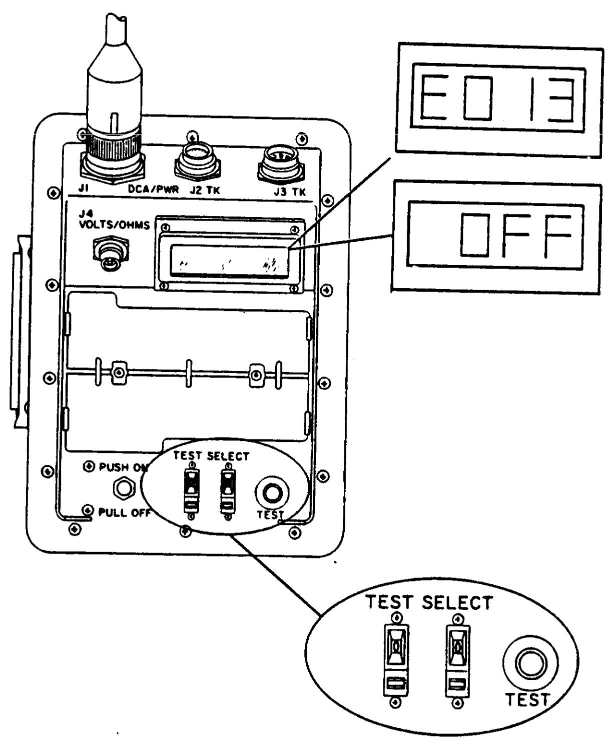
y. Press and release TEST button.

z. Wait until GO appears on display before proceeding to step aa.

aa. When GO appears, crank engine. Display will change to ---- while engine is turning.

NOTE

If E013 appears, test data cannot be analyzed because of weak batteries, or interrupted cranking during test. Correct problem and repeat step 3. If E013 message persists after two compression unbalance tests, go to the vehicle/equipment TM for alternate procedures for measuring compression.



ab. When OFF or E013 appears, stop cranking.

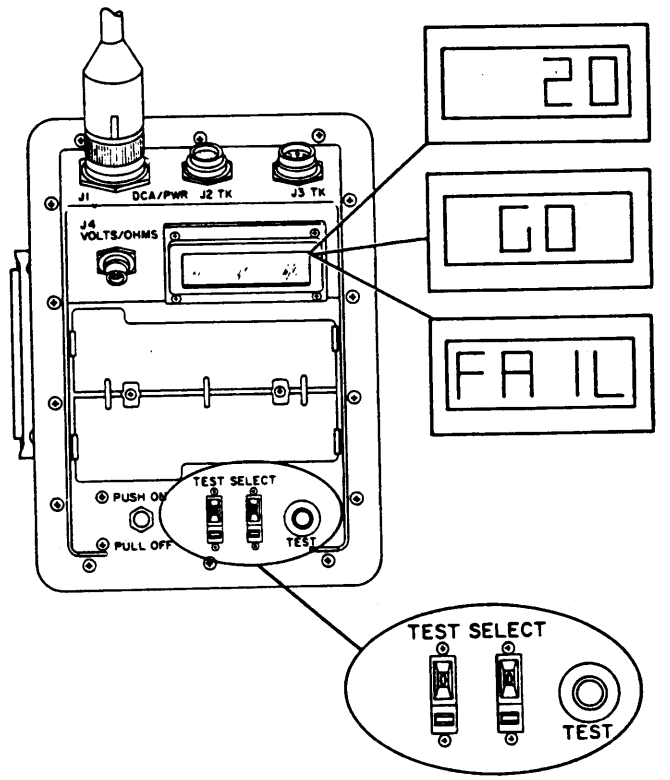
GO TO NEXT PAGE

ac. If OFF appears, wait for message to appear.

(1) If a number is displayed, refer to the vehicle/equipment TM or the vehicle test card for its meaning.

(2) If GO appears, go back to step aa.

(3) A FAIL message usually means compression is too far unbalanced to measure with STE/ICE-R. Occasionally a FAIL message may be caused by vehicle/equipment accessories that are activated during cranking or by imperfections in the starting system.



END OF TASK

2-3-46. CURRENT FIRST PEAK (POWER CABLE) TEST #72 2-3-46

Description:

This procedure measures the overall condition of the complete starting system. For additional information, see Background Information for Tests, Appendix J.

Typical Applications:

Check condition of starting system on CI or SI engines with VTM being powered from battery of vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
Turn off all electrical accessories	

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe's range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTE

If one of the following tests (73, 74, or 75) was the preceding test, go to procedure B.

NOTES

While cranking engine with bad or discharged batteries, it is possible for VTM to lose power and come on again after cranking has stopped, displaying ----- If this occurs, check battery posts and clamps. If they are loose or corroded, correct them and try again. If VTM still loses power, test #72 cannot be done. In this case, do test #76, paragraph 2-3-50, with VTM powered from alternate power source.

Do not have a battery charger connected when performing this test.

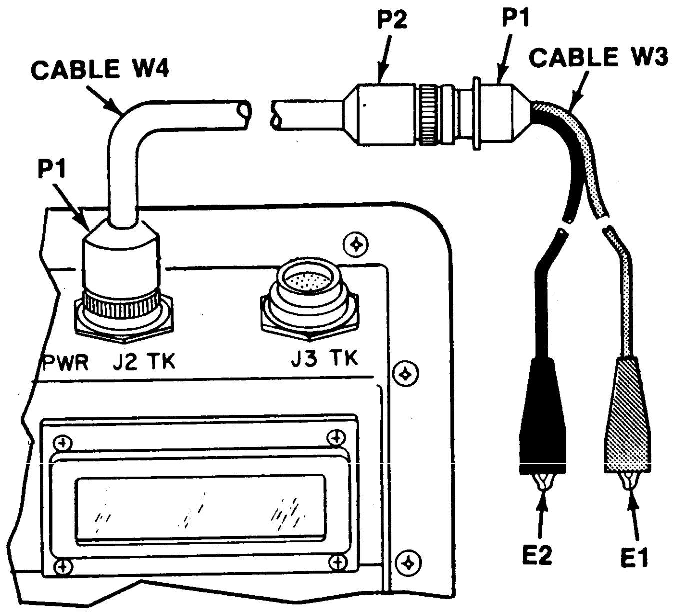
GO TO NEXT PAGE

2-3-46. CURRENT FIRST PEAK POWER CABLE) TEST #72 (cont)

A. HOOKUP AND TEST PROCEDURE

NOTE

For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 2.



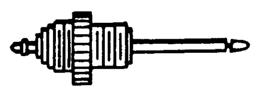
1. Set up engine to prevent starting (SI engines only).

   a. Attach connector PI of cable W4 to J2 TK.

   b. Attach connector P2 of cable W4 to connector PI of cable W3.

WARNING

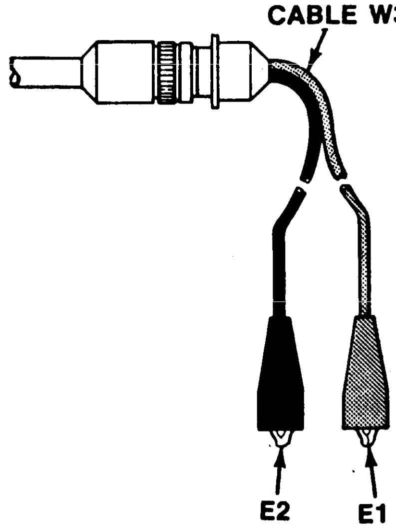
To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.



IGNITION ADAPTER

N O T E

Locate vehicle/equipment test points where measurement is to be made.



   c. InstalL ignition adapter, TK itermb 30, or locate distributor terminal of coil primary.

   d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

   e. Attach black clip E2 of cable W3 to equipment ground.

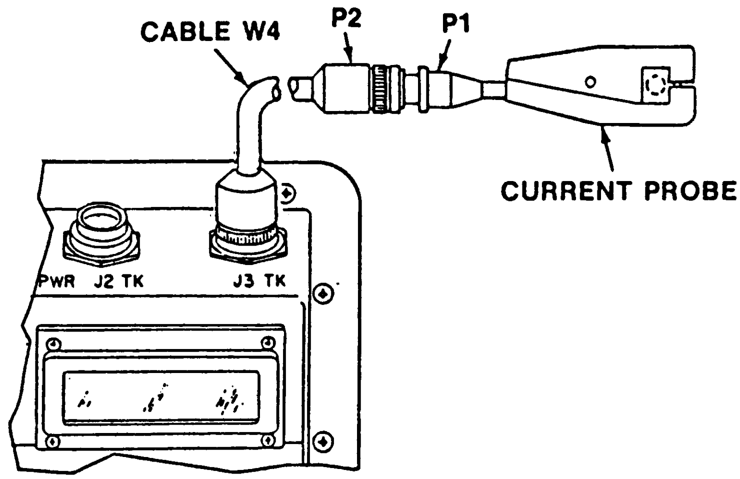
GO TO NEXT PAGE

A. **HOOKUP AND TEST PROCEDURE** (cont)

2. **Connect current probe.**

a. Attach connector P1 of cable W4 to J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.



3. **Condition current probe.**

NOTE

Locate positive (+) battery cable going to the starter motor.

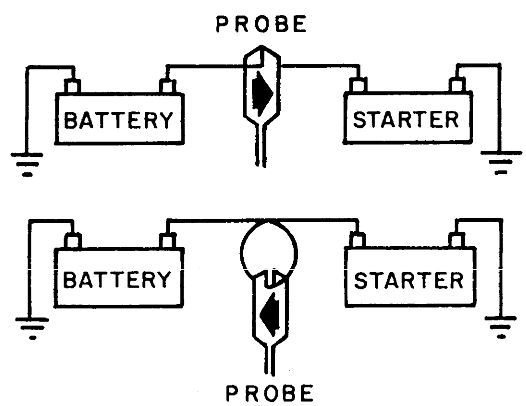
a. Clamp current probe around positive (+) battery cable going to the starter. Point arrow on probe along cable to starter. Make sure probe is closed.

NOTES

The engine must not start while performing this step. If engine starts, repeat step.

For CI engines with manual shut of valves, locate and hold fuel shut-off closed while cranking. Go to step d.

If ignition adapter cable W3 is not being used, turn off ignition; and go to step d (SI engines only).



A. **HOOKUP AND TEST PROCEDURE** (cont)

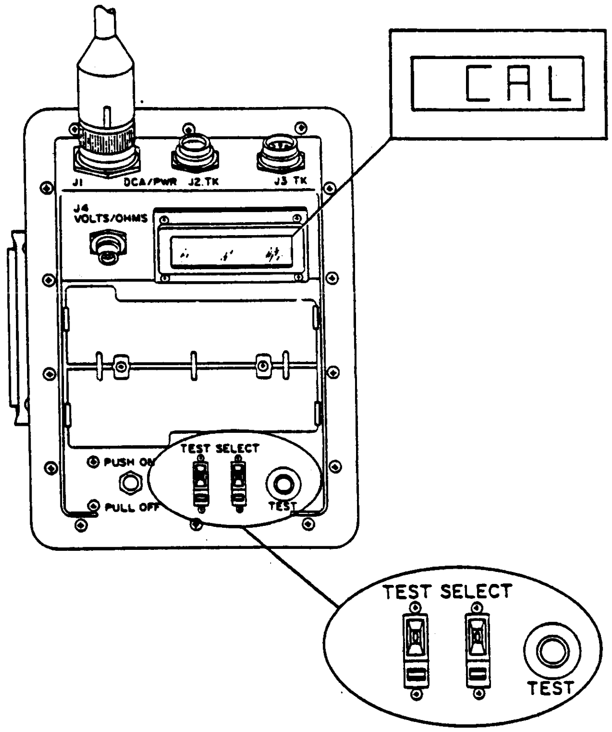
b. Set TEST SELECT switches to 11 (SI engines only).

c. Press and release TEST button (SI engines only).

d. Engage starter only long enough to briefly turn engine (approximately 1 second).

NOTE

The VID must be entered for the M151 and M880 vehicles only.



4. Do offset test.

a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 72.

c. Press and hold TEST button until CAL appears on display.

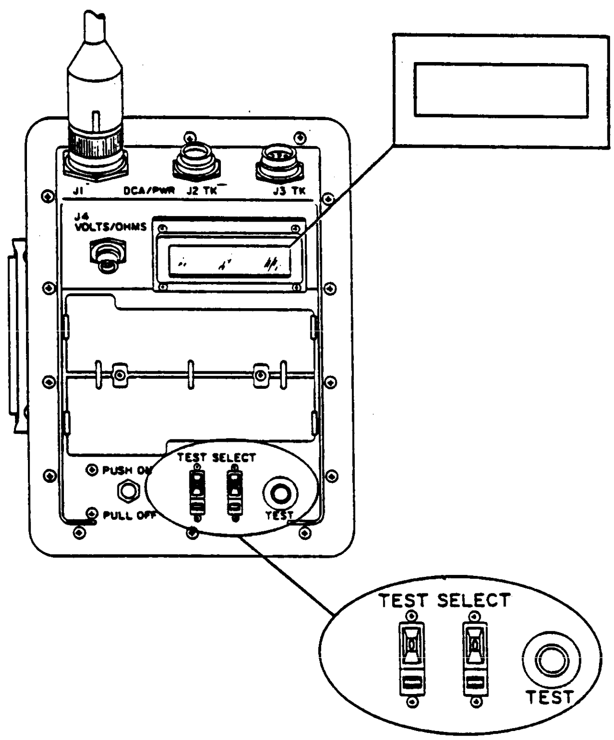
d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 5. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.

5. Measure current first peak.

NOTE

The engine must not start while performing this step. If engine starts, go back to step 3.

a. Press and release TEST button.



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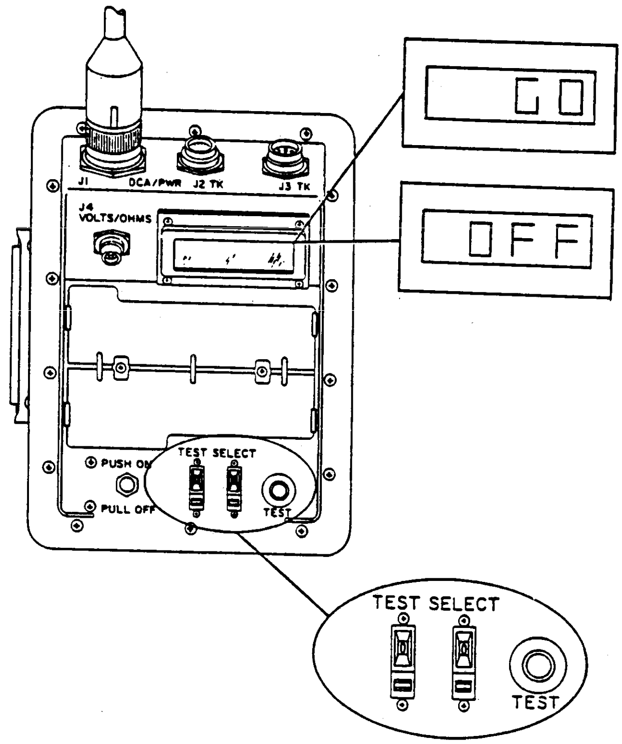
2-3-46. CURRENT FIRST PEAK (POWER CABLE) TEST #72 (cont) 2-3-46

A. **HOOKUP AND TEST PROCEDURE** (cont)



NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.

b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

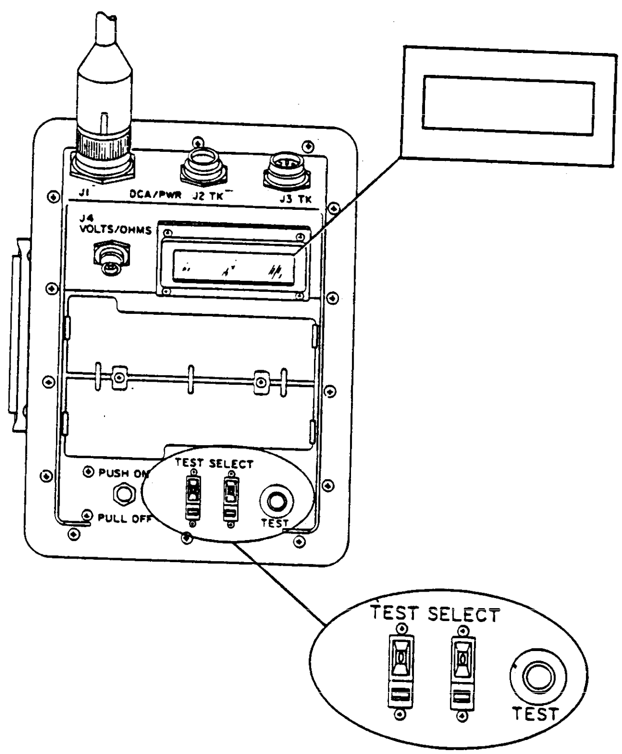
OFF, A NUMBER
.9.9.9.9
AN ERROR MESSAGE/CONDITION

NOTES

If .9.9.9.9 appears on display, the current first peak is more than 3000 amps and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections and correct as necessary. Repeat step 5. If E013 persists after three tests, VTM cannot perform test.

c. Observe displayed value (amps).



B. **USE DATA FROM PREVIOUS MEASUREMENT**

1. **Perform test.**

a. Set TEST SELECT switches to 72.

b. Press and release TEST Button.

NOTE

If any error message is displayed, go to procedure A.

c. Observe displayed value (amps).

END OF TASK

2-3-47. BATTERY INTERNAL RESISTANCE (POWER CABLE) TEST #73 2-3-47

Description:

This procedure measures the internal battery resistance. Internal battery resistance is a measure of the state of charge of the batteries. For additional information, see Background Information for Tests, Appendix J; and Battery Test Cards, Appendix H.

Typical Applications:

Evaluate batteries in CI or SI engines with VTM being powered from battery of vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
Turn off all electrical accessories	

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe's range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTE

If one of the following tests (72, 74, or 75) was the preceding test, go to procedure B.

NOTES

While cranking engine with bad or discharged batteries, it is possible for VTM to lose power and come on again after cranking has stopped, displaying ----- If this occurs, check battery posts and cl amps. If they are loose or corroded, correct them and try again. If VTM still loses power, test #73 cannot be done. In this case, do test #77, paragraph 2-3-51, with VTM powered from alternate power source.

Do not have a battery charger connected when performing this test.

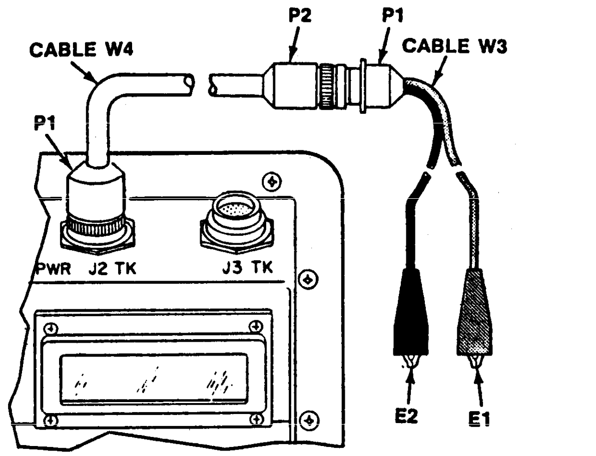
GO TO NEXT PAGE

P2-3-47. BATTERY INTERNAL RESISTANCE (POWER CABLE) TEST #73 (cont) 2-3-47

A. **HOOKUP AND TEST PROCEDURE**

NOTE

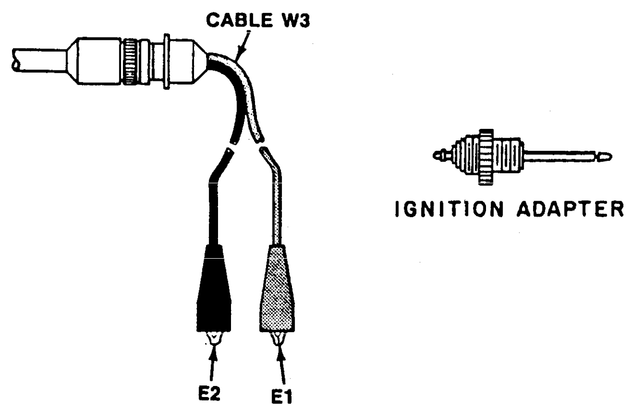
For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 2.



1. Set up engine to prevent starting (SI engines only).

a. Attach connector P1 of cable W4 to J2 TK.

b. Attach connector P2 of cable W4 to connector P1 of cable W3.



WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

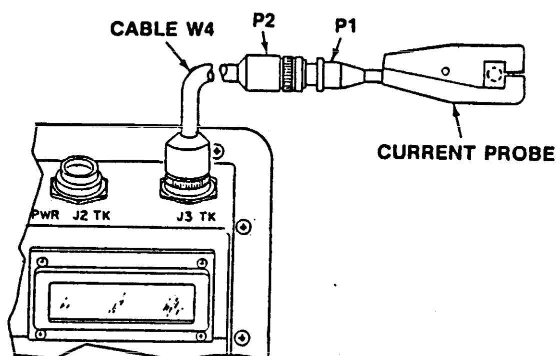
NOTE

Locate vehicle/equipment test points where measurement is to be made.

c. Install ignition adapter, TK iterm 30, or locate distributor terminal of coil primary.

d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

e. Attach black clip E2 of cable W3 to equipment ground.



2. Connect current probe.

a. Attach connector P1 of cable W4 to J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.

GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

NOTE

Batteries may be tested as series pairs, or as a pack. To test a series pair, do step 3 and go to step 5. Repeat for second pair. To test a pack, do step 4 and go to step 5.

3. Attach current probe for series pair test.

a. Locate series pair of batteries. Find pairs for which the negative terminal of one battery is connected by a cable to the positive terminal of another battery. This makes the two batteries a series pair.

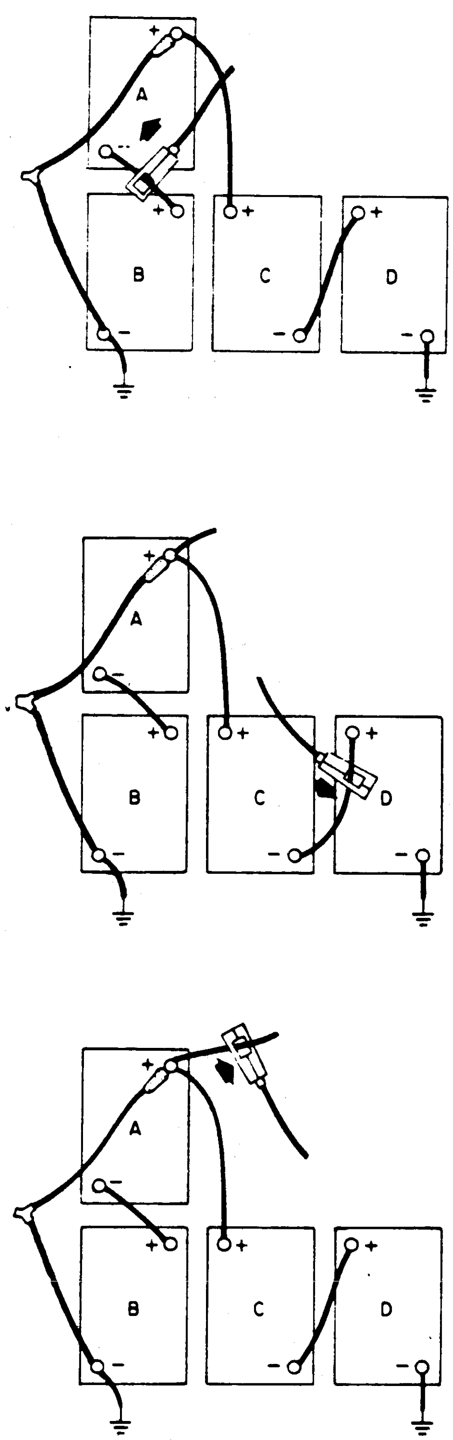
b. To test series pair A and B, clamp current probe around cable connecting battery A and battery B. Point arrow on current probe along cable towards negative terminal of battery A. Make sure current probe is closed. Go to step 5.

c. To test series pair C and D, clamp current probe around cable connecting batteries C and D. Point arrow on current probe along cable toward negative terminal of battery C. Make sure current probe is closed. Go to step 5.

4. Attach current probe for battery pack test.

a. Clamp current probe around cable going to starter.

b. Point arrow on current probe along-cable towards starter. Make sure current probe is closed.



GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

5. Condition current probe.

NOTES

The engine must not start while performing this step. If engine starts, repeat step.

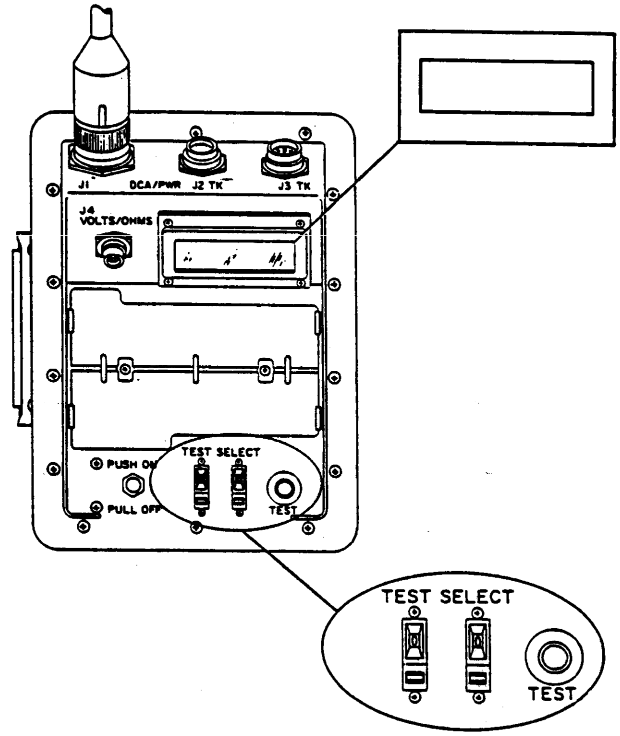
For CI engines with manual shut off valves, locate and hold fuel shut-off closed while cranking. Go to step c.

If ignition adapter cable W3 is not being used, turn off ignition, and go to step c (SI engines only).

a. Set TEST SELECT switches to 11 (SI engines only).

b. Press and release TEST button (SI engine only).

c. Engage starter only long enough to briefly turn engine (approximately 1 second).



NOTE

The VID must be entered for the M151 and M880 vehicles only.

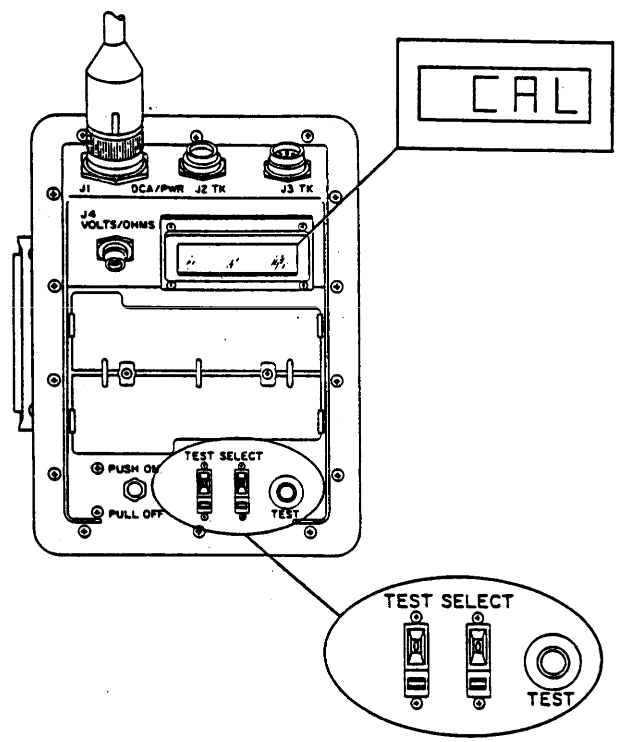
6. Do offset test.

a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 73.

c. Press and hold TEST button until CAL appears on display.

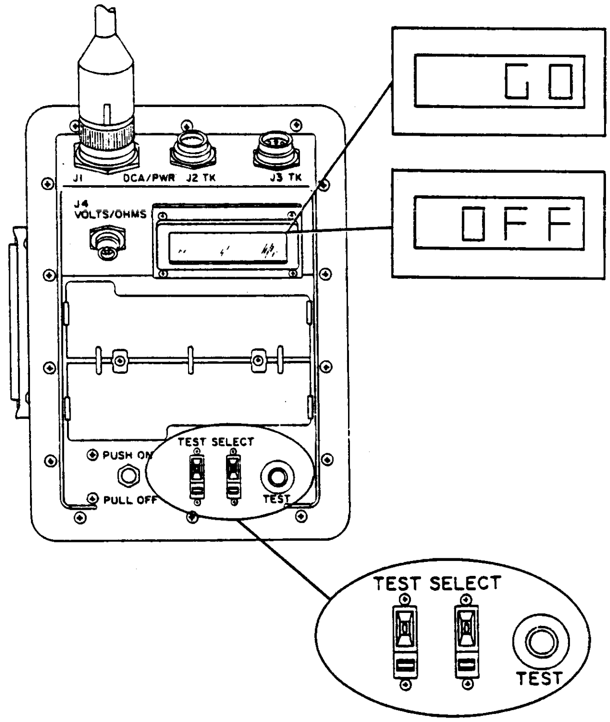
d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 7. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

7. Measure battery resistance.



NOTE

The engine must not start while performing this step. If engine starts, go back to step 5.

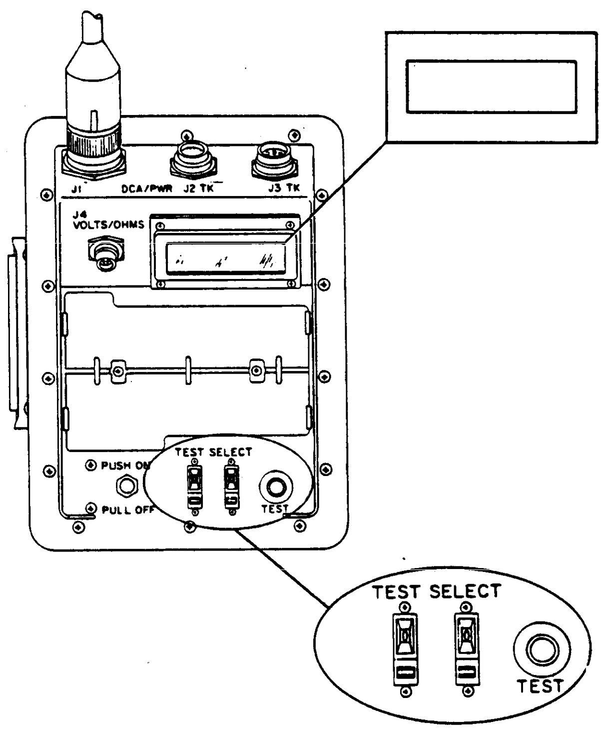
a. Press and release TEST button.

NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.

b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

OFF, A NUMBER
.9.9.9.9
AN ERROR MESSAGE



NOTES

If .9.9.9.9 appears on display, the battery resistance is beyond the range of the VTM and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections and correct as necessary. Repeat step 6. If E013 persists after three tests, VTM cannot perform test.

c. Observe displayed value (milliohms).

GO TO NEXT PAGE

B. USE DATA FROM PREVIOUS MEASUREMENT

1. Perform test.

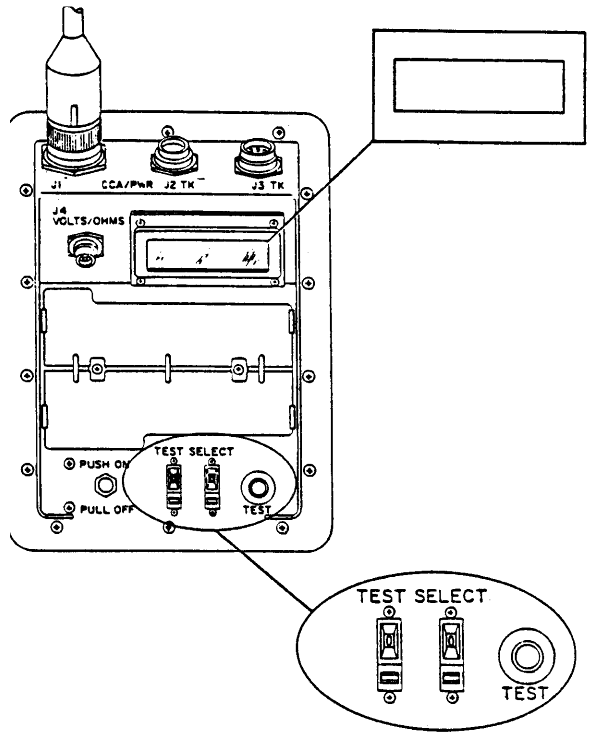
a. Set TEST SELECT switches to 73.

b. Press and release TEST Button.

NOTE

If any error message is displayed, go to procedure A.

c. Observe display value (milliohms)



END OF TASK

2-3-48. STARTER CIRCUIT RESISTANCE (POWER CABLE) TEST #74 2-3-48

Description:

This procedure measures the starter circuit resistance. For additional information, see Background Information for Tests, Appendix J.

Typical Applications:

Check resistance of complete starting system in a CI or an SI engine with VTM powered from batteries of vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
Turn off all electrical accessories	

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe's range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTE

If one of the following tests (72, 73, or 75) was the preceding test, go to procedure B.

NOTES

While cranking engine with bad or discharged batteries, it is possible for VTM to lose power and come on again after cranking has stopped, displaying ----- If this occurs, clean battery posts and clamps. If they are loose or corroded, correct them and repeat test. If VTM still loses power, test #74 cannot be done. In this case, do test #78, paragraph 2-3-52, with VTM powered from an alternate power source.

Do not have a battery charger connected while performing this test.

GO TO NEXT PAGE

A. **HOOKUP AND TEST PROCEDURE**

NOTE

For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 2.

1. Set up engine to prevent starting (SI engines only).

   a. Attach connector PI of cable W4 to J2 TK.

   b. Attach connector P2 of cable W4 to connector P1 of cable W3.

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

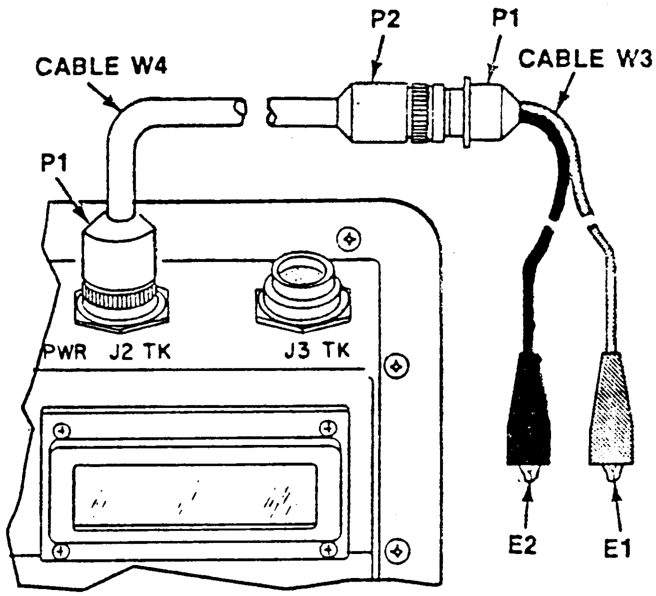
NOTE

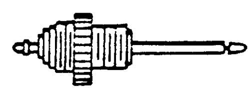
Locate vehicle/equipment test points where measurement is to be made.

   c. Install ignition adapter, TK iterm 30, or locate distributor terminal of coil primary.

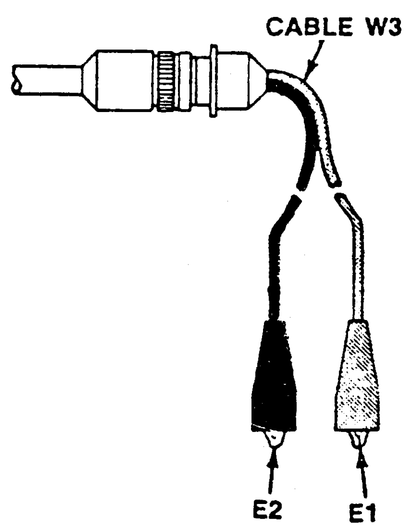
   d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

   e. Attach black clip E2 of cable W3 to equipment ground.





IGNITION ADAPTER



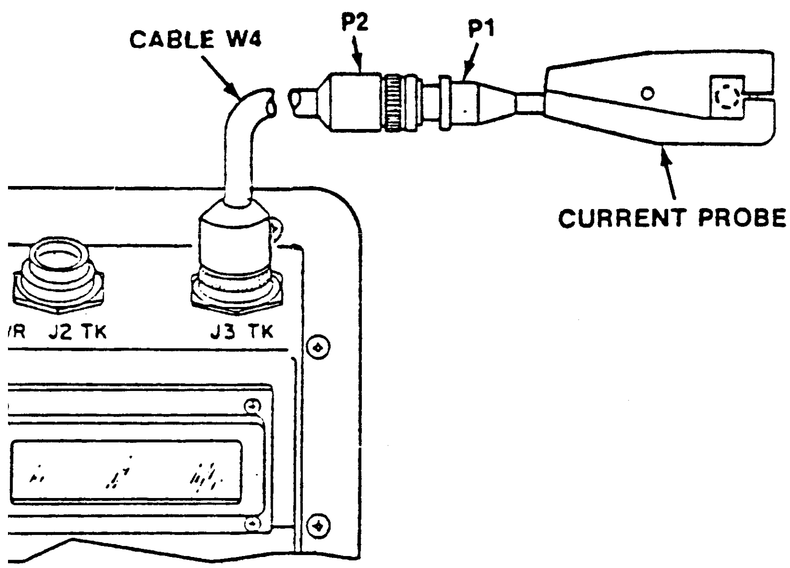
GO TO NEXT PAGE

A. **HOOKUP AND TEST PROCEDURE** (cont)

2. Connect current probe.

a. Attach connector P1 ot cable W4 to J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.



3. **Condition current probe.**

NOTE

Locate positive {+) battery cable going to the starter motor.

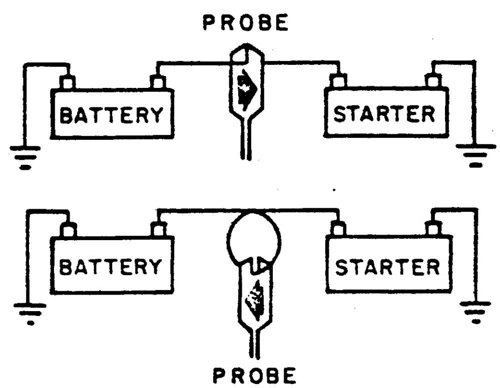
a. Clamp current probe around positive (+) battery cable going to the starter. Point arrow on probe along cable to starter. Make sure probe is closed.

NOTES

The engine must not start while performing this step. If engine starts, repeat step.

For CI engines with manual shut off valves, locate and hold fuel shut-off closed while cranking. Go to step d.

If engine adapter cable W3 is not being used, turn off ignition, and go to step d (SI engines only).



GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE (cont)

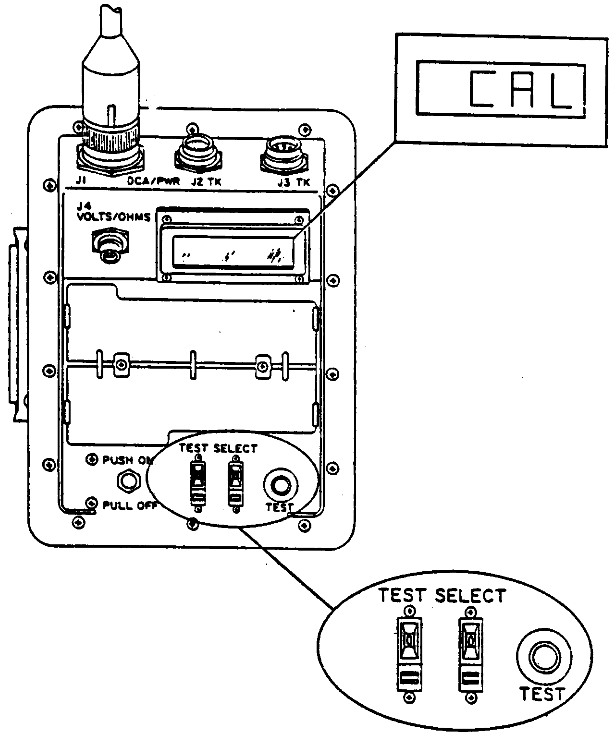
b. Set TEST SELECT switches to 11 (SI engines only).

c. Press and release TEST button (S1 engines only).

d. Engage starter only long enough to briefly turn engine (approximately 1 second) (SI engines only).

NOTE

The VID must be entered for the M151 and M880 vehicles only.



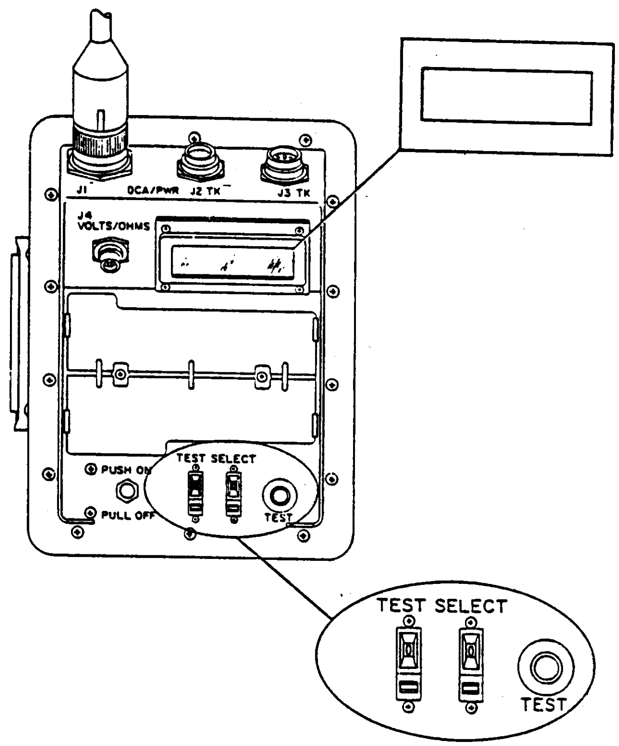
4. **Do** offset test.

a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 74.

c. Press and hold TEST buttor until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 5. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



5. Measure starter circuit resistance.

NOTE

The engine must not start while performing this step. If engine starts, go back to step 3.

a. Press and release TEST button.

GO TO NEXT PAGE

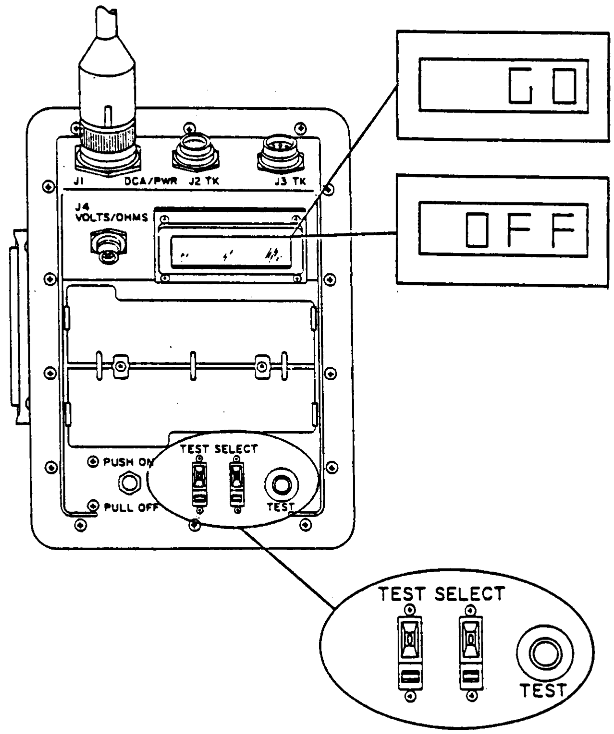
A. HOOKUP AND TEST PROCEDURE (cont)

NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.

b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

OFF, A NUMBER
.9.909.9
AN ERROR MESSAGE



NOTES

If .9.9.9.9 appears on display, the starter circuit resistance is beyond the range of the VTM and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections and correct as necessary. Repeat step 5. If E013 persists after three tests, VTM cannot perform test.

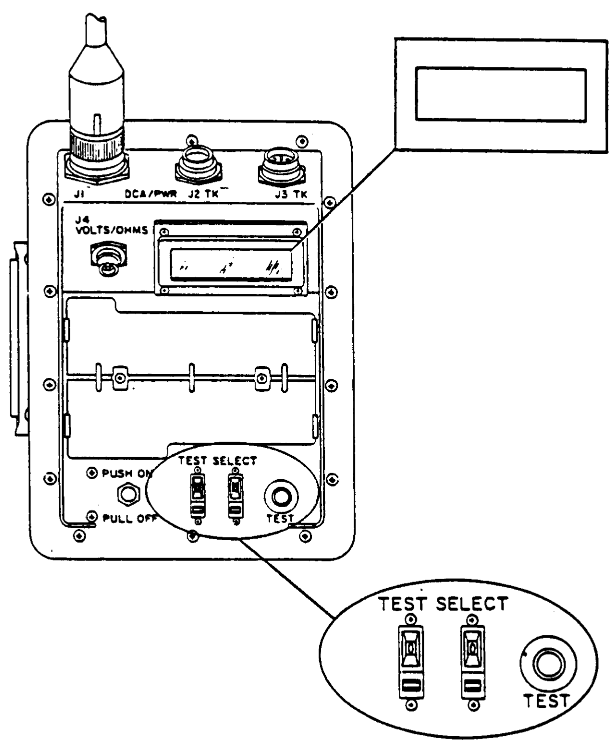
c. Observe displayed value (amps).

B. USE DATA FROM PREVIOUS MEASUREMENT

1. Perform test.

a. Set TEST SELECT switches to 74.

b. Press and release TEST Button.



NOTE

If any error message is displayed, go to procedure A.

c. Observe displayed value (amps).

END OF TASK

2-3-49. BATTERY RESISTANCE CHANGE (POWER CABLE) TEST #75 — 2-3-49

Description:

This procedure measures the rate of change of battery resistance. For additional information, see Background Information for Tests, Appendix J; and Battery Test Cards, Appendix H.

Typical Applications:

Evaluate batteries in CI or SI engines with VTM being powered from battery of vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test ,Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
Turn off all electrical accessories	

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe’s range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTE

If one of the following tests (72, 73, or 74) was the preceding test, go to procedure B.

NOTES

While cranking engine with bad or discharged batteries, it is possible for VTM to lose power and come on again after cranking has stopped, displaying ----- If this occurs, check battery posts and cl amps. If they are loose or corroded, correct and repeat test. If VTM still loses power, test #75 cannot be done. In this case, do test #79, paragraph 2-3-53, with VTM powered from an alternate power source.

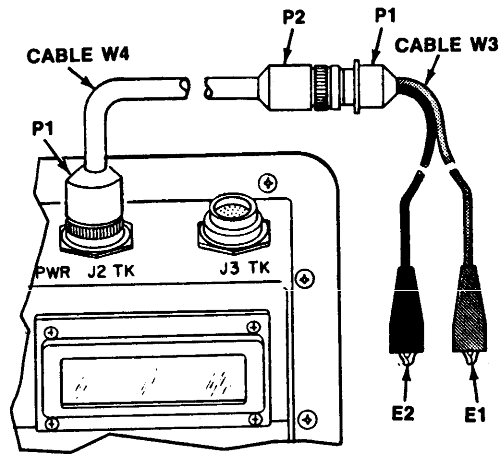
Do not have a battery charger connected when performing this test.

GO TO NEXT PAGE

A. **HOOKUP AND TEST PROCEDURE**

NOTE

For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 2.



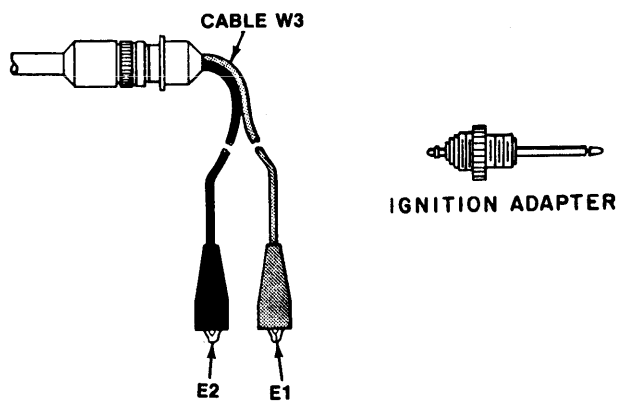
1. Set up engine to prevent starting (SI engines only).

   a. Attach connector P1 of cable W4 to J2 TK.

   b. Attach connector P2 of cable W4 to connector P1 of cable W3.

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle



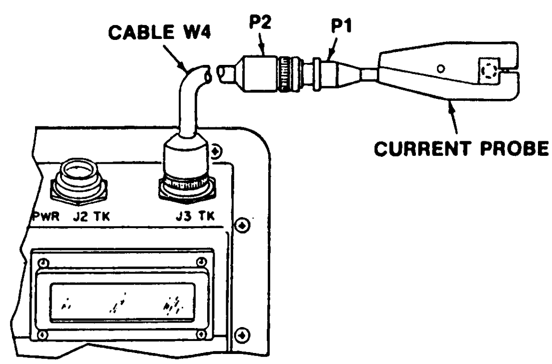
NOTE

Locate vehicle/equipment test points where measurement is to be made.

   c. Install ignition adapter, TK iterm 30, or locate distributor terminal of coil primary.

   d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

   e. Attach black clip E2 of cable W3 to equipment ground.



2. Connect current probe.

   a. Attach connector P1 of cable W4 to J3 TK.

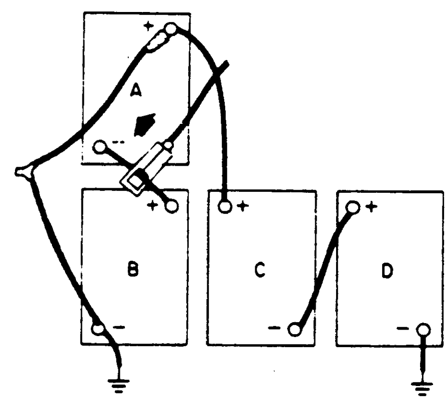
   b. Attach connector P2 of cable W4 to current probe, TK item 11.

GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

NOTE

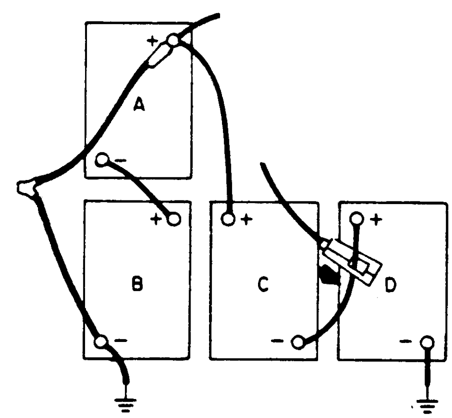
Batteries may be tested as series pairs, or as a pack. To test a series pair, do step 3 and go to step 5. Repeat for second pair. To test a pack, do step 4 and go to step 5.



3. Attach current probe for series pair test.

a. Locate series pair of batteries. Find pairs for which the negative terminal of one battery is connected by a cable to the positive terminal of another battery. This makes the two batteries a series pair.

b. To test series pair A and B, clamp current probe around cable connecting battery A and battery B. Point arrow on current probe along cable towards negative terminal of battery A. Make sure current probe is closed. Go to step 5.

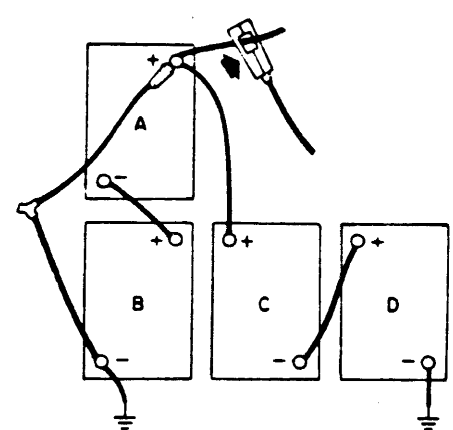


c. To test series pair C and D, clamp current probe around cable connecting batteries C and D. Point arrow on current probe along cable toward negative terminal of battery C. Make sure current probe is closed. Go to step 5.

4. Attach current probe for battery pack test.

a. Clamp current probe around cable going to starter.

b. Point arrow on current probe along cable towards starter. Make sure current probe is closed.



GO TO NEXT PAGE

2-3-49. BATTERY RESISTANCE CHANGE (POWER CABLE) TEST #75 (cont)

A. HOOKUP AND TEST PROCEDURE

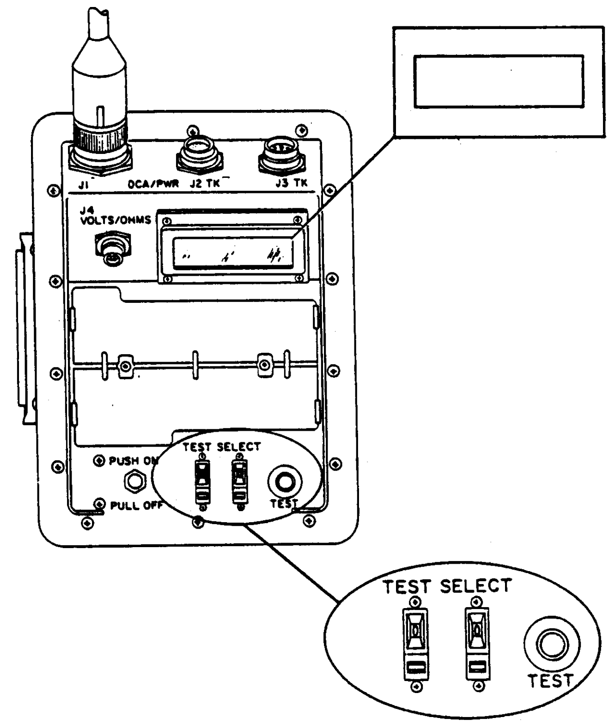
5. Condition current probe.

NOTES

The engine must not start while performing this step. If engine starts, repeat step.

For CI engines, with manual shut of values, locate and hold fuel shut-off closed while cranking. Go to step c.

If ignition adapter cable W3 is not being used, turn off ignition, and go to step c (SI engines only).



a. Set TEST SELECT switches to 11 (SI engines only).

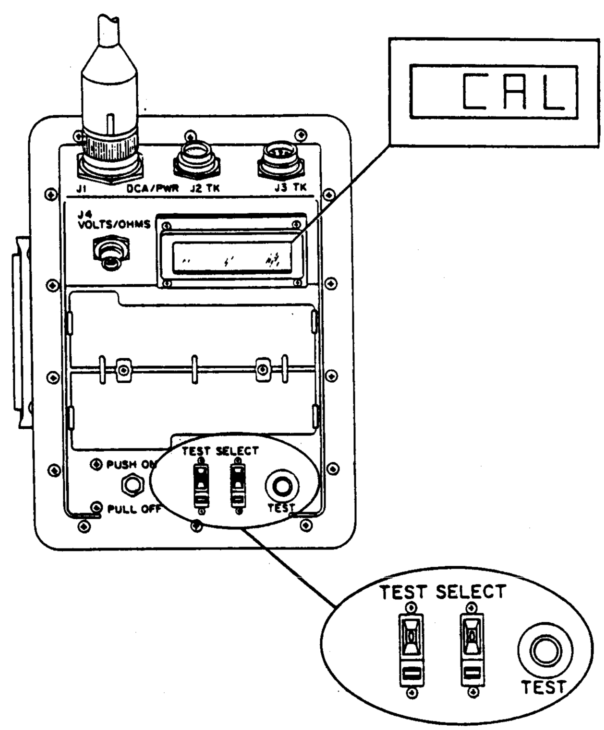
b. Press and release TEST button (SI engines only).

c. Engage starter only long enough to briefly turn engine (approximately 1 second).

NOTE

The VID must be entered for the M151 and M880 vehicles only.

6 . Do offset test.



a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 75.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 7. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.

GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

7. Measure battery resistance change.

NOTE

The engine must not start while performing this step. If engine starts, go back to step 5.

a. Press and release TEST button.

NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.

b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

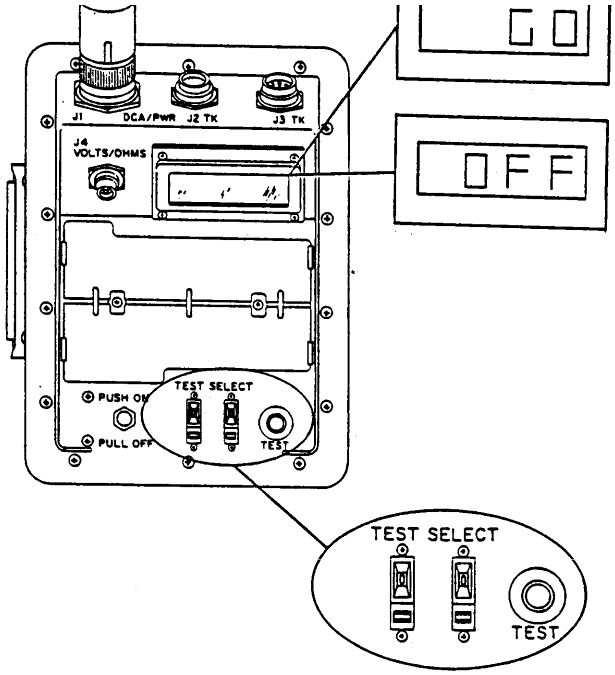
OFF, A NUMBER
.9.9.9.9
AN ERROR MESSAGE

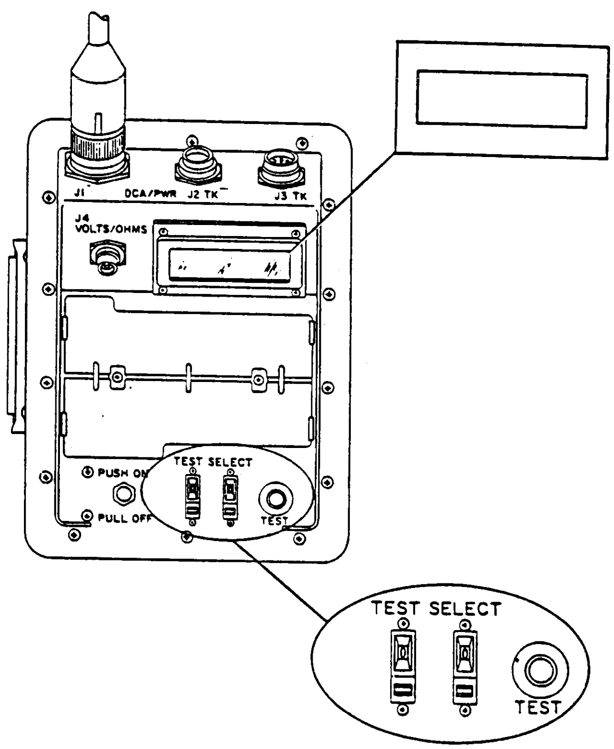
NOTES

If .9.9.9.9 appears on display, the battery resistance change value is beyond the range of the VTM and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections and correct as necessary. Repeat step 6. If E013 persists after three tests, VTM cannot perform test.

c. Observe displayed value (milliohms/sec).





GO TO NEXT PAGE

2-3-49. BATTERY RESISTANCE CHANGE (POWER CABLE) TEST #75 (CONT) 2-3-49

B. **USE DATA FROM PREVIOUS MEASUREMENT**

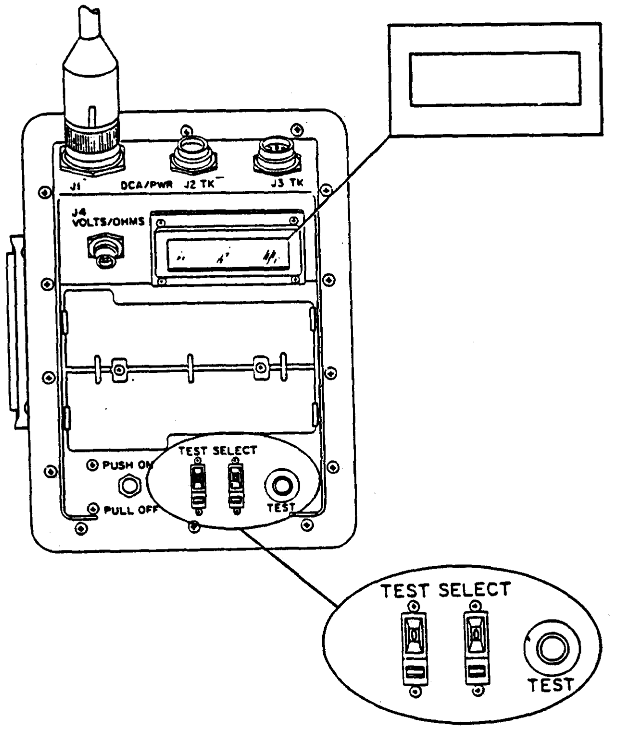
1. **Perform test.**

   a. Set TEST SELECT switches to 75.

   b. Press and release TEST Button.

If If any error displayed, go
to toprocedure A

   CO Observe displayed value
   (milliohms/sec).



END OF TASK

2-3-50. CURRENT FIRST PEAK (TEST PROBE) TEST #76 2-3-50

Description:

This procedure measures the overall condition of the complete starting system. For additional information, see Background Information for Tests, Appendix J.

Typical Applications:

Check condition of starting system on CI or SI engines with VTM not being powered from battery of vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
Turn off all electrical accessories	
VTM connected to external power supply	2-3-3

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltaqe
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe's range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTES

Do not have a battery charger connected when performing this test.

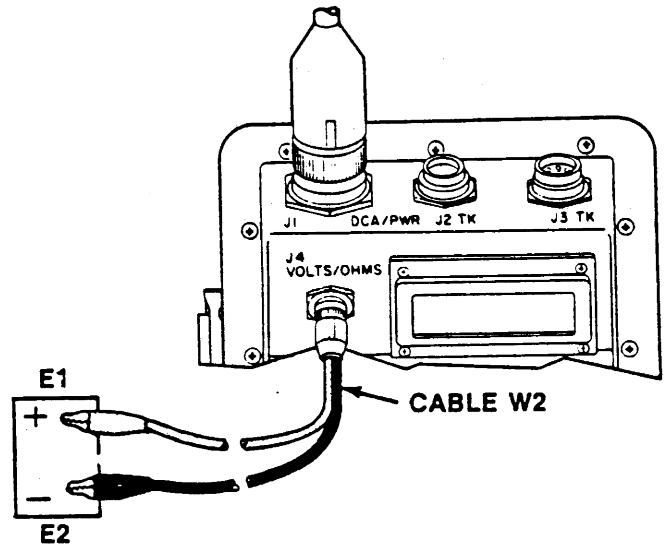
If one of the following tests (77, 78, or 79) was the preceding test, go to procedure B.

GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

NOTE

Alligator clips El and E2 on the test probe cable W2 can be replaced with other probe clips contained in the test probe kit. See paragraph 1-2-4.



1. Connect test probe cable W2.

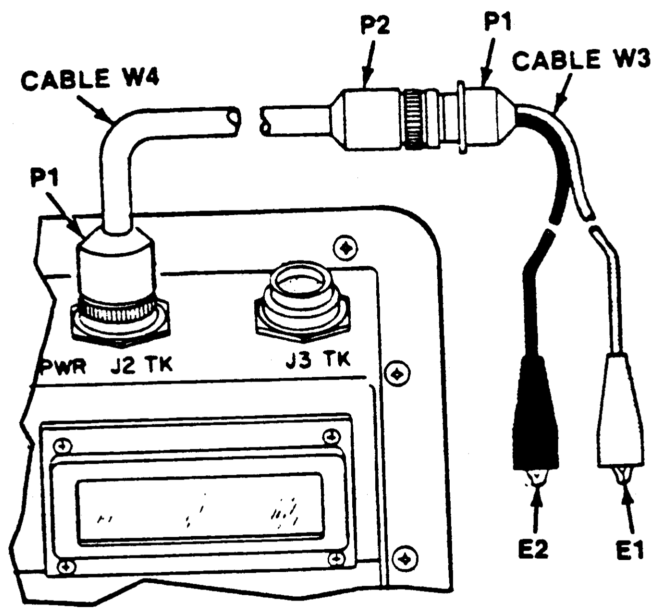
   a. Attach connector P1 of cable W2 to J4 VOLTS/OHMS.

   b. Attach red clip El to the positive (+) battery terminal closest to starter of vehicle being tested.

   c. Attach black clip E2 to the negative (-) battery terminal closest to ground of vehicle being tested.

NOTE

For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 3.



2. Set up engine to prevent starting (SI engines only).

   a. Attach connector P1 of cable W4 to J2 TK.

   b. Attach connector P2 of cable W4 to connector P1 of cable W3.

GO TO NEXT PAGE

2-3-50. CURRENT FIRST PEAK (POWER CABLE) TEST #76 (cont) 2-3-50

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

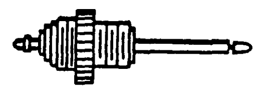
NOTE

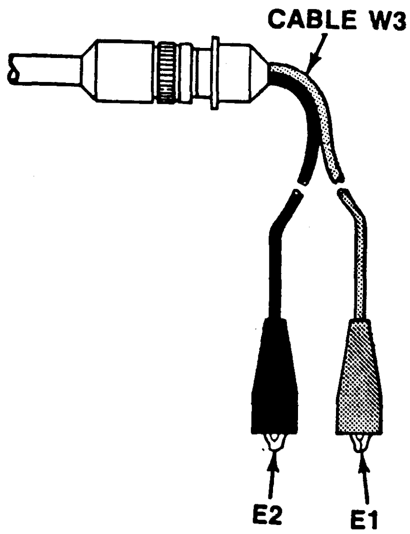
Locate vehicle/equipment test point! where measurement is to be made.

c. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.

d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

e. Attach black clip E2 of cable W3 to equipment ground.

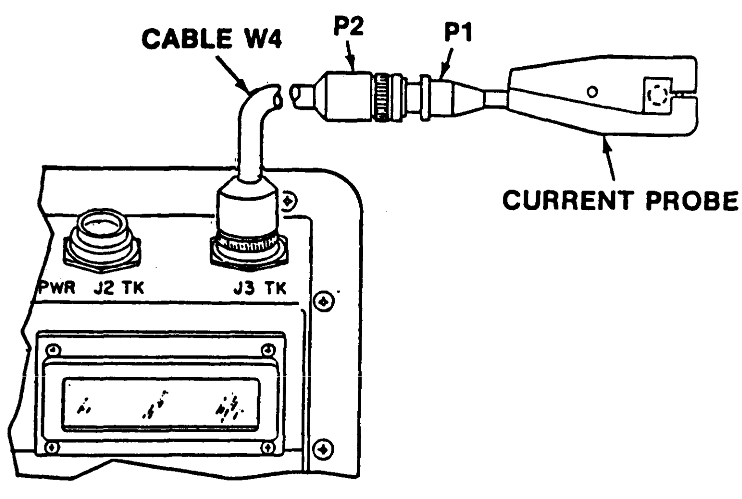




3. Connect current probe.

a. Attach connector P1 of cable W4 to J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.



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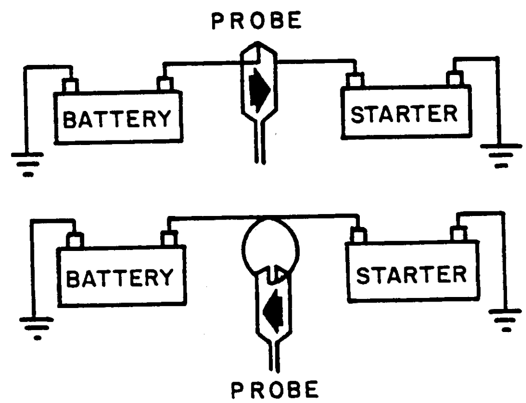
4. Condition current probe.

NOTE

Locate positive (+) battery cable going to the starter motor.



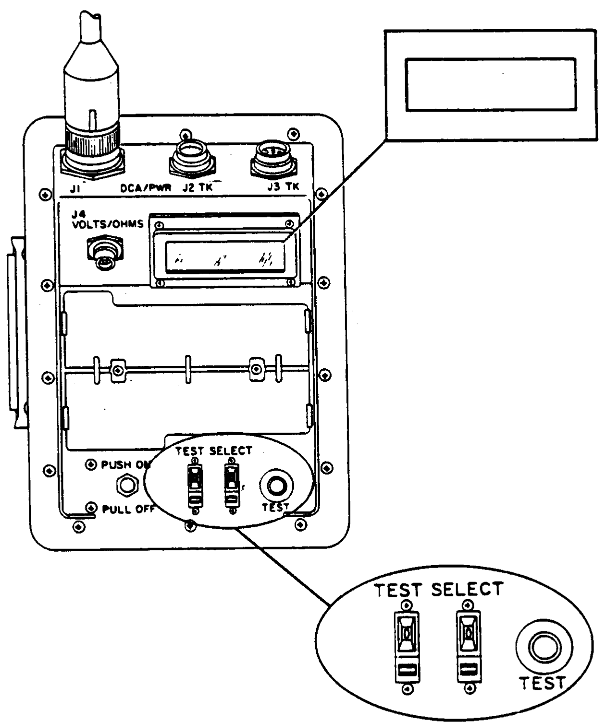
a. Clamp current probe around positive (+) battery cable going to the starter. Point arrow on probe along cable to starter. Make sure probe is closed.

NOTES

The engine must not start while **performing** this step. If engine starts, repeat step.

For CI engines, with manual shut off values, locate and hold fuel shut-off closed while cranking. Go to step d.

If ignition adapter cable W3 is not being used, turn off ignition, and go to step d (SI engines only).



b. Set TEST SELECT switches to 11 (SI engines only).

c. Press and release TEST button (SI engines only).

d. Engage starter only long enough to briefly turn engine (approximately 1 second).

GO TO NEXT PAGE

2-3-50. CURRENT FIRST PEAK (POWER CABLE) TEST #76 (cont) 2-3-50

NOTE

The VID must be entered for the M151 and M880 vehicles only.

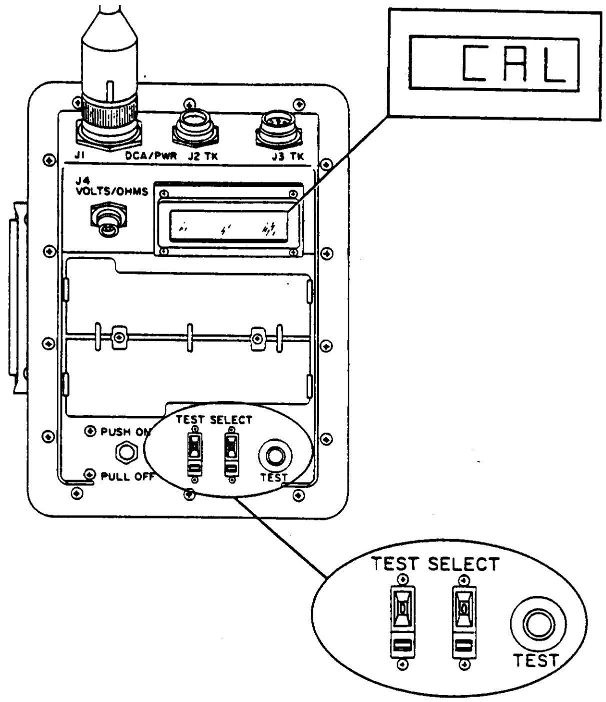
5. Do offset test.

a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 76.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 6. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



6. Measure current first peak.

NOTE

The engine must not start while performing this step. If engine starts, go back to step 4.

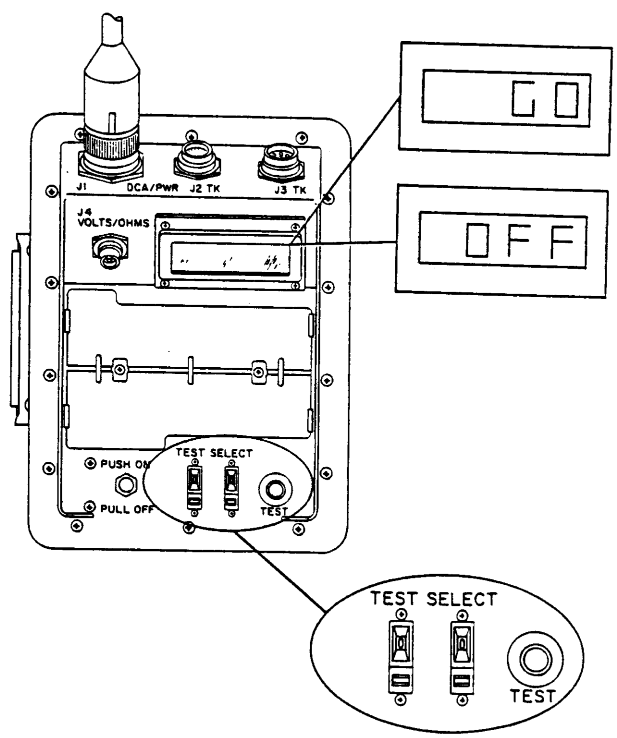
a. Press and release TEST button.

NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.

b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

OFF, A NUMBER
.9.9.9.9
AN ERROR MESSAGE



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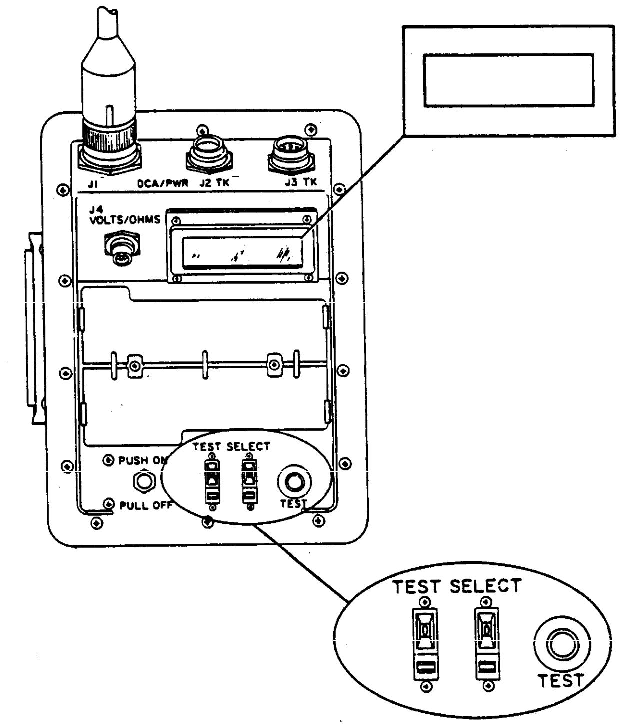


NOTES

If .9.9.9.9 appears on display, the current first peak is more than 3000 amps and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections pnd correct as necessary. Repeat step 6. If E013 persists after three tests, VTM cannot perform test.

c. Observe displayed value (amps).

B. USE DATA FROM PREVIOUS MEASUREMENT

1. Perform test.

a. Set TEST SELECT switches to 76.

b. Press and release TEST Button.

NOTE

If any error message is displayed, go to procedure A.

c. Observe displayed value (amps).

END OF TASK

2-3-51. BATTERY INTERNAL RESISTANCE (TEST PROBE) TEST #77 2-3-51

Description:

This procedure measures the internal battery resistance. It is an indication of the state of charge of the battery. For additional information, see Background Information for Tests, Appendix J; and Battery Test cards, Appendix H.

Typical Applications:

Evaluate batteries in CI or SI engines with VTM not being powered from battery of vehicle being tested. Or, to test individual batteries of a pack or pair in the vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
VTM powered from external power supply	2-3-3

Turn off all electrical accessories

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe's range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTES

Do not have a battery charger connected when performing this test.

If one of the following tests (76, 78, or 79) was the preceding test, go to procedure B.

A. CI HOOKUP AND TEST PROCEDURE

1. Set up engine to prevent starting. Locate and hold fuel shutoff closed.

GO TO NEXT PAGE

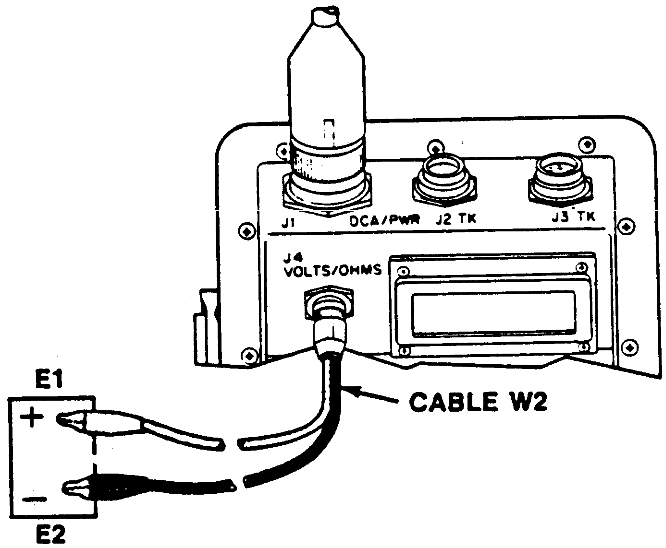
A. HOOKUP AND TEST PROCEDURE

1. Connect test probe cable W2.

a. Attach connector P1 of cable W2 to J4 VOLTS/OHMS.

b. Attach red clip E1 to the positive (+) battery terminal closest to starter of vehicle being tested.

c. Attach black clip E2 to the negative (-) battery terminal closest to ground of vehicle being tested.



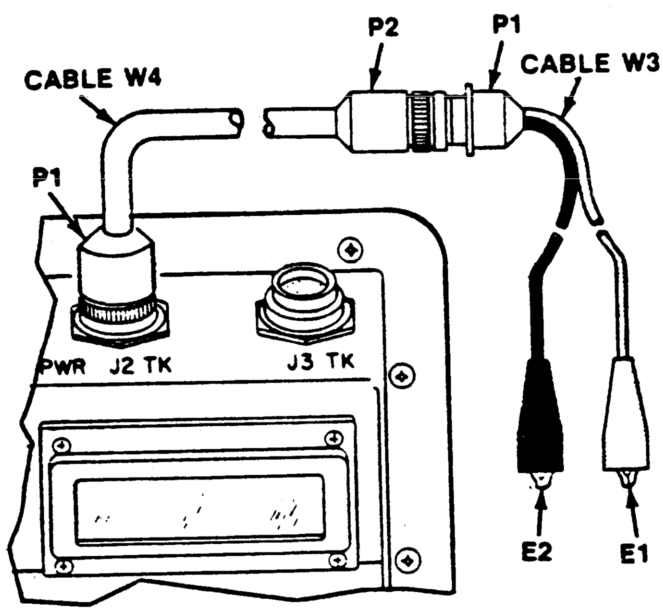
NOTE

For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 3.

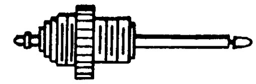
2. Set up engine to prevent starting (SI engines only).

a. Attach connector P1 of cable W4 to J2 TK.

b. Attach connector P2 of cable W4 to connector PI of cable W3.



A. **HOOKUP AND TEST PROCEDURE**



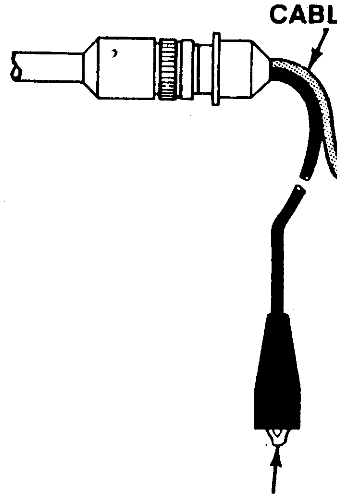
WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

NOTE

Locate vehicle/equipment test points where measurement is to be made.

c. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.



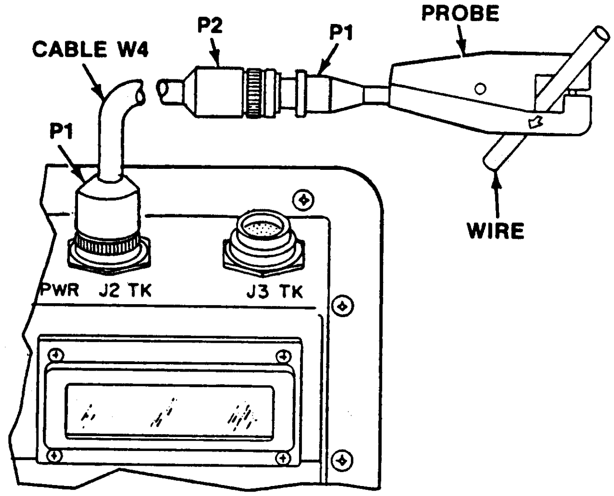
d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

e. Attach black clip E2 of cable W3 to equipment ground.

3. Connect current probe.

a. Attach connector P1 of cable W4 to J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.



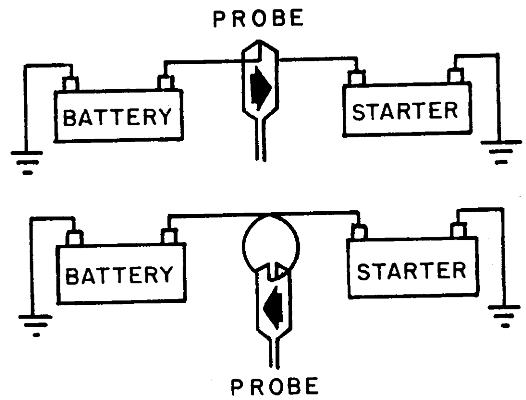
NOTE

Batteries may be tested singly, as series pairs, or as a pack. To test batteries singly, do step 4 and go to step 7. To test a series pair, do step 5 and go to step 7. Repeat for second pair. To test a pack, do step 6.

GO TO NEXT PAGE

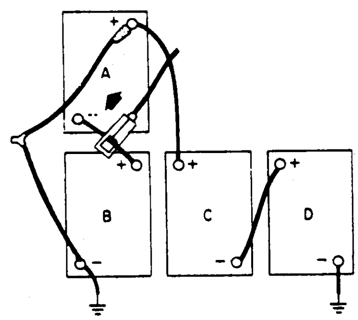
A. **HOOKUP AND TEST PROCEDURE**

4. **Attach current probe for single battery test.** Clamp current probe around cable coming from positive (+) terminal of battery being tested. Point arrow on current probe along cable away from battery. Make sure current probe is closed. Go to step 7.



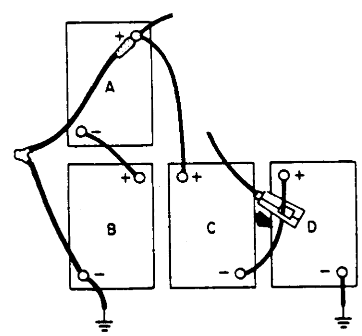
5. **Attach current probe for series pair test.**

   a. Locate series pair of batteries. Find pairs for which negative terminal of one battery is connected by a cable to positive terminal of another battery. This makes the two batteries a series pair.

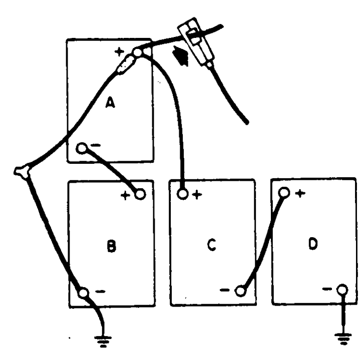


   b. To test series pair A and B, clamp current probe around cable connecting battery A and battery B. Point arrow on current probe along cable to negative terminal of battery A. Make sure current probe is closed. Go to step 1-

   c. To test series pair C and D, clamp current probe around cable connecting batteries C and D. Point arrow on current probe along cable to negative terminal of battery C. Make sure current probe is closed. Go to step 7.



6. **Attach current probe for battery pack test.** Clamp current probe around cable going to starter. Point arrow on current probe along cable to starter. Make sure current probe is closed. Go to step 7.



2-3-51. BATTERY INTERNAL RESISTANCE (TEST PROBE) TEST #77 (cont) 2-3-51

A. HOOKUP AND TEST PROCEDURE

7. Condition current probe.

NOTES

The engine must not start while performing this step. If engine starts, repeat step.

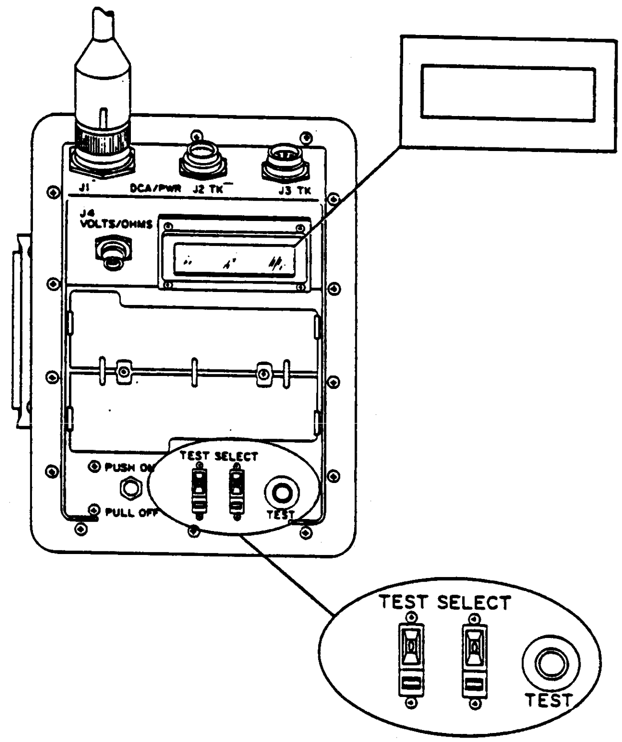
For CI engines with manual shut off values, locate and hold fuel shut-off closed while cranking. Go to step c.

If ignition adapter cable W3 is not being used, turn off ignition, and go to step c (SI engines only).

a. Set TEST SELECT switches to 11 (SI engines only).

b. Press and release TEST button (SI engines only).

c. Engage starter only long enough to briefly turn engine (approximately 1 second).



NOTE

The VID must be entered for the M151 and M880 vehicles only.

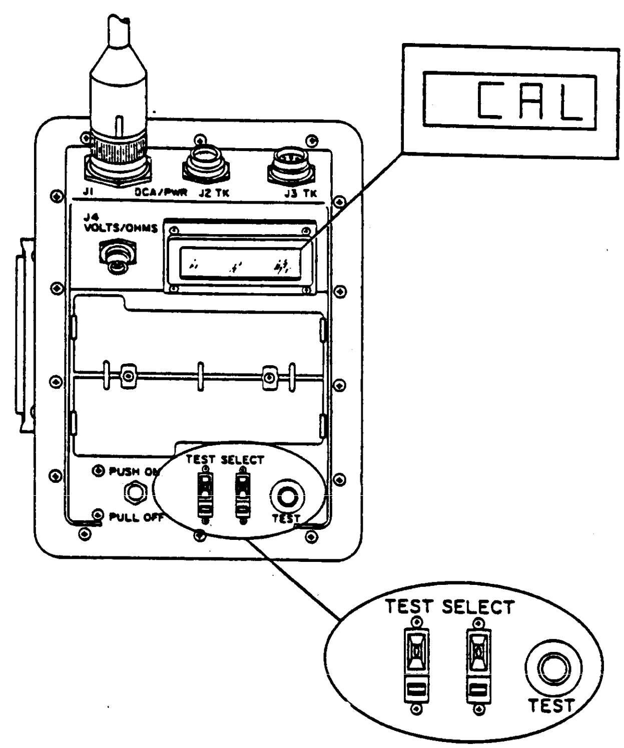
8. Do offset test.

a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 77.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 9. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



GO TO NEXT PAGE

A. **HOOKUP AND TEST PROCEDURE**

9. **Measure battery resistance.**

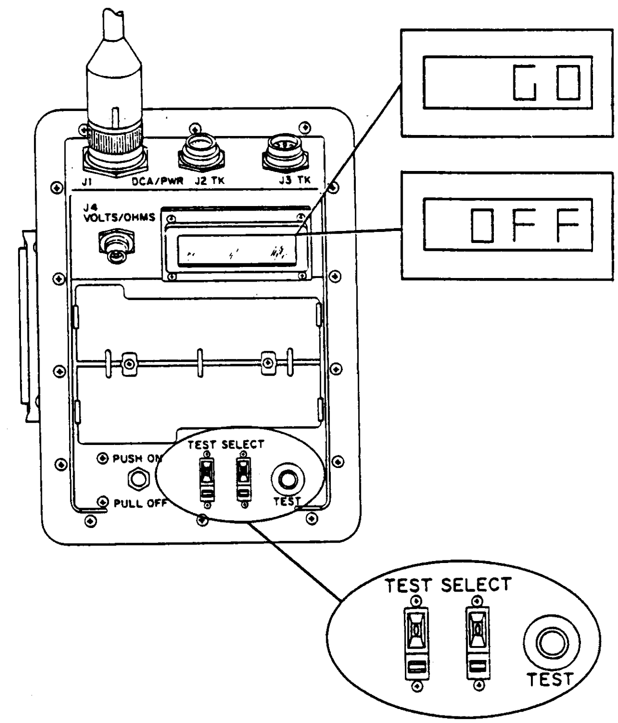
NOTE

The engine must not start while performing this step. If engine starts, go back to step 7.

a. Press and release TEST button.

NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.



b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

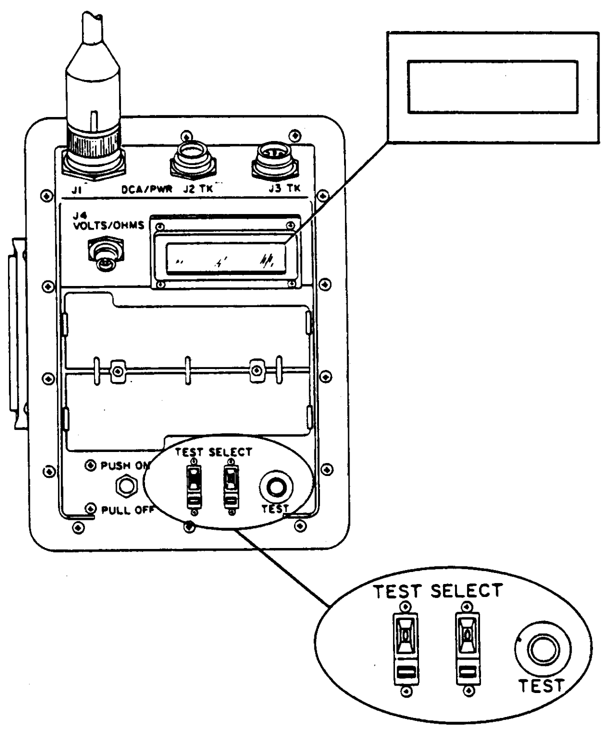
OFF, A NUMBER
.9.9.909
AN ERROR MESSAGE

NOTES

If .9.9.9.9 appears on display, the battery resistance value is beyond the range of the VTM and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections and correct as necessary. Repeat step 9. If E013 persists after three tests, VTM cannot perform test.

c. Observe displayed value (milliohms).



GO TO NEXT PAGE

B. **USE DATA FROM PREVIOUS MEASUREMENT**

1. Perform test.

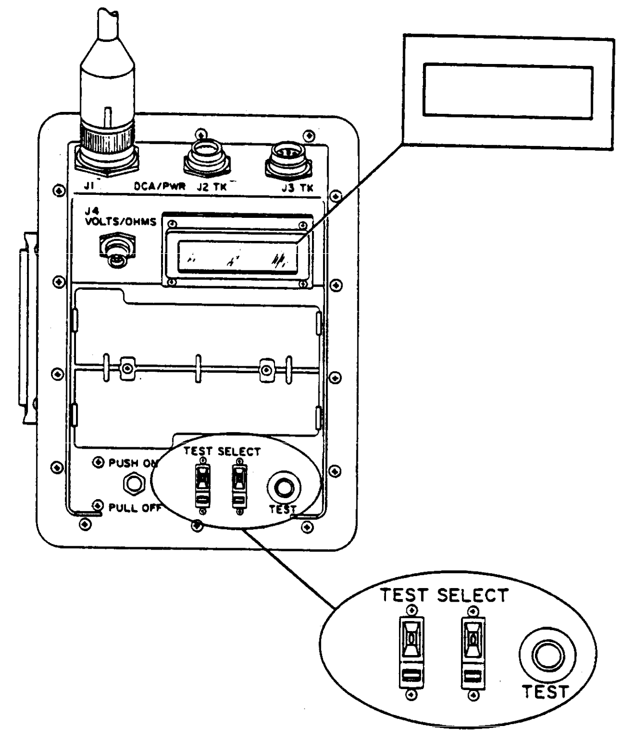
a. Set TEST SELECT switches to 77.

b. Press and release TEST Button.

NOTE

If any error message is displayed, go to procedure A.

c. Observe displayed value (milliohms).



END OF TASK

2-3-52. STARTER CIRCUIT RESISTANCE (TEST PR0BE) TEST #78 2-3-52

Description:

This procedure measures the overall condition of the complete starting system. For additional information, see Background Information for Tests, Appendix J.

Typical Applications:

Check condition of starting system on CI or SI engines with VTM not being powered from battery of vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
Turn off all electrical accessories	
VTM connected to external power supply	2-3-3

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe's range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VIM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTES

Do not have a battery charger connected when performing this test.

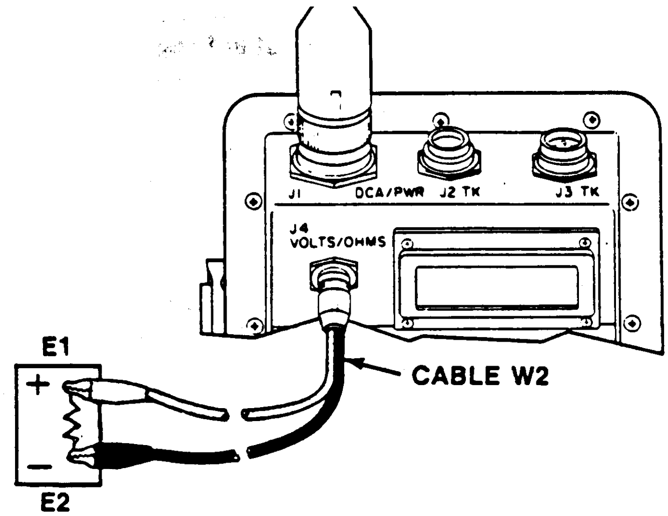
If one of the following tests (77, 78, or 79) was the preceding test, go to procedure B.

GO TO NEXT PAGE

A. **HOOKUP AND TEST PROCEDURE**

NOTE

Alligator clips El and E2 on the test probe cable W2 can be replaced with other probe clips contained in the test probe kit. See paragraph 1-2-4.



1. Connect test probe cable W2.

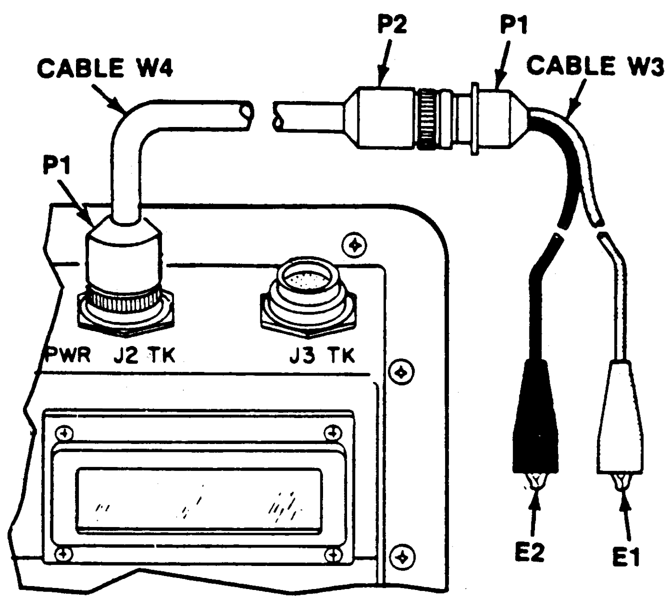
a. Attach connector P1 of cable W2 to J4 VOLTS/OHMS.

b. Attach red clip El to the positive (+) battery terminal closest to starter of vehicle being tested.

c. Attach black clip E2 to the negative (-) battery terminal closest to ground of vehicle being tested.

NOTE

For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 3.



2. Set up engine to prevent starting (SI engines only).

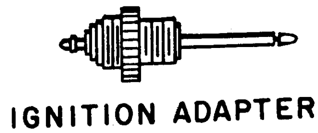
a. Attach connector P1 of cable W4 to J2 TK.

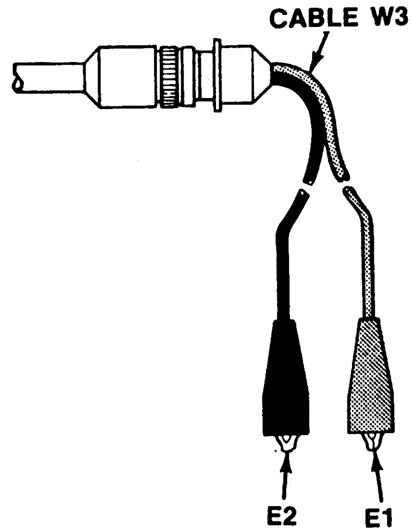
b. Attach connector P2 of cable W4 to connector P1 of cable W3.

GO TO NEXT PAGE

~~2-3-53.~~ STARTER CIRCUIT RESISTANCE (TEST PROBE) TEST #78 (cont) 2-3-52

A. **HOOKUP AND TEST PROCEDURE** (cont)





WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.

NOTE

Locate vehicle/equipment test points where measurement is to be made.

c. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.

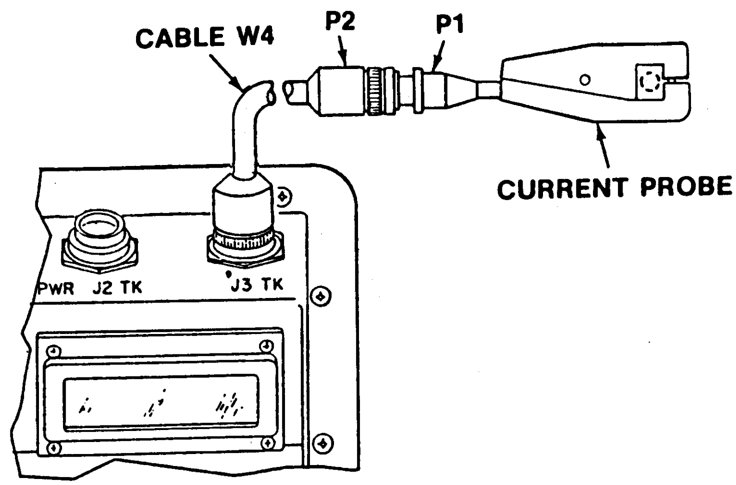
d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

e. Attach black clip E2 of cable W3 to equipment ground.

3. Connect current probe.

a. Attach connector P1 of cable W4 to J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.

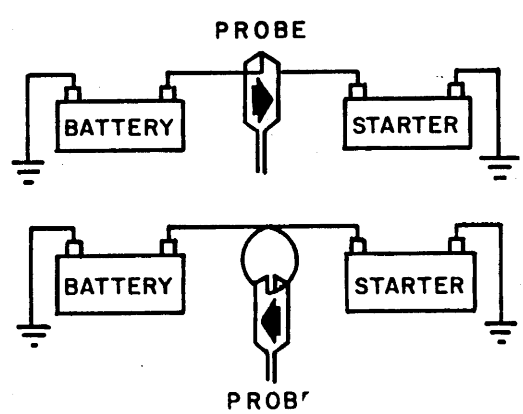


4. Condition current probe.

NOTE

Locate positive (+) battery cable going to the starter motor.

a. Clamp current probe around positive (+) battery cable going to the starter. Point arrow on probe-along cable to starter. Make sure probe is closed.



GO TO NEXT PAGE

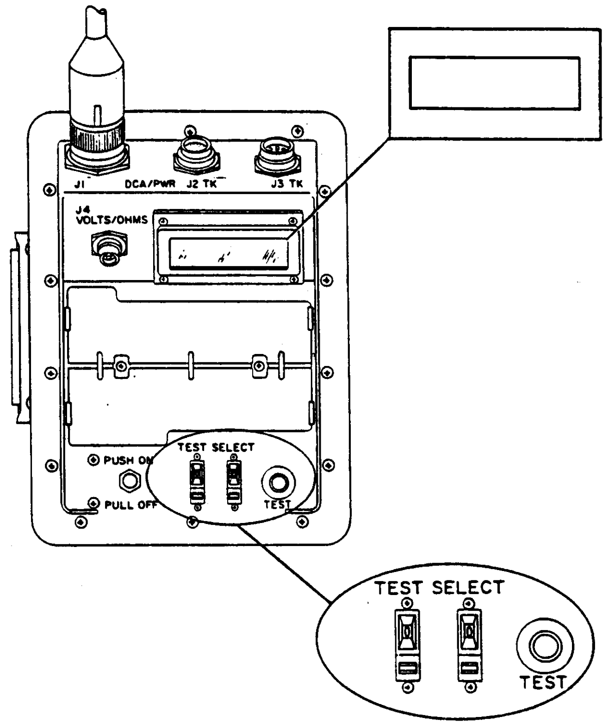
A. HOOKUP AND TEST PROCEDURE (cont)

NOTES

The engine must not start while performing this step. If engine starts, repeat step.

For CI engines, with manual shut off valves, locate and hold fuel shut-off closed while cranking. Go to step d.

If ignition adapter cable W3 is not being used, turn off ignition, and go to step d (SI engines only).



b. Set TEST SELECT switches to 11 (SI engines only).

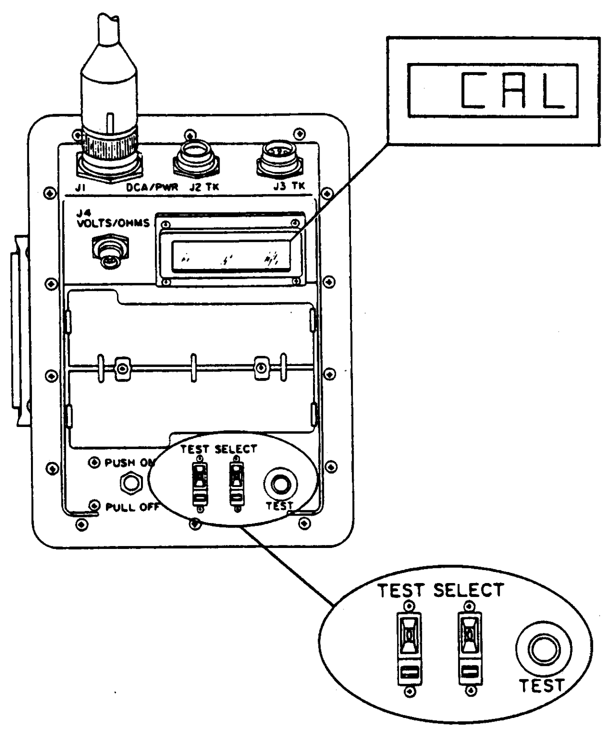
c. Press and release TEST button. (SI engines only).

d. Engage starter only long enough to briefly turn engine (approximately 1 second).

NOTE

The VID must be entered for the M151 and M880 vehicles only.

5. Do offset test.



a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 78.

c. Press and hold TEST button until CAL appears on display.

d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +225, proceed to step 6. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.

GO TO NEXT PAGE

2-3-52. STARTER CIRCUIT RESISTANCE (TEST PROBE) TEST #78 (cont)

A. HOOKUP AND TEST PROCEDURE (cont)

6. Measure starter circuit resistance.

NOTE

The engine must not start while performing this step. If engine starts, go back to step 4.

a. Press and release TEST button.

NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.

b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

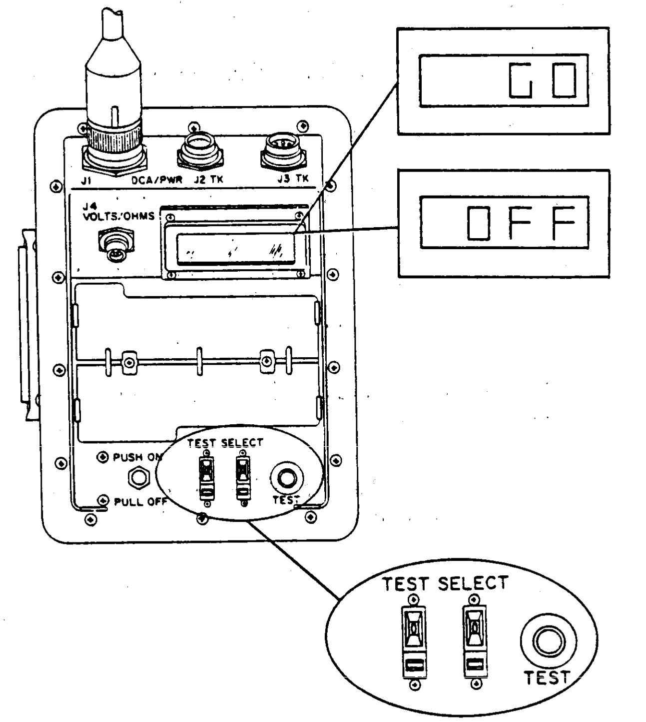
OFF, A NUMBER
.9.9.9.9
AN ERROR MESSAGE

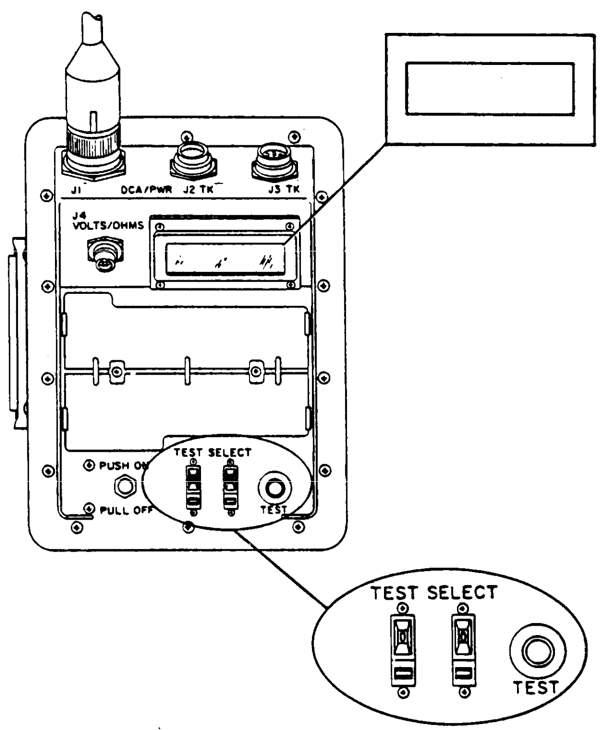
NOTES

If .9.9.9.9 appears on display, the starter circuit resistance is beyond the range of the VTM and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections and correct as necessary. Repeat step 6. If E013 persists after three tests, VTM cannot perform test.

c. Observe displayed value (milliohms).





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2-3-52. STARTER CIRCUIT RESISTANCE (TEST PROBE) TEST #78 (cont) 2-3-52

A. H00KUP AND TEST PROCEDURE (cont)

B. USE DATA FROM PREVIOUS MEASUREMENT

1. Perform test.

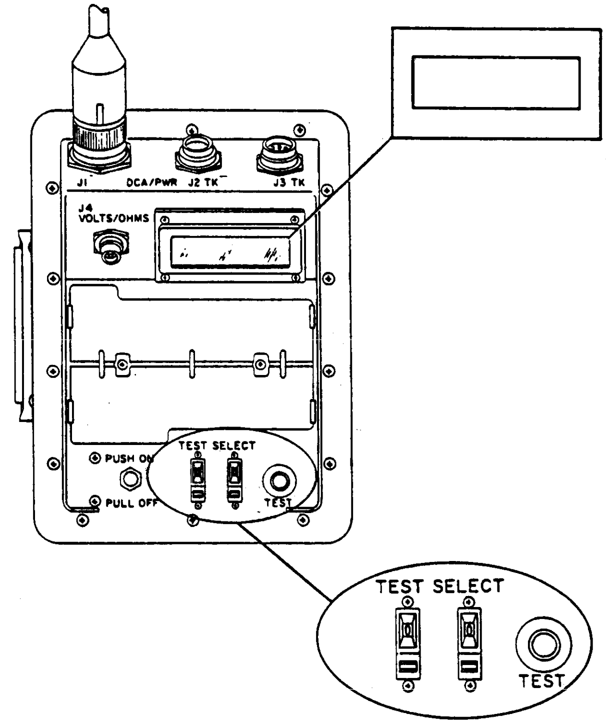
a. Set TEST SELECT switches to 78.

b. Press and release TEST Button.

NOTE

If any error message is displayed, go to procedure A.

c. Observe displayed value (milliihms).



END OF TASK

2-3-53. BATTERY RESISTANCE CHANGE (TEST PROBE) TEST #79 2-3-53

Description:

This procedure measures the battery resistance change. This is an indication of battery condition. For additional information, see Background Information for Tests, Appendix J; and Battery Test Cards, Appendix H.

Typical Applications:

Evaluate batteries in CI or SI engines with VTM not being powered from vehicle being tested. Or, to test individual batteries of a pack or pair in the vehicle being tested.

References:

Vehicle/Equipment TM

Pre-Test Procedures:

Procedure	Ref
Run confidence test	2-2-3
Warm up engine to operating temperature (if possible)	
Enter VID (M151 & M880 only)	2-3-14
Turn off all electrical accessories	
VTM connected to external power supply	2-3-3

Possible Error Messages:

EO02 Transducer not connected
EO05 Offset not performed
EO08 VTM does not detect battery voltage
E013 VTM cannot use data received
E020 No first peak information was detected by the VTM.
E021 VTM cannot calculate result because current is over current probe's range.

WARNING

On vehicles with a master switch in the negative (-) battery cable, sparking may occur if the VTM case touches the vehicle while master switch is off and VTM is on. Sparking in the presence of fuel or fuel vapors presents a potential hazard. Avoid hazard by doing all testing with the vehicle master switch on.

Vehicle engine must be off before installing cables to prevent injury to personnel or damage to equipment.

NOTES

Do not have a battery charger connected when perfrorming this test.

If one of the following tests (76, 77, or 78) was the preceding test, go to procedure B.

A. CI HOOKUP AND TEST PROCEDURE.

1. **Set up engine to prevent starting.** Locate and hold fuel shutoff closed.

GO TO NEXT PAGE

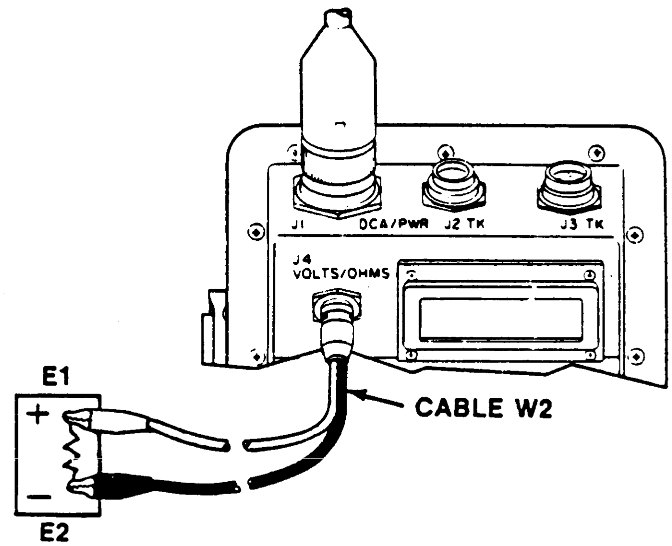
A. HOOKUP AND TEST PROCEDURE

1. Connect test probe cable W2.

a. Attach connector P1 of cable W2 to J4 VOLTS/OHMS.

b. Attach red clip El to the positive (+) battery terminal closest to starter of vehicle being tested.

c. Attach black clip E2 to the negative (-) battery terminal closest to ground of vehicle being tested.



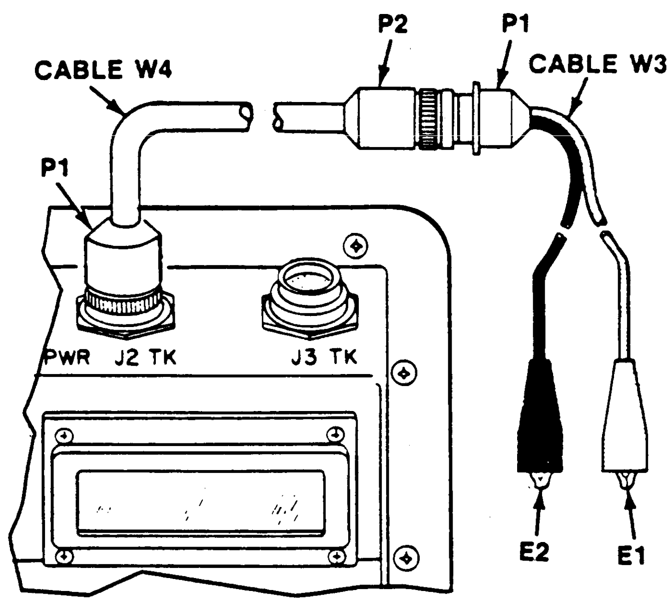
NOTE

For CI vehicles/equipment, or for SI vehicles/equipment with separate starter and ignition switches, go to step 3.

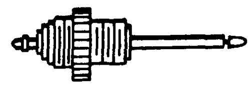
2. Set up engine to prevent starting (S1 engines only).

a. Attach connector P1 of cable W4 to J2 TK.

b. Attach connector P2 of cable W4 to connector P1 of cable W3.



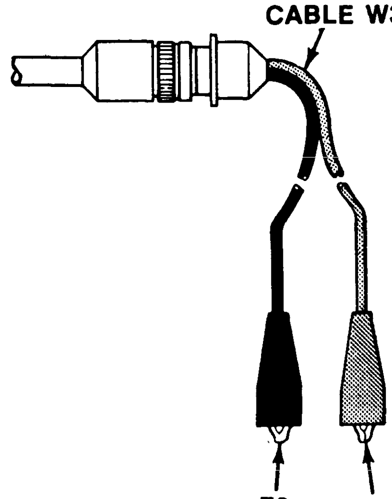
A. **HOOKUP AND TEST PROCEDURE**



IGNITION ADAPTER

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition cable or ignition adapter to vehicle.



NOTE

Locate vehicle/equipment test points where measurement is to be made.

c. Install ignition adapter, TK item 30, or locate distributor terminal of coil primary.

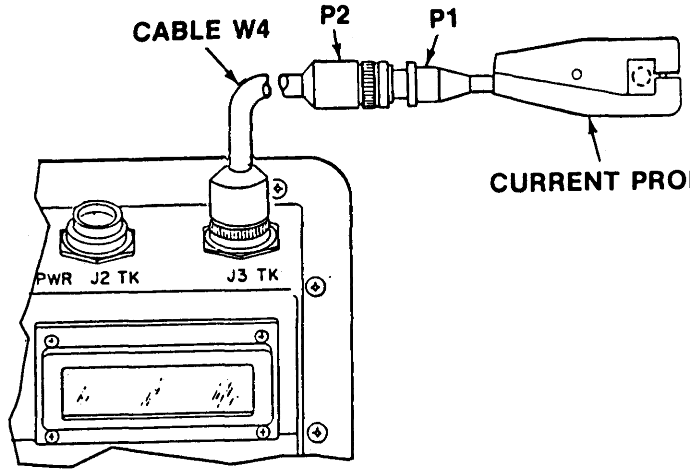
d. Attach red clip El of cable W3 to ignition adapter or distributor terminal of coil primary.

e. Attach black clip E2 of cable W3 to equipment ground.

3. Connect current probe.

a. Attach connector P1 of cable W4 to J3 TK.

b. Attach connector P2 of cable W4 to current probe, TK item 11.



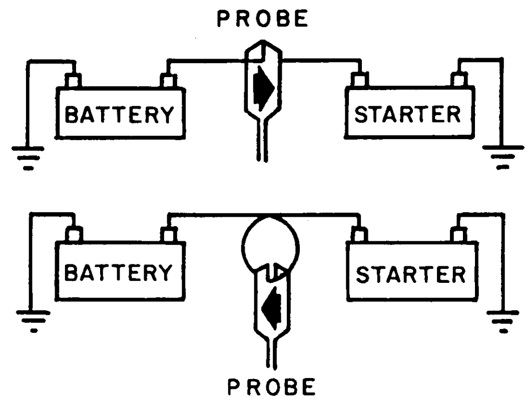
NOTE

Batteries may be tested singly, as series pairs, or as a pack. To test batteries singly, do step 4 and go to step 7. To test a series pair, do step 5 and go to step 7. Repeat for second pair. To test a pack, do step 6.

GO TO NEXT PAGE

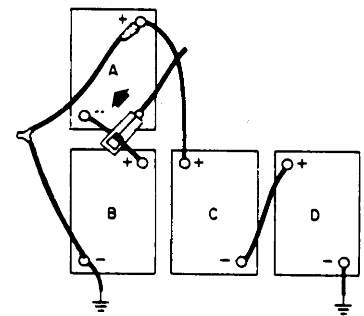
A. HOOKUP AND TEST PROEDURE

4. Attach current probe for single battery test. Clamp current probe around cable coming from positive (+) terminal of battery being tested. Point arrow on current probe along cable away from battery. Make sure current probe is closed. Go to step 7.



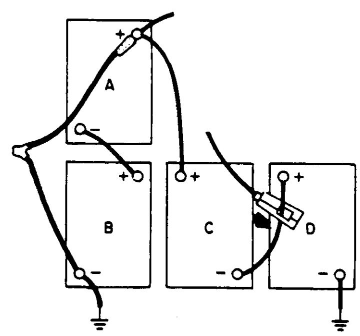
5. Attach current probe for series pair test.

a. Locate series pair of batteries. Find pairs for which negative terminal of one battery is connected by a cable to positive terminal of another battery. This makes the two batteries a series pair.

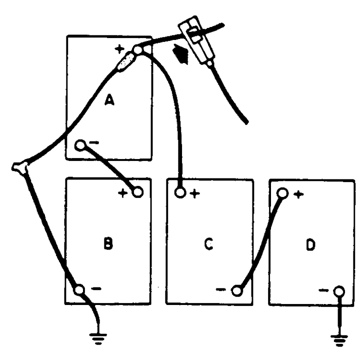


b. To test series pair A and B, clamp current probe around cable connecting battery A and battery B. Point arrow on current probe along cable to negative terminal of battery A. Make sure current probe is closed. Go to step 7.

c. To test series pair C and D, clamp current probe around cable connecting batteries C and D. Point arrow on current probe along cable to negative terminal of battery C. Make sure current probe is closed. Go to step 7.



6. Attach current probe for battery pack test. Clamp current probe around cable going to starter. Point arrow on current probe along cable to starter. Make sure current probe is closed. Go to step 7.



GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

7. Condition current probe.

NOTES

The engine must not start while performing this step. If engine starts, repeat step.

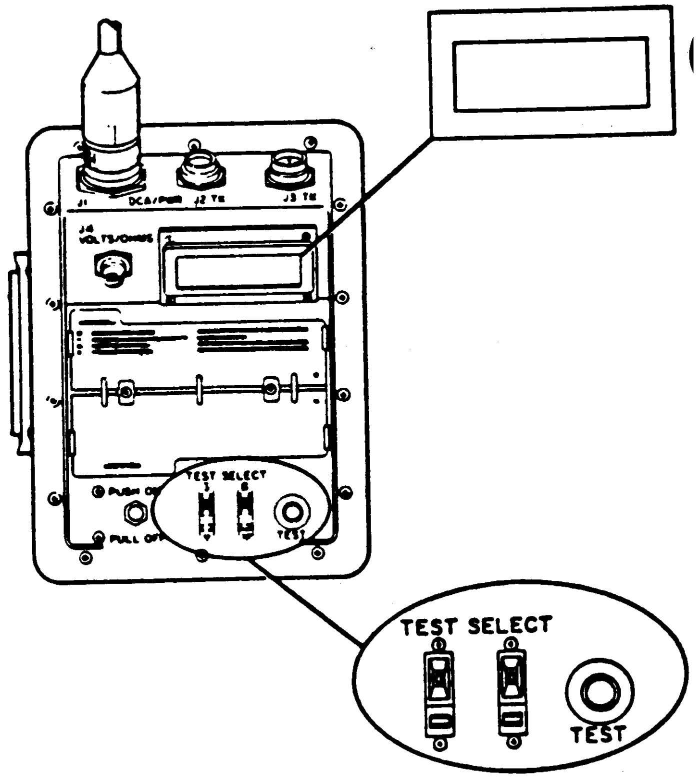
For CI engines with manual shut off values, locate and hold fuel shut-off closed while cranking. Go to step c.

If ignition adapter cable W3 is not being used, turn off ignition, and go to step c (SI engines only).

a. Set TEST SELECT switches to 11 (SI engines only).

b. Press and release TEST button (SI engines only).

c. Engage starter only long enough to briefly turn engine (approximately 1 second).



NOTE

The VID must be entered for the M151 and M880 vehicles only.

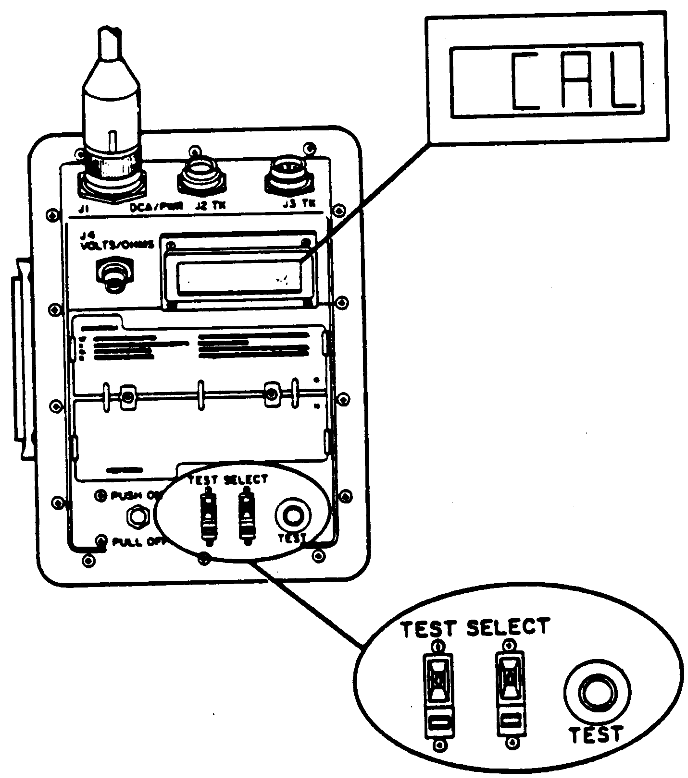
8. Do offset test.

a. Make sure all vehicle accessories are off.

b. Set TEST SELECT switches to 79.

c. Press and hold TEST button until CAL appears on display.

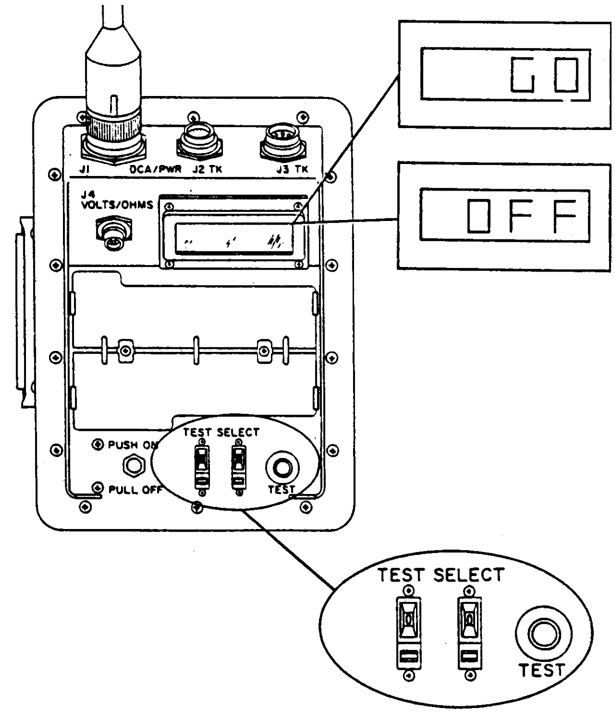
d. Release TEST button; wait for offset value to appear on display. If offset is within -225 to +Y25, proceed to step 9. If offset is not within -225 to +225, refer to Offset Fault Isolation paragraph 3-2-2.



GO TO NEXT PAGE

A. HOOKUP AND TEST PROCEDURE

9. Measure battery resistance change.



NOTE

The engine must not start while performing this step. If engine starts, go back to step 7.

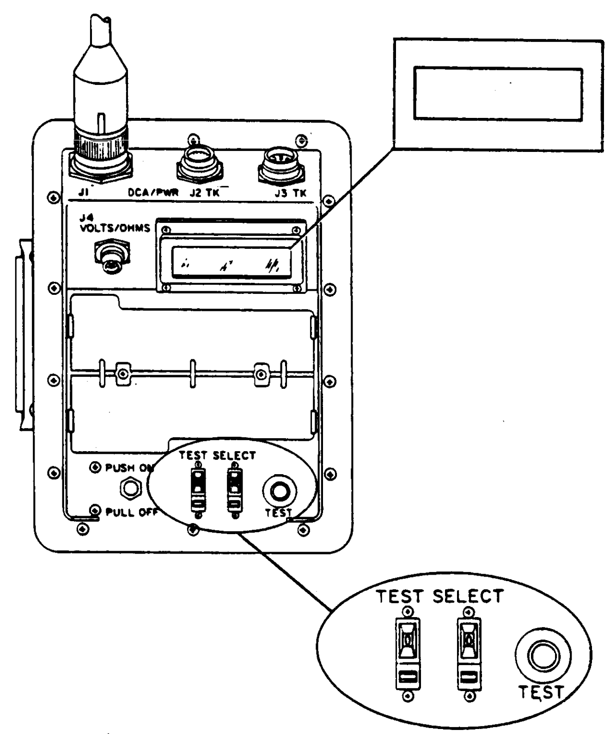
a. Press and release TEST button.

NOTE

Never engage the starter for longer than 2 seconds. If GO remains on the display after the 2 seconds, a battery may be bad. Check individual batteries.

b. When GO appears on display, engage starter for 2 seconds or until one of the following appears on the display:

OFF, A NUMBER
.9.9.9.9
AN ERROR MESSAGE



NOTES

If .9.9.9.9 appears on display, the battery resistance change value is beyond the range of the VTM and cannot be measured with STE/ICE-R.

If E013 appears on display, then check battery connections and correct as necessary. Repeat step 9. If E013 persists after three tests, VTM cannot perform test.

c. Observe displayed value (milliohms/see).

GO TO NEXT PAGE

B. USE DATA FROM PREVIOUS MEASUREMENT

1. Perform test.

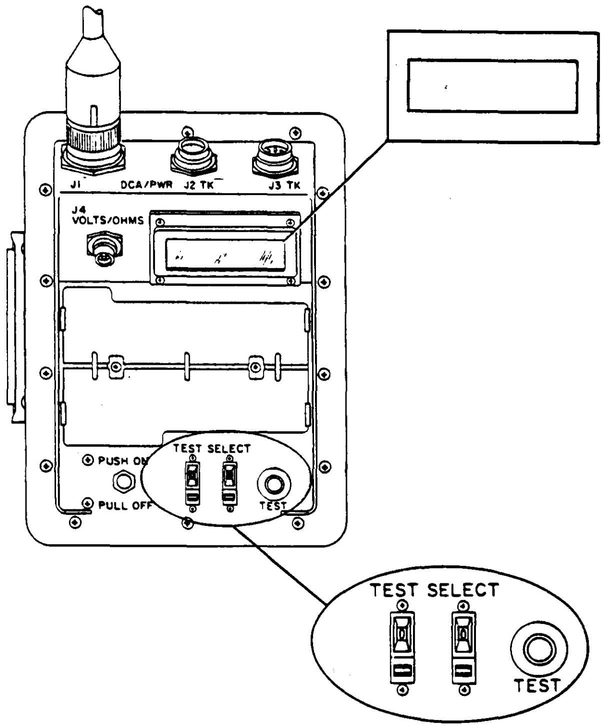
a. Set TEST SELECT switches to 79.

b. Press and release TEST Button.

NOTE

If any error message is displayed, go to procedure A.

c. Observe displayed value (milliohms/see).



END OF TASK

2-3-54. DIAGNOSTIC CONNECTOR ASSEMBLY TESTS 2-3-54

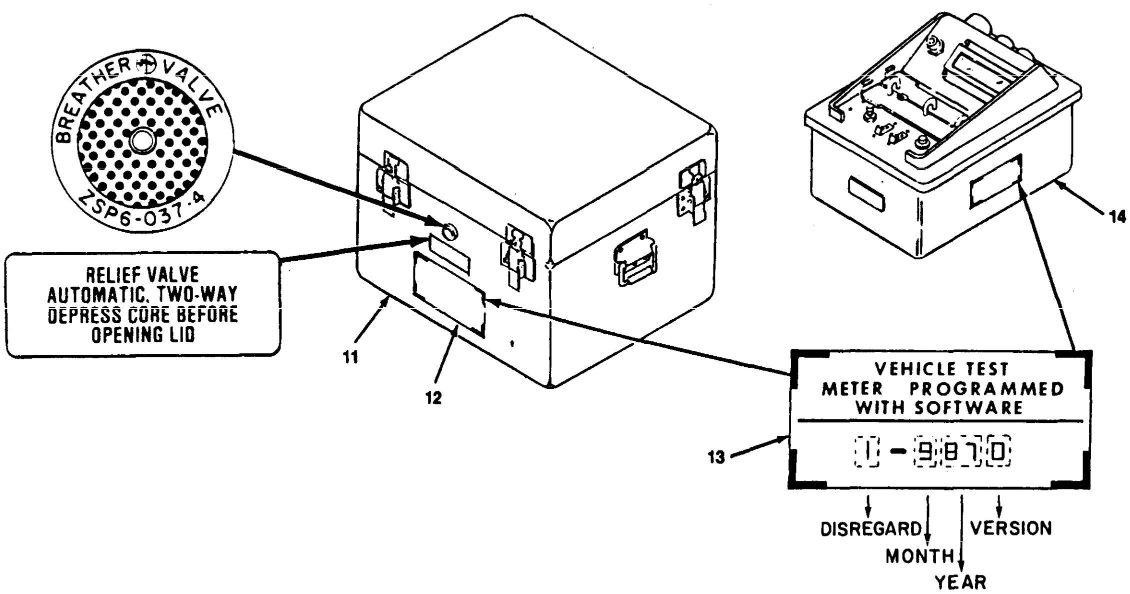
The diagnostic connector assembly (DCA) is mounted on a vehicle/equipment and allows the VTM to make measurements on the engine and accessories. The wiring harness for his connector is attached to a number of electrical test points and transducers inside the vehicle/equipment. This allows the user to determine the condition of chicle/equipment without disassembling the equipment to gain access.

Vehicles are classified into 13 DCA classes based on engine, fuel system, and testing requirements. Each class of DCA is identified with a code resistor. The VTM reads this code resistor for information it needs to make a measurement. Further test control is provided by DCA system wiring or resistors in the DCA. This identifies the type of transducer and speed sensor information. Test #62 can be used to display the identification of a DCA. Some vehicles have two DCAS to handle the required number of test points. The vehicle/equipment TM will give the test numbers to be used.

Error messages that may appear on the VTM display, can be caused by a faulty DCA or a faulty VTM. The vehicle/equipment TM will refer you to a fault isolation procedure to correct the problem.

Refer to paragraph 2-3-3, VTM Power Up, for procedures to connect the VTM to a DCA. All procedures for making DCA measurements are listed in the vehicle/equipment TM.

2-3-55. DECALS AND INSTRUCTION PLATES 2-3-55



The STE/ICE-R set has only one instruction plate. This plate is attached to the STE/ICE-R transit case and contains instructions for the pressure relief valve. The instruction is as follows: RELIEF VALVE AUTOMATIC, TWO-WAY DEPRESS CORE BEFORE ENING LID.

The STE/ICE~R set has two identical decals to show the software revision number. One decal is located on the VTM, and the other is located on the transit case. The oftware revision number has a month (one digit), a year (two digits) and the version umber which is always zero.

END OF SECTION

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

Section IV is a description of how the STE/ICE-R is used under unusual conditions and has only one paragraph:

2-4-1. OPERATlON UNDER UNUSUAL CONDITIONS 2-4-1

The STE/ICE-R test set is designed to be used outdoors where temperature and humidity are factors in making measurements. The VTM'S operating temperature range is from 20"F to 125"F. At the extremes of this range, it is necessary to perform an offset test within 30 seconds of each and every measurement that requires an offset test. This is the only requirement for outdoor use. It is also a good practice to shelter the VTM from direct rain and extreme solar radiation while in use.

END OF CHAPTER

Chapter Three - MAINTENANCE

This chapter includes information on fault isolation procedures and STE/ICE-R maintenance. It contains the following sections:

Section I. TOOLS AND EQUIPMENT

This section includes information on tools and equipment and has one paragraph:

3-1-1. REPAIR PARTS AND SPECIAL TOOLS 3-1-1

Refer to Appendix E for Repair Parts and Special Tools List.

END OF SECTION

Section II. FAULT ISOLATION

The purpose of this section is to isolate STE/ICE-R faults to a replaceable unit (cable, transducer, or VTM). Each type of fault has its own fault isolation paragraph. Fault isolation procedures for each of the error messages will isolate the cause of the error and will recommend the required action. A hose and fitting assembly fault isolation procedure is included to isolate engine compression check failures to the engine or the hose. A fault symptom list is also provided as a quick aid to correct STE/ICE-R problems.

Section II contains the following paragraphs:

GO TO NEXT PAGE

3-2-1. FAULT SYMPTOMS 3-2-1

The fault symptom list (Table 3-1) covers test set problems that could arise while using STE/ICE-R. The table is to be used after the operator has checked that all procedures have been correctly followed.

The table consists of three columns: problem, causes, and corrective action. To use the table, look in the first column to see if your symptom is listed. If it is, column two will list the possible causes of the malfunction. Associated with each entry in column two is a corrective action entry in column three. Perform all corrective actions from top to bottom until the problem is corrected or corrective action list is completed. If the problem cannot be resolved by following this table, and the symptom is in the table, then return the STE/ICE-R set to DS Maintenance for repair.

If a problem should arise which does not show one of the symptoms in the table, go to the beginning of this section of the TM to see if one of the fault isolation procedures described there can be used to find/correct the problem. If one is not found, then return the STE/ICE-R set to DS maintenance for repair.

The fault isolation procedures should be used as follows:

The cable fault isolation procedure should be used when a malfunction is encountered which could be caused by one of the STE/ICE-R cables. This procedure is normally utilized by other isolation procedures to verify that the cable is not the cause of the problem.

The offset fault isolation procedure should be used to determine the cause of an offset malfunction (cable, transducer, or VTM).

The confidence test fault isolation procedure should be used to determine if unit level repairable/replaceable items are the cause of the confidence test failure.

The power up fault isolation procedure should be used to determine the cause of a power up problem and to effect a repair/replace of the defective unit.

The transducer fault isolation procedures (current probe, pressure, igniton adapter) should be used when an obviously faulty reading is encountered while performing a measurement.

The hose and fitting assembly fault isolation procedure should be used if an engine fails a compression check using the hose and fitting assembly.

GO TO NEXT PAGE

Table 3-1 VTM Fault Symptom List

PROBLEM	CAUSES	CORRECTIVE ACTION
VTM display does not light up.	VTM protective circuitry triggered ON	PULL OFF VTM power switch. Wait 60 seconds. PUSH ON VTM power switch.
	Reversed W5 cable connections	Check connections.
	Poor battery conditions	Go to Power Up Fault Isolation, paragraph 3-2-5.
Wrong display power up sequence. Will not display .8.8.8.8 followed by - - - - after 2 seconds.	Faulty display module	Go to Digital Display Modules Replacement, paragraph 3-3-2.
		Go to Power Up Fault Isolation, paragraph 3-2-5.
Display power up sequence OK. VTM will not respond to TEST SELECT switch or TEST push button.	Bad VTM	Replace VTM; return to DS Maintenance.
VTM loses power and displays .8.8.8.8 followed by - - - - after 2 seconds.	Poor/dirty connections	Check/clean connections.
	Batteries in poor condition or discharged	Recharge or use alternate batteries.
	Bad W5 or W1 Cable	Go to Cable Fault Isolation, paragraph 3-2-3.
	Bad VTM	Replace VTM; return to DS Maintenance.

GO TO NEXT PAGE

Table 3-1 VTM Fault Sympton List (cont)

PROBLEM	CAUSES	CORRECTIVE ACTION
Wrogn characters are displayed	Batteries in poor condition or discharged	Recharge or use alternate batteries. Recycle power.
	Faulty display module	Go to Digital Display Modules Replacement, paragraph 3-3-2.
	Bad VTM	Run Confidence Test, paragraph 2-2-3.
VTM power switch trips to PULL OFF.	VTM case shorted to vehicles with master relay in the negative side of the battery	Isolate VTM case from vehicle, or turn ON vehicle master switch.
	Bad DCA or DCA cable	Use W5 cable for power.
	Bad VTM	Go to Power Up Fault Isolation, paragraph 3-2-5.
Confidence test failed. VTM will not display PASS.	Bad DCA or W1 cable	Go to Confidence Test Fault Isolation, paragraph 3-2-4.
	Bad TK transducer or W4 cable	
	Bad VTM	
Offset test failed, and confidence test passed.	Bad TK transducer, probe, cable or, input signal is present	Go to Offset Fault Isolation, paragraph 3-2-2.
	Bad vehicle DCA, trans- ducer or cable	

GO TO NEXT PAGE

3-2-1. FAULT SYMPTOMS (cont)

Table 3-1 VTM Fault Symptom List (cont)

PROBLEM	CAUSES	CORRECTIVE ACTION
Displays .9.9.9.9	Measurement range of test exceeded	Use alternate test procedure, or test with required range.
	Offset test performed with input signal present	Perform offset test with no input signal.
	Bad transducer	Go to transducer fault isolation procedure for type of transducer used.
	Bad VTM	
Test set not zero at beginning of test.	Normal test set zero drif Go to Measurement Accuracies, Appendix I.	Perform offset test.
	Bad VTM	Run Confidence Test, paragraph 2-2-3.
Displays E O 0 0 thru E03 3.	Test setup problem	Go to error message fault isolation procedure for the error message displayed.
	Wrong transducer selected	
	Bad cables, probe or transducer	
	Bad VTM	
Displays C # # #	Confidence test error message	Go to Confidence Test Fault Isolation, paragraph 3-2-4.

END OF SECTION

3-2-2. OFFSET FAULT ISOLATION 3-2-2

Description:

This paragraph describes isolation procedures to determine the cause of a transducer offset failure.
Possible failure causes include:

- Faulty VTM
- Faulty Transducer
- Faulty Transducer cable
- Faulty Unit under test
- Input signal present

Application:

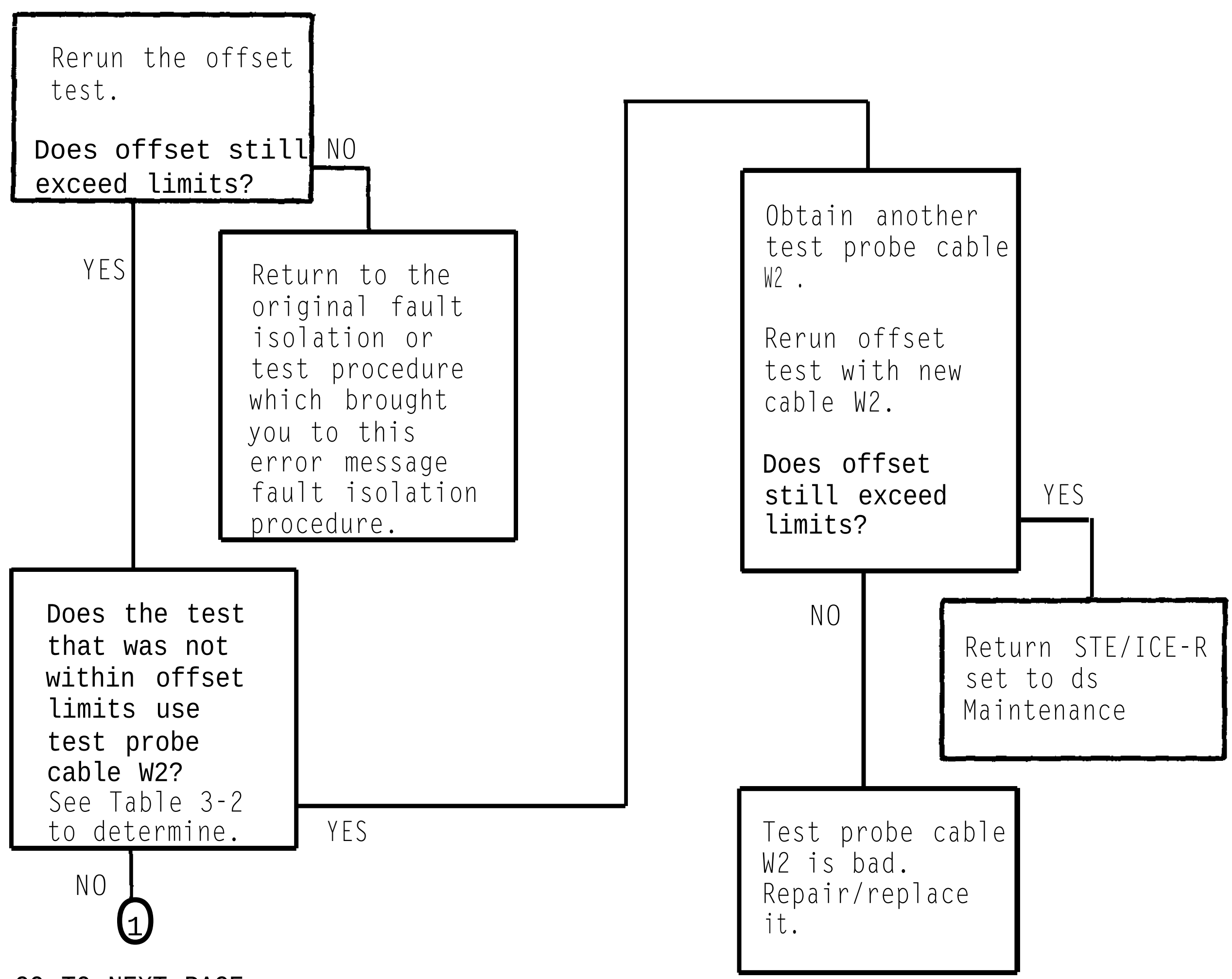
Applies when the VTM exceeds the offset limit while in the TK mode.

Pre-Isolation Procedures:

Disconnect transducer cable from the VTM and from the unit under test. Remove the transducer. Look for bent pins on the VTM, the transducer and on cable connectors.

Reconnect the transducer to the cable and the cable to the VTM. Do not connect the transducer at this time.

Run confidence test, paragraph 2-2-3.



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1

1. If transducer cable, W4, is connected to VTM at J3 TK, connect it to J2 TK.

2. If transducer cable, W4, is connected to VTM at J2 TK, connect it to J3 TK.

3. Rerun the offset test.

Does offset still exceed limits?

NO

VTM connector is faulty.

1. Continue vehicle testing using the good channel.

2. Return to original fault isolation or test procedure which brought you to this error fault isolation procedure.

3. When vehicle testing is complete, return STE/ICE-R set to DS Maintenance.

YES

1. Substitute other transducer cable W4 from TK Kit.

2. Rerun the offset test.

2

GO TO NEXT PAGE

2

Does offset still exceed limits?

NO

Original transducer cable W4 is bad. Replace it.

YES

Remove transducer. Install another transducer from the TK Kit.

Run offset test.

1. Set TEST SELECT switches to a test that uses the new transducer (see Table 3-2).

2. Press and hold TEST button until CAL appears on display.

3. Release TEST button and wait for offset value to appear on display.

Does offset still exceed limits as shown on Table 3-2?

YES

Return STE/ICE-R set to DS Maintenance.

NO

Remove transducer. Install another transducer from the TK Kit.

Run offset test.
1. Set TEST SELECT switches to a test that uses the new transducer (see Table 3-2).

2. Press and hold TEST button until CAL appears on display.

3. Release TEST button and wait for offset value to appear on display.

3

GO TO NEXT PAGE

3

Does offset still exceed limits as shown on Table 3-2?

YES

Return STE/ICE-R set to DS Maintenance.

NO

The original transducer that was used to begin the fault isolation procedure is bad.

Replace it.

NOTE

If you were using the red transducer with test #49, you may continue vehicle testing by substituting the blue transducer and using Test #50.

Table 3-2 Offset Values List

TEST	TRANSDUCER OR TEST LEADS	OFFSET LIMITS	TK/CABLE NOMENCLATURE
45	Red pressure transducer	-4.5 to +4.5	TK 22
46	Red pressure transducer	-4.5 to +4.5	TK 22
47	Red pressure transducer	-7.5 to +7.5	TK 22
48	Red pressure transducer	-90 to +90	TK 22
49	Red pressure transducer	-4.0 to +4.0	TK 22
50	Blue pressure transducer	-150 to +150	TK 17
51	Optional pressure transducer	-450 to +450	None
72	Current probe	-225 to +225	TK 11
73	Current probe	-225 to +225	TK 11
74	Current probe	-225 to +225	TK 11
75	Current probe	-225 to +225	TK 11
76	Current probe	-225 to +225	TK 11
77	Current probe	-225 to +225	TK 11
78	Current probe	-225 to +225	TK 11
79	Current probe	-225 to +225	TK 11
88	Test probe cable	-6.8 to +6.8	142
88	Current probe	-225 to +225	TK 11
89	Test probe cable	-6.8 to +6.8	W2
90	Current probe	-225 to +225	TK 11
91	Test probe cable	-225 to +225	W2
92	Test probe cable	-6.0 to +6.0	W2
93	Test probe cable	-6.8 to +6.8	W2
95	Test probe cable	-225 to +225	W2

END OF TASK

3-2-3. CABLE FAULT ISOLATION 3-2-3

DESCRIPTION:

This paragraph describes fault isolation procedures for the five different types of cables that are used with STE/ICE-R set (W1, W2, W3. W4, and W5). In all of these procedures, the recommended approach is to try another known good cable of the same type to see if the malfunction disappears when the substitute cable is used. The substitute cables may be obtained from the unit supply or from another STE/ICE-R set.

If a substitute cable cannot be obtained, then a continuity check must be performed. Refer to the applicable table and the figure in this paragraph for pin locations. A check must also be made to determine if wires which are not supposed to be connected, are internally connected on the cable. The check can be done by testing for continuity between the cable connector pin in question and all other pins in that connector. This check should be repeated for all of the signal pins in the connector.

Application:

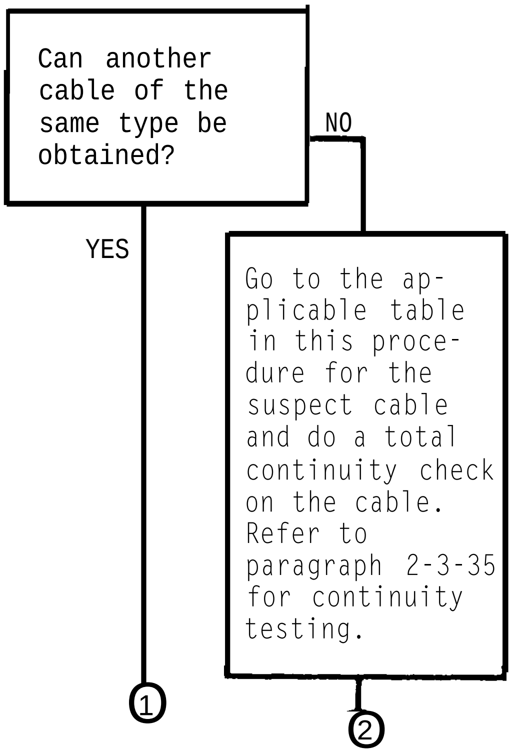
These procedures are used when there is some question as to whether one of the STE/ICE-R cables is bad.

Pre-Isolation Procedures:

Disconnect cable on both ends and look for bent pins on the VTM connector and on the cable connectors.

Cable Isolation Procedures

For W1, W2, W3, W4 and W5 fault isolation, proceed as follows:



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1

Try malfunction-ing procedure with new cable.

Does procedure malfunction?

YES

Is this malfunction different from the one you started the test with?

YES

Borrowed cable might be bad. Restart the procedure at Step 1.

NO

Return borrowed cable. Original cable is not the problem.

End of cable fault isolation.

NO

Original cable is bad. Repair/replace it. See MAC, Appendix B.

Continue testing using borrowed cable.

Return to the original fault isolation or test procedure which brought you to this cable fault isolation procedure.

2

Is cable good?

YES

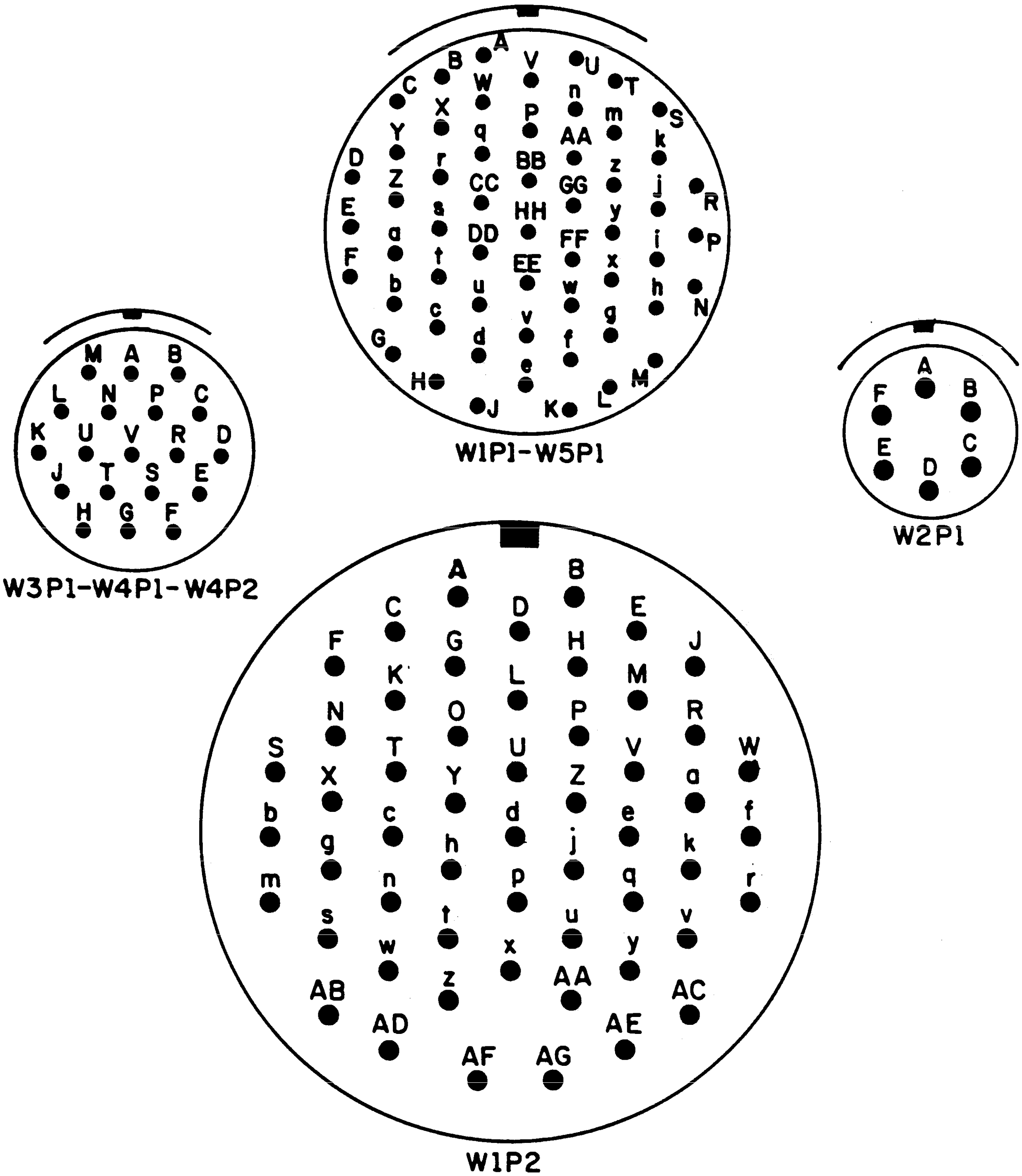
Cable was not the problem. End of cable fault isolation.

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

NO

Repair/replace cable. See MAC, Appendix B.

GO TO NEXT PAGE



Connector Pin Locations

Table 3-3, DCA Cable W1 Wire Connection List

FROM	TO
P1-A	Cable Shield
P1-B	P2-B
P1-C	P2-C
P1-D	P2-D
P1-E	P2-E
P1-F	P2-F
P1-G	Shield 5, 6
P1-H	P2-H
P1-J	P2-J
P1-K	Shield 8, 9
P1-L	P2-L
P1-M	P2-M
P1-l	P2-N
P1-i	P2-O
P1-P	P2-P
P1-R	P2-R
P1-S	P2-S
P1-T	P2-T
P1-U	P2-U
P1-V	P2-V
P1-W	P2-W
P1-X	P2-X
P1-Y	P2-Y
P1-Z	P2-Z
P1-a	P2-a
P1-b	P2-b
P1-c	P2-c
P1-d	P2-d
P1-e	Shield 27, 28

Table 3-3, DCA Cable W1 Wire Connection List (cont)

FROM	TO
P1-f	P2-f
Pl-g	P2-g
Pl-h	P2-h
P1-j	P2-j
P1-k	P2-k
P1-m	P2-m
P1-n	P2-n
P1-p	P2-p
P1-q	P2-q
P1-r	P2-r
P1-s	P2-s
P1-t	P2-t
P1-u	P2-u
P1-v	P2-V
P1-w	P2-w
P1-x	P2-x
P1-y	P2-y
Pi-z	P2-Z
P1-AA	P2-AA
P1-BB	P2-AB
Pi-cc	P2-AC
P1-DD	P2-AD
P1-EE	P2-AE
P1-FF	P2-AF
P1-GG	Inner Shield
Cable Shield	P2-A
Shield 5, 6	P2-G
Shield 8, 9	P2-K
Shield 27, 28	P2-e
Inner Shield	P2-AG

GO TO NEXT PAGE

Table 3-4, Test Probe Cable W2 Hire Connection List

FROM	TO
Pi-A	El (Red Clip)
Pi-B	E2 (Black Clip

Table 3-5, Ignition Adapter Cable W3 Mire Connection List

FROM	TO
P1-G	El (Red Clip)
P1-H	E2 (Black Clip)
P1-N	P1-H
P1-E	P1-v

Table 3-6, Transducer Cable W4 Hire Connection List

FROM	TO
PI-A	P2-A
Pi-B	P2-B
Pi-C	Shield 1, 2
P1-D	Cable Shield
P1-E	P2-E
P1-F	Shield 7, 8
P1-G	P2-G
P1-H	P2-H
P1-J	P2-J
P1-K	P2-K
Pi-L	P2-L
P1-M	P2-M
P1-N	P2-N
P1-P	P2-P
P1-R	P2-R
P1-s	P2-S
P1-T	P2-T
P1-u	P2-U
P1-v	P2-V
Shield 1, 2	P2-C
Cable Shield	P2-D
Shield 7, 8	P2-F

Table 3-7, Power Cable W5 Wire Connection List

FROM	TO
Pi-E	El (Red Clip)
Pi-F	E2 (Black Clip)
Pi-G	Shield 3, 4
Pi-v	El (Red Clip)
Pi-w	E2 (Black Clip)
Shield 1,2	Shield 3, 4

END OF TASK

3-2-4. CONFIDENCE TEST FAULT ISOLATION 3-2-4

Description:

This paragraph describes fault isolation procedures to determine whether a VTM is bad or whether some other part of the system caused the STE/ICE-R to display a confidence test error message. Possible other causes include:

- A bad STE/ICE-R cable
- A bad TK transducer
- A bad DCA harness or transducer

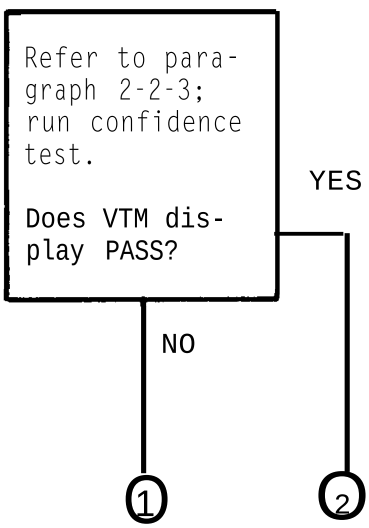
Application:

This procedure is used when the VTM displays a confidence test error message beginning with a C and followed by any group of numbers between 000 and 999. This error message may occur during normal operation or as a result of running the confidence test.

Pre-Isolation Procedures:

Disconnect all cables from the VTM except the power cable W5. If DCA cable W1 was used to power the VTM, then disconnect it. Use cable W5 for power.

Look for bent pins on VTM connectors and all connectors of removed cables.



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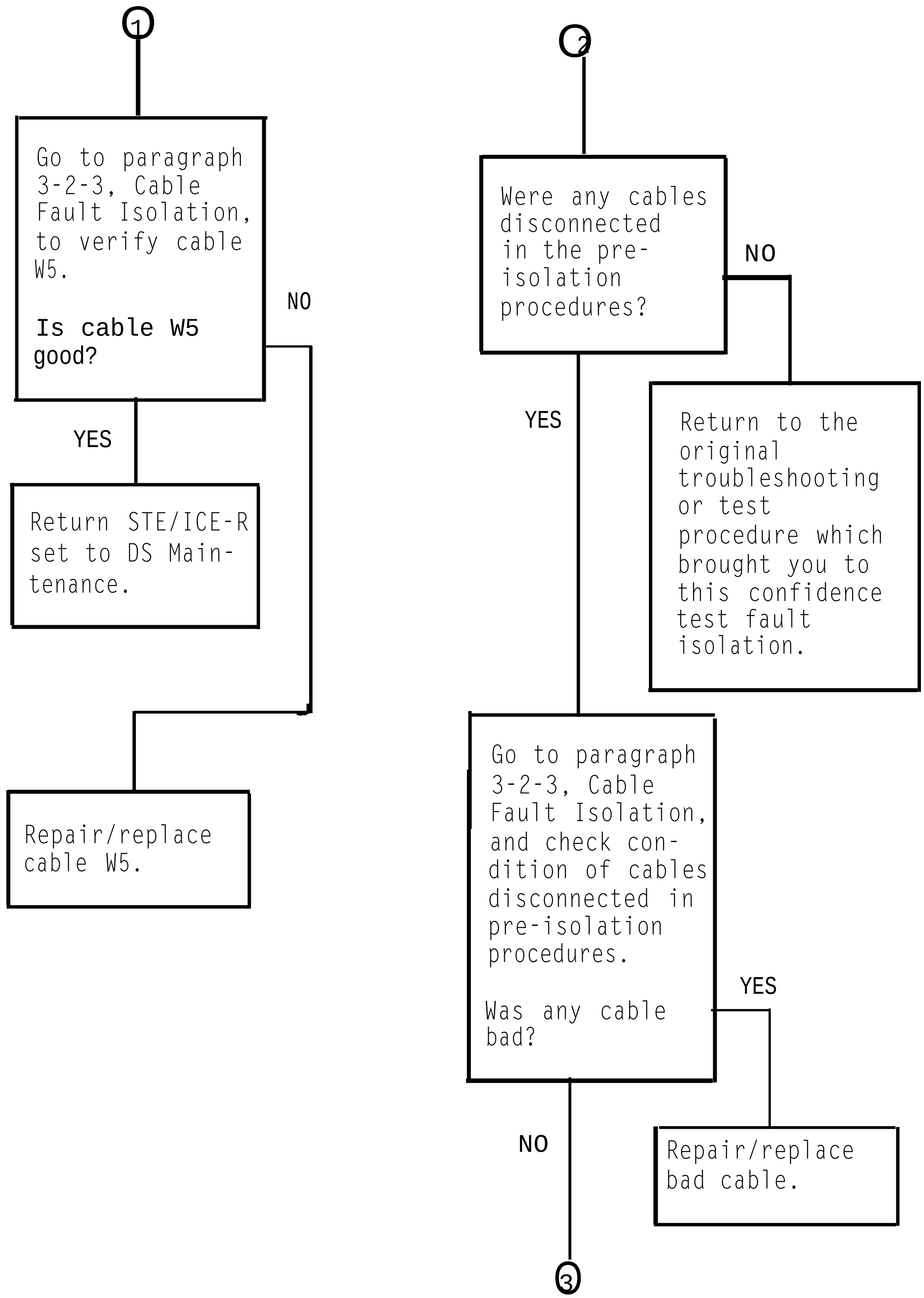
3-2-4. CONFIDENCE TEST FAULT ISOLATION (cont) 3-2-4



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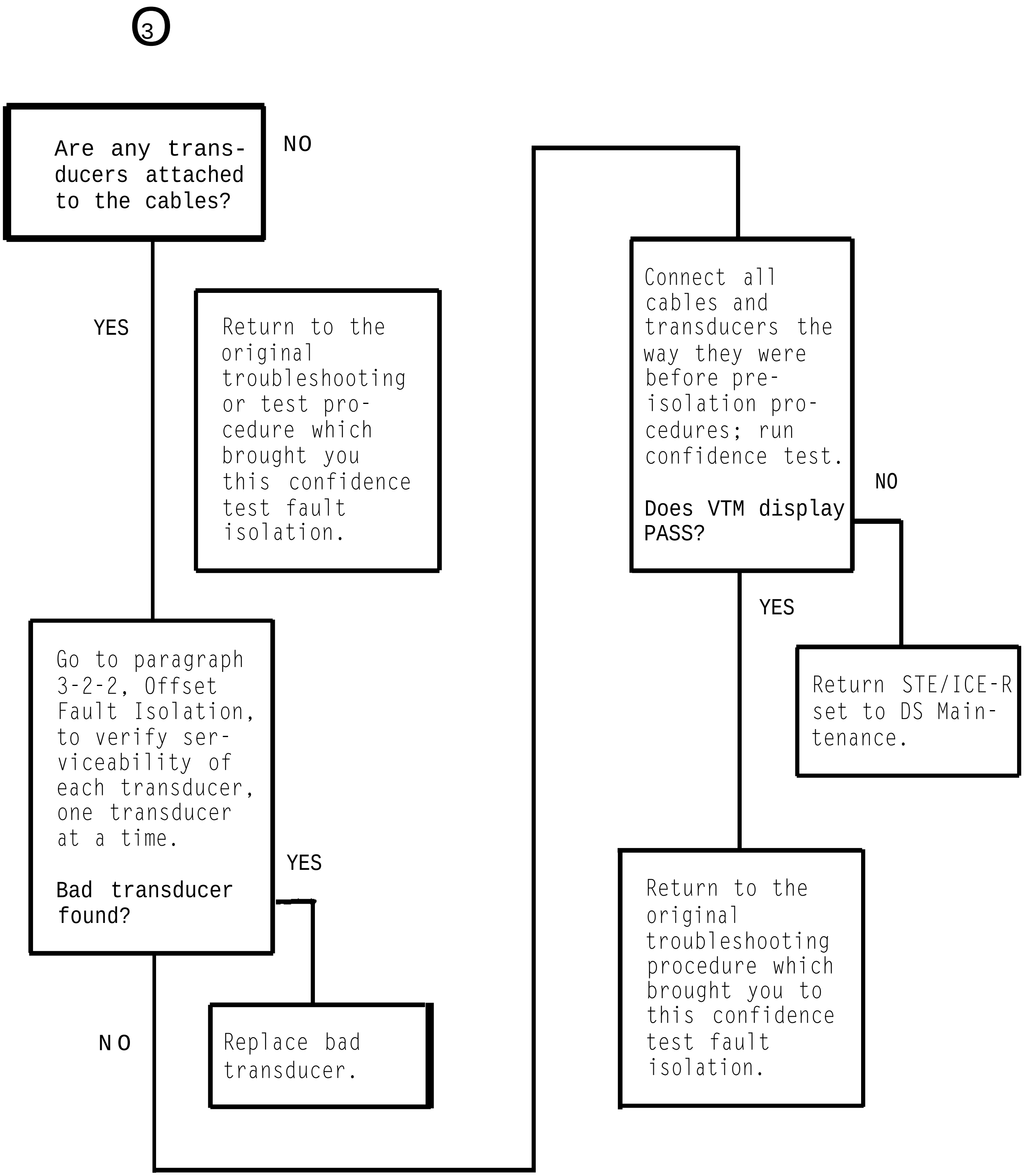

3
Are any transducers attached to the cables?
NO
YES
Return to the original troubleshooting or test procedure which brought you this confidence test fault isolation.
Go to paragraph 3-2-2, Offset Fault Isolation, to verify serviceability of each transducer, one transducer at a time.
Bad transducer found?
YES
NO
Replace bad transducer.
Connect all cables and transducers the way they were before pre-isolation procedures; run confidence test.
Does VTM display PASS?
NO
YES
Return STE/ICE-R set to DS Maintenance.
Return to the original troubleshooting procedure which brought you to this confidence test fault isolation.

END OF TASK

3-2-5. POWER UP FAULT ISOLATION 3-2-5

This paragraph includes:

A. TK Power Up Fault Isolation

B. DCA Power Up Fault Isolation

Description:

This procedure is used if display does not come on when VTM power switch is set to PUSH ON. Use these procedures to determine which repairable/ replaceable unit is faulty. Possible causes include:

- Faulty VTM
- Faulty cable
- Weak batteries

Application:

This procedure is used when the VTM power up procedure fails in either the TK or DCA mode.

Pre-Isolation Procedures:

For procedure A, check connections of power cable W5 to vehicle/equipment battery. For procedure B, check connections of DCA cable W1 to vehicle/equipment DCA connector.

Check for proper polarity. Secure connections.

Check battery connections including connections between batteries.

Check that power switch is set to PUSH ON.

NOTES

If the display does not come on when power switch is set to PUSH ON, then set power switch to PULL OFF. Make sure that the hookup is not reversed (reversed polarity). If the hookup is correct, wait 10 seconds before trying to turn VTM on again. This delay will allow time for the overvoltage protection circuits in the VTM to recover.

For TK mode, do procedure A.
For DCA mode, do procedure B.

GO TO NEXT PAGE

A. POWER UP FAULT ISOLATION (TK MODE)

Power VTM from known good batteries by using VTM Power Up procedure, paragraph 2-3-3.

PUSH ON VTM power switch.

Does the VTM power up correctly?

YES

Original batteries powering VTM are faulty.

Recharge batteries. Run applicable STE/ICE-R Battery Tests, Appendix H.

NO

Try to obtain another power cable W5 from another STE/ICE-R set or from unit supply.

Can another cable W5 be obtained?

NO

Refer to Cable Fault Isolation Procedure, paragraph 3-2-3; perform continuity check on original power cable W5.

Is power cable W5 good?

NO

YES

Return STE/ICE-R set to DS maintenance.

YES

Connect new power cable W5 to VTM and power source using Power Up procedure, paragraph 2-3-3.

PUSH ON VTM power switch.

Does the VTM power up correctly?

YES

Original power cable W5 is faulty.

Repair/replace it.

NO

Return STE/ICE-R set to DS maintenance.

GO TO NEXT PAGE

B. POWER UP FAULT ISOLATION (DCA MODE)

Remove DCA cable W1; connect VTM directly to vehicle/equipment batteries by using power cable W5.

Perform Power Up procedure, paragraph 2-3-3.

Does the VTM power up correctly?

YES

DCA cable W1 or installed DCA harness is faulty.

Go to vehicle/equipment TM for DCA fault isolation procedures.

NO

Power VTM from known good batteries using power cable W5, and perform Power Up procedure, paragraph 2-3-3.

Does the VTM power up correctly?

YES

Original batteries powering VTM are faulty.

Recharge batteries; run applicable Battery Tests, Appendix H.

NO

Return STE/ICE-R set to DS maintenance.

END OF TASK

3-2-6. HOSE AND FITTING ASSEMBLY TK ITEM #10 FAULT ISOLATION 3-2-6

Description:

This procedure is used to determine if there are leaks in an assembly comprising the hose and fitting assembly, TK item 10, and the 1000 PSI pressure transducer, blue stripe, TK item 17.

Application:

This procedure applies whenever there is a low pressure reading on the VTM display. Such a reading indicates either a fault in the vehicle/equipment under test or a leak in the hose and fitting assembly.

Pre-Isolation Procedures:

None.

Required Tools:

Wrench, adjustable, 6-inch

Use a wrench to tighten relief valve. Check valve.

Was either valve loose?

YES

Repeat procedure that exhibited low pressure. If procedure passes, continue with testing. Otherwise, return to this fault isolation procedure.

NO

1

GO TO NEXT PAGE

(1)

Is a pressure source available that can pressurize assembly to at least 80 PSI?

YES → (3)

NO

Use SI Engine compression as a pressure source.

1. Warm engine to normal operating temperature.

2. Remove all spark plugs.

3. Install hose and fitting assembly in place of one spark plug.

4. Apply teflon tape to 1000 psi pressure transducer(blue stripe).

5. Install pressure transducer on hose and fitting assembly.

6. Connect P1 of cable W4 to J2 TK or J3 TK of VTM.

7. Connect P2 of cable W4 to 1000 psi transducer (blue stripe).

8. Set TEST SELECT switches to 50.

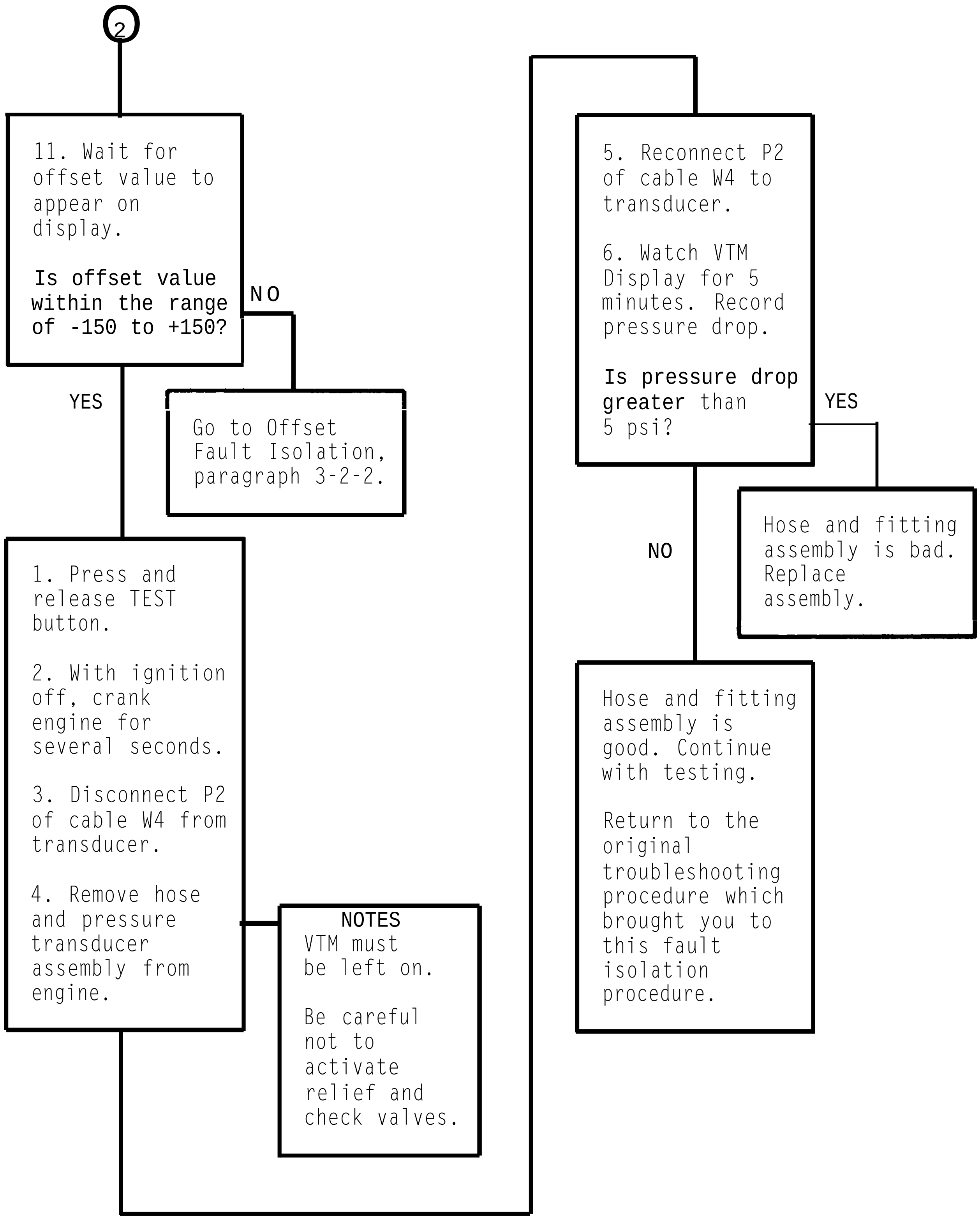
9. Press and hold TEST button until CAL appears on display.

10. Release TEST button.

(2)

GO TO NEXT PAGE

3-2-6. HOSE AND FITTING ASSEMBLY TK ITEM #10 FAULT ISOLATION (cont) 3-2-6



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3-2-6. HOSE AND FITTING ASSEMBLY TK ITEM #10 FAULT ISOLATION (cont) 3-2-6

3

1. Apply teflon tape to 1000 psi pressure transducer (blue stripe).

2. Install transducer into hose and fitting assembly.

3. Connect P1 of cable W4 to J2 TK or J3 TK of the VTM.

4. Connect PS of cable W4 to 1000 psi transducer (blue stripe).

5. Set TEST SELECT switches to 50.

6. Press and hold TEST button until CAL appears on display. Release test button.

Is offset value within range of -150 to +150?

NO

Go to Offset Fault Isolation, paragraph 3-2-2.

YES

1. Press and release TEST button.

CAUTION

OO not apply more than 150 psi to hose and fitting assembly. Damage to hose may result.

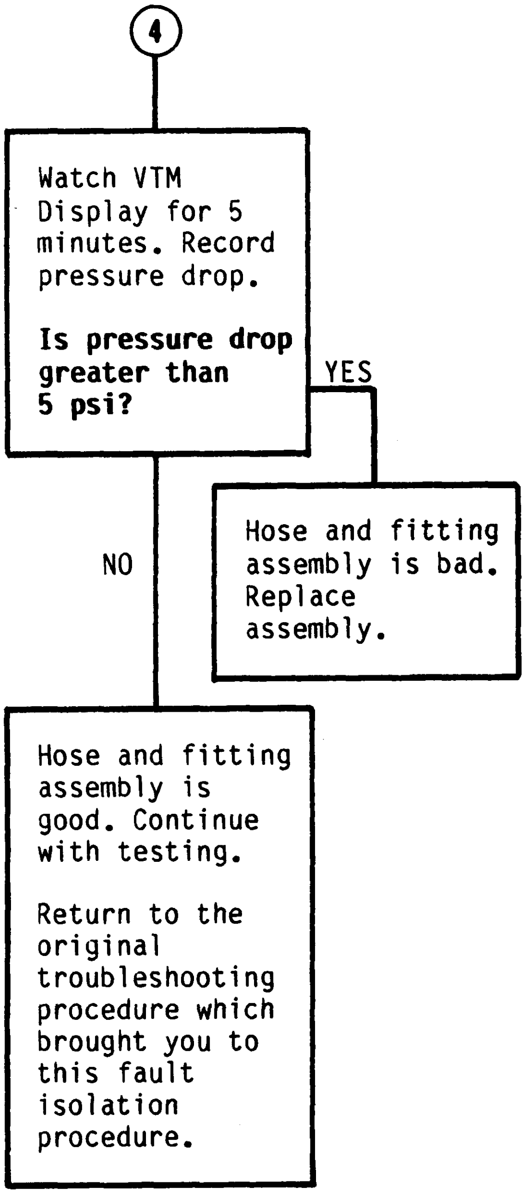
2. Apply approximately 80 psi of pressure to hose and fitting assembly.

3. Remove pressure source.

4

GO TO NEXT PAGE

3-2-6. HOSE AND FITTING ASSEHBLY TK ITEM #10 FAULT ISOLATION (cont) 3-2-6



END OF TASK

3-2-7. CURRENT PROBE TK ITEM #11 FAULT ISOLATION 3-2-7

Description:

This paragraph describes isolation procedures to determine the cause of a faulty current reading. Possible failure causes include:

- Faulty VTM
- Faulty Current Probe
- Faulty Cable

Application:

This procedure applies whenever an obviously faulty test result is displayed while using current probe, TK Item 11.

Faulty test results include but may not be limited to the following indications:

- A zero reading when current is applied to the current probe.
- A large number reading when no current is applied.
- Any reading outside of that which the test set should indicated.

Pre-Isolation Procedures:

Disconnect transducer cable W4 from the VTM and from vehicle/equipment. Remove the current probe. Look for bent or broken pins on the VTM, the probe, and cables. Check that the jaws of the probe open and close properly.

Review the test procedure for measurement being attempted. Go over each step, and verify that procedure has been followed exactly and that no steps have been omitted.

Reconnect current probe to cable W4; connect cable W4 to the VTM. Do not connect probe to the vehicle/equipment at this time.

Run confidence test, paragraph 2-2-3.

Connect current probe to vehicle/equipment under test.

GO TO NEXT PAGE

3-2-7. CURRENT PROBE TK ITEM #11 FAULT ISOLATION (cont) 3-2-7

NOTE

Refer to procedure for measurement being attempted. Rerun hookup and offset test procedures. Make sure there is no current on the probe when offset test is performed.

Does offset test result exceed limits listed in offset test procedure?

YES

1

Go to Offset Fault Isolation, paragraph 3-2-2.

NO

Repeat measurement where reading was in error.

Is the measurement still in error?

NO

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

YES

1. If probe cable W4 was connected to VTM at J3 TK, connect it to J2 TK.

2. If probe cable W4 was connected to VTM at J2 TK, connect it to J3 TK.

3. Repeat measurement where reading was in error.

Is measurement still in error?

YES

( )

NO

One channel in VTM is faulty.

2

GO TO NEXT PAGE

1

2

1. Continue vehicle testing using good channel.

2. Return to original fault isolation or test procedure which brought you to this error message fault isolation procedure.

3. When vehicle testing is complete, return STE/ICE-R set to DS Maintenance.

1. Substitute other transducer cable W4 from TK Kit.

2. Repeat measurement where reading was in error.

Is measurement still in error?

NO

Original transducer cable W4 is bad. Replace it.

YES

Obtain another current probe, TK Item 11, from unit supply or another STE/ICE-R set.

Replace current probe with borrowed unit.

Is measurement still in error?

NO

Original current probe used to begin fault isolation procedure is bad. Replace it.

YES

Return STE/ICE-R set to DS Maintenance.

Return borrowed current probe.

END OF TASK

3-2-8. PRESSURE TRANSDUCER TK ITEM #17 FAULT ISOLATION 3-2-8

Description:

This paragraph describes isolation procedures to determine the cause of a faulty pressure reading.

Possible failure causes include:

- Faulty VTM
- Faulty Transducer
- Faulty Cable

Application:

This procedure applies whenever an obviously faulty test result is displayed while using the 1000 psi pressure transducer, TK Item 17. Obviously faulty test results include (but are not limited to) zero indications when pressure is applied to the transducer, a large reading when no pressure is applied, or a reading outside that which the test set should indicate.

Pre-Isolation Procedures:

Disconnect transducer cable W4 from the VTM and from the vehicle/equipment under test. Remove the transducer. Look for bent or broken pins on the VTM, transducer and cables. Check that there is no blockage inside the transducer. Do not damage internal transducer screen.

Review test procedure for measurement being attempted. Go over each step. Verify that the procedure has been followed exactly and that no steps have been omitted.

Reconnect current probe to cable W4. Connect cable W4 to the VTM. Do not connect transducer to the vehicle/equipment being tested at this time.

Run confidence test, paragraph 2-2-3.

Connect transducer to vehicle/equipment under test.

GO TO NEXT PAGE

3-2-8. PRESSURE TRANSDUCER TK ITEM #17 FAULT ISOLATION (cont) 3-2-8

NOTE

Refer to procedure for measurement being attempted. Rerun hookup and offset test procedures. Make sure there is no pressure on transducer when offset test is performed.

Does offset test result exceed limits listed in test procedure?

YES

Go to Offset Fault Isolation, paragraph 3-2-2.

NO

Repeat measurement where reading was in error.

Is measurement still in error?

YES

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

1. If transducer cable W4 was connected to VTM at J3 TK, connect it to J2 TK.

2. If transducer cable W4 was connected to VTM at J2 TK, connect it to J3 TK.

3. Rerun measurement.

Is measurement still in error?

NO

One channel in VTM is faulty.

2

YES

1

GO TO NEXT PAGE

3-2-8. PRESSURE TRANSDUCER TK ITEU #17 FAULT ISOLATION (cont)

1

2

1. Continue vehicle testing using good channel.

2. Return to original fault isolation or test procedure which brought you to this error message fault isolation procedure.

3. When vehicle testing is complete, return STE/ICE-R set to DS Maintenance.

1. Substitute other transducer cable W4 from TK Kit.

2. Rerun measurement.

Is measurement still in error?

NO

Original transducer cable W4 is bad. Replace it.

YES

Obtain another 1000 psi transducer (TK Item 17) from unit supply or another STE/ICE-R set.

Replace 1000 PSI transducer with borrowed unit.

Is measurement still in error?

NO

Original transducer used to begin fault isolation procedure is bad. Replace it.

YES

Return STE/ICE-R set to DS Maintenance.

Return borrowed transducer.

END OF TASK

3-2-9. PRESSURE TRANSDUCER TK ITEM #22 FAULT ISOLATION 3-2-9

Description:

This paragraph describes isolation procedures to determine the cause of a faulty test result.

Possible failure causes include:
- Faulty VTM
- Faulty Transducer
- Faulty Cable

Application:

This procedure applies whenever an obviously faulty test result is displayed while using the 25 psi pressure transducer, TK Item 22.

Obviously faulty test results include (but are not limited to) zero indication when pressure is applied to the transducer, a large reading when no Pressure is applied. or a reading outside that which the-test set should indicate.

Pre-Isolation Procedures:

Disconnect transducer cable W4 from the VTM and from the vehicle/ equipment. Remove the transducer. Look for bent or broken pins on the VTM, transducer, and cables. Check that there is no blockage inside the transducer. Do not damage internal transducer screen. If using snubber, TK Item 21, check snubber for blockage.

Review test procedure for measurement being attempted. Go over each step. Verify that the procedure has been followed exactly and that no steps have been omitted.

Reconnect the transducer to cable W4. Connect cable W4 to the VTM. Do not connect transducer to the vehicle/ equipment being tested at this time.

Run confidence test, paragraph 2-2-3.

Connect transducer to the vehicle/equipment under test.

GO TO NEXT PAGE

3-2-9. PRESSURE TRANSDUCER TK ITEM #22 FAULT ISOLATION (cont) 3-2-9

NOTE

Refer to procedure for measurement being attempted. Rerun hookup and offset test procedures. Make sure there is no pressure on the transducer when offset test is performed.

Does offset test result exceed limits listed in offset test procedure?

YES

Go to Offset Fault Isolation, paragraph 3-2-2.

NO

Repeat measurement where reading was in error.

Is the measurement still in error?

NO

Return to the original fault isolation or test procedure which brought you to this fault isolation procedure.

YES

1. If transducer cable W4 was connected to VTM at J3 TK, connect it to J2 TK.

2. If transducer cable W4 was connected to VTM at J2 TK, connect it to J3 TK.

3. Repeat measurement where reading was in error.

Is measurement still in error?

YES

1

NO

One channel in VTM is faulty.

2

GO TO NEXT PAGE

3-2-9. PRESSURE TRANSDUCER TK ITEM #22 FAULT ISOLATION (cont) 3-2-9

1

2

1. Continue vehicle testing using good channel.

2. Return to the original fault isolation or test procedure which brought you to this fault isolation procedure.

3. When vehicle testing is complete, return STE/ICE-R set to DS Maintenance.

1. Substitute other transducer cable W4 from TK Kit.

2. Rerun measurement.

Is measurement still in error?

NO

Original transducer cable W4 is bad. Replace it.

YES

3

GO TO NEXT PAGE

3

Obtain another 25 psi pressure transducer (TK Item 22) from unit supply or another STE/ICE-R set.

Replace 25 psi pressure transducer with borrowed unit.

Repeat measurement.

Is measurement still in error?

NO

Original transducer used to begin fault isolation procedure is bad. Replace it.

YES

Return STE/ICE-R set to DS Maintenance.

Return borrowed transducer.

NOTE

If fault was discovered while performing test #49, testing may continue using 1000 psi transducer(blue stripe), TK Item 17, and STE/ICE-R test #50.

END OF TASK

3-2-10. IGNITION ADAPTER TK ITEM #30 FAULT ISOLATION 3-2-10

Description:

This paragraph describes isolation procedures to determine the cause of a faulty speed reading on an SI engine.

Possible failure causes include:
- Faulty VTM
- Faulty Ignition Adapter
- Faulty Cable (W3 or W4)

Application:

This procedure applies whenever obviously faulty test results are detected during a measurement that uses SI ignition adapter, TK Item 30.

Obviously faulty test results include (but are not limited to) zero readings when the engine is cranking above 50 RPM, a speed reading when the engine is not turning, or a reading outside that which the test set should indicate.

Pre-Isolation Procedures:

Disconnect transducer cable W4 from the VTM and vehicle/equipment. Remove cable W3 from cable W4. Look for bent or broken pins on the VTM and cables W3 and W4. Check that the ignition adapter makes solid contact with the pickoff point inside the distributor.

Review the test procedure for measurement being attempted. Go over each step, and verify that procedure has been followed exactly and that no steps have been omitted.

Reconnect cable W3 to cable W4. Connect cable W4 to the VTM. Do not connect ignition adapter to the vehicle/equipment being tested at this time.

Run confidence test, paragraph 2-2-3.

Connect the ignition adapter to equipment under test. Check for proper hookup.

GO TO NEXT PAGE

3-2-10. IGNITION ADAPTER TK ITEM #30 FAULT ISOLATION (cont) 3-2-10

Repeat measurement where reading was in error.

Is measurement still in error?

NO

Return to the original fault isolation or test procedure which brought you to this fault isolation procedure.

YES

1. If adapter cable W4 was connected to VTM at J3 TK, connect it to J2 TK.

2. If adapter cable W4 was connected to VTM at J2 TK, connect it to J3 TK.

3. Repeat measurement where reading was in error.

Is measurement still in error?

NO

One channel in VTM is faulty.

1. Continue vehicle testing using good channel.

2. Return to original fault isolation or test procedure which brought you to this fault isolation procedure.

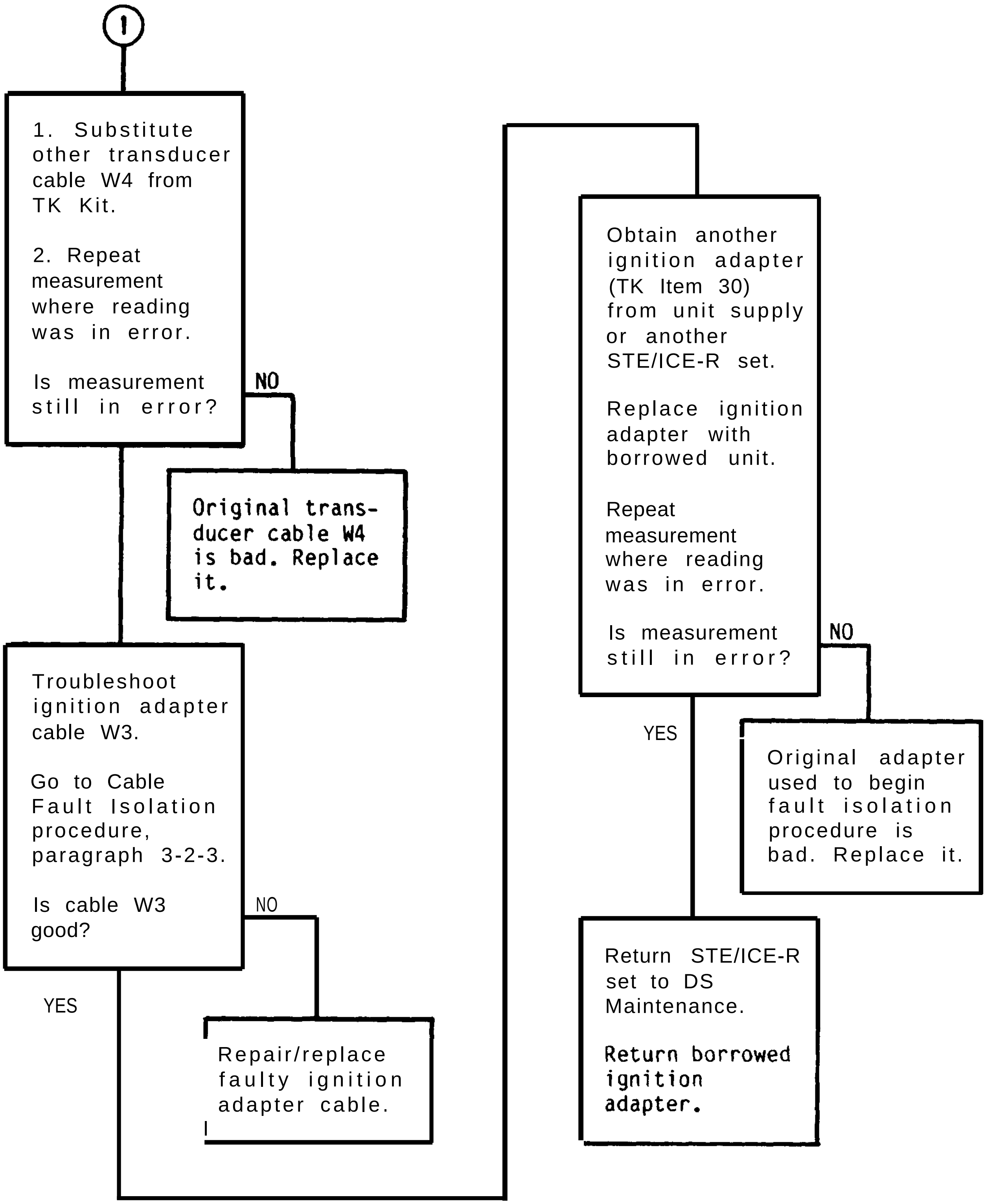
3. When vehicle testing is complete, return STE/ICE-R set to DS Maintenance.

YES

1

GO TO NEXT PAGE

3-2-10. IGNITION ADAPTER TK ITEM #30 FAULT ISOLATION (cont) 3-2-10



END OF TASK

3-2-11. PULSE TACHOMETER TK ITEM #34 FAULT ISOLATION 3-2-11

Description:

This paragraph describes isolation procedures to determine the cause of a faulty test result on a CI engine.

Possible failure causes include:
- Faulty VTM
- Faulty Pulse Tachometer
- Faulty Cable

Application:

This procedure applies whenever an obviously faulty test result is displayed while using pulse tachometer, TK Item 34.

Faulty test results include (but are not limited to) a zero indication when engine is cranking above 50 RPM, a zero indication when engine is not turning, or a reading outside that which the test set should indicate.

Pre-Isolation Procedures:

Disconnect transducer cable W4 from the VTM and vehicle/equipment. Remove pulse tachometer. Look for bent or broken pins on the VTM, pulse tachometer and cables. Check that pulse tachometer shaft rotates freely.

Review the test procedure for measurement being attempted. Go over each step, and verify that procedure has been followed exactly and that no steps have been omitted.

Reconnect pulse tachometer to cable W4. Connect cable W4 to the VTM. Do not connect pulse tachometer to the vehicle/equipment being tested at this time.

Run confidence test, paragraph 2-2-3.

Connect the pulse tachometer to vehicle/ equipment under test. Check for proper hookup.

GO TO NEXT PAGE

3-2-11. PULSE TACHOMETER TK ITEM #34 FAULT ISOLATION (cont) 3-2-11

Repeat measurement where reading was in error.

Is the measurement still in error?

NO

Return to the original fault isolation or test procedure which brought you to this fault isolation procedure.

YES

1. If pulse tachometer cable W4 was connected to VTM at J3 TK, connect it to J2 TK.

2. If pulse tachometer cable W4 was connected to VTM at J2 TK, connect it to J3 TK.

1. Repeat measurement where reading was in error.

Is measurement still in error?

NO

One channel in VTM is faulty.

1. Continue vehicle testing using good channel.

2. Return to original fault isolation or test procedure which brought you to this fault isolation procedure.

3. When vehicle testing is complete, return STE/ICE-R set to DS Maintenance.

YES

1

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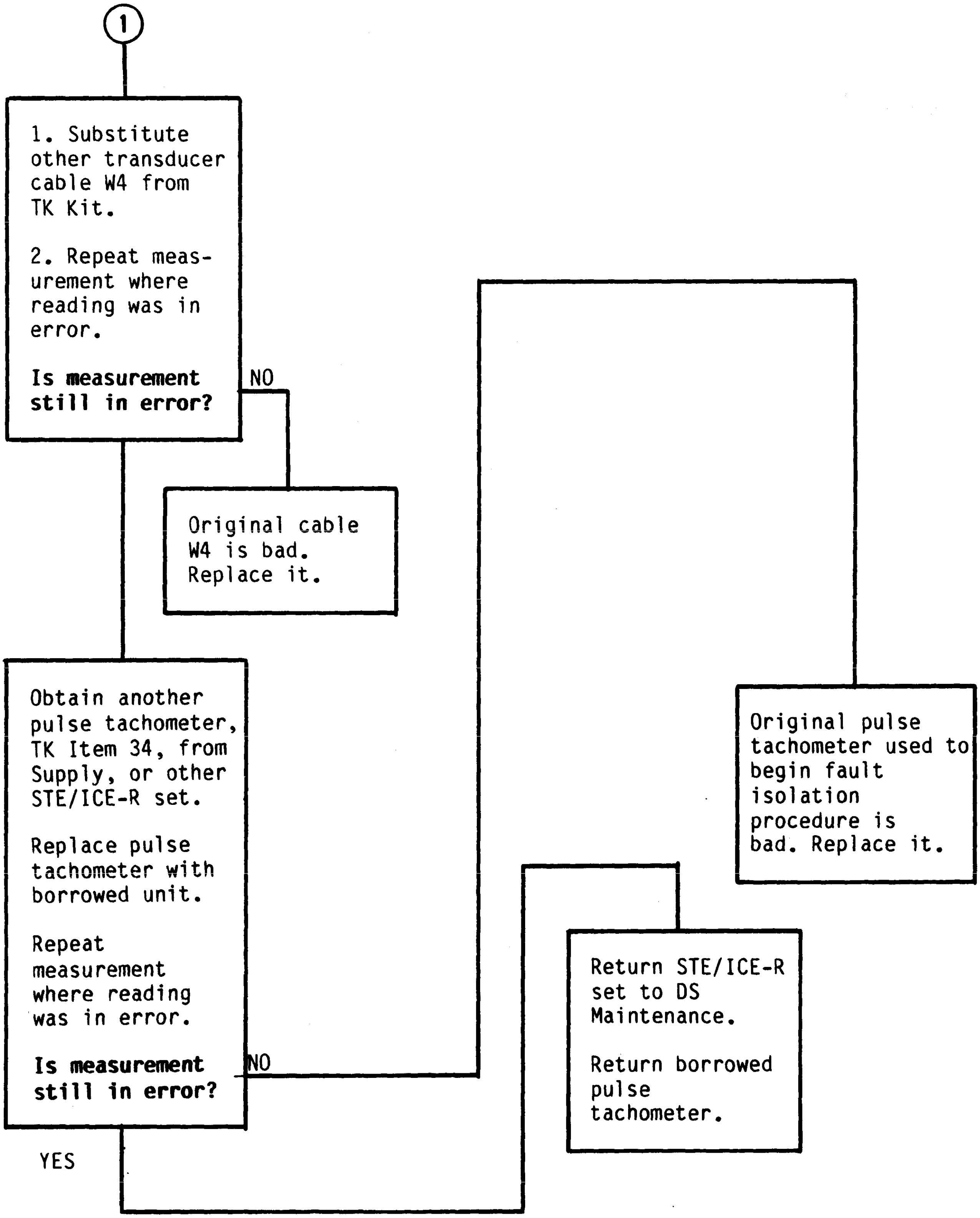
3-2-11. PULSE TACHOMETER TK ITEM #34 FAULT ISOLATION (cont) 3-2-11



END OF TASK

3-2-12. 10,000 PSI PRESSURE TRANSDUCER FAULT ISOLATION 3-2-12

Description:

This paragraph describes isolation procedures to determine the cause of a faulty pressure reading.

Possible failure causes include:
- Faulty VTM
- Faulty Transducer
- Faulty Cable

Application:

This procedure applies whenever an obviously faulty test result is displayed while using 10,000 psi pressure tranducer (optional item, see AAL).

Obviously faulty test results include (but are not limited to) zero indications when pressure is applied to the transducer, a large reading when no pressure is applied, or a reading outside that which the test set should indicate.

Pre-Isolation Procedures:

Disconnect transducer cable W4 from the VTM and from the vehicle/equipment under test. Remove the transducer. Look for bent or broken pins on the VTM, transducer and cables. Check that there is no blockage inside the transducer. Do not damage internal transducer screen.

Review test procedure for measurement being attempted. Go over each step. Verify that the procedure has been followed exactly and that no steps have been omitted.

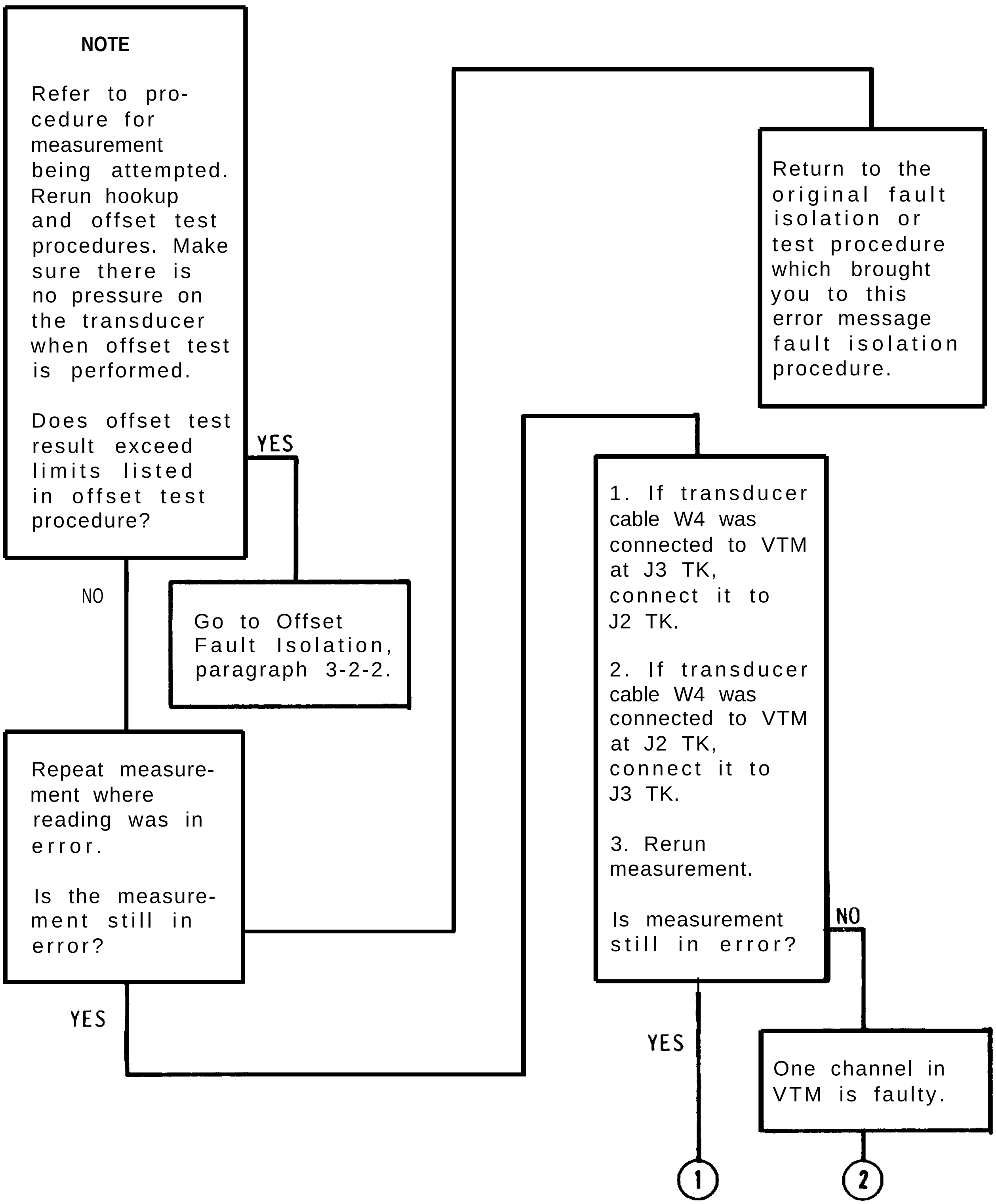
Reconnect the transducer to cable W4. Connect cable W4 to the VTM. Do not connect transducer to the equipment being tested at this time.

Run confidence test, paragraph 2-2-3.

Reconnect transducer to the vehicle/equipment under test.

GO TO NEXT PAGE

3-2-12. 10,000 PSI PRESSURE TRANSDUCER FAULT ISOLATION (cont) 3-2-12



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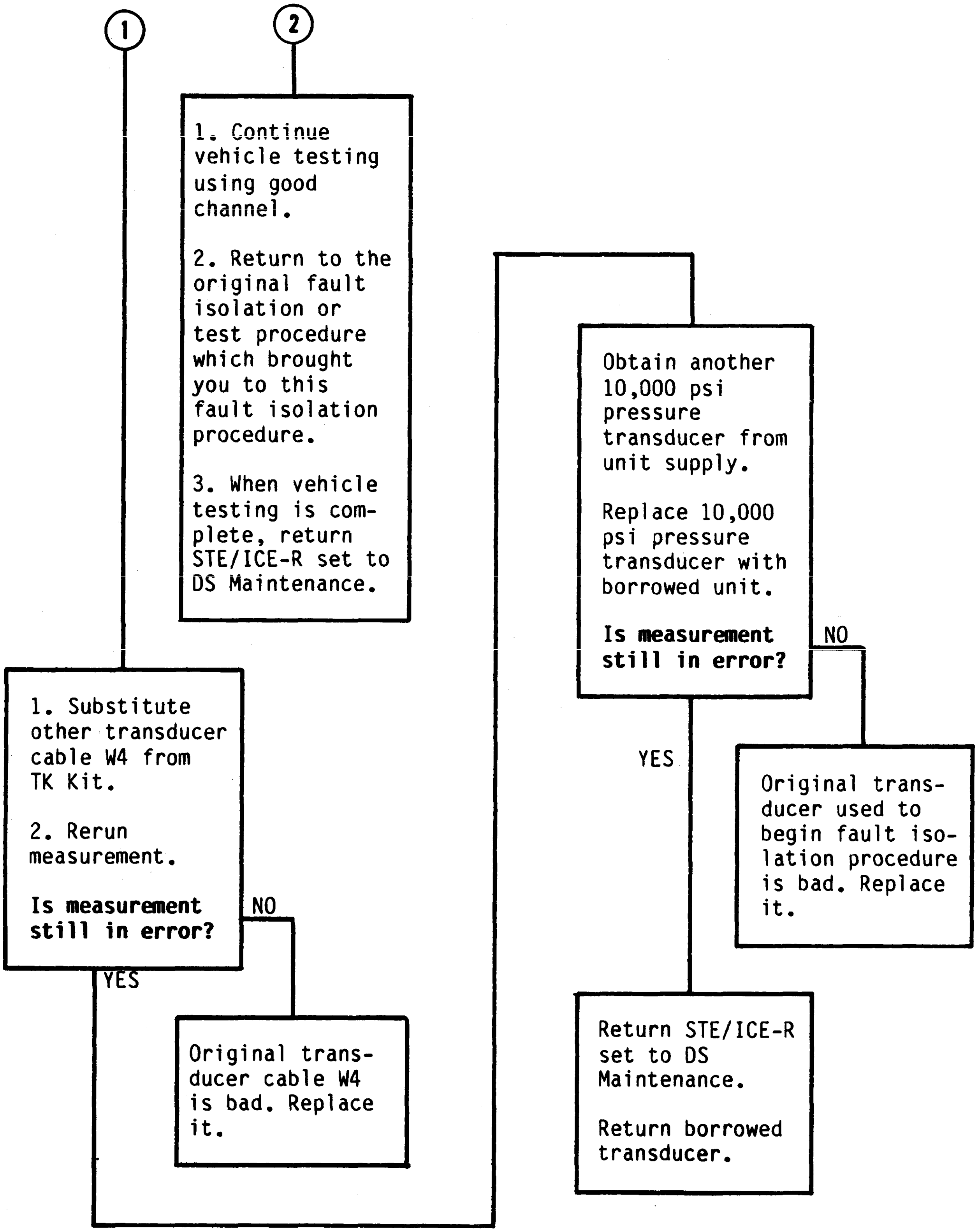
3-2-12. 10,000 PSI PRESSURE TRANSDUCER FAULT ISOLATION (cont) 3-2-12



END OF TASK

3-2-13. ERROR MESSAGE EOOO FAULT ISOLATION 3-2-13

Description:

This message indicates that the VTM has been asked for information which it does not have. This error message is a proper response if the information requested is not available to the VTM.

Application:

Applies only to the tests listed below. If this error message appears during any other test, return STE/ICE-R set to DS maintenance.

59 Display Number of cylinders

61 Display VID

62 Display DCA ID

63 Display J2 TK ID

64 Display J3 TK ID

Pre-Isolation Procedures:

Check that TEST SELECT switches are set to correct test number.

Check that all connect ons are correct and secure.

If you are not in test 62 and you are using DCA cable W1 to power the VTM, replace cable W1 with cable W5. Connect cable W5 to a known good battery.

If you are in test 59, you must have previously entered number-of-cylinders information with test 58, a CYL prompt message, a VID(with a test 60), or a UEH prompt message (not all VIDS have cylinder information).

If you are in test 61, you must have previously entered a vehicle identification number with test 60 or a UEH prompt message. The number entered should be displayed.

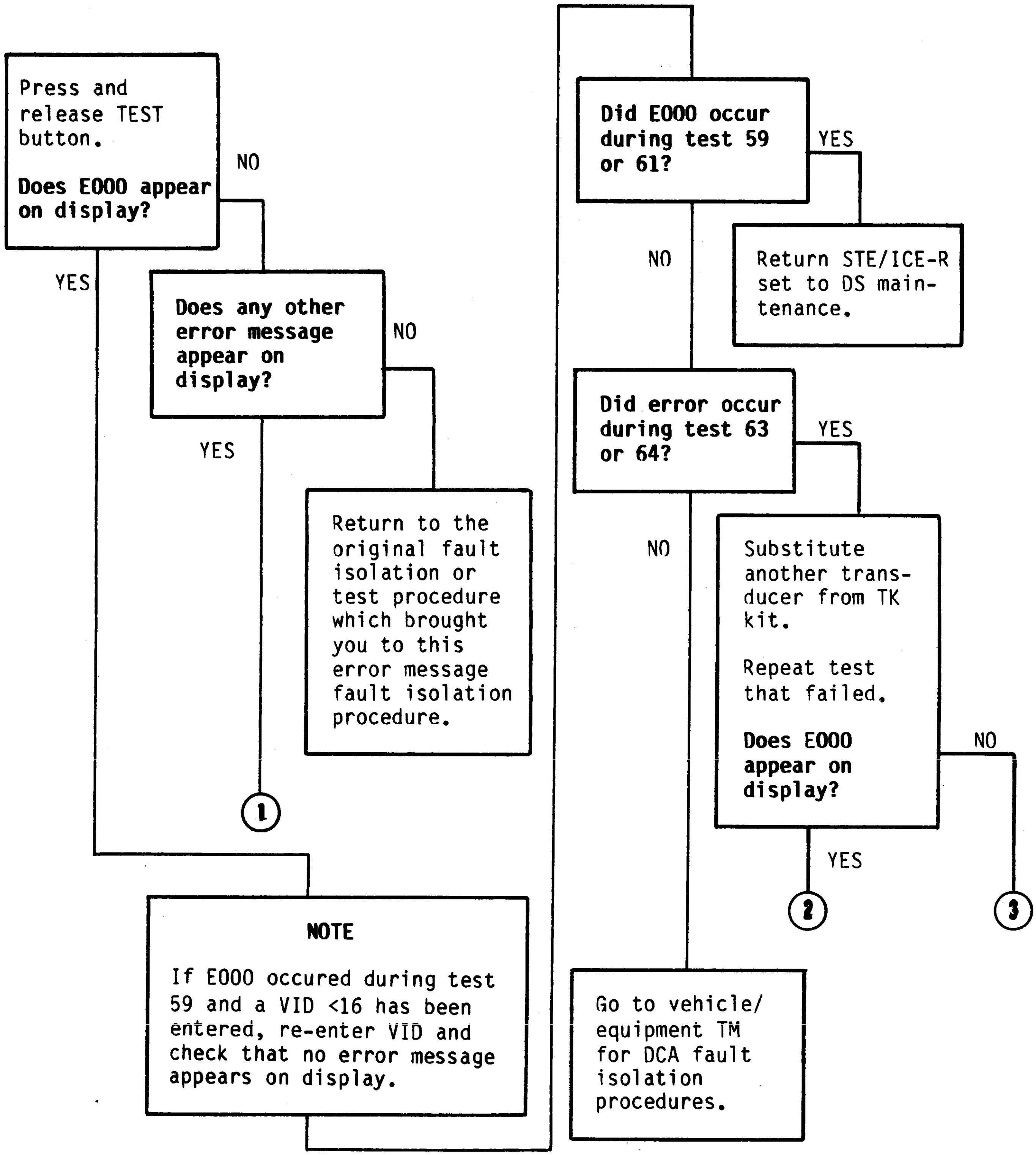
If you are in test 62, the VTM must be connected to the vehicle with DCA cable W1. For fault isolation procedure, go to Vehicle/Equipment TM.

If you are in test 63, there must be a transducer connected to J2 TK with TK cable W4. See table 2-7 for correct transducer ID number.

If you are in test 64, there must be a transducer connected to J3 TK with TK cable W4. See table 2-7 for correct transducer ID number.

GO TO NEXT PAGE

3-2-13. ERROR MESSAGE E000 FAULT ISOLATION (cont) 3-2-13



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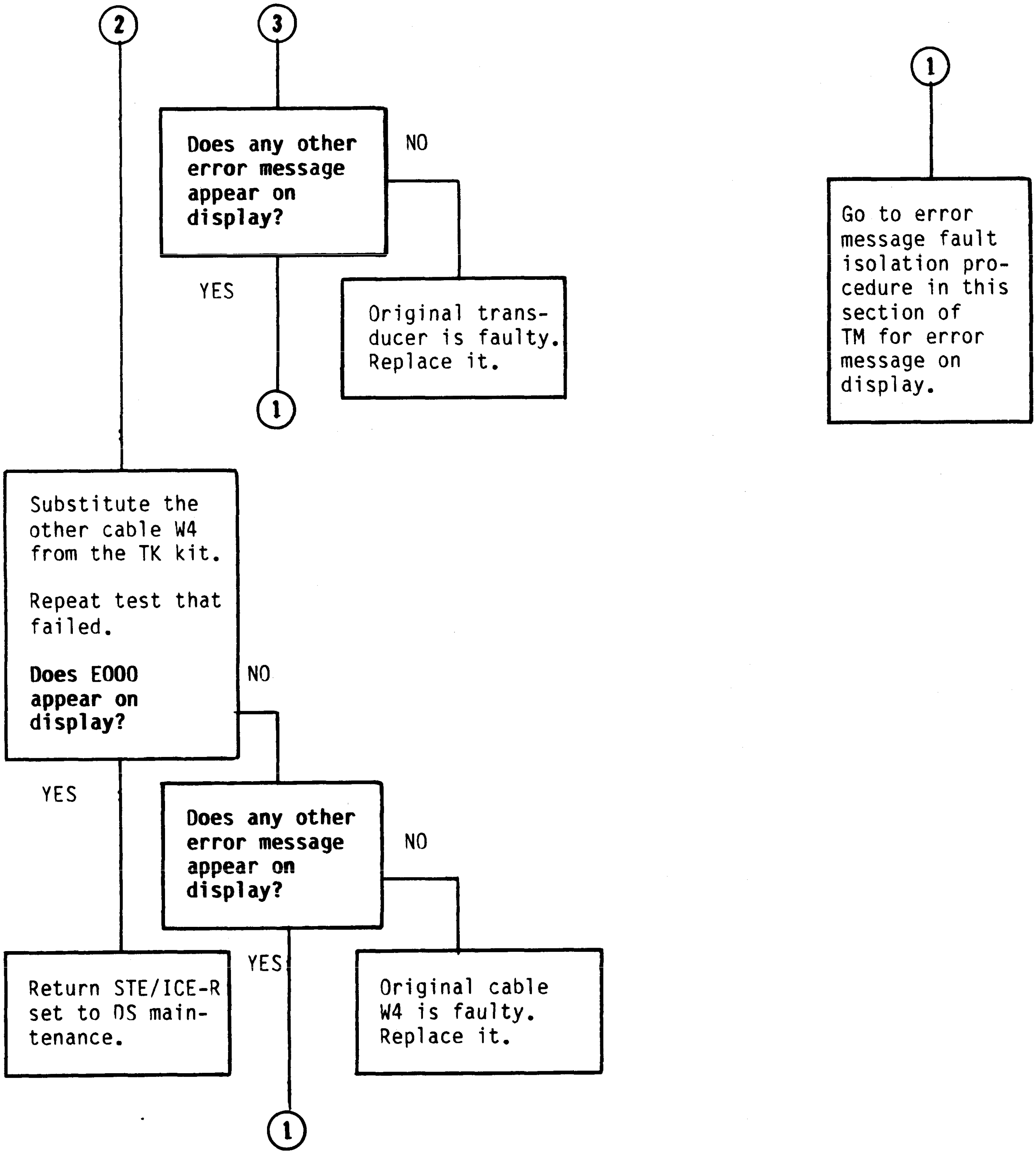
3-2-13. ERROR MESSAGE E000 FAULT ISOLATION (cont) 3-2-13



END OF TASK

3-2-14. ERROR MESSAGE E001 FAULT ISOLATION 3-2-14

Description:

This message indicates that a test number not used by the VTM has been entered into the VTH.

Application:

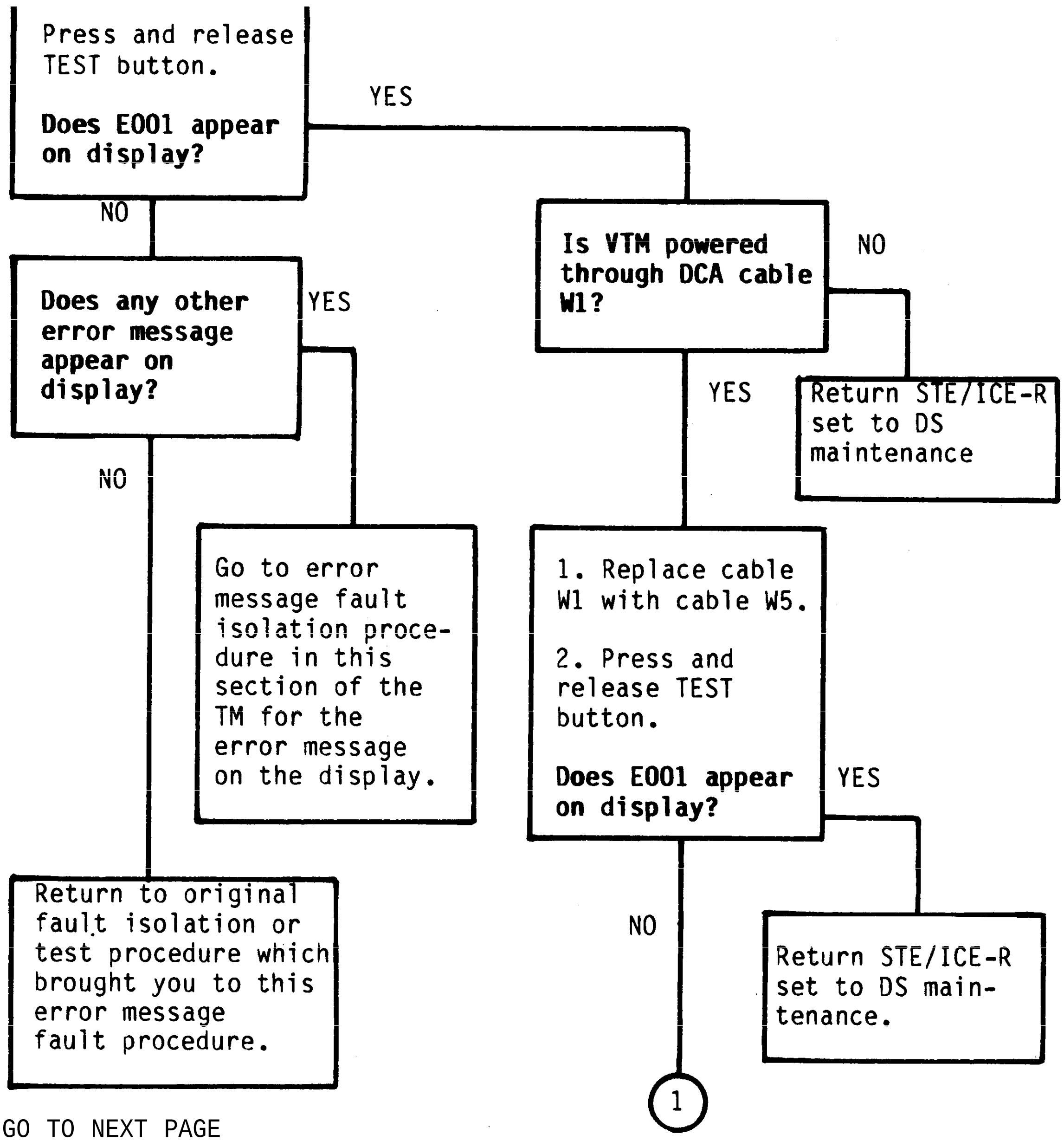
Applies to test numbers 0,07,08,09, 19 and 55.

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Run confidence test, paragraph 2-2-3.

Check that TEST SELECT switches are set to correct test number. Refer to test selection guide, table 2-5. Do cable fault isolation, paragraph 3-2-3.



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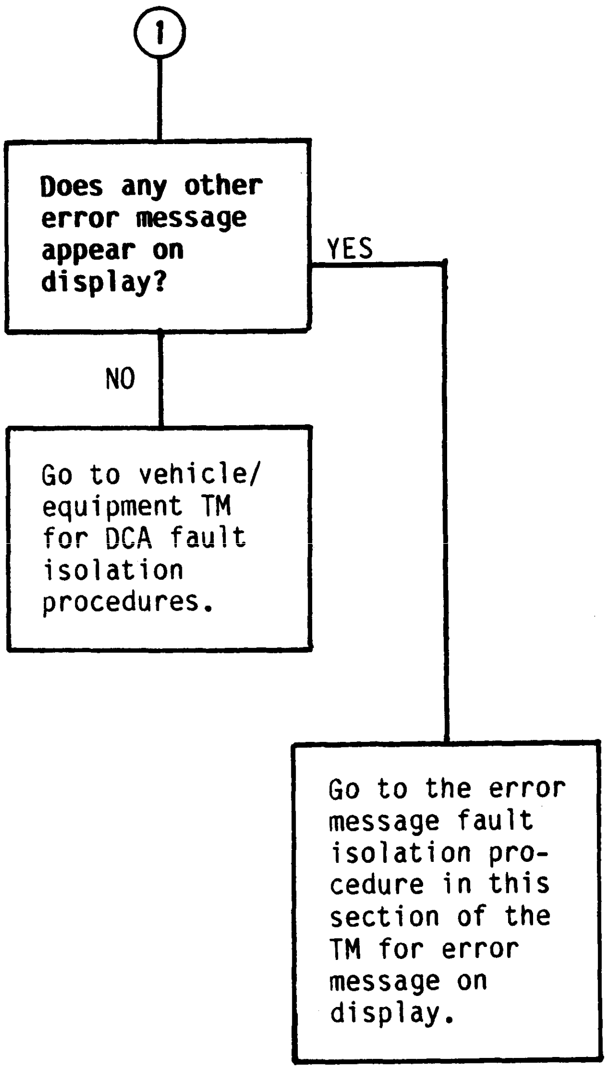
3-2-14. ERROR MESSAGE E001 FAULT ISOLATION (cont) 3-2-14



END OF TASK

3-2-15. ERROR MESSAGE E002 FAULT ISOLATION 3-2-15

Description:

This message indicates that the required transducer is not connected.

Application:

Applies to the following tests in TK mode. If this error message appears during any other test, return STE/ICE-R set to DS Maintenance:

45 Vacuum 0-30 in. mercury
46 Vacuum variation 0-30 in. mercury
47 Pressure 0-50 in. mercury
48 Vacuum o-150 in. water
49 pressure O-25 psIG
50 Pressure 0-1000 PSIG
51 Pressure 0-4500 PSIG
52 Reserved
72 Current first peak
73 Battery internal resistance
74 Starter circuit resistance
75 Battery resistance change
76 Current first peak
77 Battery internal resistance
78 Starter circuit resistance
79 Battery resistance change
88 Live circuit resistance
90 DC current 0-1500 amps
95 AC current 0-700 amps
97 AC frequency 40-500 Hz.

Pre-Isolation Procedures:

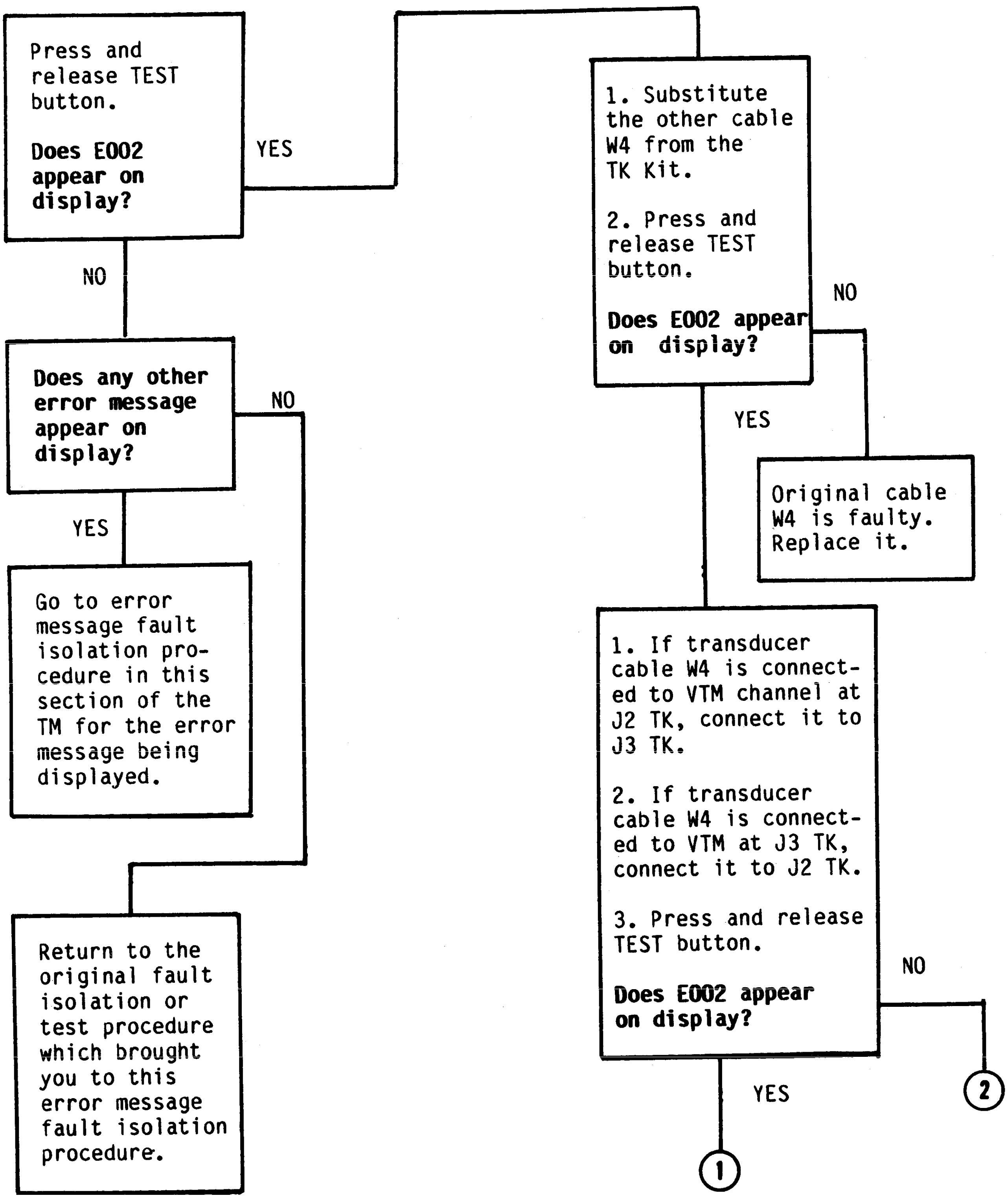
Check that TEST SELECT switches are set to correct test number.

If you are using DCA cable W1 to power the VTM, replace cable W1 with cable W5. Connect cable W5 to a known good battery.

Check that all connections are correct and secure. Check that correct transducer is attached to cable W4.

GO TO NEXT PAGE

3-2-15. ERROR MESSAGE E002 FAULT ISOLATION (cont)



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3-2-15. ERROR MESSAGE E002 FAULT ISOLATION (cont)

1

2

Original connector is faulty.

Continue testing using other connector.

When vehicle testing is completed, return STE/ICE-R set to DS Maintenance.

1. If required transducer cable W4 is attached to VTM J2 TK, enter 63 on TEST SELECT switches.

2. If required transducer cable W4 is attached to VTM J3 TK, enter 64 on TEST SELECT switches.

3. Press and release TEST button.

4. Refer to table 2-7 or proper TK ID.

Does proper TK ID appear on display?

YES

NO

1. Check that all pre-isolation procedures have been done.

2. Set TEST SELECT switches to test number that caused E002 to appear on display.

3. Press and release TEST button.

Does E002 appear on display?

NO

YES

Return STE/ICE-R set to DS Maintenance.

3

1. Substitute another transducer from TK kit.

2. Refer to Table 2-7 for proper TK ID.

3. Press and release TEST button.

Does proper TK ID appear on display for new transducer?

YES

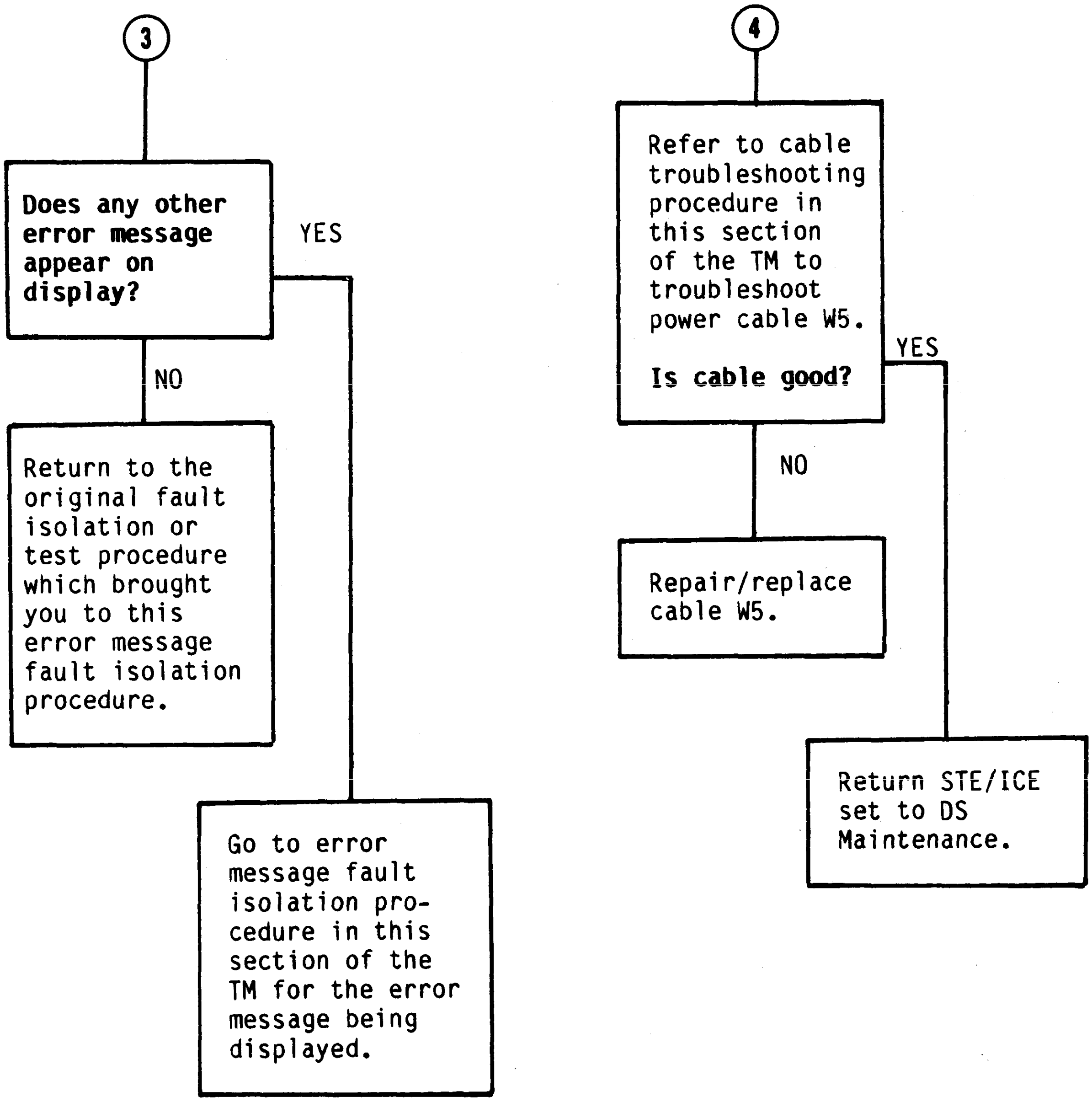
NO

4

1

Original transducer is bad. Replace it.

GO TO NEXT PAGE


3
Does any other error message appear on display?
YES
NO
Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.
Go to error message fault isolation procedure in this section of the TM for the error message being displayed.
4
Refer to cable troubleshooting procedure in this section of the TM to troubleshoot power cable W5.
Is cable good?
YES
NO
Repair/replace cable W5.
Return STE/ICE set to DS Maintenance.

END OF TASK

3-2-16. ERROR MESSAGE E003 FAULT ISOLATION 3-2-16

Description:

This message indicates that a test number has been entered which does not apply to the equipnent being tested.

Application:

Applies only to DCA tests. DCA tests are listed in the vehicle/equipment TM. If this error message appears during any other test, return STE/ICE-R set to DS Maintenance.

Pre-Isolation Procedures:

Check that TEST SELECT switches are set to correct test number.

Check that all connections are correct and secure.

Disconnect cables W2, W3, W4 and W5 if connected.

Check that VTM is attached to a DCA.

Go to vehicle/equipment TM and check if test is valid for DCA attached.

Go to vehicle/ equipment TM for DCA fault isola- tion procedures.

END OF TASK

3-2-17. ERROR MESSAGE E005 FAULT ISOLATION

Description:

This message indicates that a needed offset test was not done.

Application:

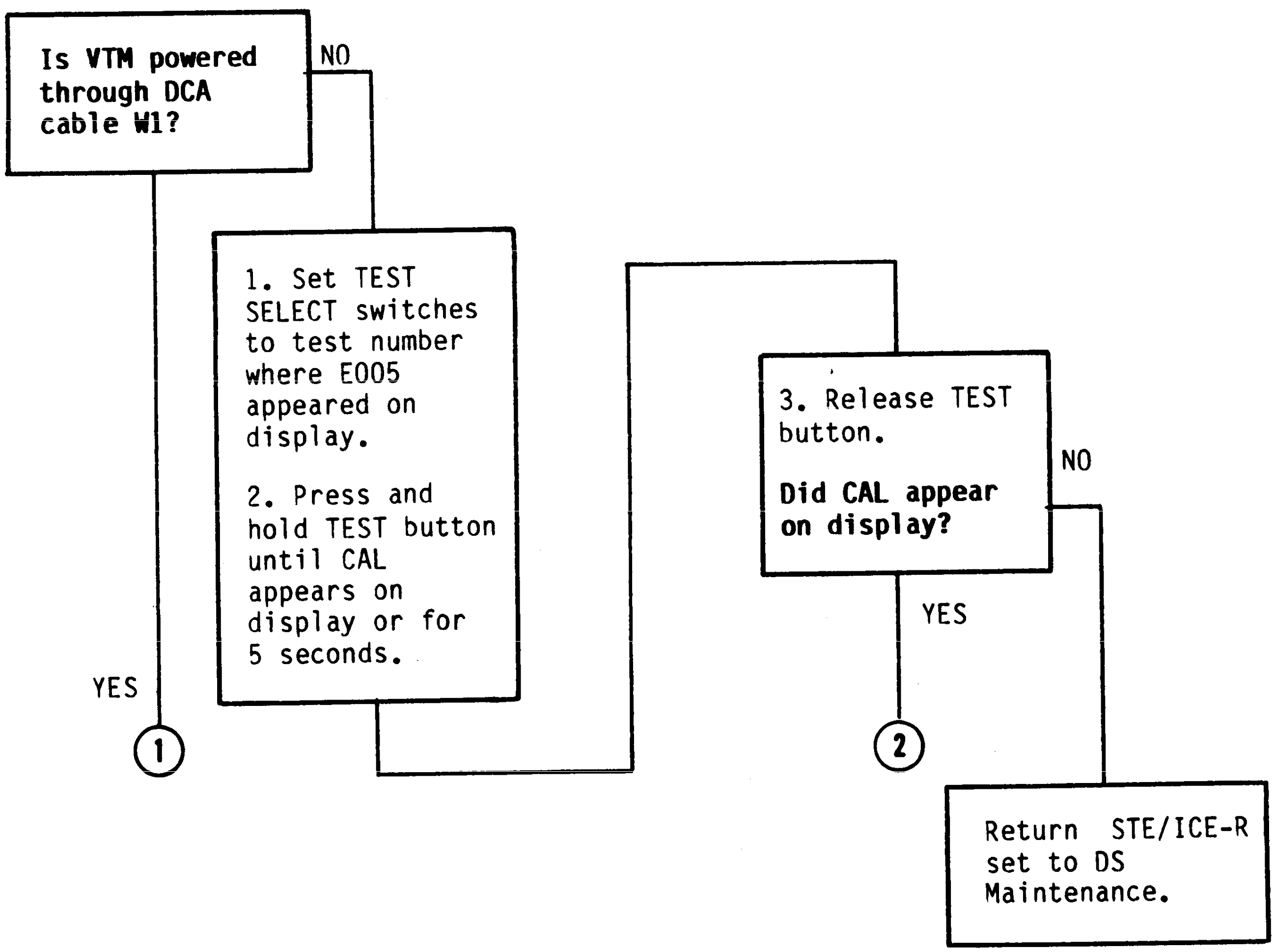
Applies only to tests which require an offset. Tests requiring an offset are indicated in table 2-5.

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.

Check that (1) no pressure is applied to the pressure transducer, (2) test leads are connected together, (3) current probe is removed from any wire that is carrying current, (4) vehicle (equipment) master switch is off, and (5) that vehicle (equipment) is off.



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3-2-17. ERROR MESSAGE E005 FAULT ISOLATION (cont) 3-2-17

1

Is test a DCA only test?

YES

Go to vehicle/ equipment TM for DCA fault isolation procedures.

Replace DCA cable W1 with power cable W5.

1. Set TEST SELECT switches to test number where E005 appeared.

2. Press and hold TEST button until CAL is displayed or for 5 seconds.

3. Release TEST button.

Did CAL appear on display?

YES

2

NO

Return STE/ICE-R set to DS Maintenance.

2

Does any error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO

Does .9.9.9.9 appear on display?

YES

Go to Offset Fault Isolation procedure, paragraph 3-2-2.

NO

3

GO TO NEXT PAGE

3

Press and release TEST button.

Does E005 appear on display?

YES

Return STE/ICE-R set to DS Maintenance.

NO

Does any other error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO

Return to original fault isolation or test procedure which brought you to this error message fault isolation procedure.

END OF TASK

3-2-18. ERROR MESSAGE E007 FAULT ISOLATION 3-2-18

Description:

This message indicates that the number of cylinders information being entered into the Vll! conflicts with information stored in the VTM by a previous VID entry(test 60 or UEH-prompt message).

Application:

Applies to the following test:

58 Enter Number of Cylinders

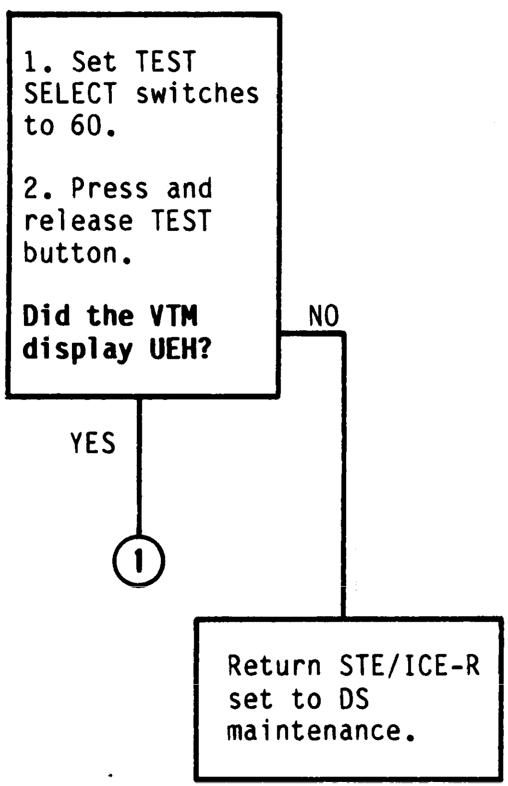
Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to 0S maintenance.

See vehicle test card or vehicle/ equipment TM for correct number of cylinders information for vehicle under test.

Reset VTM power:

1. PULL OFF VTM power switch
2. PUSH ON VTM power switch



GO TO NEXT PAGE

1

1. Set TEST SELECT switches to correct VID for vehicle under test.

2. Press and release TEST button.

Did VID entered appear on display?

NO

Return STE/ICE-R set to DS Maintenance.

YES

1. Set TEST SELECT switches to 58.

2. Press and release TEST button.

Does the VTM display CYL?

NO

Return STE/ICE-R set to DS Maintenance.

YES

1. Set TEST SELECT switches to correct number of cylinders for vehicle under test.

2. Press and release TEST button.

Did number of cylinders for vehicle under test appear on display?

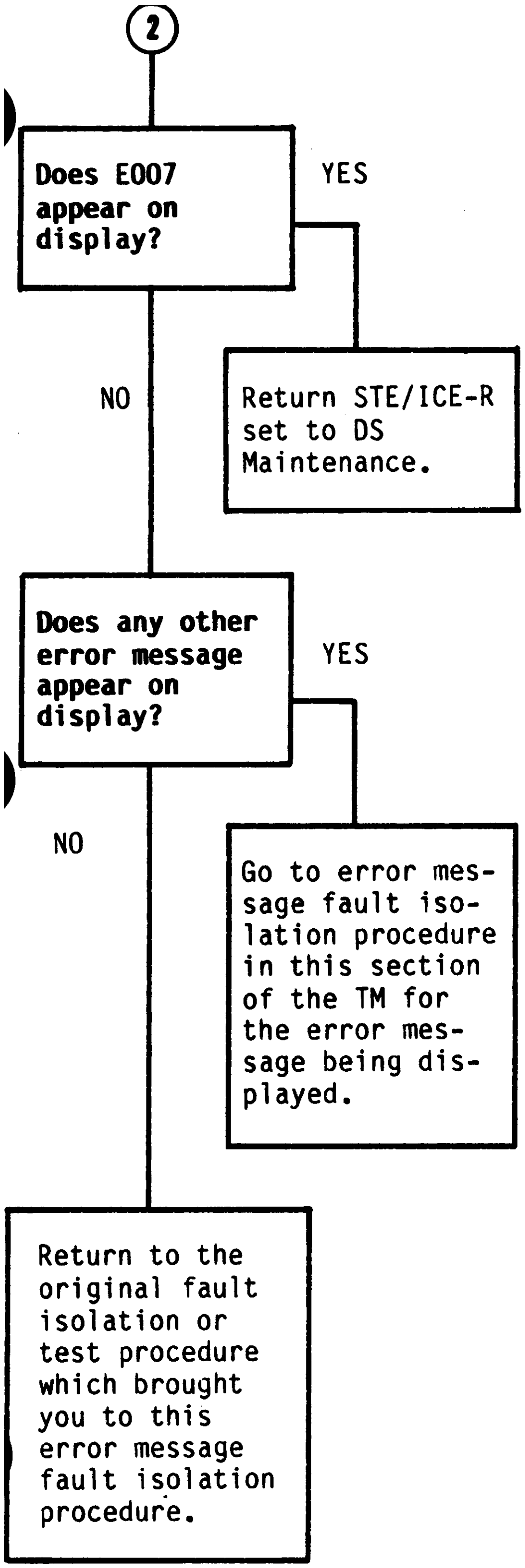
NO

Return STE/ICE-R set to DS Maintenance.

YES

2

GO TO NEXT PAGE


2
Does E007 appear on display?
YES
Return STE/ICE-R set to DS Maintenance.
NO
Does any other error message appear on display?
YES
Go to error message fault isolation procedure in this section of the TM for the error message being displayed.
NO
Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

END OF TASK

3-2-19. ERROR MESSAGE E008 FAULT ISOLATION

Description:

This message indicates that the VTM is not receiving the required voltage signal for the selected test.

Application:

Applies to following tests:

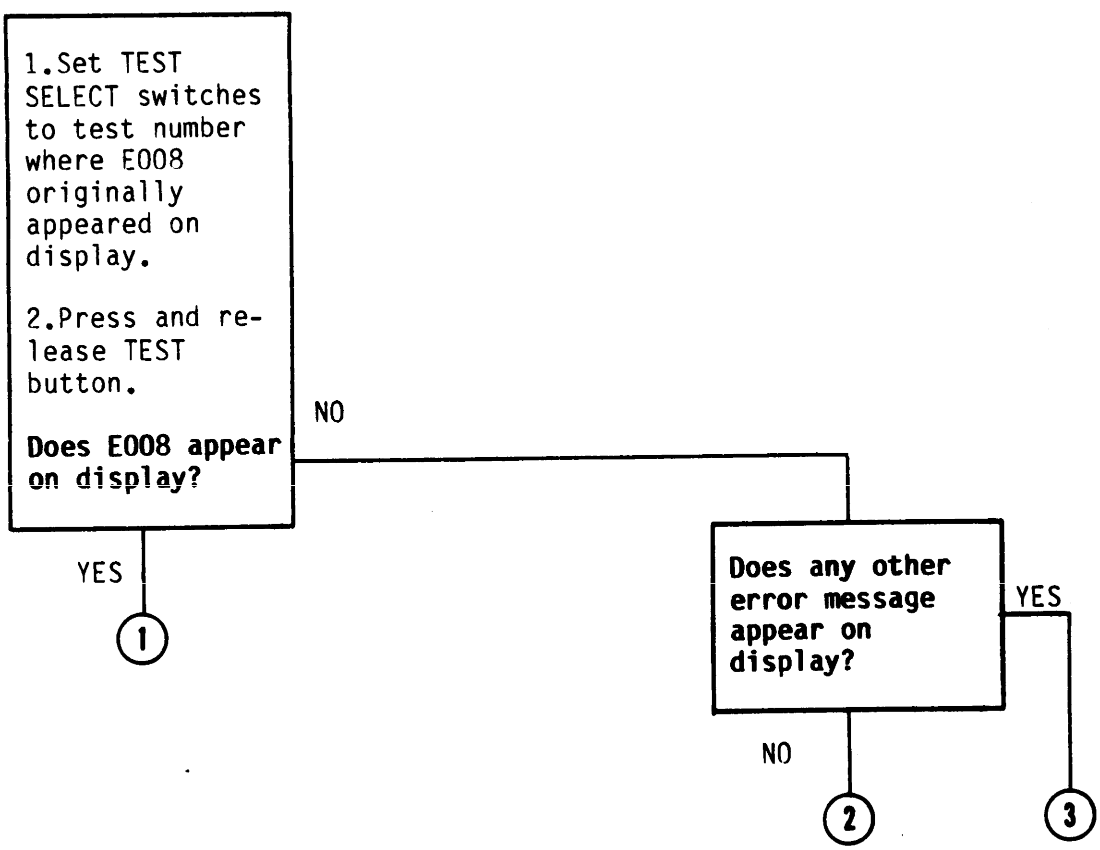
14 Compression Unbalance
15 Compression Unbalance
72 Current First Peak
73 Battery Internal Resistance
74 Starter Circuit Resistance
75 Battery Resistance Change
76 Current First Peak
77 Battery Internal Resistance
78 Starter Circuit Resistance
79 Battery Resistance Change

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page.. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.

If TEST SELECT switches were set to 15, 76, 77, 78, or 79, check that test probe cable W2 is connected to the batteries under test.



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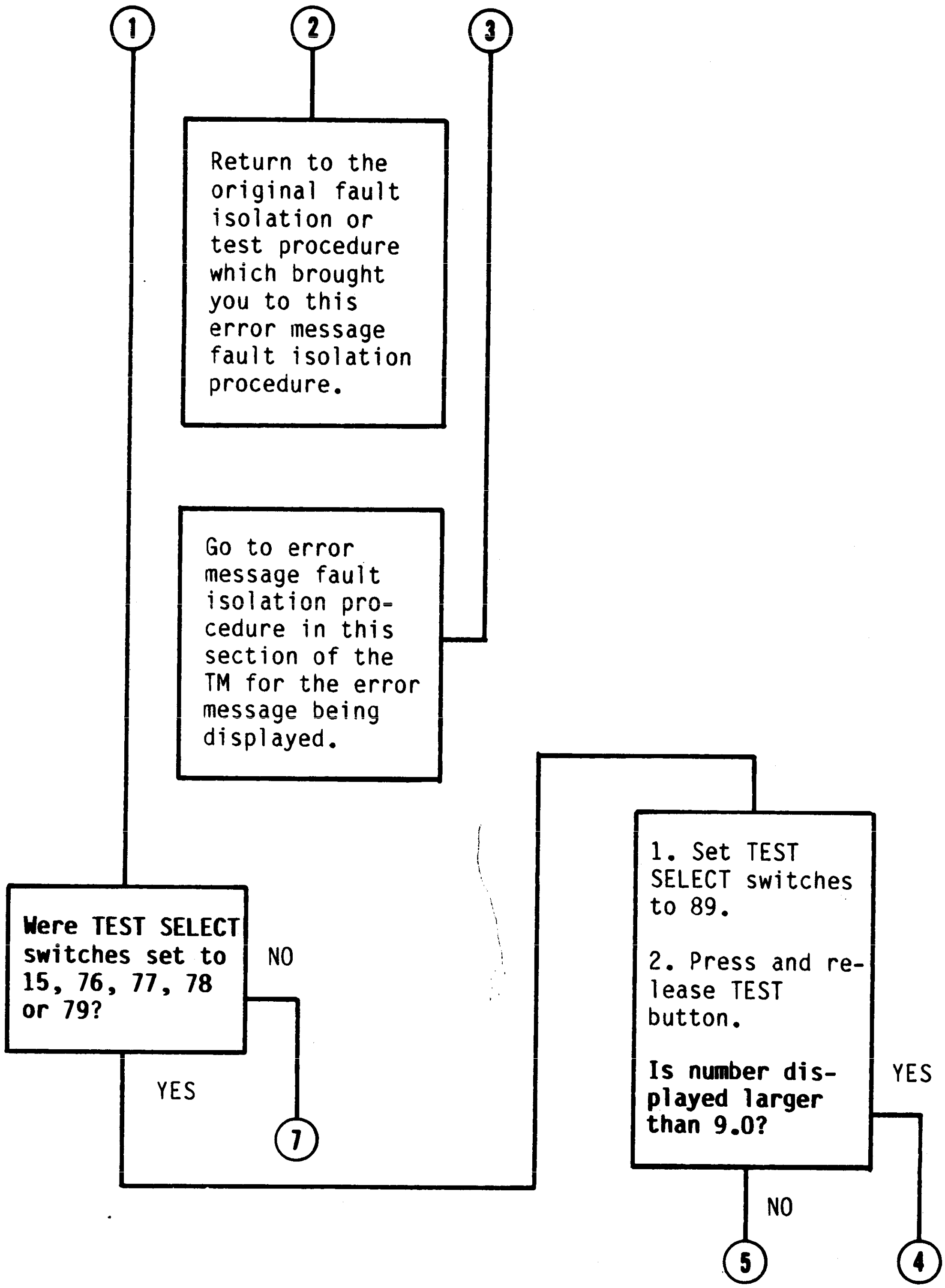

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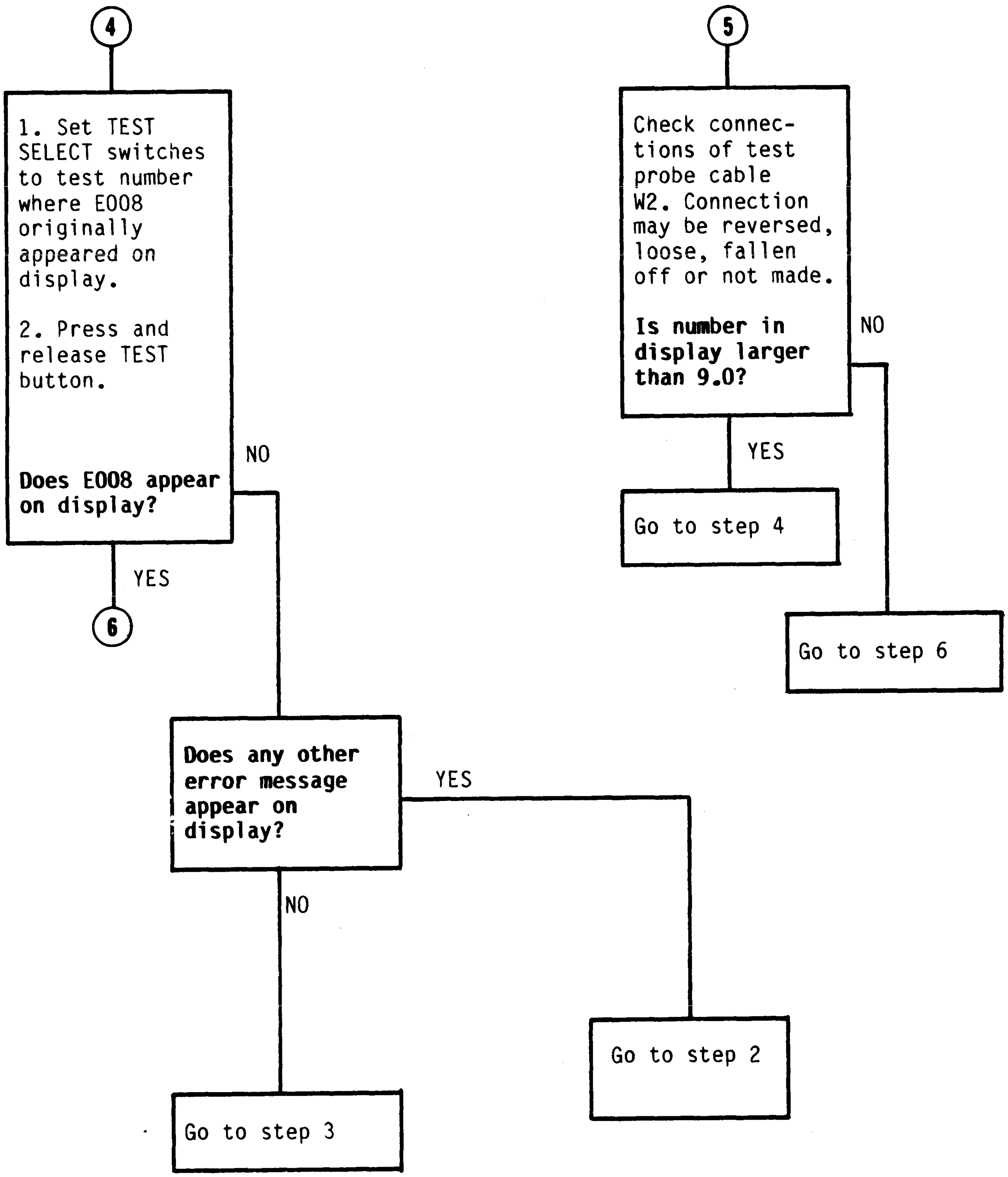


GO TO NEXT PAGE

6

1. Obtain a known good cable W2.

2. Connect the good cable W2 to the VTM and to the test point.

3. Set TEST SELECT switches to test number where E008 appeared on display.

4. Press and release TEST button.

Does E008 appear on display?

NO

Original test probe cable W2 is bad. Repair/replace it.

YES

Return STE/ICE-R set to DS Maintenance.

7

1. Set TEST SELECT switches to 67.

2. Press and release TEST button.

Is number displayed larger than 9.0?

NO

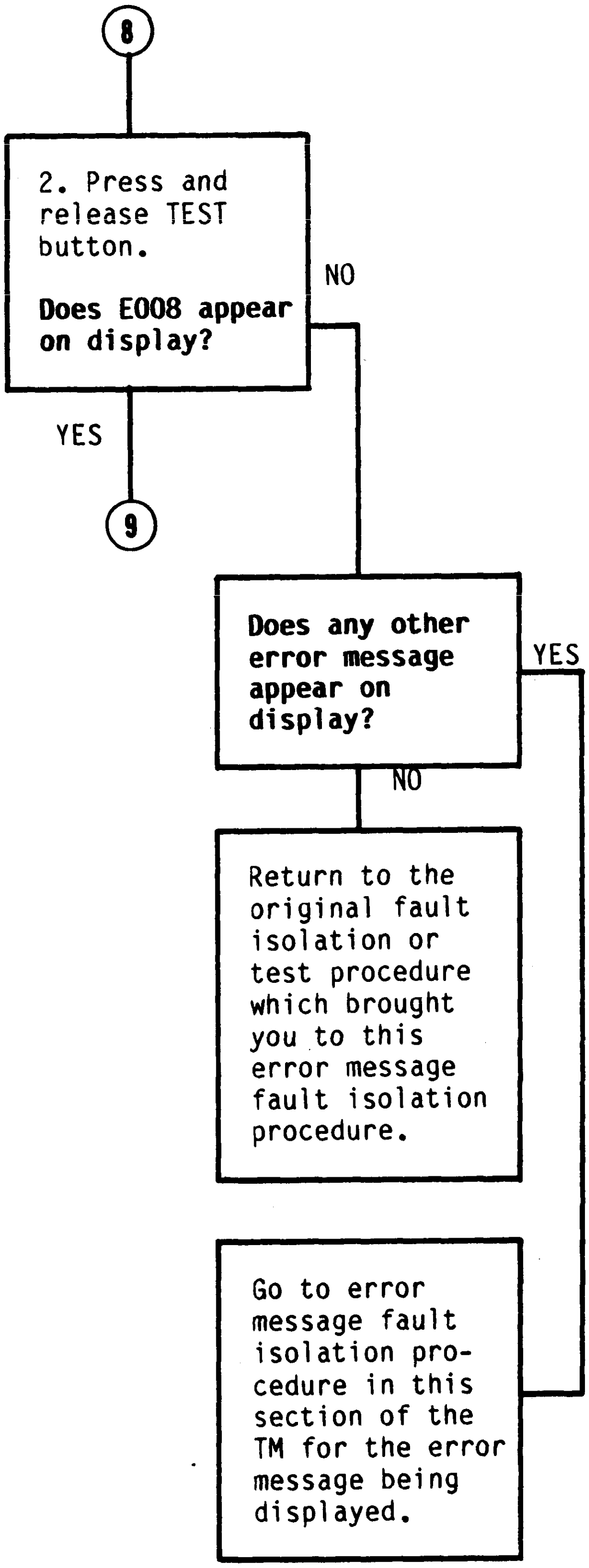
9

YES

1. Set TEST SELECT switches to test number where E008 appeared on display.

8

GO TO NEXT PAGE



GO TO NEXT PAGE

3-2-19. ERROR MESSAGE E008 FAULT ISOLATION (cont) 3-2-19

9

Are you using DCA cable W1 to power VTM?

NO → 10

YES

1. Replace DCA cable W1 with power cable W5.

2. Press and release TEST button.

Does E008 appear on display?

YES

Return STE/ICE-R set to DS Maintenance.

NO

Does any other error message appear on display?

YES

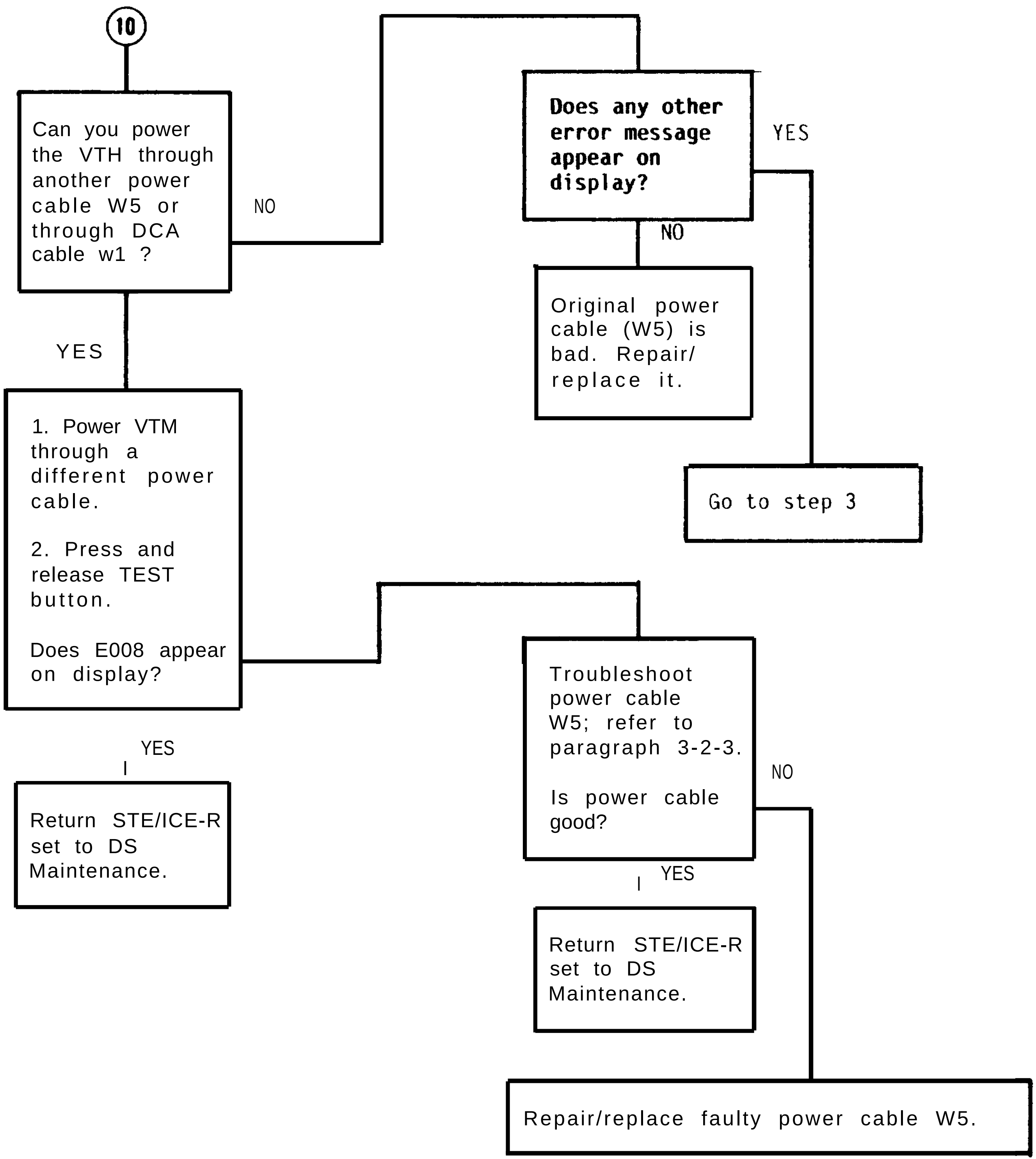
Go to step 3

NO

Go to vehicle/equipment TM for DCA fault isolation procedures.

GO TO NEXT PAGE

3-2-19. ERROR MESSAGE E008 FAULT ISOLATION (cont) 3-2-19



END OF TASK

3-2-20. ERROR MESSAGE E009 FAULT ISOLATION 3-2-20

Description:

This message indicates that the VTM is not receiving the engine speed signal. This applies only to engine power test and S1 full power simulation.

Application:

Applies to the following tests:

01 Display RPM with Next Measurement
05 SI Full Power Simulation
12 Power (RPM/SEC)
13 Power (Percent)

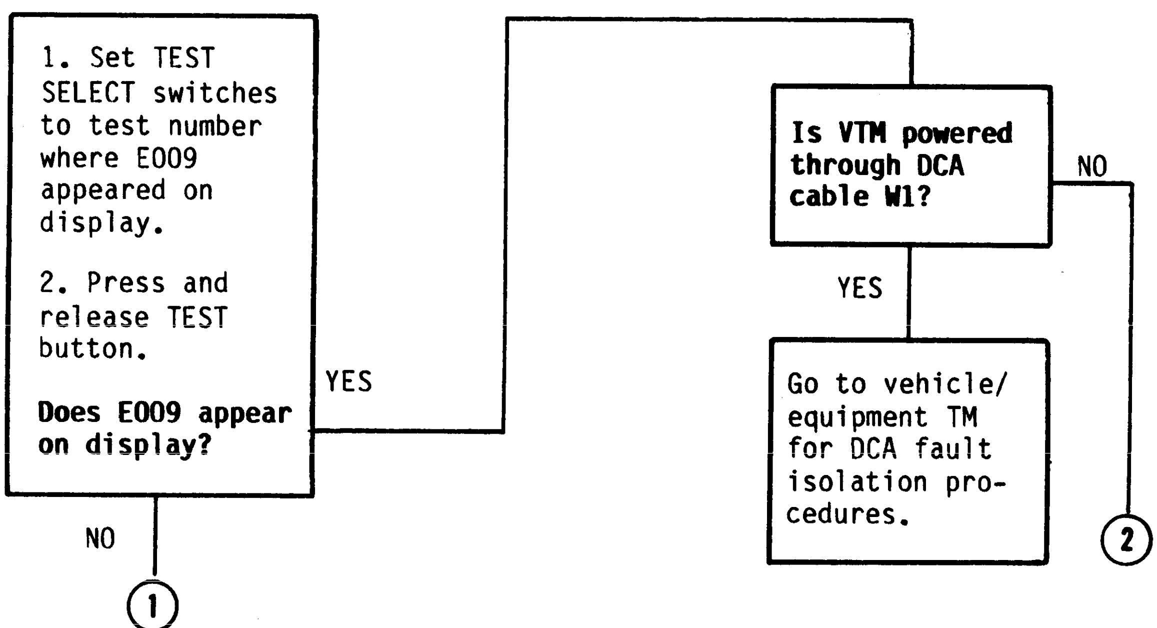
Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.

If in TK mode for SI engines, check that cable W3 is connected properly.

If in either TK mode or DCA mode, check that engine is running when test is initiated.



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1

Does any other error message appear on display?

YES

NO

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

2

1. If speed transducer cable W4 is connected to VTM at J2 TK, connect it to J3 TK.

2. If speed transducer cable W4 is connected to VTM at J3 TK, connect it to J2 TK.

3. Press and release TEST button.

Does E009 appear on display?

NO

VTM channel originally connected is faulty.

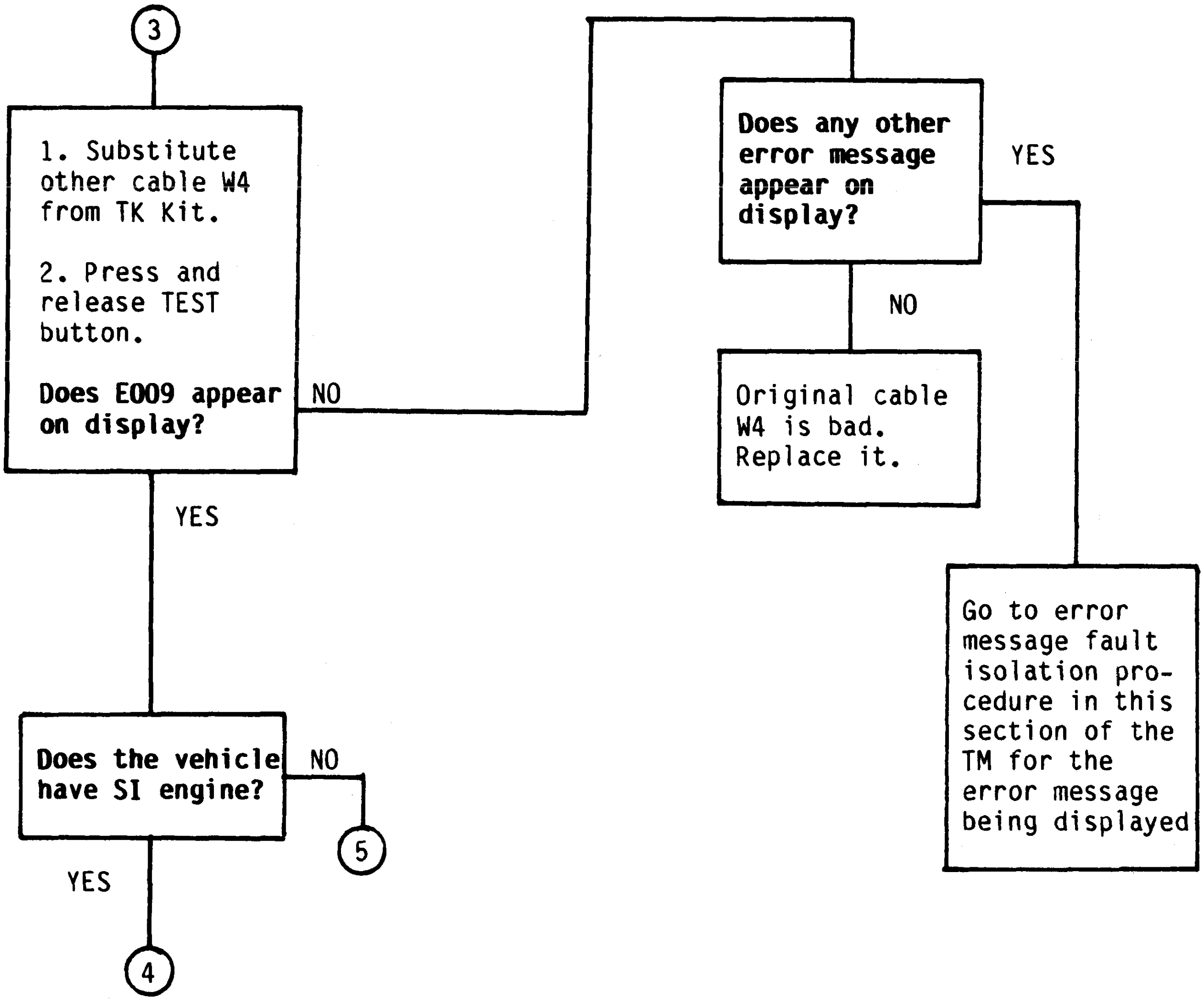
Continue vehicle testing using good channel.

When testing is completed, return STE/ICE-R set to DS Maintenance.

YES

3

GO TO NEXT PAGE



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5

1. Replace pulse tachometer, TK item 34, with a known good pulse tachometer.

2. Set TEST SELECT switches to test number where E009 appeared on display.

3. Press and release TEST button.

Does E009 appear on display?

YES

Return STE/ICE-R set to DS Maintenance.

NO

Does any other error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed

NO

Original pulse tachometer is bad; replace it.

4

NOTE

In TK mode on an SI engine, ignition adapter may be installed incorrectly. Make sure ignition adapter is installed correctly.

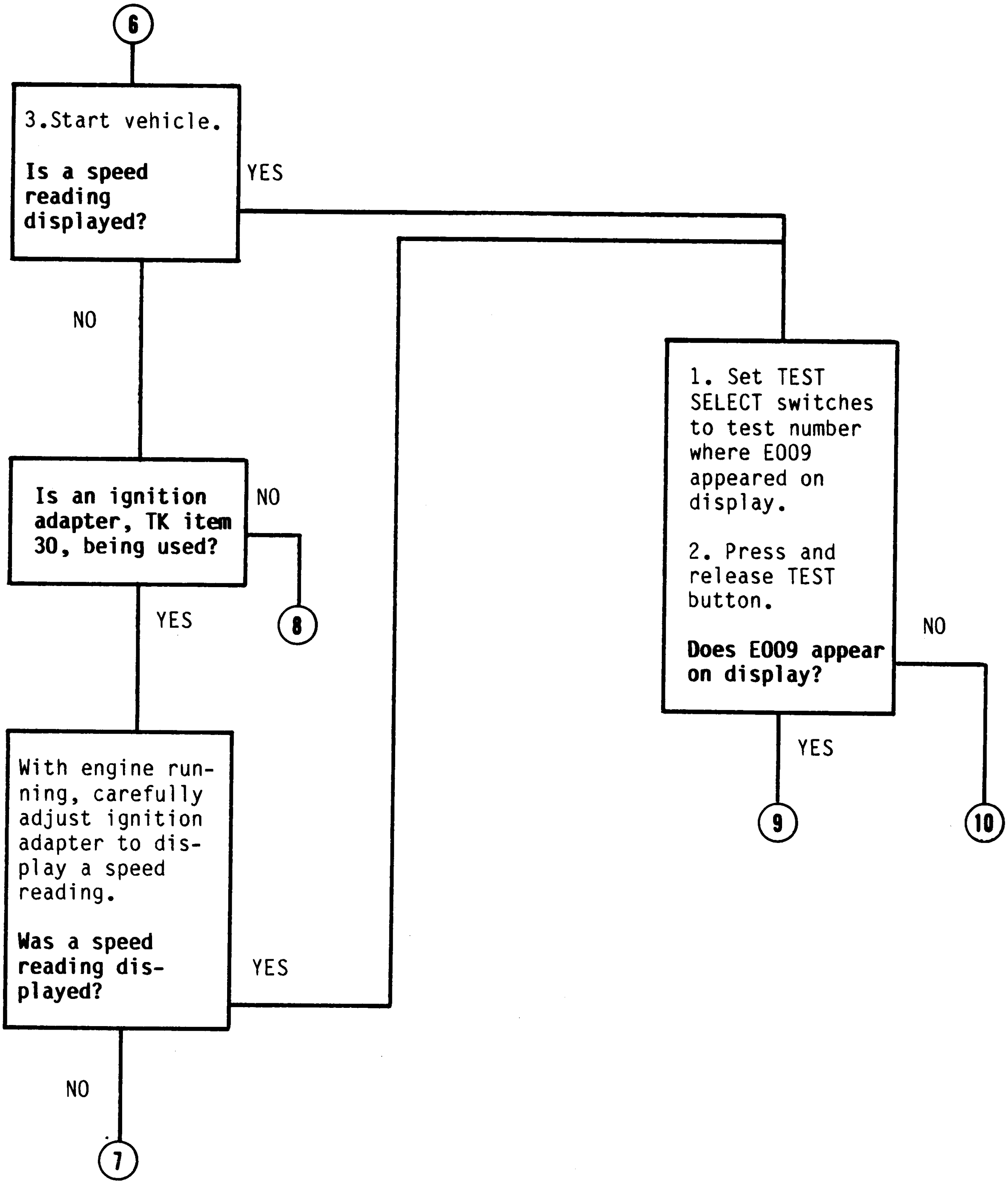
1. Set TEST SELECT switches to 10.

2. Press and release TEST button.

6

GO TO NEXT PAGE

3-2-20. ERROR MESSAGE E009 FAULT ISOLATION (cont) 3-2-20



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9

Return STE/ICE-R set to DS Maintenance.

10

Does any other error message appear on display?

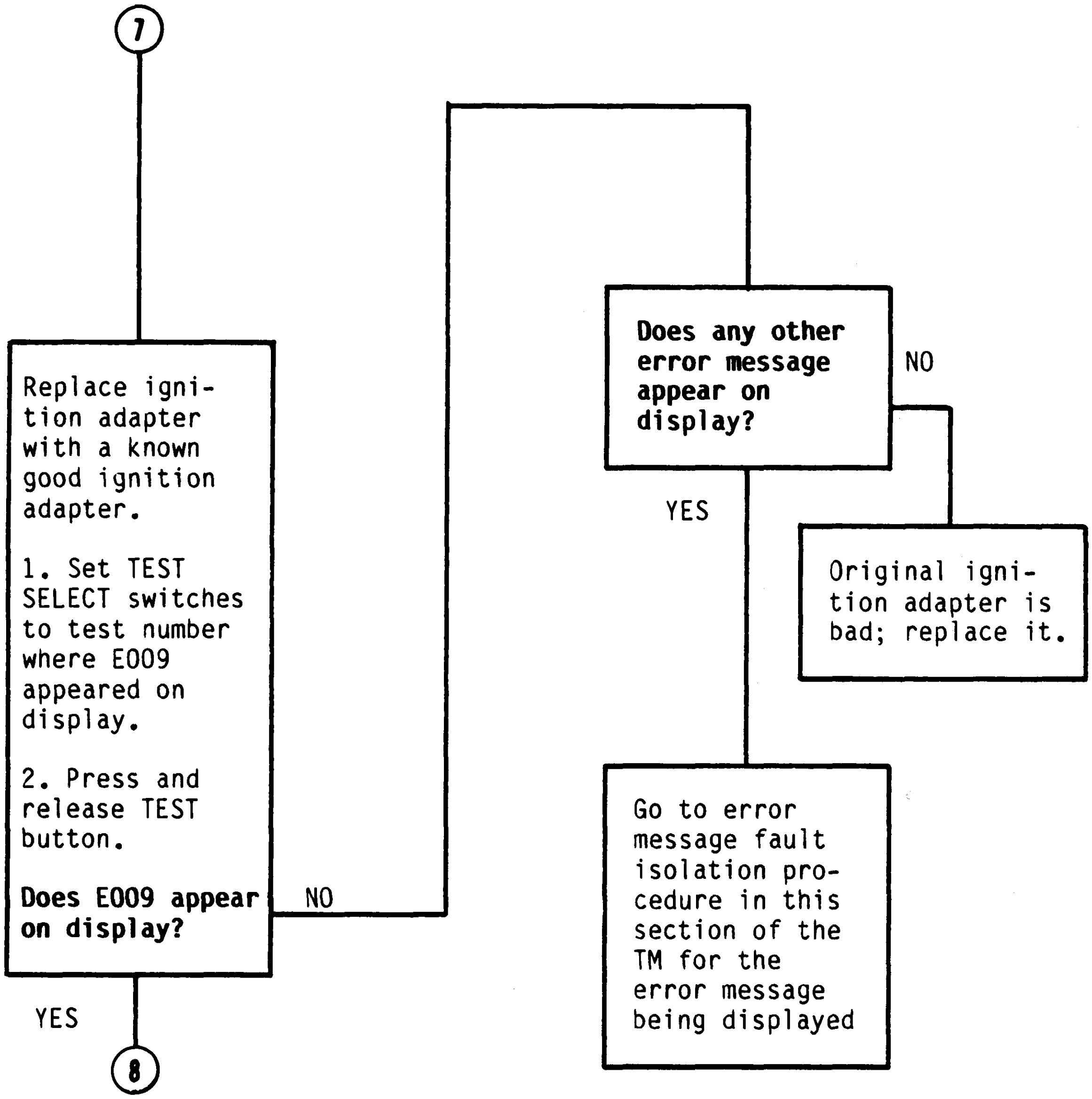
NO

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed

GO TO NEXT PAGE



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8

1. Replace ignition adapter cable W3 with a known good ignition adapter cable.

2. Set TEST SELECT switches to test number where E009 appeared on display.

3. Press and release TEST button.

Does E009 appear on display?

YES

Return STE/ICE-R set to DS Maintenance.

NO

Does any other error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed

NO

Original ignition adapter cable W3 is bad. Repair/replace it.

END OF TASK

3-2-21. ERROR MESSAGE E010 FAULT ISOLATION 3-2-21

Description:

This message indicates that a wrong VID was entered into the VTM, or that a VID was entered which doesn't match the DCA attached.

Application:

Applies to the following tests:
13 Power Test
14 Compression Unbalance Test
15 Compression Unbalance Test
60 Enter VID

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

VID must be a number between 1 and 99.

Is this test#13 14,or 15; or is VTM powered through DCA cable W1 from one vehicle and testing another?

YES

Press and release TEST button. Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

NO

See vehicle test card or vehicle/equipment TM to get correct VID for vehicle under test.

1. Set TEST SELECT switches to 60.

2. Press and release TEST button.

3. Wait for prompting message UEH to appear on display.

4. Set TEST SELECT switches to correct VID for vehicle under test.

5. Press and release TEST button.

Did VID for vehicle under test appear on display?

VID may be followed by another message.

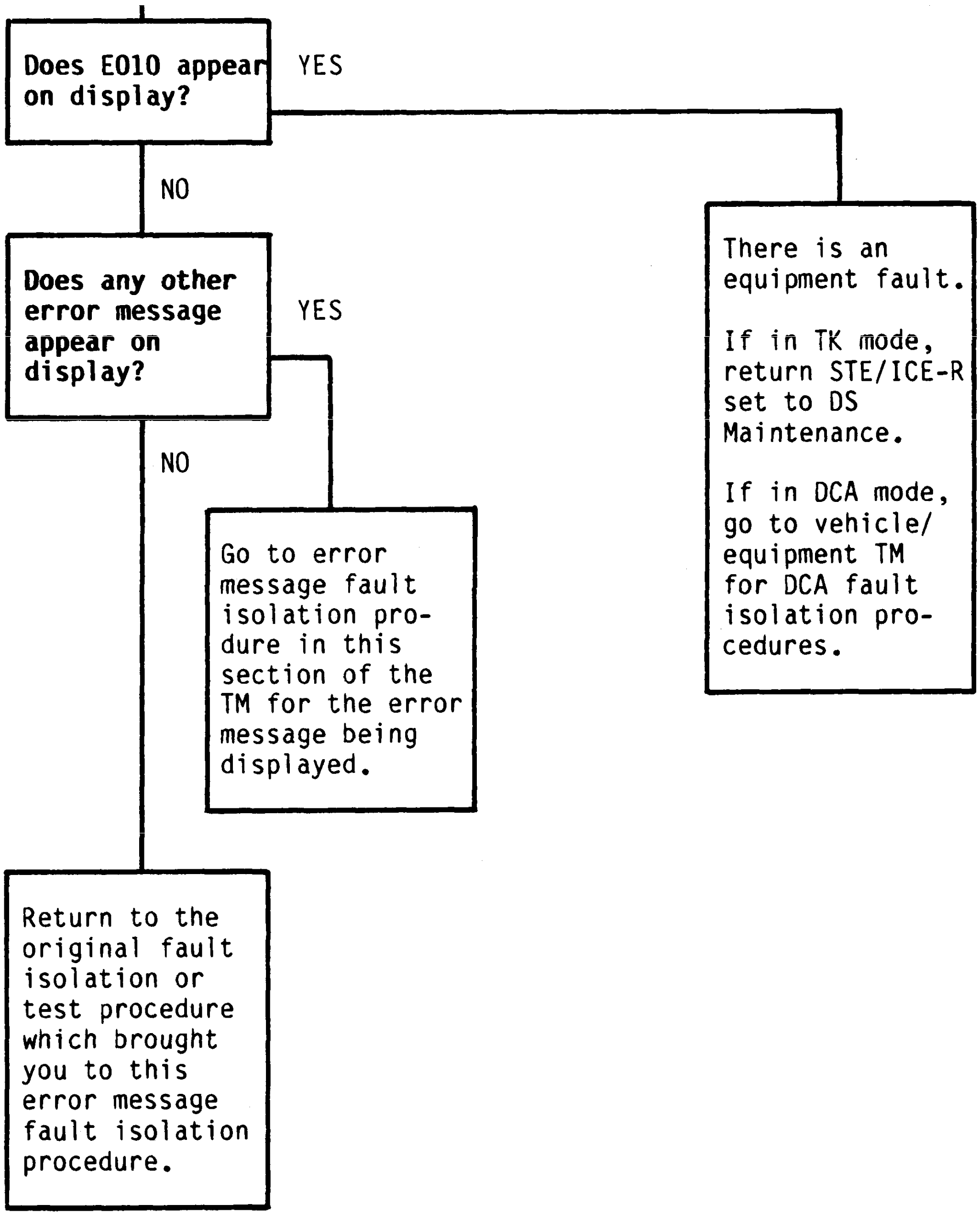
NO

Return STE/ICE-R set to DS Maintenance.

YES

1

GO TO NEXT PAGE


Does E010 appear on display?
YES
NO
There is an equipment fault.
If in TK mode, return STE/ICE-R set to DS Maintenance.
If in DCA mode, go to vehicle/ equipment TM for DCA fault isolation procedures.
Does any other error message appear on display?
YES
NO
Go to error message fault isolation procedure in this section of the TM for the error message being displayed.
Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

END OF TASK

3-2-22. ERROR MESSAGE E011 FAULT ISOLATION 3-2-22

Description:

This message indicates that the throttle control was operated incorrectly during power test.

Application:

Applies to the following tests:

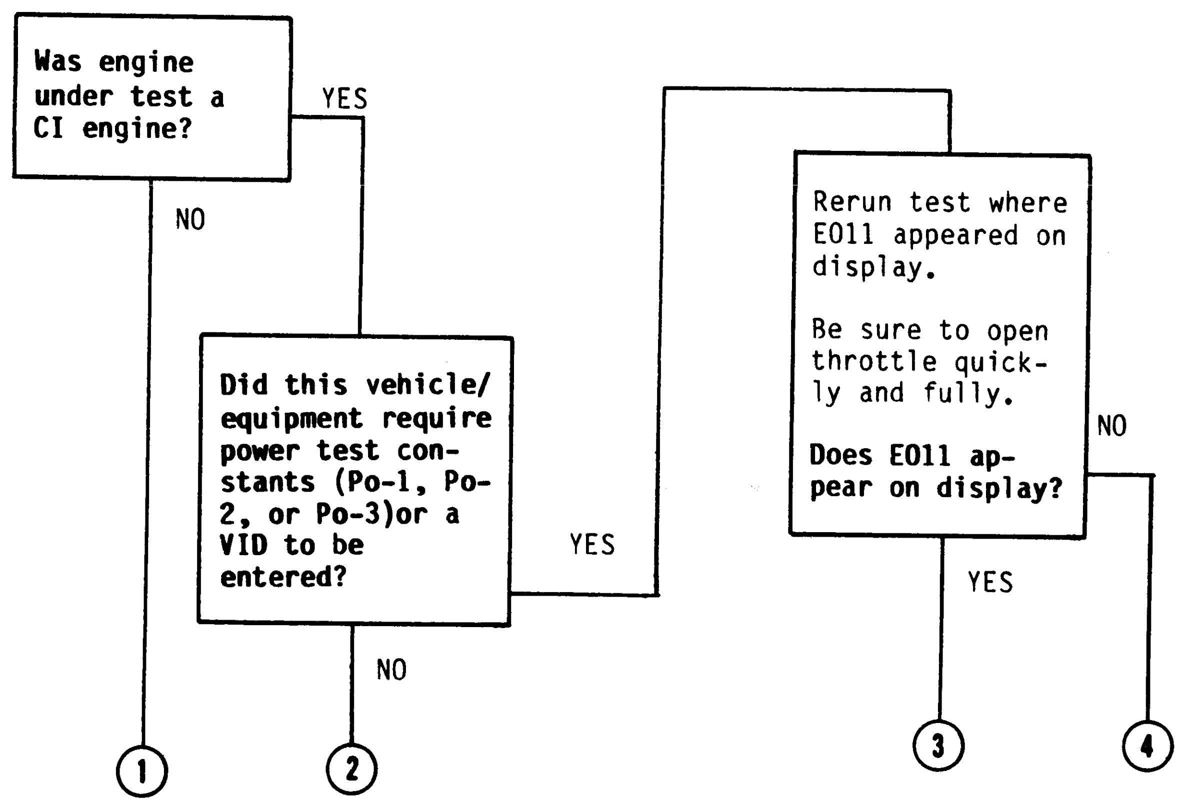
\# 12 Power RPM/SEC
\# 13 Power Percent

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.

Check that either the correct VID or correct number of cylinders have been entered for the vehicle/equipment under test.



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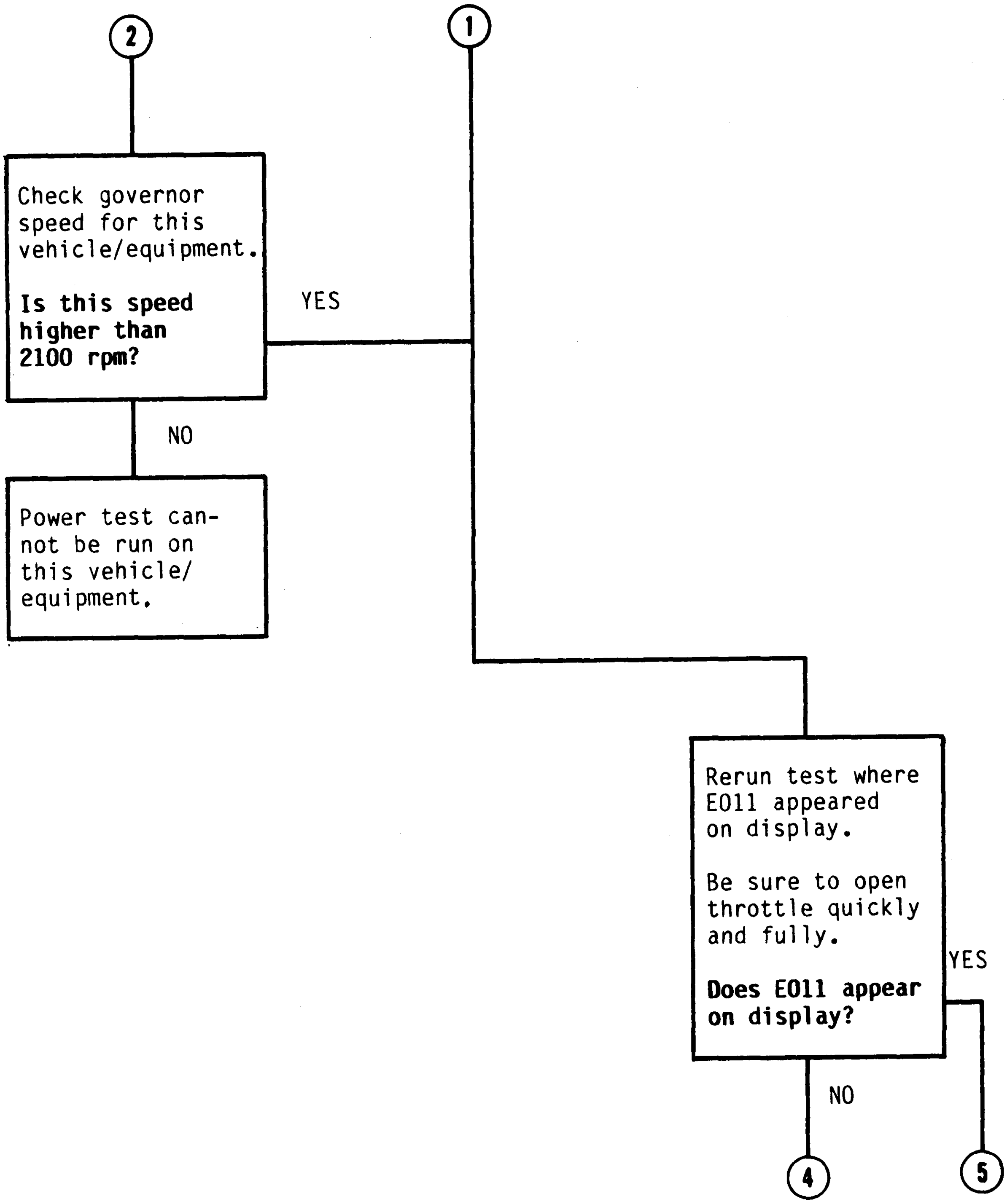

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3

Try a known good vehicle/equipment. Rerun the test where E011 appeared on display.

Does E011 appear on display?

YES

Return STE/ICE-R set to DS Maintenance.

NO

Does any other error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO

Fault is in original vehicle/equipment, not in VTM. The data from this vehicle/equipment cannot be used by the VTM for this test.

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

GO TO NEXT PAGE

3-2-22. ERROR MESSAGE E011 FAULT ISOLATION (cont)

4

Does any other error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

5

For CI Engines:

Did time to accelerate from 1000 rpm to 2000 rpm, or time to decelerate between 2000 and 1000 rpm exceed 42 seconds?

For SI Engines:

Did time between final speed burst and engine kill exceed 42 seconds.

NO

Return STE/ICE-R set to DS Maintenance.

YES

Vehicle/equipment shows extemely abnormal behavior which is outside of VTM's measuring capability.

END OF TASK

3-2-23. ERROR MESSAGE E012 FAULT ISOLATION 3-2-23

Description:

This message indicates that the SI ignition adapter(TK item 30) or CI pulse tachometer(TK item 34) is inoperable.

Application:

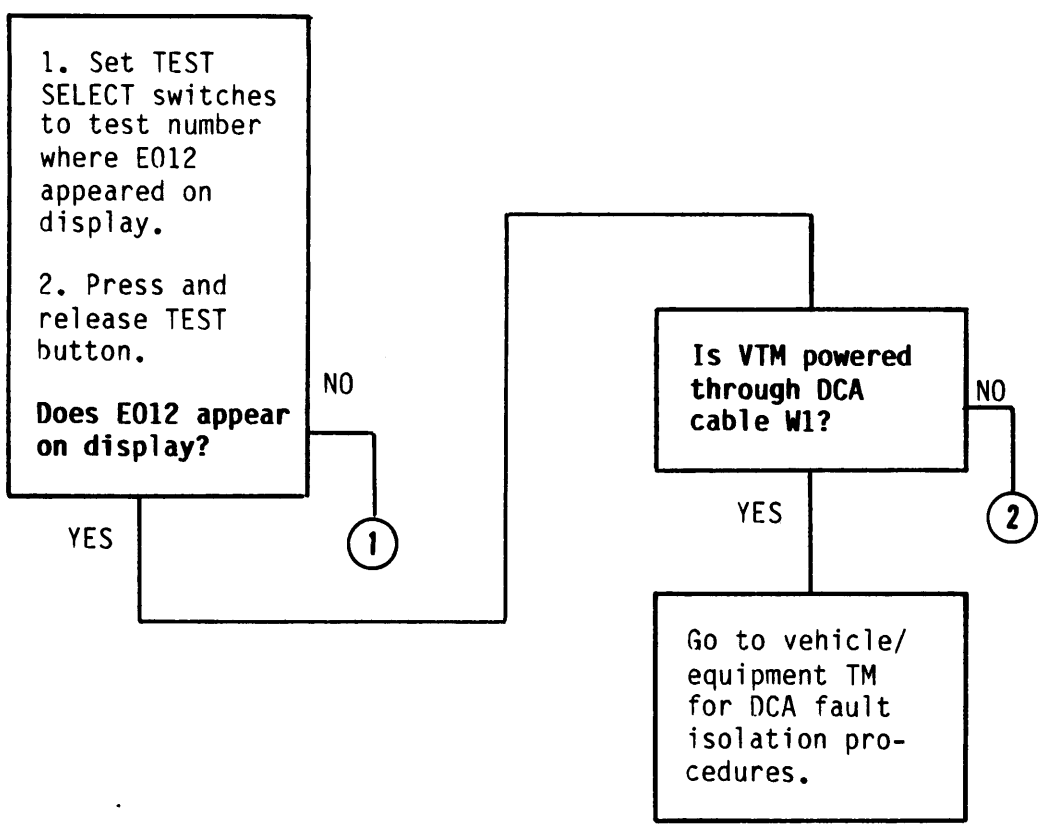
Applies to the following tests:

01 Display RPM with Next Measurement
05 SI Full Power Simulation
10 Engine RPM (average)
11 Engine RPM (cranking)
12 Power (RPM/SEC)
13 Power (Percent)
16 Dwell Angle
17 Points Voltage

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.



GO TO NEXT PAGE

1

Does any other error message appear on display?

YES — Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO — Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

2

1. If speed transducer cable W4 is connected to VTM at J2 TK, connect it to J3 TK.

2. If speed transducer cable W4 is connected to VTM at J3 TK, connect it to J2 TK.

3. Press and release TEST button.

Does E012 appear on display?

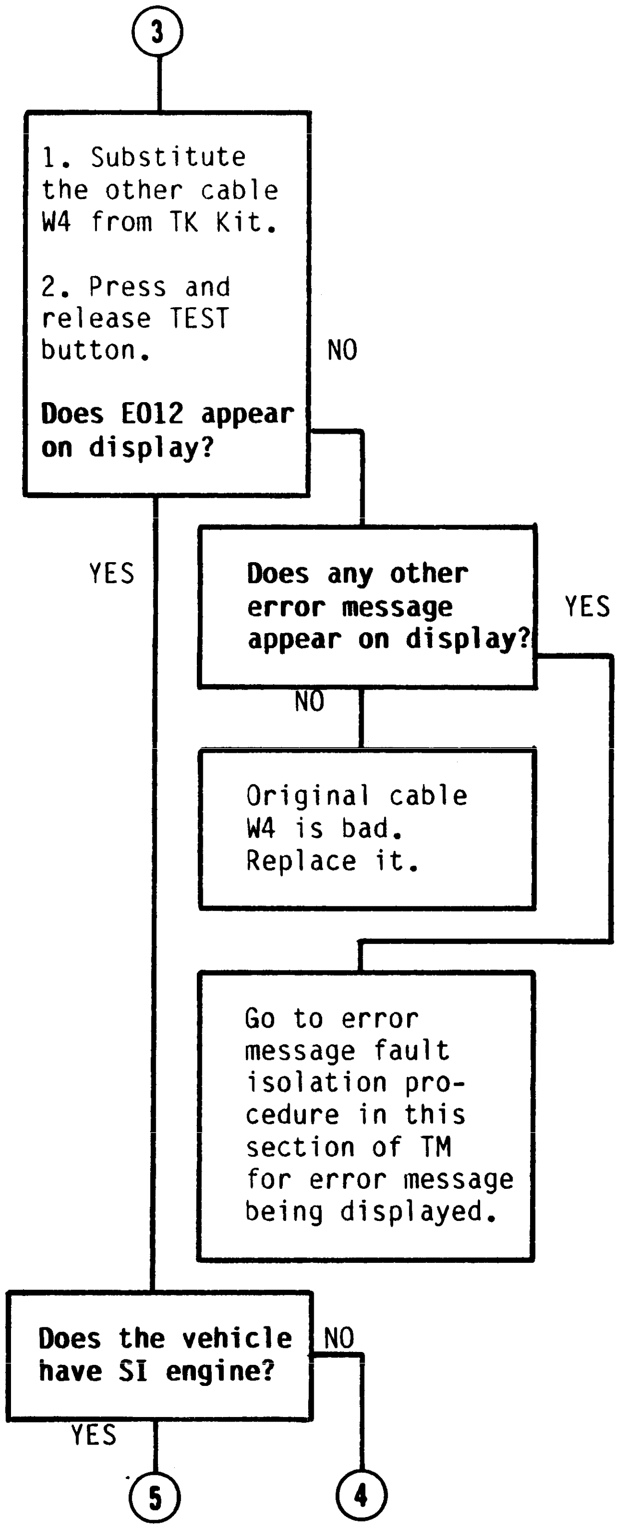
YES — 3

NO — VTM channel originally connected is faulty.

Continue vehicle testing using good channel.

When testing is completed, return STE/ICE-R set to DS Maintenance.

GO TO NEXT PAGE



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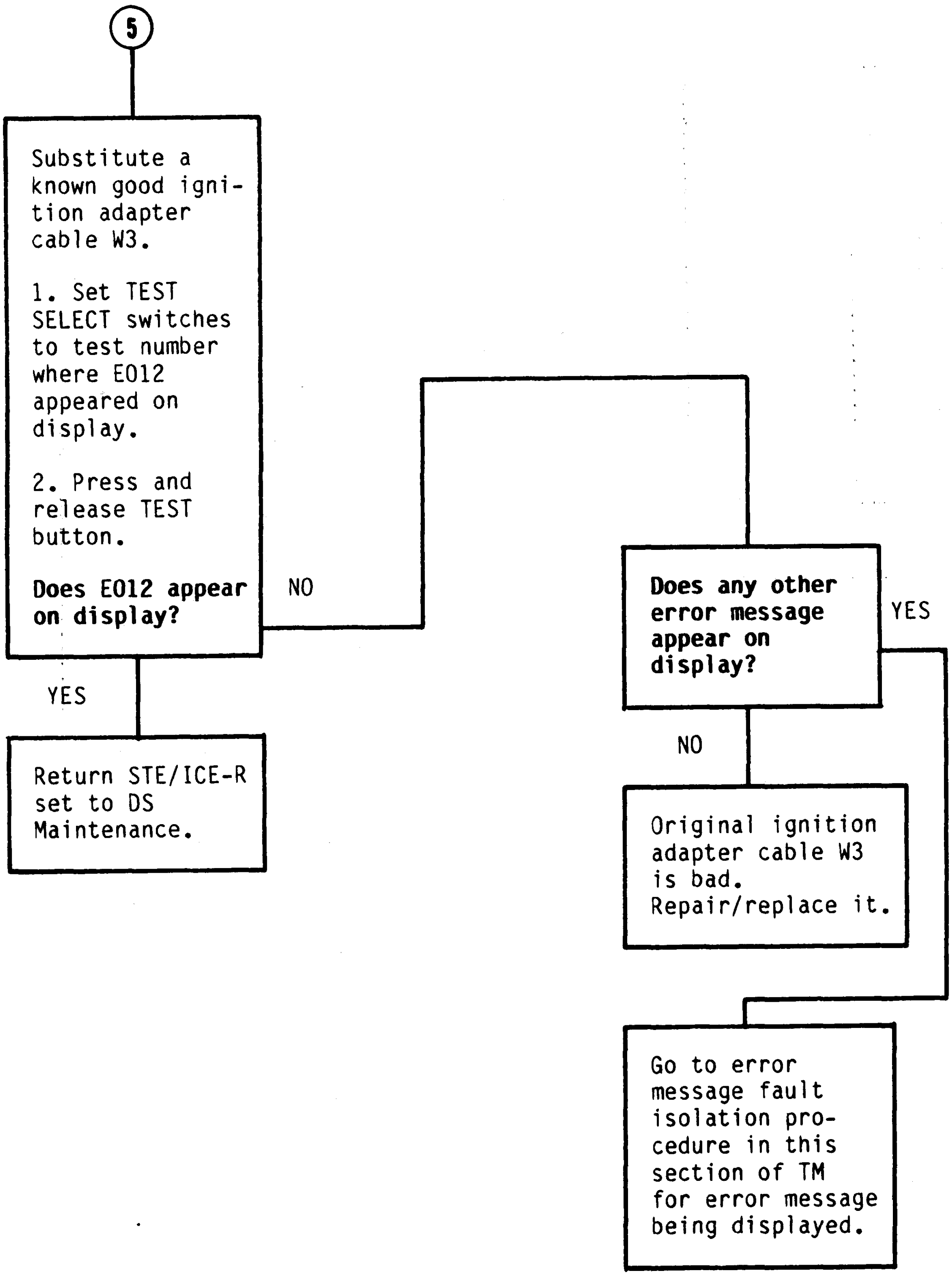

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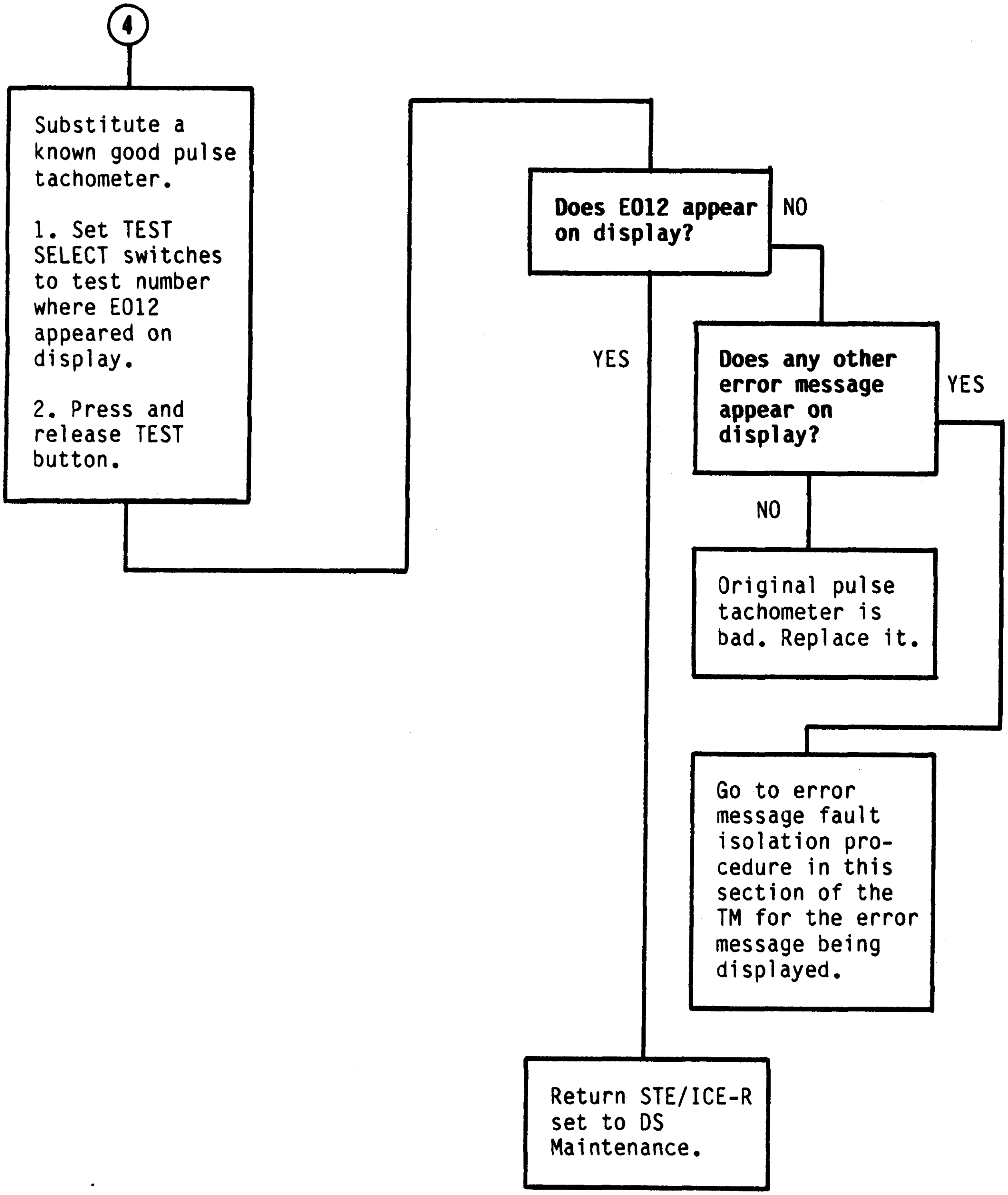
3-2-23. ERROR MESSAGE E012 FAULT ISOLATION (cont) 3-2-23



END OF TASK

3-2-24. ERROR MESSAGE E013 FAULT ISOLATION

Description:

This message indicates that the VTM cannot analyze data for the test being done.

Application:

Applies to the following tests:

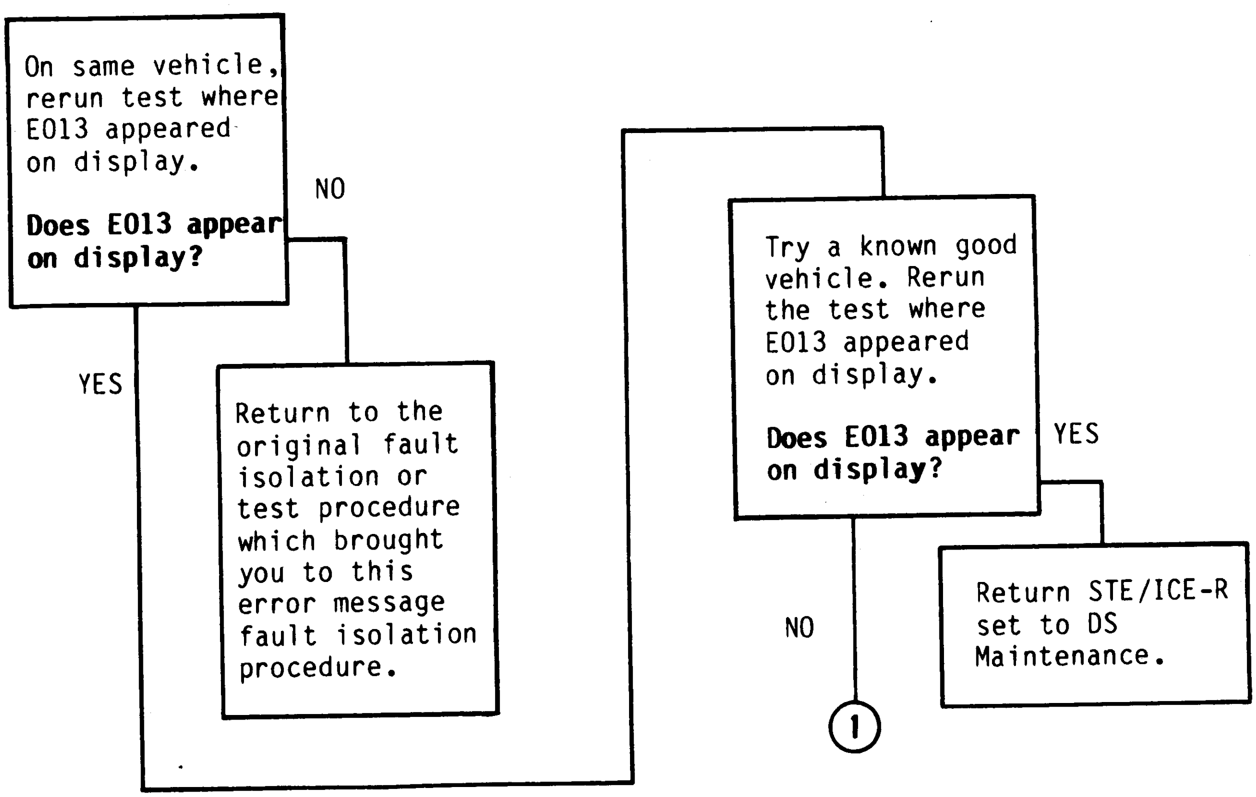
#14 Compression Unbalance
15 Compression Unbalance
72 Current First Peak
73 Battery Internal Resistance
74 Starter Circuit Resistance
75 Battery Resistance Change
76 Current First Peak
77 Battery Internal Resistance
78 Starter Circuit Resistance
79 Battery Resistance Change

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under Application on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.

Check that correct VID, if required, has been entered for the vehicle under test. Use test #61 to see the VID that was entered. Compare this with correct VID shown on vehicle/equipment test card or in vehicle/ equipment TM.



GO TO NEXT PAGE

1

Does any other error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO

Original vehicle has fault, not the VTM. The data from this vehicle cannot be used by the VTM for this test.
Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

END OF TASK

3-2-25. ERROR MESSAGE E014 FAULT ISOLATION 3-2-25

Description:

This message indicates that the wrong number of cylinders was entered into the VTM.

Application:

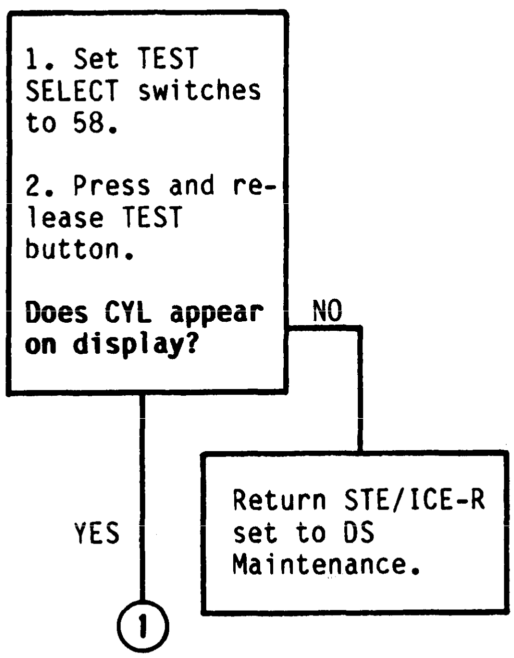
Applies to the following tests:

01 Display RPM with next Measurement
05 SI Full Power Simulation
10 Engine Average RPM
11 Engine Cranking RPM
12 Power RPM/SEC
13 Power Percent
14 Compression Unbalance
15 Compression Unbalance
16 Dwell Angle
58 Enter Number of Cylinders

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that the correct number of cylinders has been entered for the vehicle under test. See vehicle test card or vehicle/equipment TM for the correct number of cylinders.



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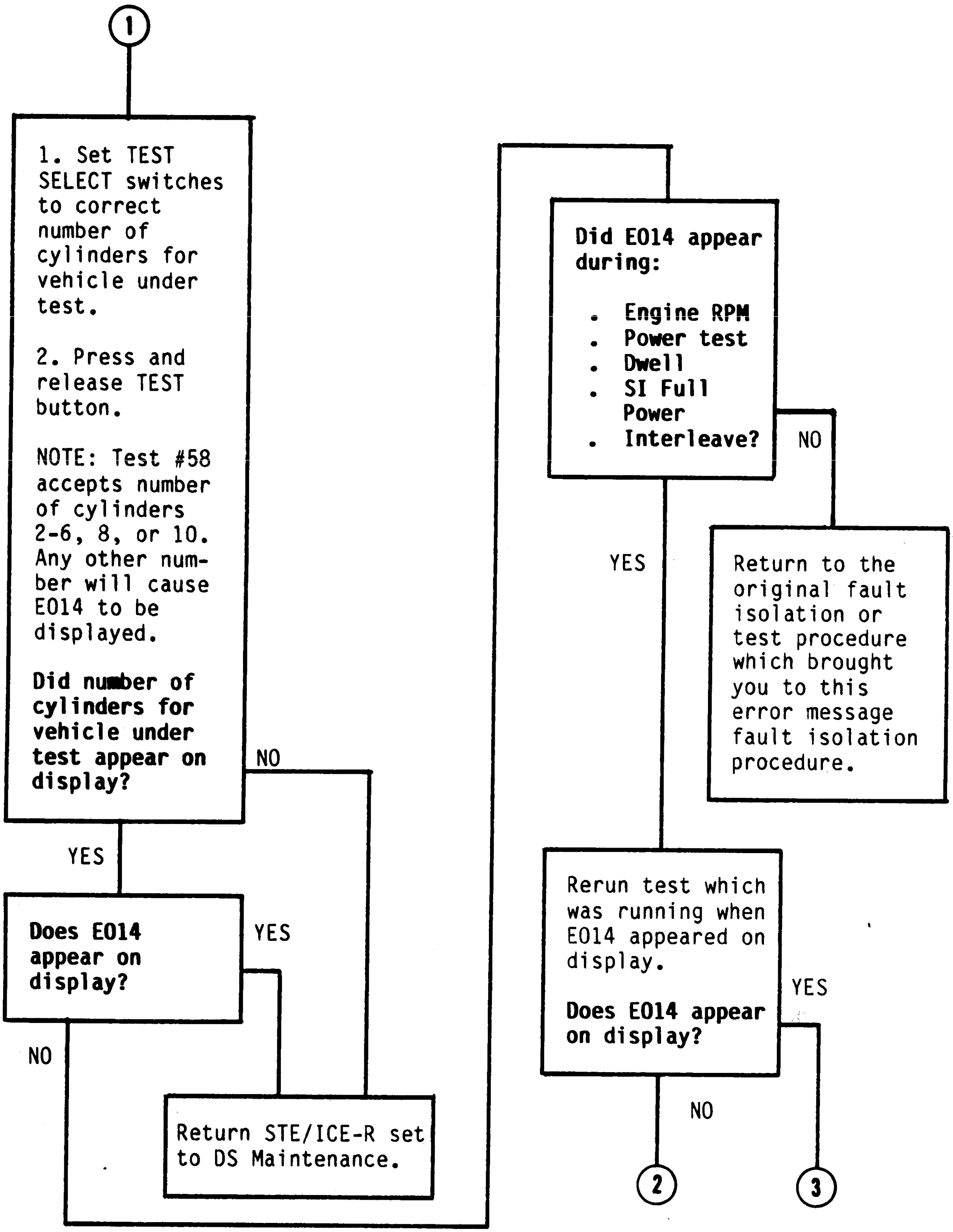

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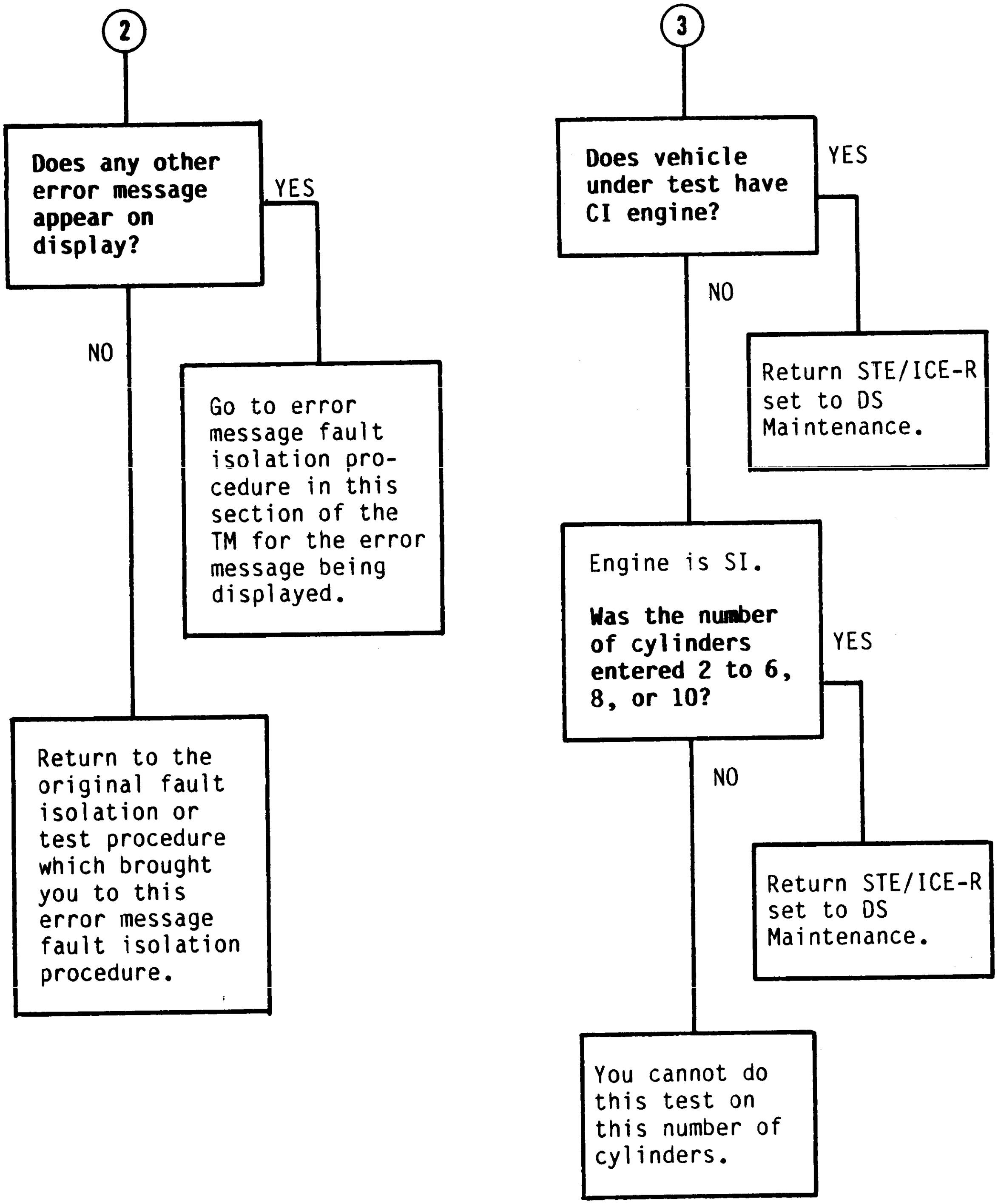

2
Does any other error message appear on display?
YES
Go to error message fault isolation procedure in this section of the TM for the error message being displayed.
NO
Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.
3
Does vehicle under test have CI engine?
YES
Return STE/ICE-R set to DS Maintenance.
NO
Engine is SI.
Was the number of cylinders entered 2 to 6, 8, or 10?
YES
Return STE/ICE-R set to DS Maintenance.
NO
You cannot do this test on this number of cylinders.

END OF TASK

3-2-26. ERROR MESSAGE E017 FAULT ISOLATION 3-2-26

Description:

This message indicates that the equipment is not running or that the ignition adapter (TK item 30) is defective or missing.

Application:

Applies to the following test:

#16 Dwell Angle

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page.

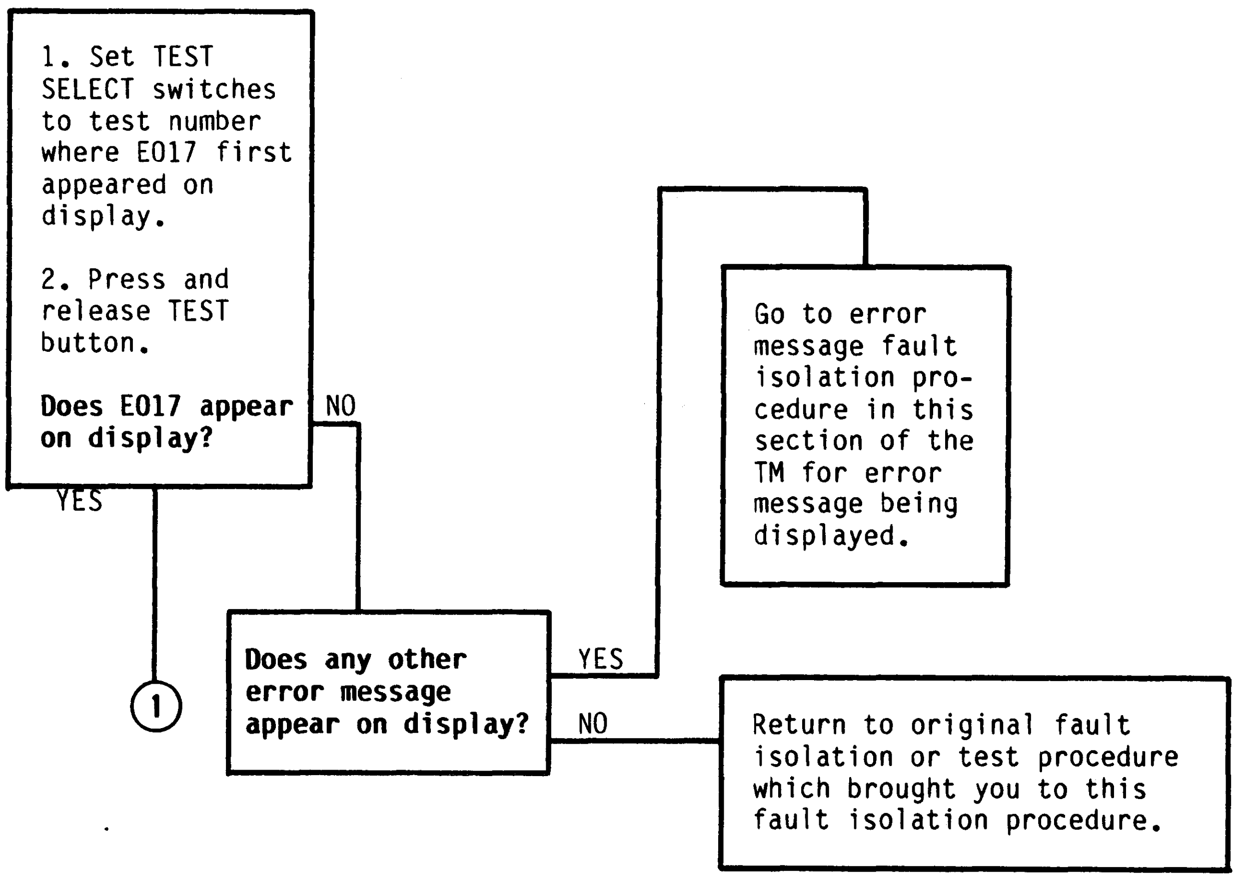
If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.

Check that in the TK mode, ignition adapter cable W3 is connected properly.

Check that the engine is running when the Dwell Angle test is initiated.

Start engine before running E017 fault isolation procedure.



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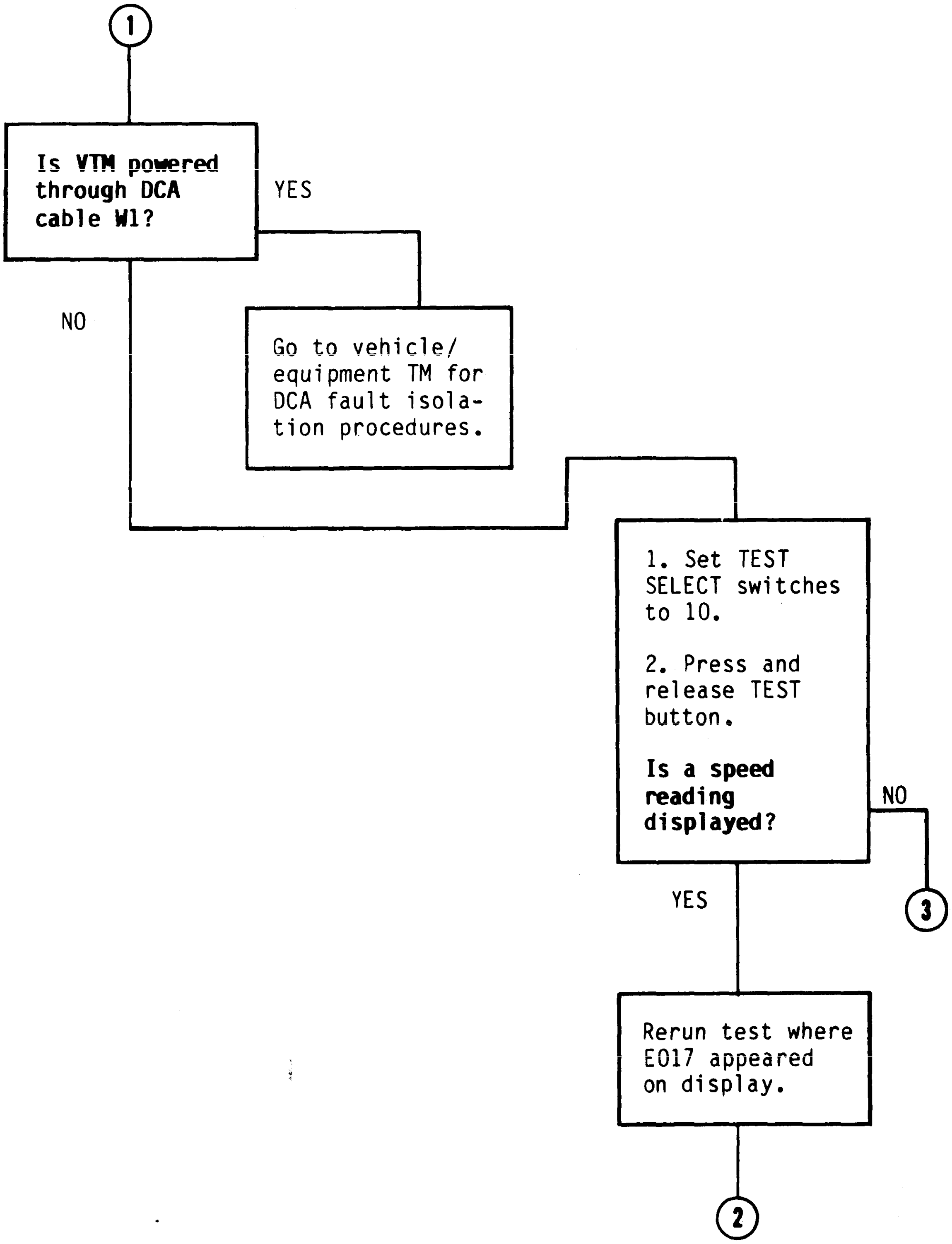
3-2-26. ERROR MESSAGE E017 FAULT ISOLATION (cont) 3-2-26



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Does E017 appear on display?

YES

Return STE/ICE-R set to DS Maintenance.

NO

Does any other error message appear on the display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO

Return to the original fault isolation or test procedure which brought you to this error message fault isolation procedure.

1. If a speed transducer cable W4 is connected to VTM channel at J2 TK, connect it to J3 TK.

2. If a speed transducer cable W4 is connected to VTM channel at J3 TK, connect it to J2 TK.

3. Rerun test where E017 appeared on display.

Does E017 appear on the display?

YES

4

NO

Does any other error message appear on display?

YES

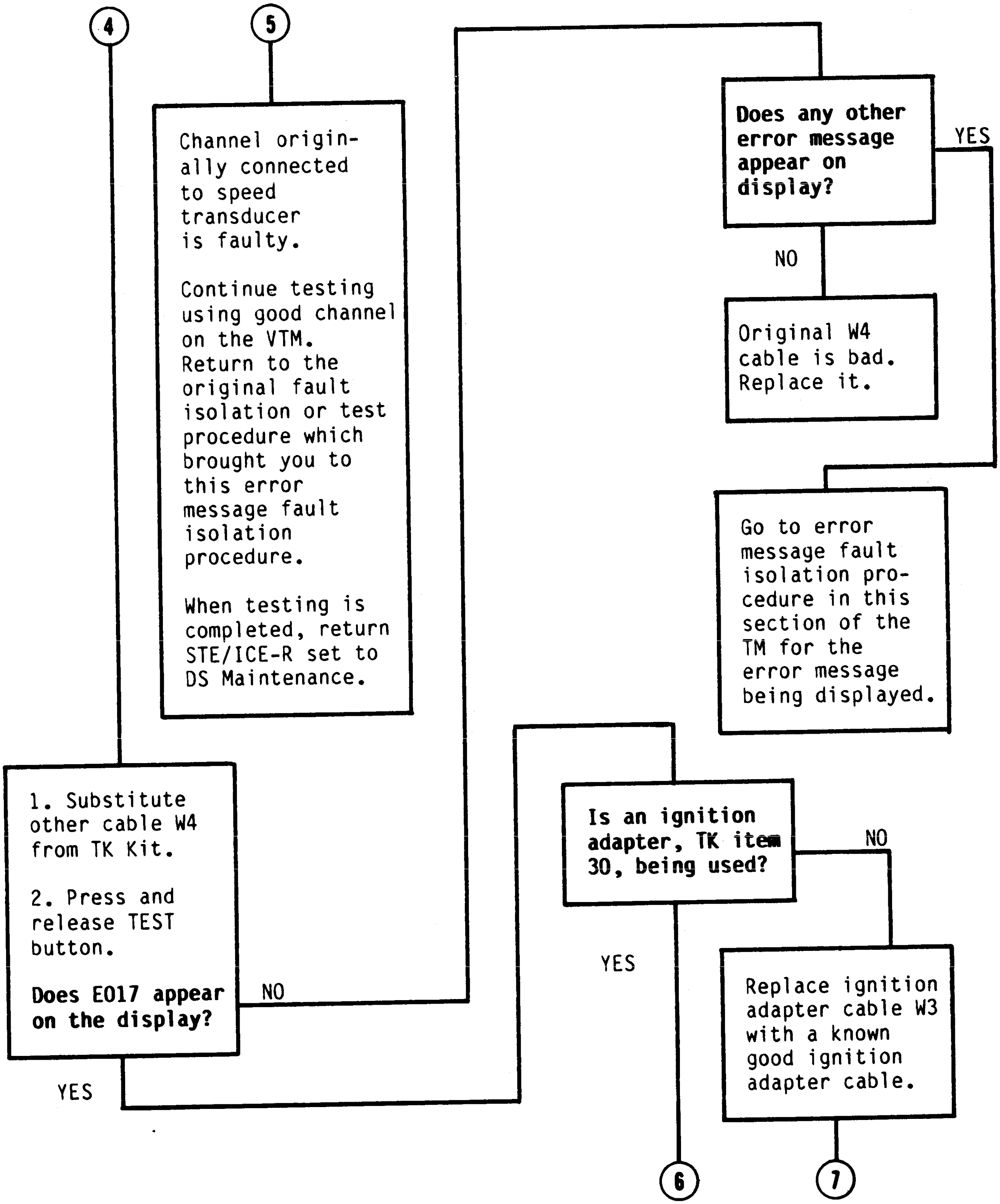
Go to error message fault isolation procedure in this section of TM for error message displayed.

NO

5

GO TO NEXT PAGE

3-2-26. ERROR MESSAGE E017 FAULT ISOLATION (cont)



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6

WARNING

To prevent damage to equipment or injury to personnel, turn engine off before attaching ignition adapter cable or ignition adapter to vehicle.

1. Replace ignition adapter with a known good ignition adapter.

2. Restart engine.

3. Set TEST SELECT switches to test number where E017 appeared on display.

4. Press and release TEST button.

Does E017 appear on display?

NO

Does any other error message appear on display?

YES

Go to error message fault isolation procedure in this section of the TM for the error message being displayed.

NO

Original ignition adapter is bad. Replace it.

YES

Replace ignition adapter cable W3 with a known good ignition adapter cable.

7

GO TO NEXT PAGE

7

1. Set TEST SELECT switches to test number where E017 appeared on display.

2. Press and release TEST button.

Does E017 appear on display?

NO

Does any other error message appear on display?

YES

NO

Original ignition adapter cable W3 is bad. Repair/replace it.

YES

Go to error message fault isolation procedure in this section of TM for error message being displayed.

Return STE/ICE-R set to DS Maintenance.

END OF TASK

3-2-27. ERROR MESSAGE E018 FAULT ISOLATION 3-2-27

Description:

This message indicates that the test was terminated automatically to protect the VTM. It occurs normally if a speed or frequency measurement has been repeatedly reading zero for a long time (approximately 15 minutes). This serves as an automatic shutoff for the test (the VTM will still be on).

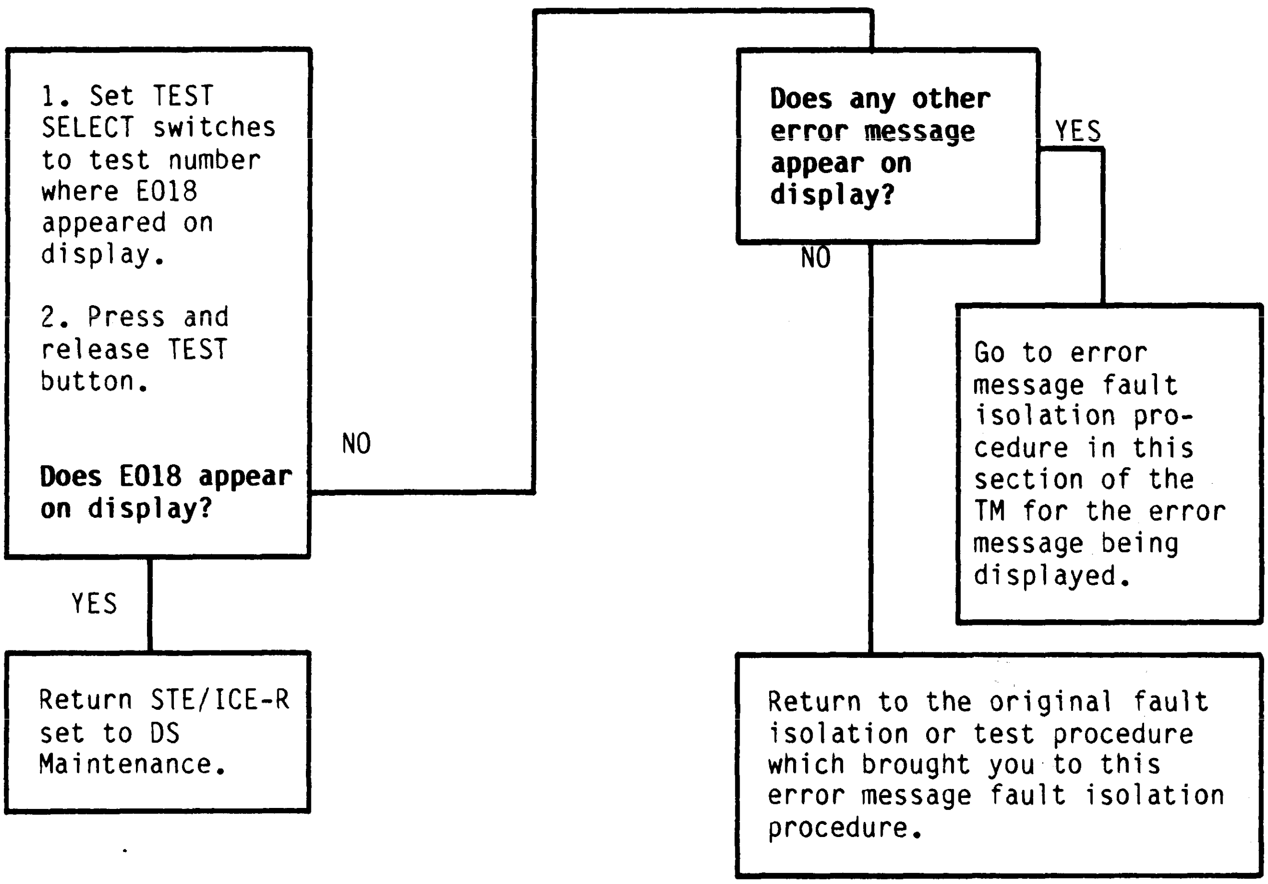
Application:

Applies to the following tests:

10 Engine Average RPM
11 Engine Cranking RPM
96 Test Probe AC Frequency 40-500 Hz
97 Current Probe AC Frequency 40-500 Hz

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-f? to DS maintenance.



END OF TASK

3-2-28. ERROR MESSAGE E020 FAULT ISOLATION 3-2-28

Description:

This message indicates that the current was too low for the VTM to perform a measurement.

Application:

Applies to the following tests:

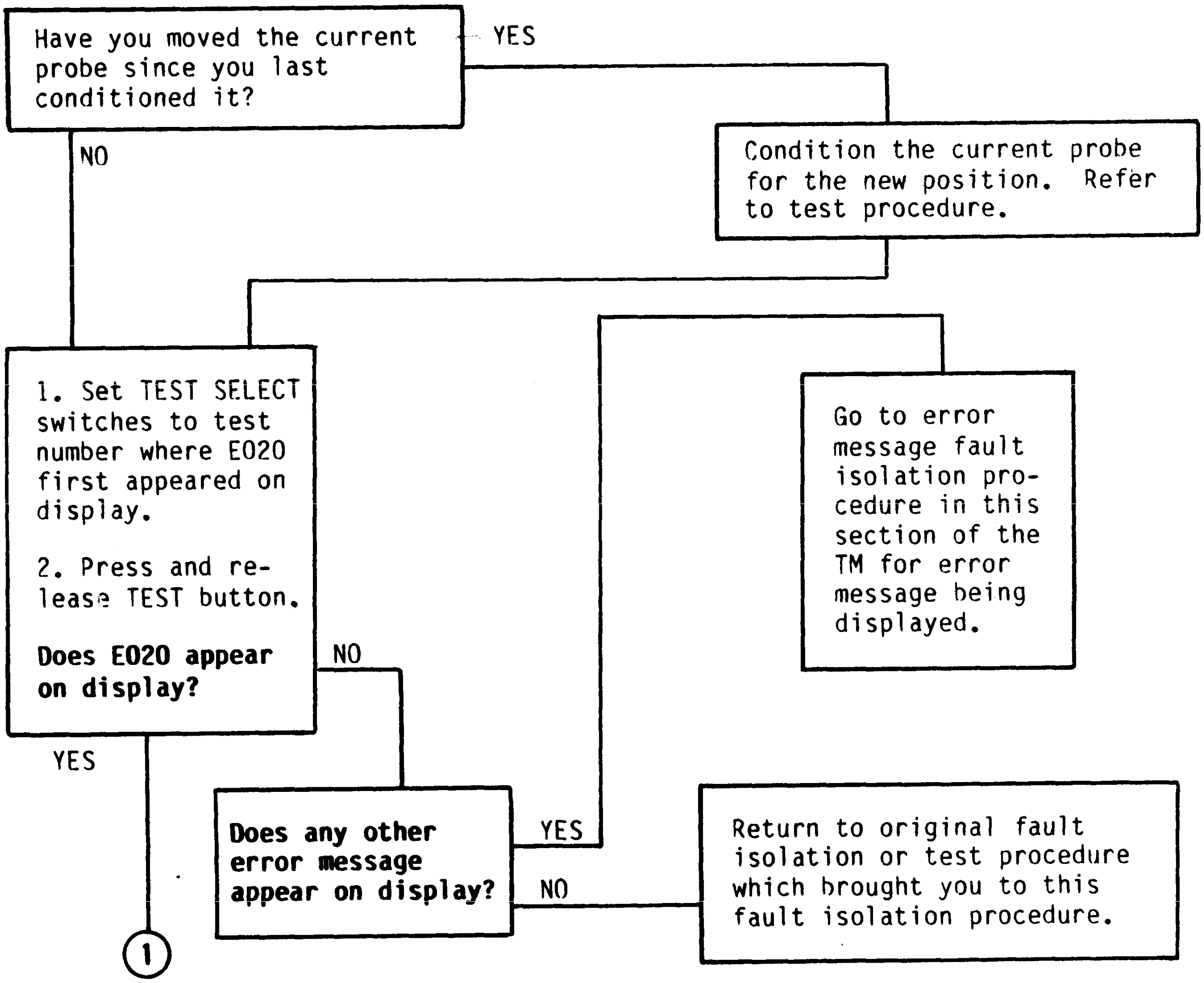
73 Battery internal resistance
74 Starter circuit resistance
77 Battery internal resistance
78 Starter circuit resistance

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.

Check that either the correct VID or correct number of cylinders have been entered for the vehicle under test.



GO TO NEXT PAGE

1

Try the same test on a known good vehicle.

Does E020 appear on display?

YES

VTM is at fault. Return STE/ICE-R set to DS maintenance.

NO

Does any other error message appear on display?

NO

Original vehicle has a problem in the starting circuit which prevents STE/ICE-R usage. Refer to vehicle/equipment TM for troubleshooting procedure.

YES

Go to error message fault isolation procedure in this section of the TM for error message being displayed.

END OF TASK

3-2-29. ERROR MESSAGE E021 FAULT ISOLATION 3-2-29

Description:

This message indicates that the current was too high for the VTM to perform a measurement.

Application:

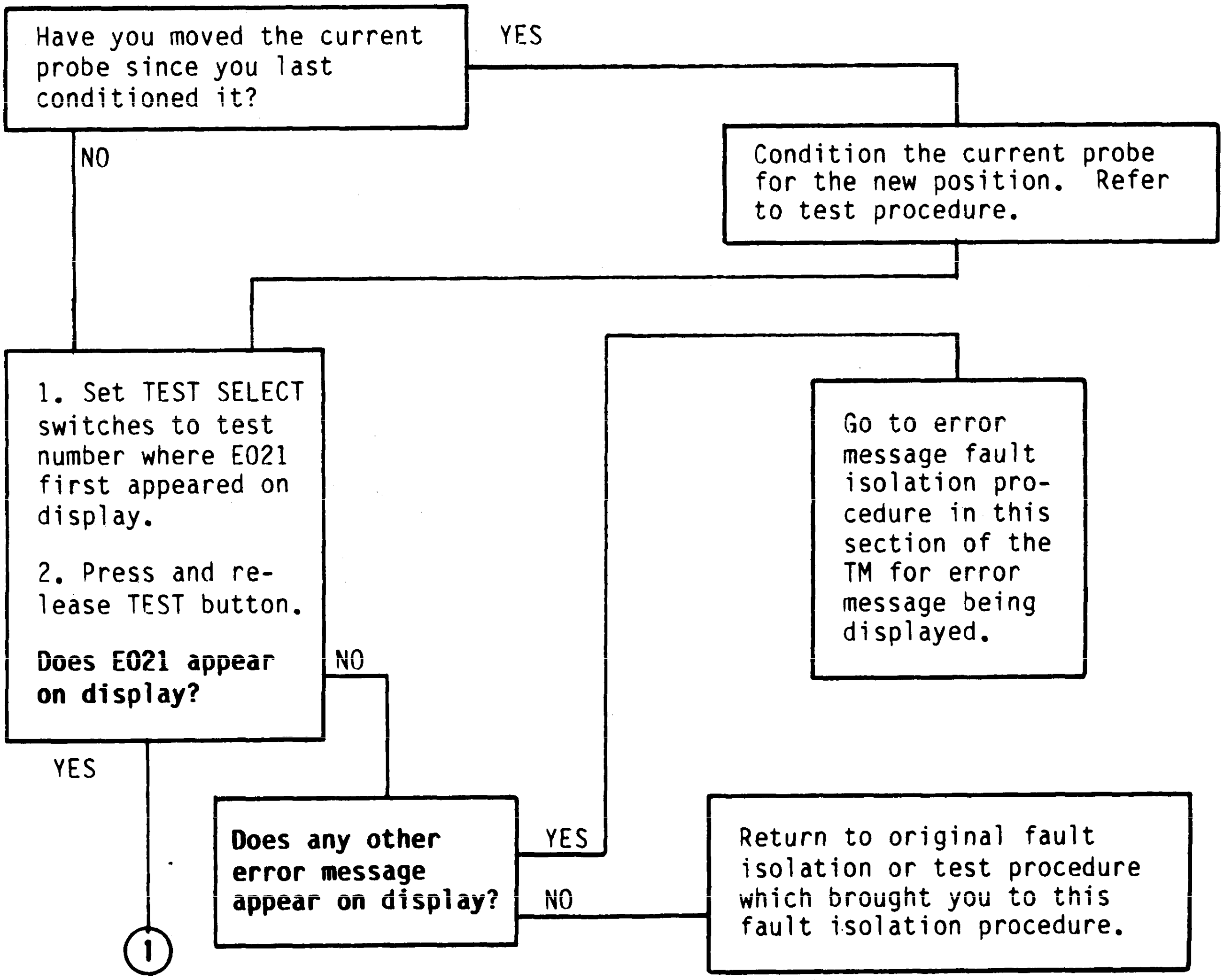
Applies to the following tests:

72 Current first peak
73 Battery internal resistance
74 Starter circuit resistance
76 Current first peak
77 Battery internal resistance
78 Starter circuit resistance

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance. Check that all connections are correct and secure.

Check that either the correct VID or correct number of cylinders have been entered for the vehicle under test.



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1

Try the same test on a known good vehicle.

Does E021 appear on display?

YES

VTM is faulty. Return STE/ICE-R set to DS maintenance.

NO

Does any other error message appear on display?

NO

Original vehicle has a problem in the starting circuit which prevents STE/ICE-R use. Refer to vehicle/equipment TM for troubleshooting procedure.

YES

Go to error message fault isolation procedure in this section of the TM for error message being displayed.

END OF TASK

3-2-30. ERROR MESSAGE E022 FAULT ISOLATION

Description:

This message indicates that an external voltage was detected in the circuit under test while measuring resistance.

Application:

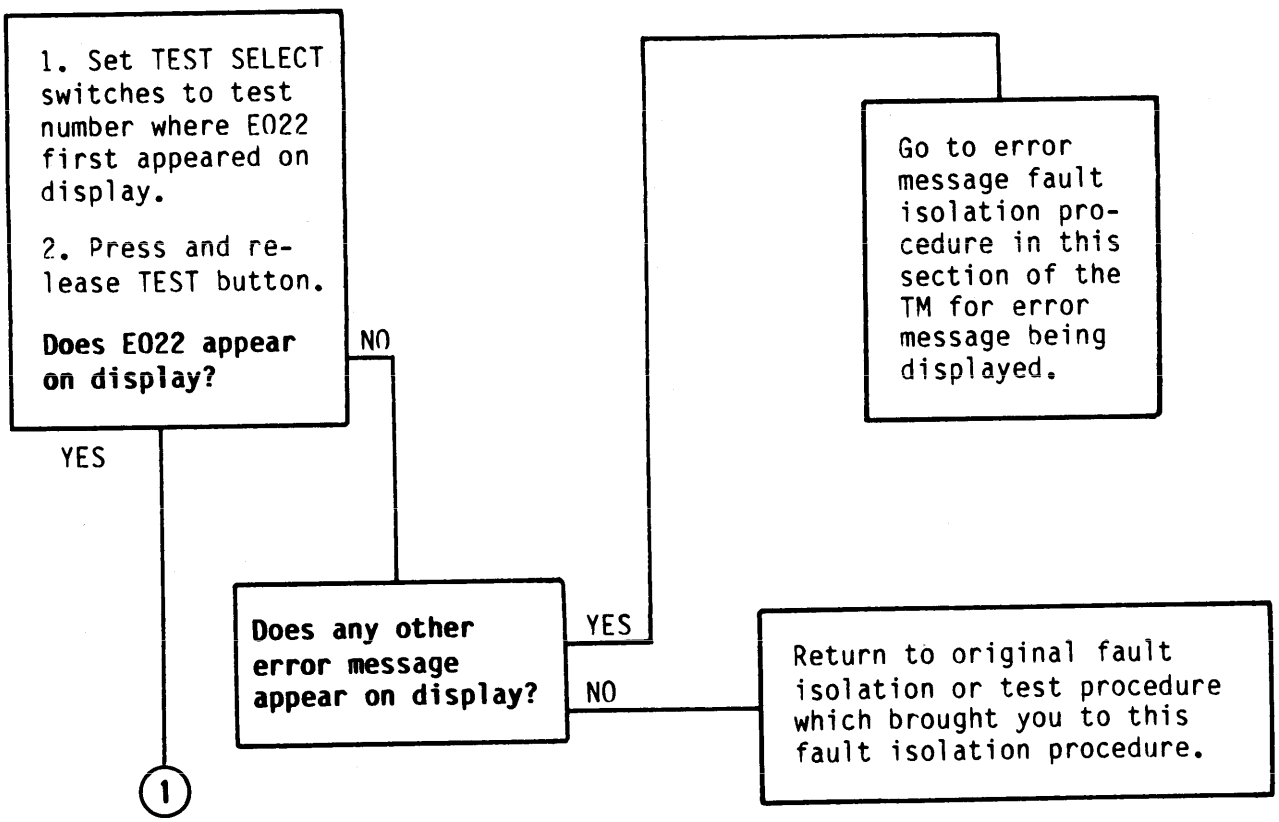
Applies to the following tests:

91 Resistance and continuity 0 to 4500 ohms
92 Resistance 0 to 40 Kohms

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance. Check that all connections are correct and secure.

Check that there is no power in the circuit being measured.



GO TO NEXT PAGE

1

1. Disconnect test probe cable W2 from the resistor.

2. Perform test #89 on the resistor.

NOTE:
You are measuring voltage across the resistor.

Is the measurement less than 4 volts?

YES

1. Disconnect test probe cable W2 from the resistor.

2. Set TEST SELECT switches to test number 91 or 92 where E022 first appeared on the display.

3. Attach red clip E1 to black clip E2 on test probe cable W2.

4. Press and hold TEST button until CAL appears on display.

5. Release TEST button; and wait for offset value to appear on display. Offsets must be within the following limits:

TEST	WITHIN
91	-225 to +225
92	-6.0 to +6.0

Is the offset value within the limits specified?

YES

2

NO

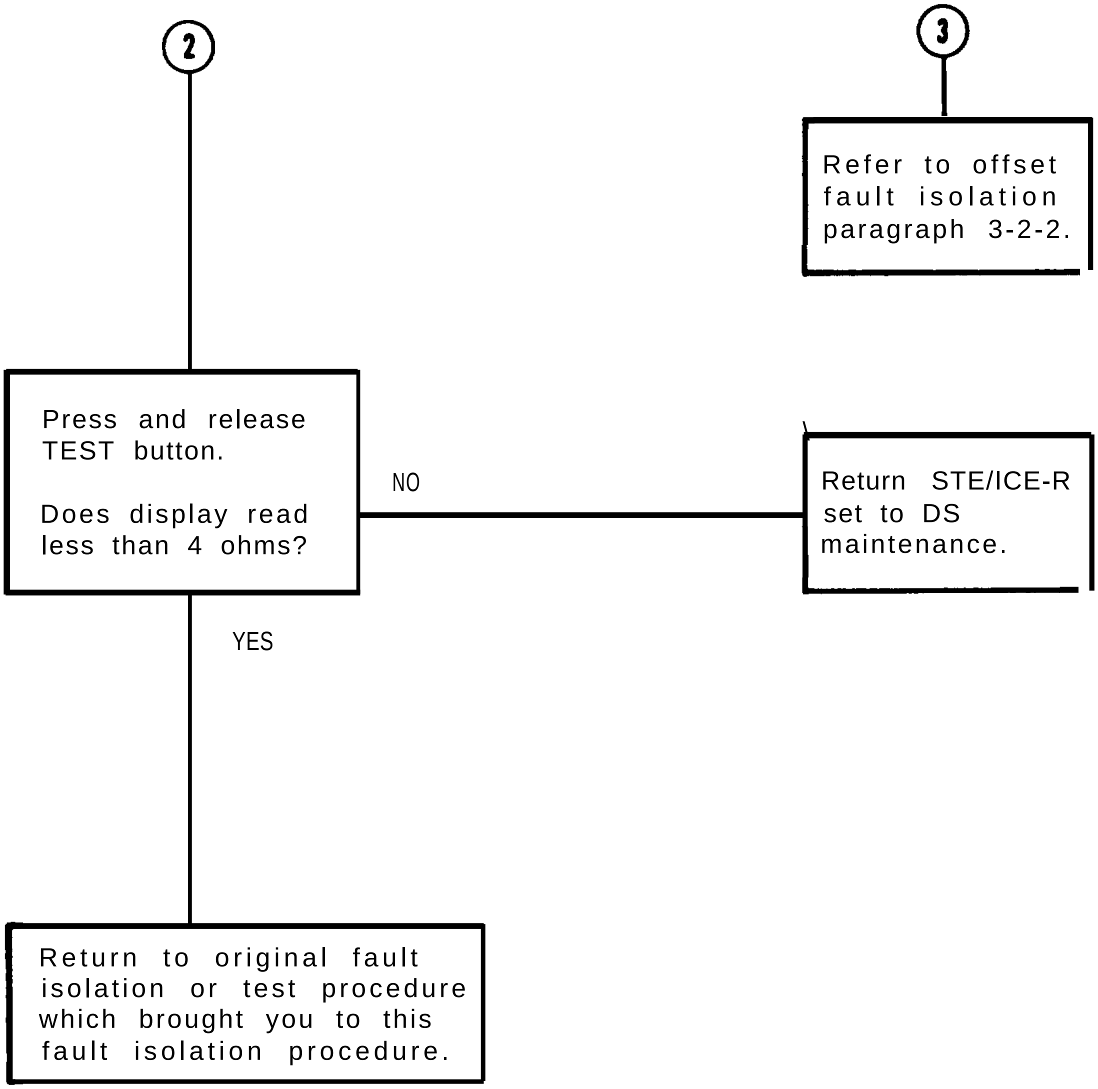
3

NO

External voltage is present in the circuit under test and a resistance measurement cannot be made.

GO TO NEXT PAGE

3-2-30. ERROR MESSAGE E022 FAULT ISOLATION (cont) 3-2-30



END OF TASK

3-2-31. ERROR MESSAGE E023 FAULT ISOLATION 3-2-31

Description:

This message indicates that the VTM'S constant voltage source is not working.

Application:

All tests will be affected by the failure of the internal power supply.

Is VT powered through DCA cable W1

NO

Refer to confidence test fault isolating paragraph 3-2-4.

YES

1. Pull off VTM power switch.

2. Disconnect connector P1 of cable W1 from J1 DCA/PWR of VTM.

3. Go to paragraph 2-3-3 and perform TK power up procedure.

Did VTM pass confidence test?

NO

Refer to confidence test fault isolation, paragraph 3-2-4.

Yes

Go to vehicle/equipment TM for DCA fault isolation procedure.

END OF TASK

3-2-32. ERROR MESSAGE E024 FAULT ISOLATION 3-2-32

Description:

This message indicates that the test number entered is not valid for the VID stored in the VTM.

Application:

Applies to the following tests:

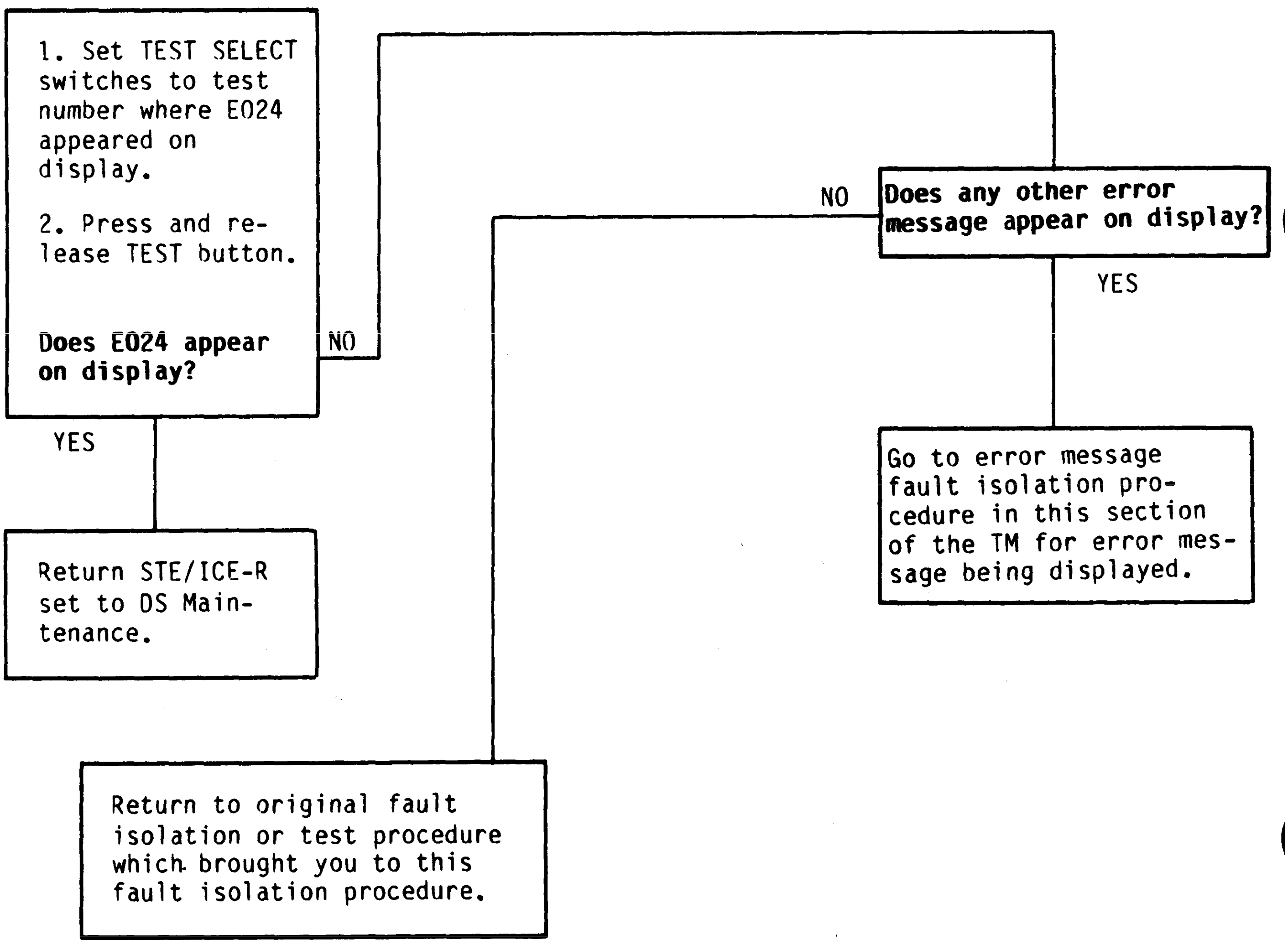
13 Power test (percent)
14 Compression unbalance
15 Compression unbalance

Pre-Isolation Procedures:

Check that TEST SELECT switches are set to the correct test number before proceeding.

Check vehicle/equipment TM to verify that the test number is valid for vehicle/equipment.

Check that all connections are correct and secure.



END OF TASK

3-2-33. ERROR MESSAGE E027 FAULT ISOLATION 3-2-33

Description:

This message indicates that the constants for the compression unbalance test were entered incorrectly.

Application:

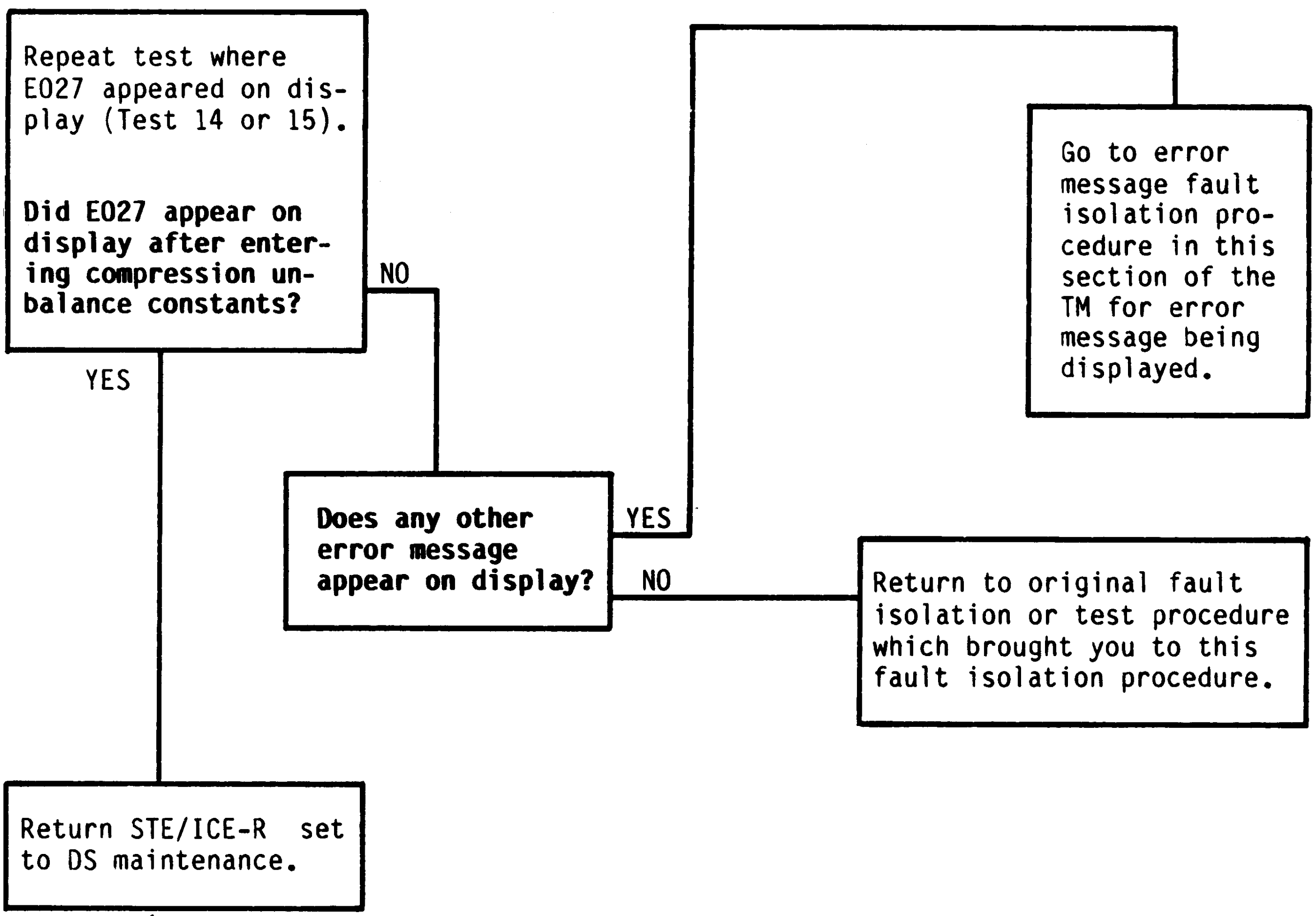
Applies to the following tests:

14 Compression unbalance
15 Compression unbalance

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under Application on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance. Check that all connections are correct and secure.

Refer to vehicle/equipment TM to verify the compression unbalance constants.



END OF TASK

3-2-34. ERROR MESSAGE E028 FAULT ISOLATION 3-2-34

Description:

This error message indicates that the test just entered cannot be used with Control Function #06.

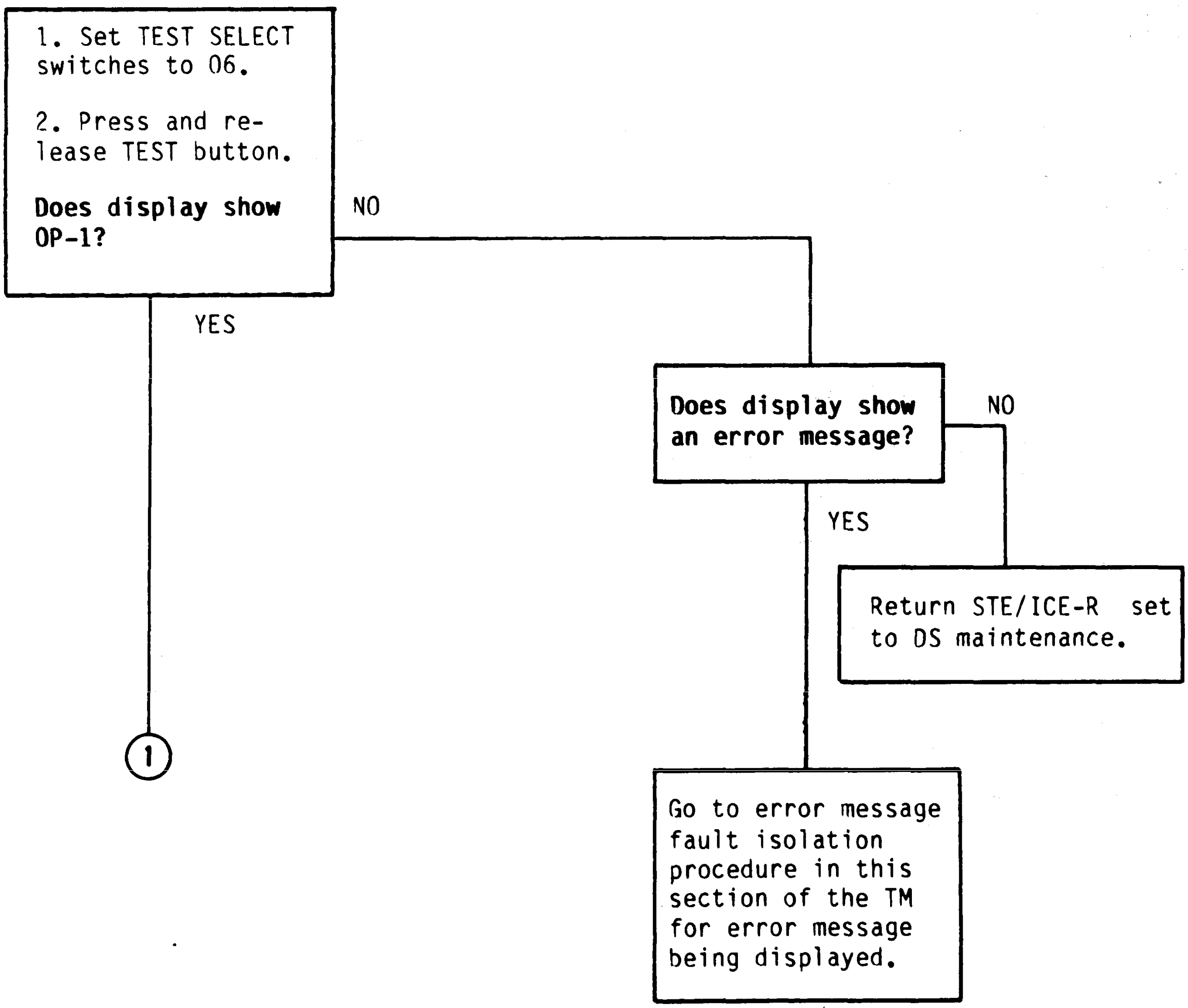
Application:

Applies to the those tests listed in Table 2-6 with an X in column for Control Function #06.

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.



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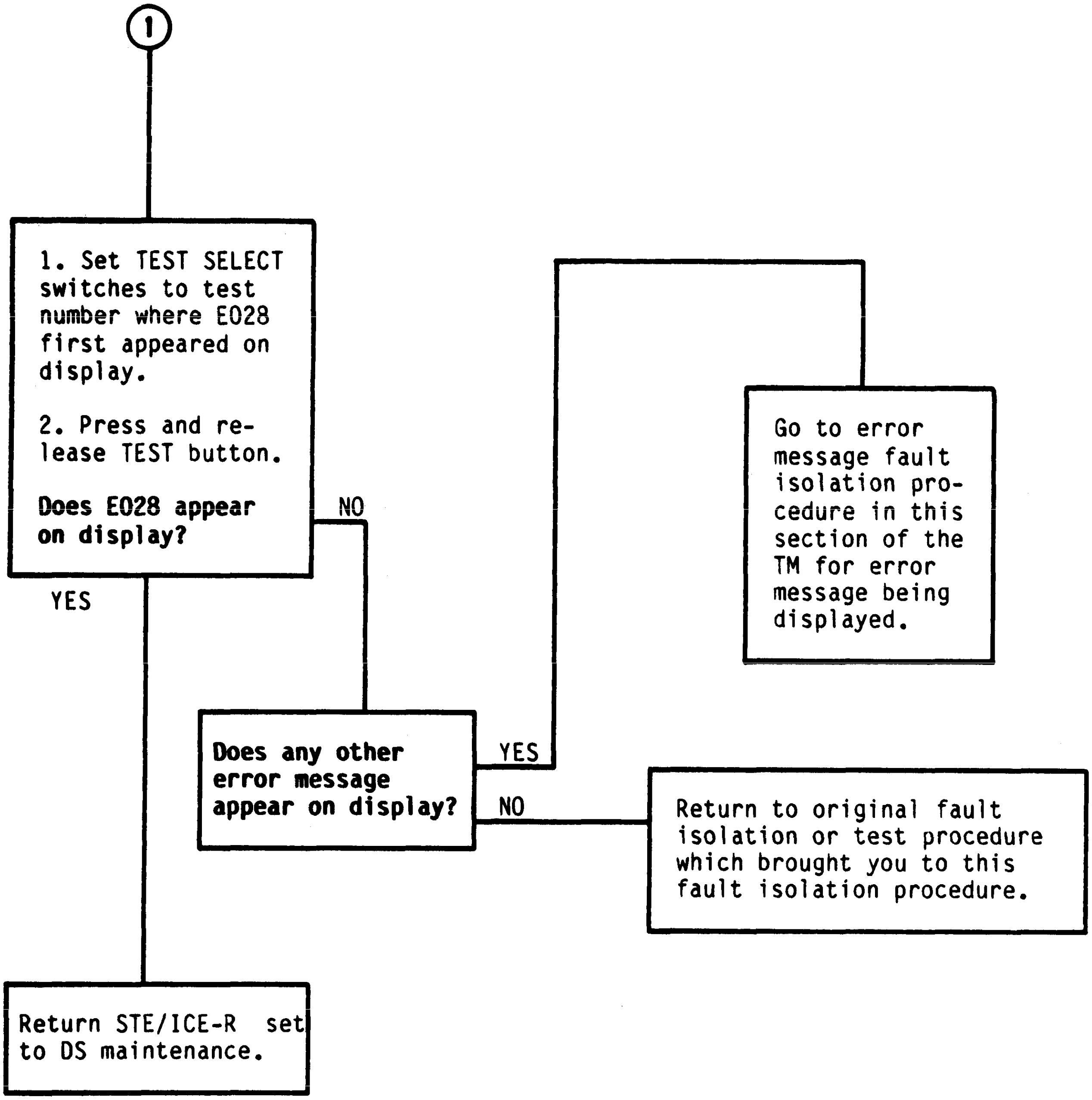

1
1. Set TEST SELECT switches to test number where E028 first appeared on display.
2. Press and release TEST button.
Does E028 appear on display?
NO
YES
Go to error message fault isolation procedure in this section of the TM for error message being displayed.
Does any other error message appear on display?
YES
NO
Return to original fault isolation or test procedure which brought you to this fault isolation procedure.
Return STE/ICE-R set to DS maintenance.

END OF TASK

3-2-35. ERROR MESSAGE E030 FAULT ISOLATION 3-2-35

Description:

This error message indicates that the VID entered conflicts with the attached transducer.

Application:

Applies to the following tests:

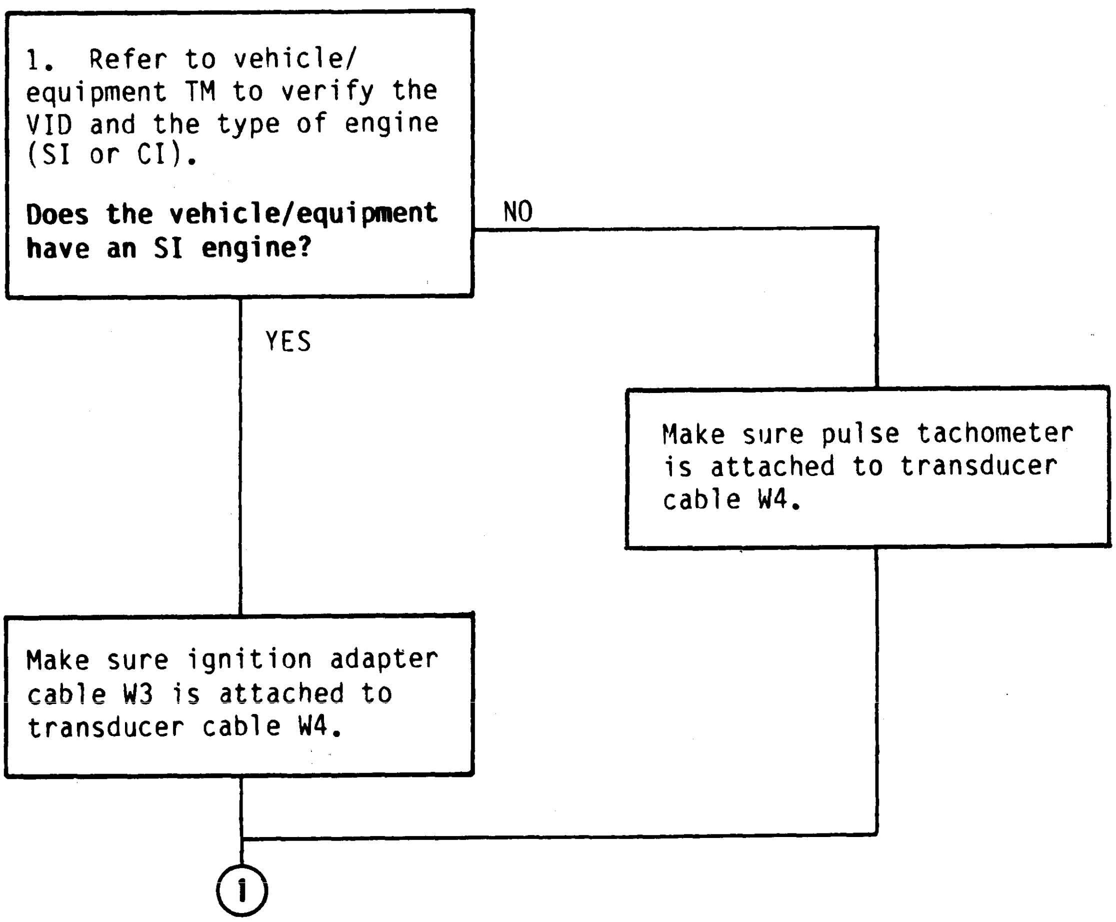
12 Power (RPM/See)
13 Power (percent)

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Make sure that pulse tachometer or ignition adapter cable W3 is attached to VTM.

Check that all connections are correct and secure.



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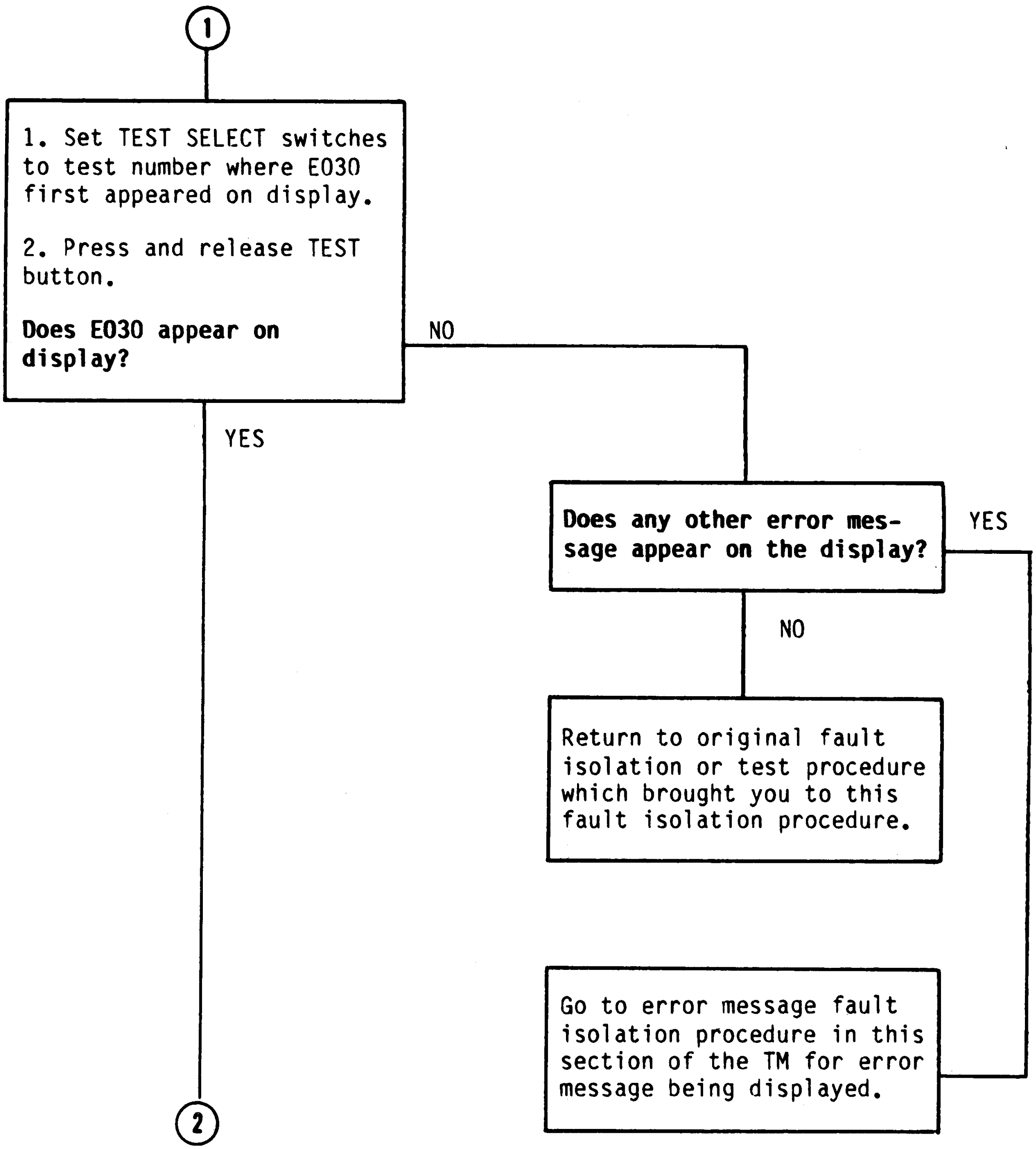
3-2-35. ERROR MESSAGE E030 FAULT ISOLATION (cont) 3-2-35



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2

1. If transducer cable W4 was connected to VTM at J3 TK, connect it to J2 TK.

2. If transducer cable W4 was connected to VTM at J2 TK, connect it to J3 TK.

3. Press and release TEST button.

Does E030 appear on display?

YES → 3

NO

Does any other error message appear on the display?

YES

Go to error message fault isolation procedure in this section of TM error message for being displayed.

NO

One connector is faulty.

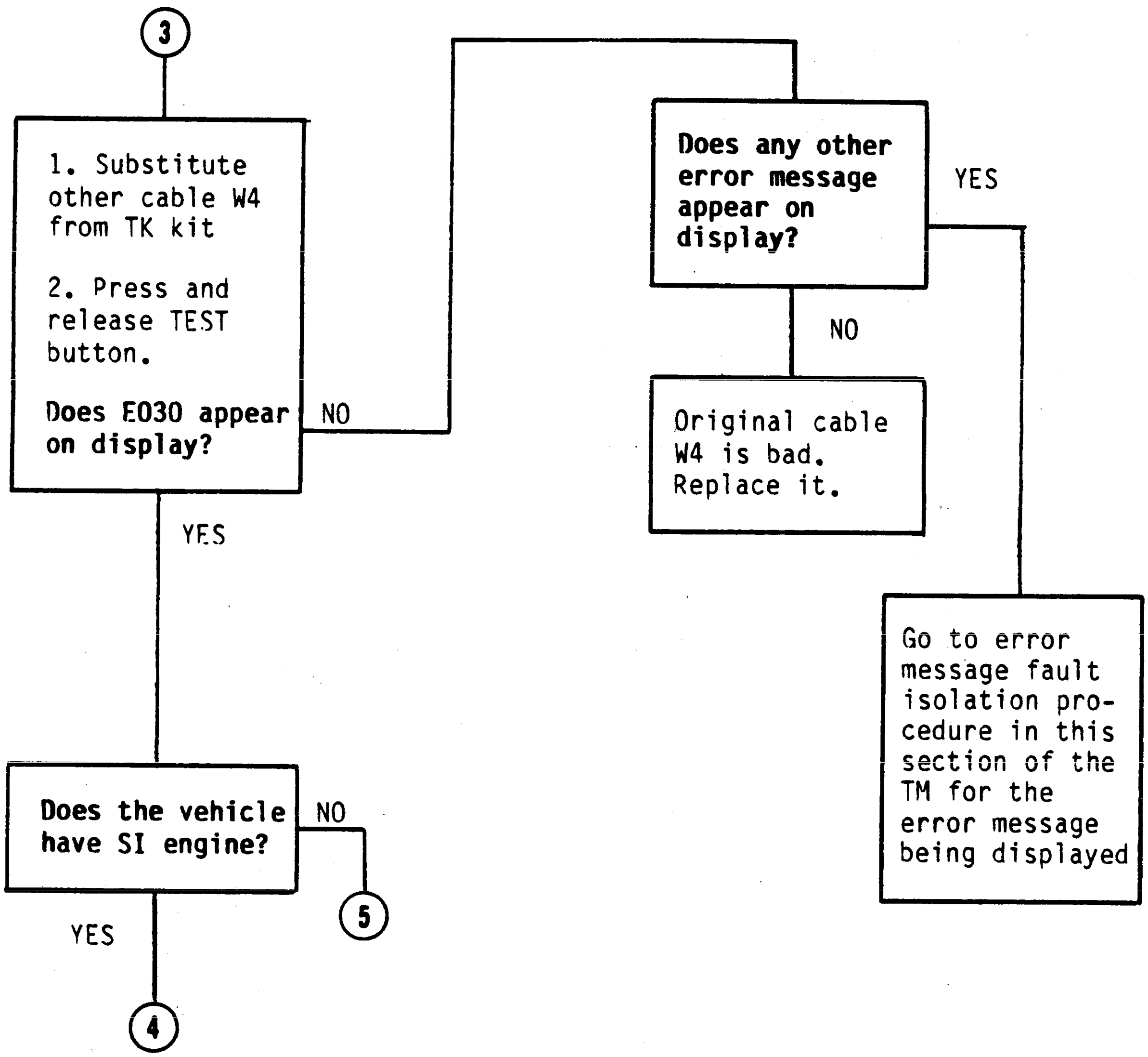
1. Continue testing using good connector.

2. Return to original fault isolation or test procedure which brought you to this error message fault isolation procedure.

3. When vehicle testing is complete, return STE/ICE-R set to DS maintenance.

GO TO NEXT PAGE

2-35. ERROR MESSAGE E030 FAULT ISOLATION (cont) 3-2-35



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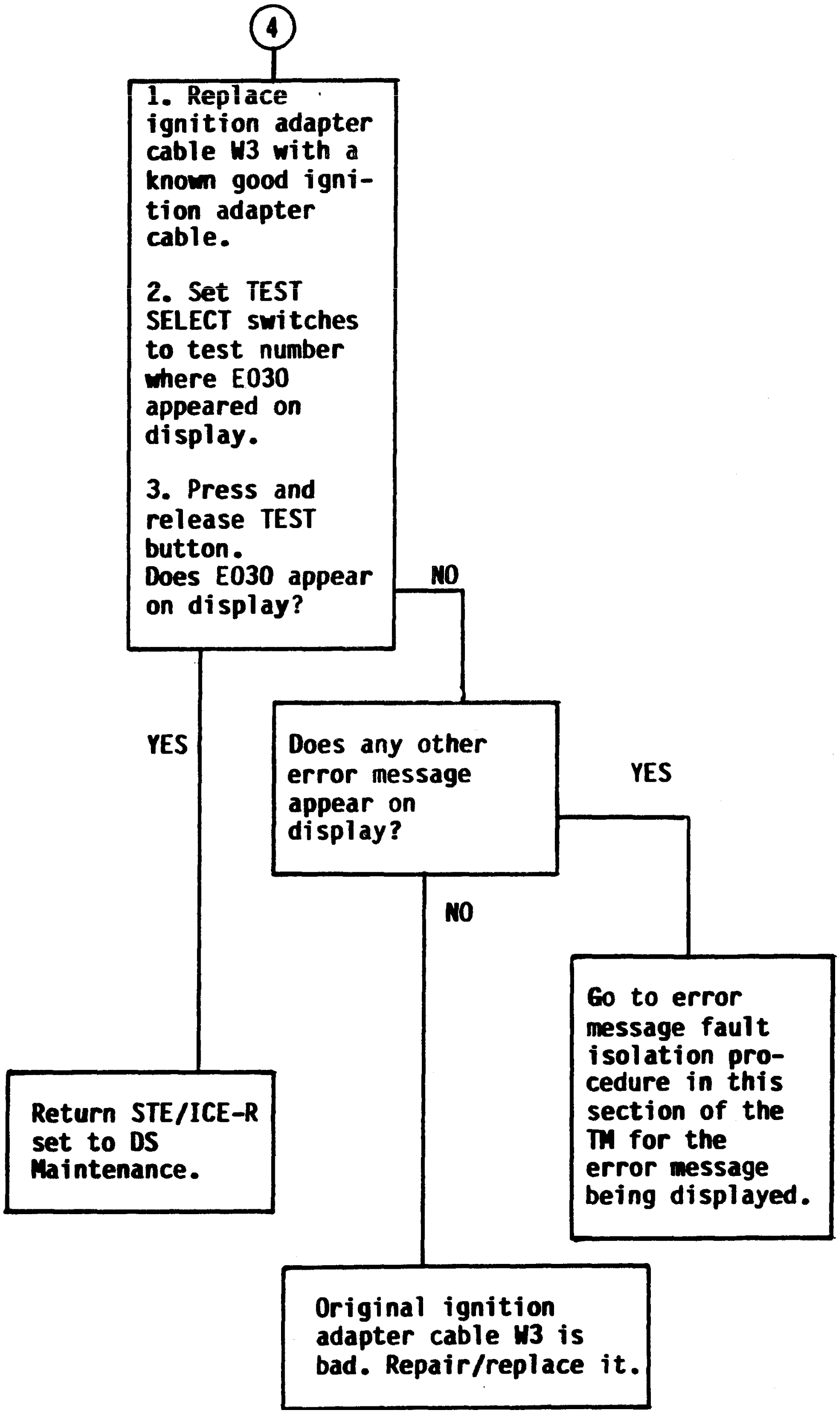

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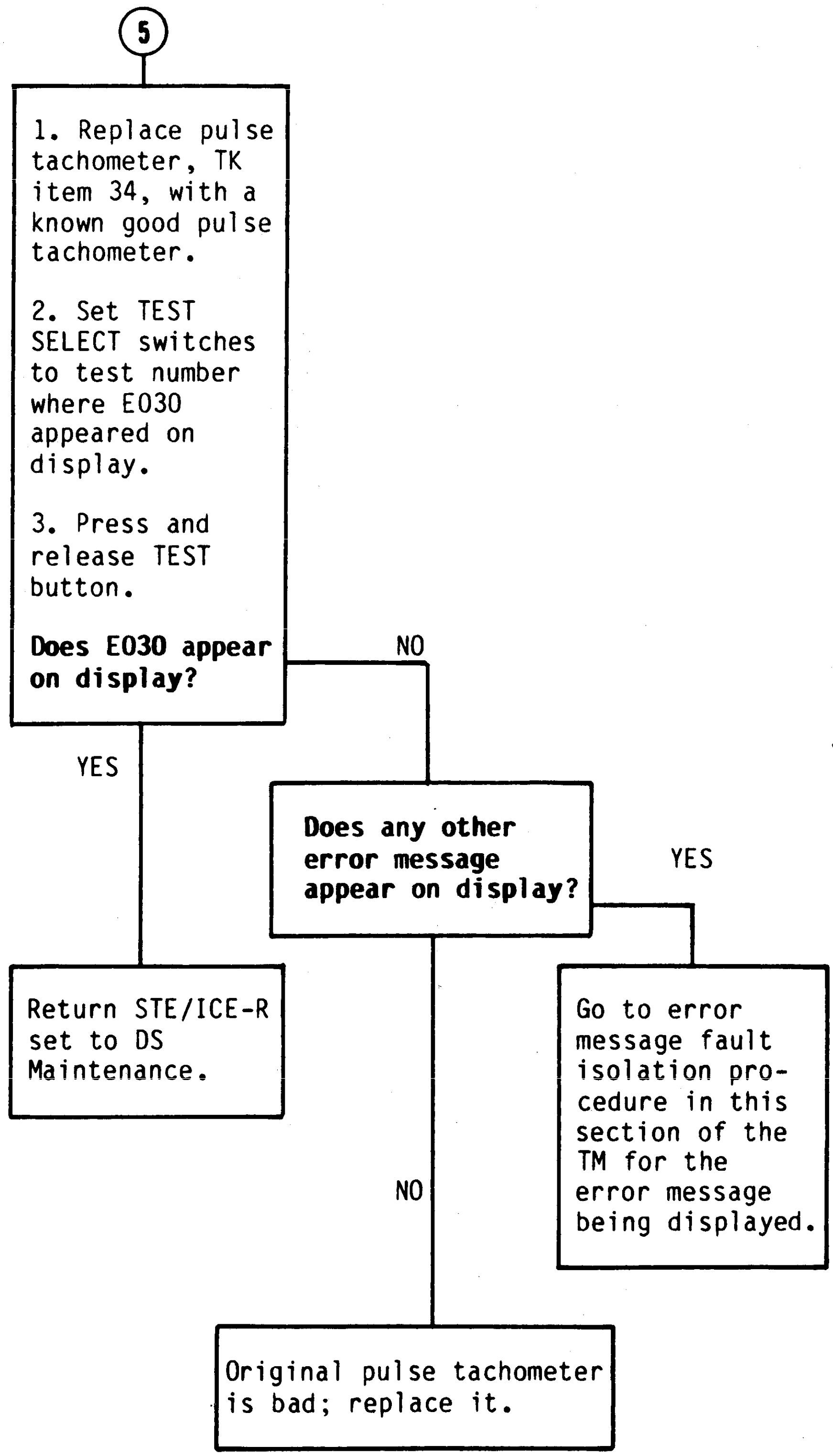
3-2-35. ERROR MESSAGE E030 FAULT ISOLATION (cont) 3-2-35



END OF TASK

3-2-36. ERROR MESSAGE E032 FAULT ISOLATION

Description:

This error message indicates that the vehicle's cranking speed varies too much for a compression unbalance measurement.

Application:

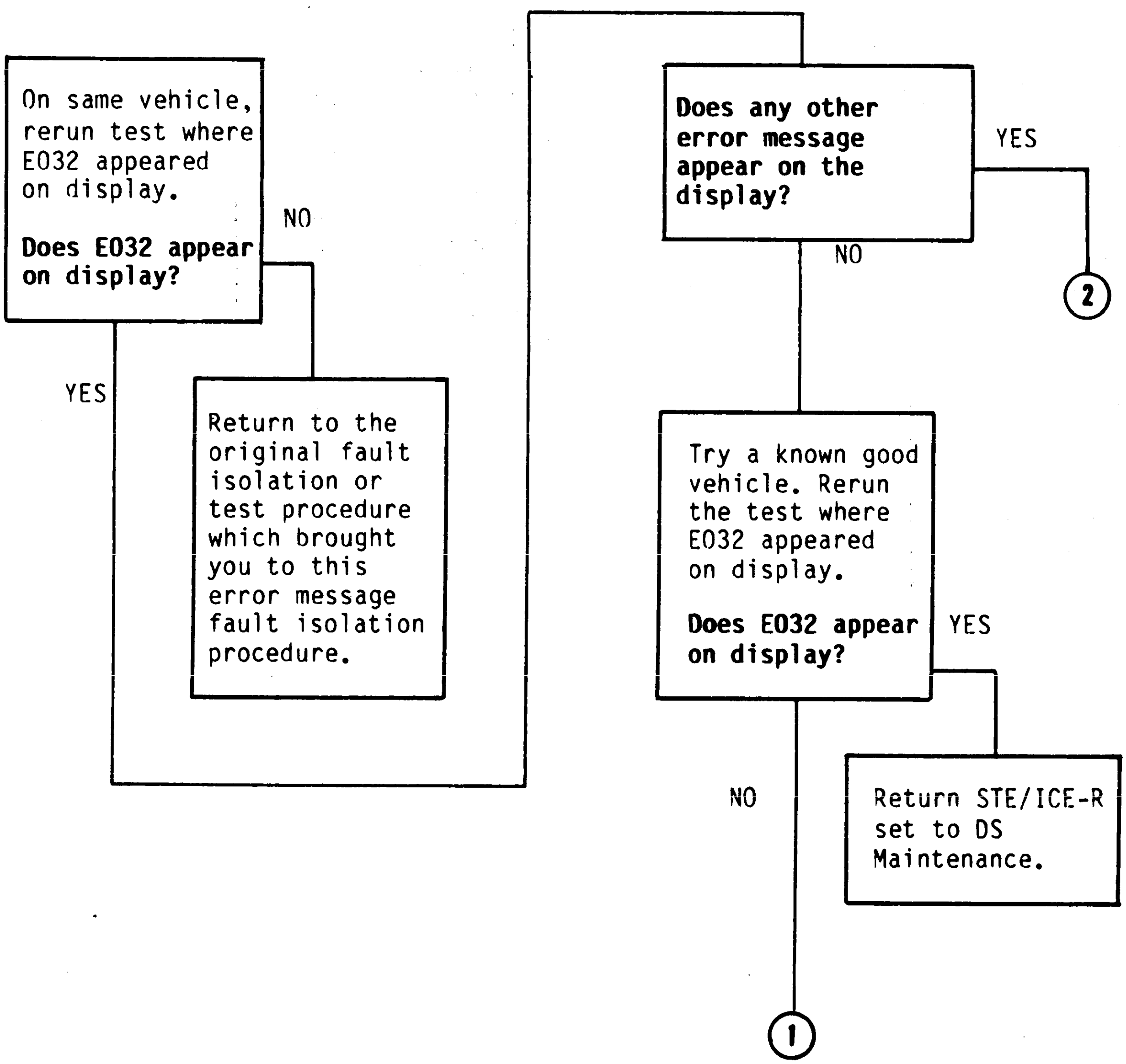
Applies to the following tests:

\# 14 Compression unbalance
\# 15 Compression unbalance

Pre-Isolation Procedures:

Check that the test number you intended to run matches a test number listed under **Application** on this page. If these numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.

Check that all connections are correct and secure.



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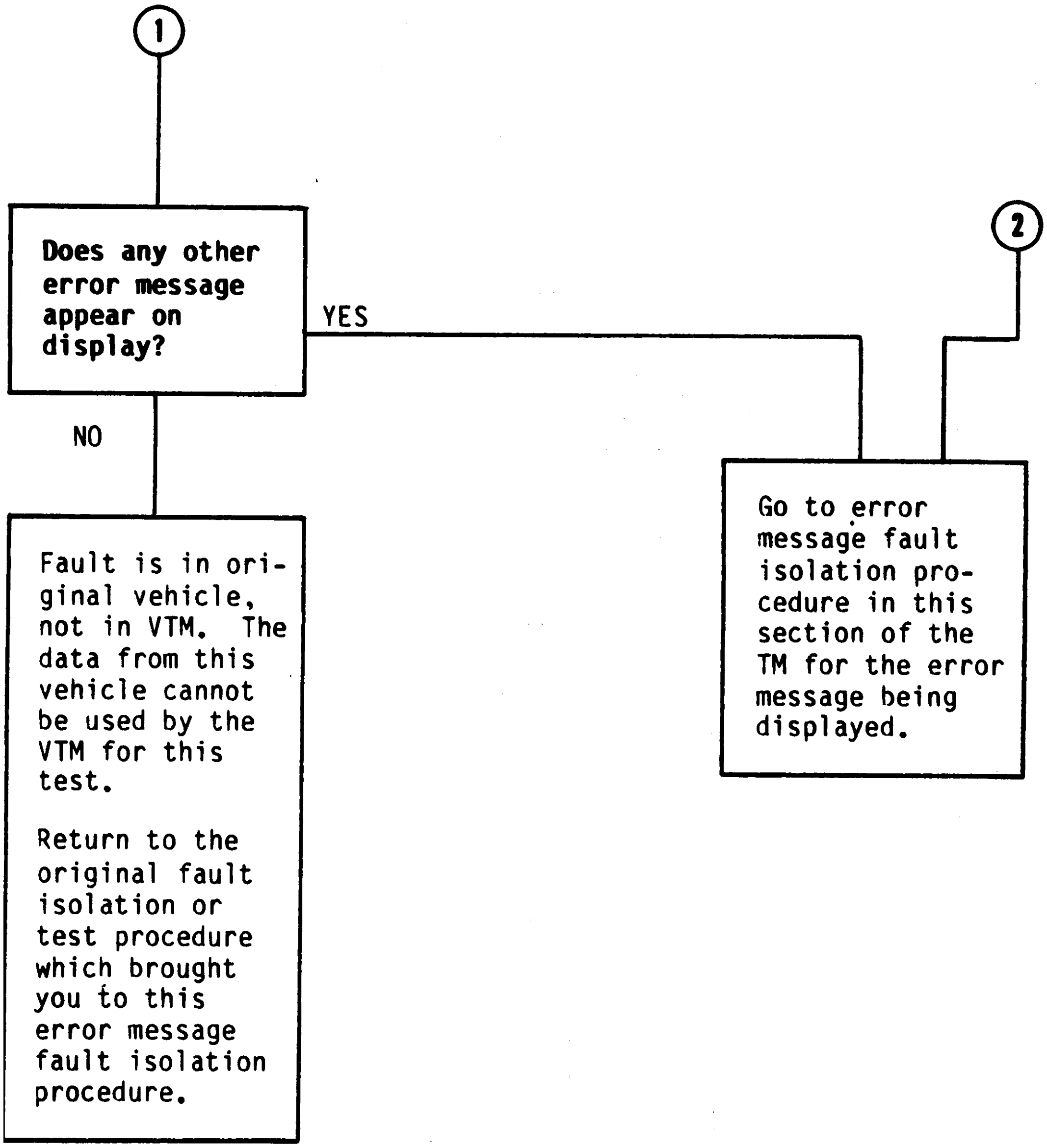
3-2-36. ERROR MESSAGE E032 FAULT ISOLATION (cont) 3-2-36



END OF TASK

3-2-37. ERROR MESSAGE E033 FAULT ISOLATION 3-2-37

Description:

This error message indicates that the power test value entered was not accepted by the VTM (the value must be 1, 2, 3, or 4).

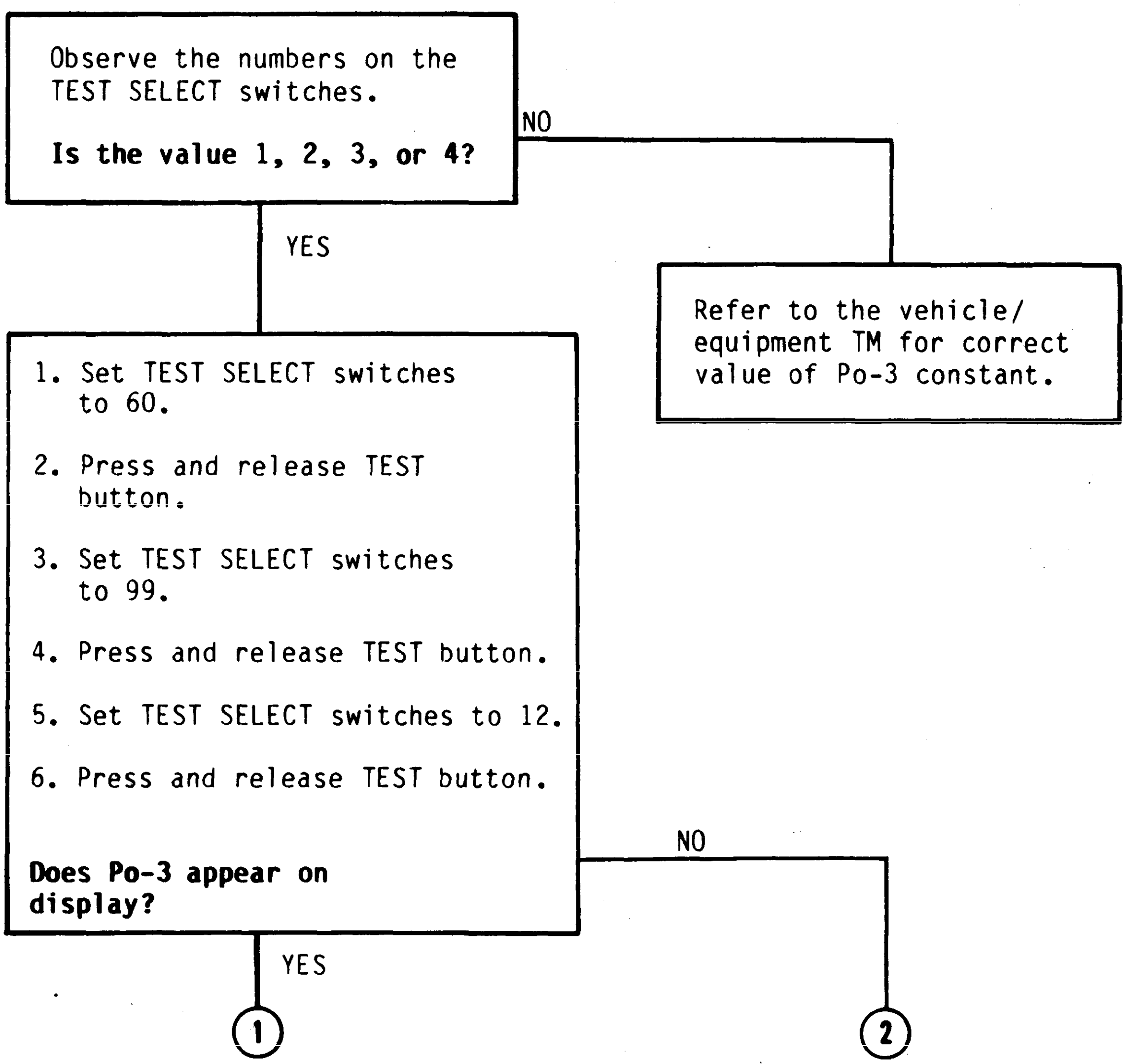
Application:

Applies to the following test:

12 Power test

Pre-Isolation Procedures:

Check that the test number you intended to run matches the test number listed under **Application** on this page. If the numbers match, proceed with the test. If they do not match, return STE/ICE-R to DS maintenance.



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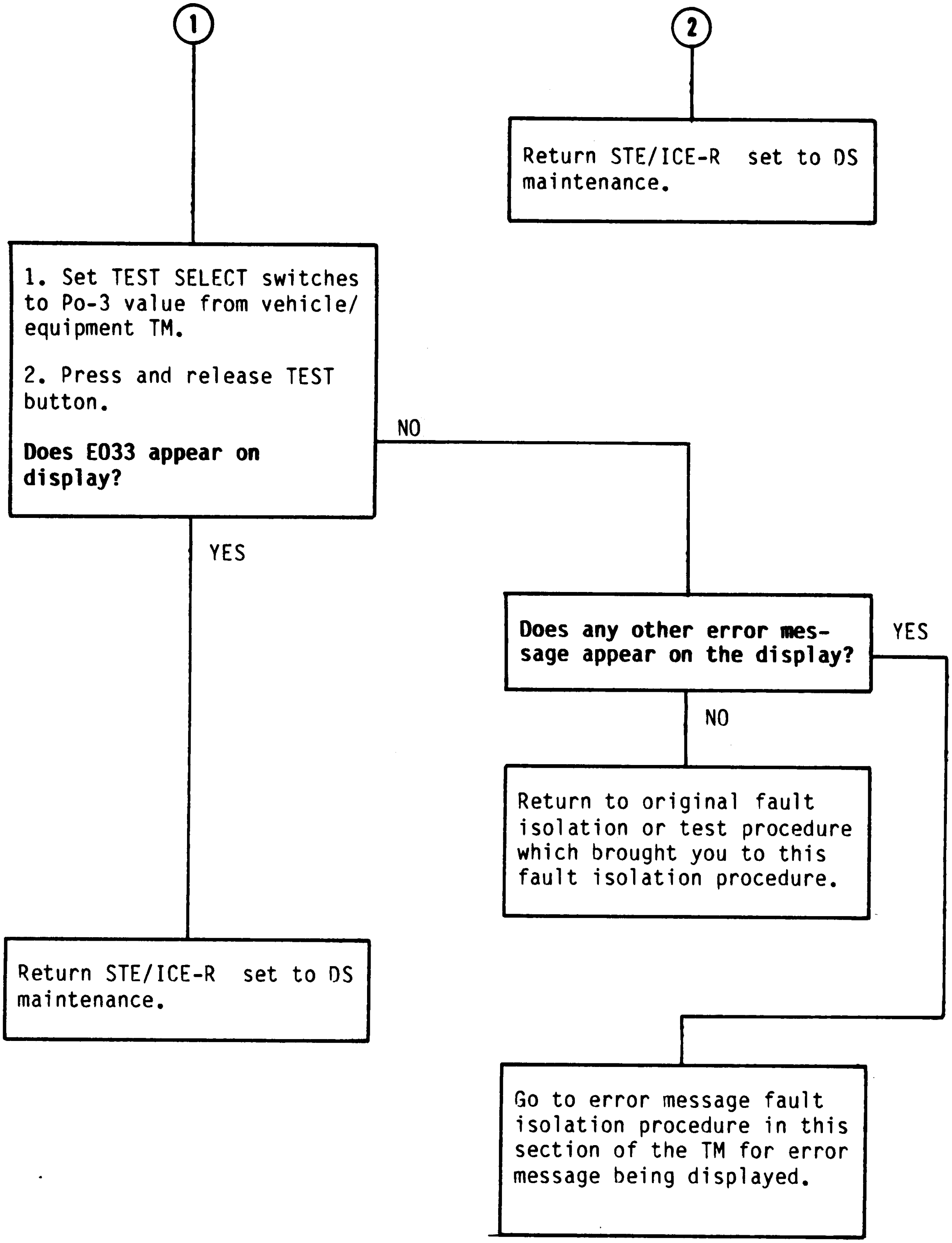

1
2
Return STE/ICE-R set to DS maintenance.
1. Set TEST SELECT switches to Po-3 value from vehicle/ equipment TM.
2. Press and release TEST button.
Does E033 appear on display?
NO
YES
Does any other error message appear on the display?
YES
NO
Return to original fault isolation or test procedure which brought you to this fault isolation procedure.
Return STE/ICE-R set to DS maintenance.
Go to error message fault isolation procedure in this section of the TM for error message being displayed.

END OF TASK

Section III. MAINTENANCE PROCEDURES

Section III describes how to repair the STE/ICE-R equipment and has the following paragraphs:

3-3-1. INSPECTION AND CLEANING 3-3-1

Comon Tools:

None

Expendable Materials:

Dry cleaning solvent
Grease-cleaning compound
Oil

A. INSPECTION

Refer to Preventive Maintenance Checks and Services, Paragraph 2-2-2.

GO TO NEXT PAGE

B. **CLEANING**

WARNING

Drycleaning solvent is flamable. Do not smoke or use near open flame or spark.

Do not use fuel, gasoline, or benzine (benzol) for cleaning. These items are prohibited as cleaning agents.

Sharp tools used in cleaning threads can cause injury. Use care in handling sharp tools.

CAUTION

Do not submerge transducers in solvents or blow out with high pressure air. Damage to transducer may result.

1. **Thread cleaning.** Use Drycleaning solvent and sharp tool to clean grease or dirt from threads of transducers or fittings.

2. **Test point cleaning.** Use a solution of one part grease-cleaning compound to four parts Drycleaning solvent to dissolve grease or oil from engine blocks, chassis or other parts where transducers or fittings are to be mounted.

3. **Rust prevention.**

   a. Rinse and dry clean parts.

   b. Coat threads and metal surfaces of cleaned parts with film of light grade oil (Appendix D, item 6).

END OF PARAGRAPH

3-3-2. DIGITAL DISPLAY MODULES REMOVAL/INSTALLATION 3-3-2

Common Tools:

No. 1 Common shop set

Materials/Parts:

Display Module 1669222

Equipment Conditions:

VTM on clean work surface
VTM power set to OFF
All cables disconnected from VTM

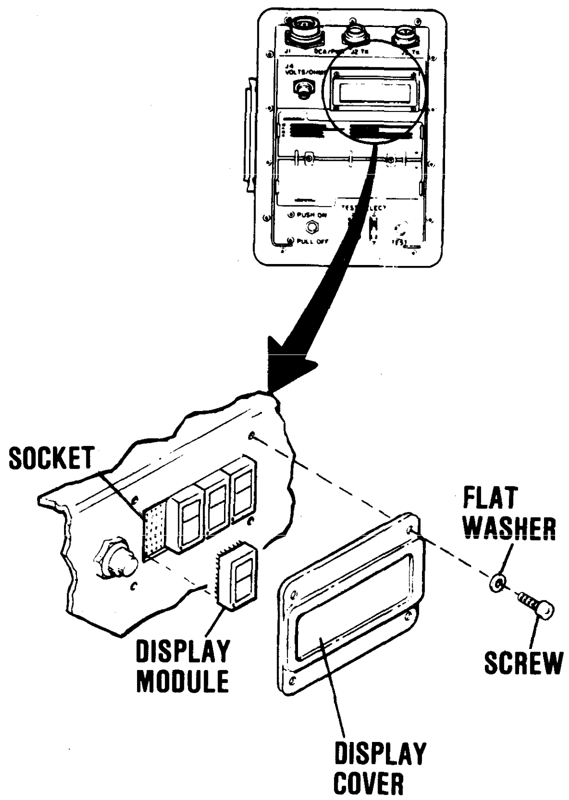
A. REMOVAL

1. Remove display cover.

   a. Remove four screws and flat washers securing display cover.

   b. Remove display cover.

2. Remove module. Pull display module from socket.



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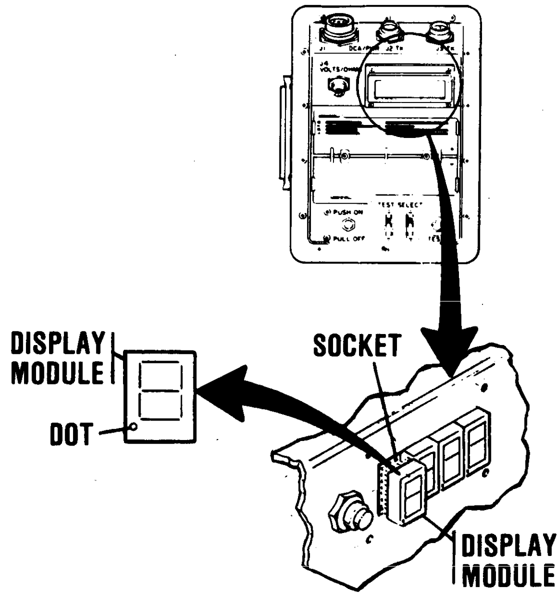
B. INSTALLATION

1. Install display module.

   a. Place display module in socket with dot at lower left corner.

   b. Push display module into socket.



2. **Install display cover.**

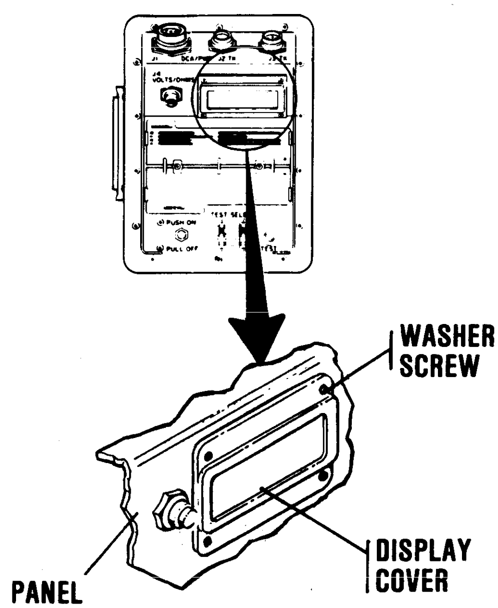
   a. Position display cover on panel .

   b. Secure display cover with four screws and flat washers.

NOTE

If replaced display module does not work after performing confidence test, return STE/ICE-R set to DS maintenance.

3. Run confidence test. Refer to paragraph 2-2-3.



END OF TASK

3-3-3. FLIP CARD SET REMOVAL/INSTALLATION

Common Tools:

No. 1 common shop set

Materials/parts:

Flip card set

Equipment Conditions:

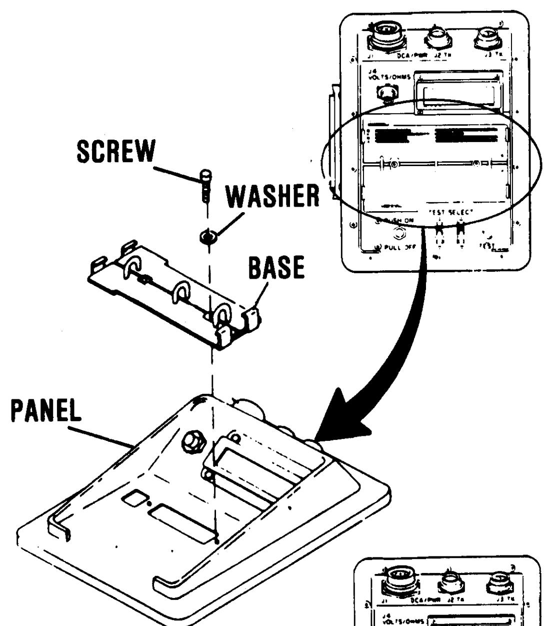
VTM on clean work surface
VTM power set to OFF
All cables disconnected from VTM

A. REMOVAL

1. Remove card holder base.

a. Remove two screws and washers.

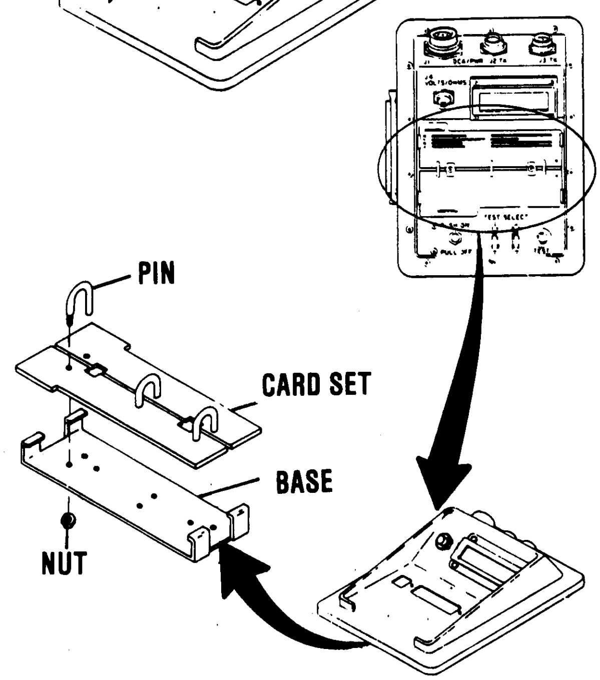
b. Lift card holder base from panel.



2. Remove card set.

a. Using wrench, remove three nuts from card holder pins.

b. Lift card holder set from card holder base; remove card set.



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B. INSTALLATION

Install card set.

a. Place card holder pins through holes in card set and card holder base.

b. Using wrench, tighten three nuts on card holder pins; secure card holder set to base.

2. Install card holder base.

a. Place card holder base on front panel so that card set can be read when the VTM is in the upright position.

b. Tighten two screws and flat washers. Secure card holder base to panel.

END OF TASK

3-3-4. ELECTRICAL CLIP REPLACEMENT 3-3-4

This task covers: A. Removal B. Wire Preparation C. Installation

Common Tools:

No. 1 common shop set
Heat gun
Soldering set, PN 3439-00-460-7198
Stripper, wire

Materials/Parts:

Alcohol	6505-00-205-6513
Clip (Cable W3)	11669233
Clip (Cable W5)	570431
Clip, insulator, black	11669230-4
Clip, insulator, red	11669230-3
Flux	
Sleeving, insulation, heat shrinkable	MIL-I-23053/4
Solder, rosin core	CMPSN-SN63

Equipment Condition:

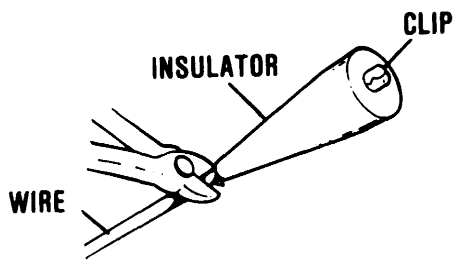
Cable on clean work surface
Cable disconnected from VTM

A. REMOVAL

1. Ranove clip and insulator.

   a. Using pliers, cut off wire close to clip insulator and clip.

   b. Discard clip insulator and clip.

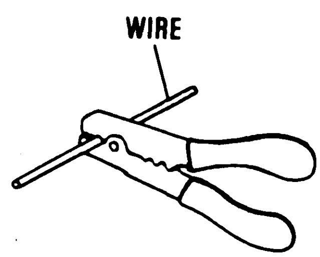


B. WIRE PREPARATION

1. Prepare wire.

   a. Using wire stripper, strip 1 inch of insulation from end of wire.

   b. Using-soldering set, tin the l-inch of bare wire.



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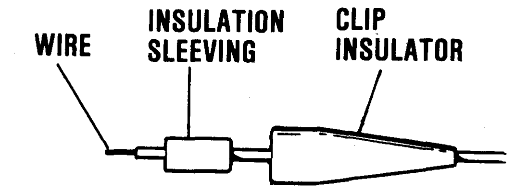
C. INSTALLATION

Install insulation.

a. Slide clip insulator onto wire.

b. Slide one-inch piece of insulation sleeving onto wire.

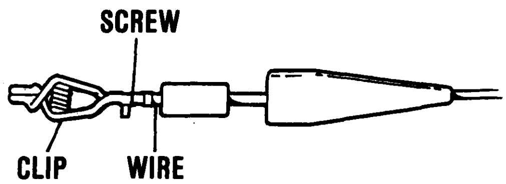


2. Install clip.

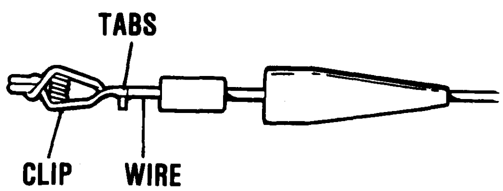
a. Wrap tinned end of wire under screw of clip.

b. Tighten screw, and secure wire.

c. Solder wire to clip. Apply solder to tinned end of wire and screw.

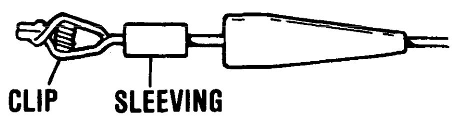


3. Secure clip. Secure clip using lons nose pliers; crimp tabs of clip over wire.



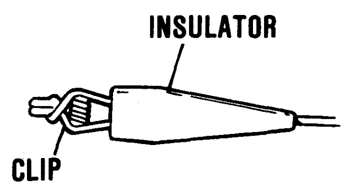
4. Insulate clip.

a. Slide insulation sleeving over tabs and screw.



b. Using heat gun, heat and shrink sleeving.

c. Slide clip insulator over clip.



END OF TASK

3-3-5. W2 CABLE REPAIR PROCEDURE 3-3-5

Common Tools: none

Materials/Parts:

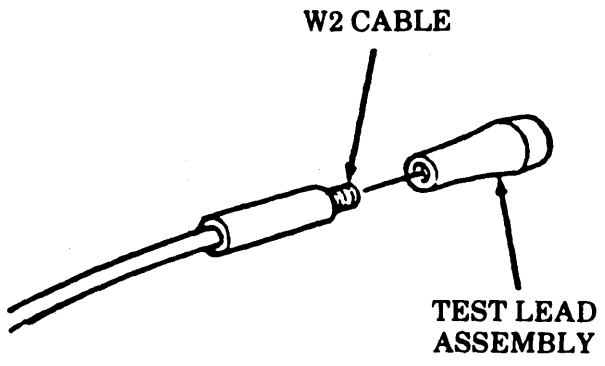
Test lead assembly, PN 12259302
Test lead assembly, PN 12259303

Equipment Condition:

Cable disconnected from VTM

1. Unscrew defective test lead assembly from W2 cable.

2. Screw new test lead assembly onto W2 cable.



END OF TASK

3-3-6. W2 CABLE ID TAG REPLACEMENT 3-3-6

Common Tools:

No. 1 common shop set

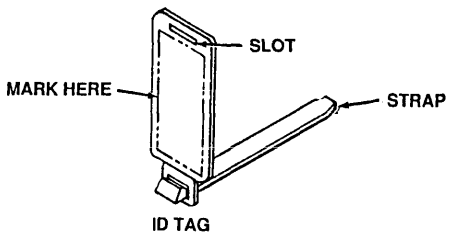
Materials/Parts:

ID tag MS 3368-1-0B

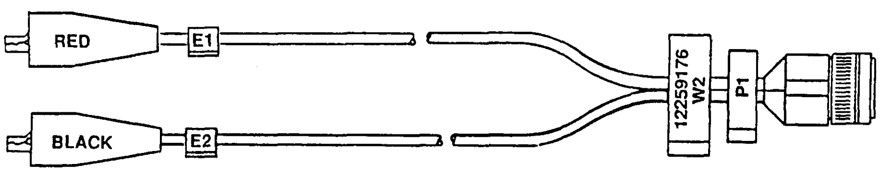
Equipment Condition:

Cable disconnected from VTM

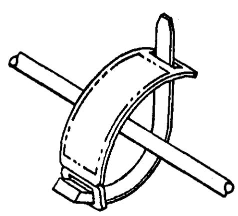
1. Remove defective tag by cutting off with diagonal pliers.



2. Mark replacement tag as necessary.



3. Attach tag to cable by looping strap through slot.



4. Cut off excessive strap with diagonal pliers.

END OF TASK

Appendix A - REFERENCES

A-1. SCOPE

This appendix lists all forms, pamphlets, technical manuals and bulletins referenced in this manual.

A-2. FORMS

Recommended Changes to DA Publications	DA Form 2028-2
Quality Deficiency Report	SF 368
Organizational Maintenance Requirements for STE/ICE-R	DA Form 12-38
	DA Form 2404

A-3. FIELD MANUALS

First Aid for Soldiers	FM 21-11

A-4. TECHNICAL MANUALS

Procedures for Destruction of Electronics Materiel To Prevent Enemy Use (Electronics Command)	TM 750-244-2

A-5. MISCELLANEOUS PUBLICATIONS

The Army Maintenance Management System (TAMMS)	DA Pam 738-750
Index of Technical Publications	DA Pam 25-30
Field Instructions for Painting and Preserving Electronic Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters	TB 43-0118
Expendable Items (except Medical, Class V, Repair Parts and Heraldic Items)	CTA 50-970

Appendix B - MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General.

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

B-2. **Maintenance Functions.** Maintenance functions will be limited to and defined as follows (except for ammunition MAC):

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

Exception is authorized for ammunition MAC to permit the redesignation/redefinition of maintenance function headings to more adequately identify ammunition maintenance functions. The heading designations and definitions will-be included in the appropriate technical manual for each category of ammunition.

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h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services[2] or other maintenance actions[3] to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to resotre an item to a completely serviceable/operational condition as prescribed by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

l. Fault Locate/Troubleshoot. The process of investigating and detecting the cause of equipment malfunctioning: the act of isolating a fault within a system or unit under test.

B-3. Explanation of Columns in the MAC, Section II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For detailed explanation of these functions, see Paragraph A-2.)

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to

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[2] Services - inspect, test, service, adjust, aline, calibrate, or replace.
[3] Actions - welding, grinding, riveting, straightening, facing, remachining, or resurfacing.

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perform the specific task identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

O. . . . . .Operator or crew/unit maintenance.
F. . . . . Direct support maintenance.
H . . . . .General support maintenance.
D . . . . .Depot maintenance.

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetical order, which shall be keyed to the remarks contained in Section IV.

B-4. Explanation of columns in Tool and Test Equipment Requirements, Section III.

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The national stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. Explanation of Columns in Remarks, Section IV.

a. Column 1, Reference Code. The code recorded in Column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

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Section II. MAINTENANCE ALLOCATION CHART FOR STE/ICE-R TEST SET

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
6715	VEHICLE TEST METER	Inspect	0.1	0.1		0.1		
		Test	0.1	0.1		0.1		(A)
		Fault Locate/ Troubleshoot	0.3	0.5		0.27		
		Repair	0.3	0.93		2.86		
		Calibrate		4.0		4.0		
		Reprogram		0.5		0.5		
	COMPUTER BOARD	Replace		0.1				
		Repair				1.0		
	SPECIAL FUNCTION BOARD	Replace		0.1				
		Repair				1.0		
		Calibration		4.0		4.0		
	MUX/ADCON BOARD	Replace		0.1				
		Repair				1.0		
		Calibration		4.0		4.0		
	CLOCK/DISPLAY DRIVER BOARD	Replace		0.1				
		Repair				1.0		
	I/O BOARD	Replace		0.1				
		Repair				1.0		
	DC/DC CONVERTER	Test		0.4				
		Replace		0.5				
	CAPACITOR BANK ASSEMBLY	Test		0.3				
		Replace		0.5				
	CURRENT PROBE	Inspect	0.1					
	VACUUM TRANSDUCER	Inspect	0.1					
	PRESSURE TRANSDUCER	Inspect	0.1					
	PRESSURE TRANSDUCER 10,000 PSI	Inspect	0.1					

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Section II. MAINTENANCE ALLOCATION CHART
FOR
STE/ICE-R TEST SET (Cont.)

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
6715	PULSE TACHOMETER	Inspect	0.1					
	IGNITION ADAPTER	Inspect	0.1					
	CABLE ASSEMBLY-W1	Inspect	0.1					
		Test	0.4					
	CABLE ASSEMBLY-W2	Inspect	0.1					
		Test	0.4					(B)
		Repair		0.5				(C)
	CABLE ASSEMBLY-W4	Inspect	0.1					
		Test	0.4					
	CABLE ASSEMBLY-W5	Inspect	0.1					
		Test	0.4					
		Repair	0.5					(B)
	CABLE ASSEMBLY-W3	Inspect	0.1					
		Test	0.4					
		Repair	0.5					(B)
	DISPLAY COVER	Inspect	0.1					
		Replace	0.1					
	DISPLAY	Inspect	0.1					
		Replace	0.1					
	TEST PROBE KIT	Inspect	0.1					
	TEST SWITCH	Inspect		0.1				
		Replace		0.7				
	TEST SELECT SWITCH	Inspect		0.1				
		Replace		0.7				
	TRANSDUCER TRAY W/COVER	Inspect	0.1					
	TRANSIT CASE	Inspect	0.1					

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Section II. MAINTENANCE ALLOCATION CHART
FOR
STE/ICE-R TEST SET (Cont.)

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY O	F	H	D	(5) TOOLS AND EQPT.	(6) REMARKS
6715	CIRCUIT BREAKER	Inspect Replace		0.1 0.4				
	INFORMATION CARD SET	Inspect Replace	0.1 0.2					
	IDENTIFICATION PLATE	Inspect Replace	0.1	 0.3				
	T-ADAPTER	Inspect Test		0.1 0.4				
	HOSE AND FITTING ASSEMBLY	Inspect Test	0.1 0.4					

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Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS FOR STE/ICE-R TEST SET

(NOT APPLICABLE)

Section IV. REMARKS

REFERENCE CODE	REMARKS
A	Confidence Test
B	Replace Alligator Clips Only
C	Replace Solder Lugs on Probe End

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Appendix C - ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

C-1 . SCOPE

This appendix lists additional items authorized for the support of your STE/ICE-R set.

C-2. GENERAL

This list identifies items that do not have to accompany the STE/ICE-R set and that do not have to be turned in with it. These items are authorized by CTA, MTOE, TDA, or JTA.

C-3. **EXPLANATION OF LISTING**

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e. CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST

(1) National Stock No.	(2) Description: (FSCM) and Part Number	(3) U/M	(4) Qty.
6685-01-193-1733	10,000 PSI Transducer: (19207) 12258956	EA	1

Appendix D - EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. SCOPE

This appendix lists the expendable/durable supplies and materials needed to operate and maintain the STE/ICE-R Test Set. These items are authorized by CTA 50-970, Expendable Items (except Medical, Class V, Repair Parts, and Heraldic Items).

D-2. EXPLANATION OF COLUMNS

a. Column 1, Item Number. This number is assigned to the entry in the listing. The item is referenced in the associated task sheet under "Supplies".

b. Column 2, Level. This column identifies the lowest level of maintenance that requires the listed item.

O- Organizational Maintenance

c. Column 3, National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column 4, Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parentheses followed by the part number.

e. Column 5, Unit of Measure (U/M). Indicates the measure used in performing the actual function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

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Section II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS

(1) Item No.	(2) Level	(3) National Stock No.	(4) Description	(5) U/M
1	0	6505-00-205-6513	Alcohol, Denatured	Qt.
2	0	3439-00-555-4629	Solder, Tin Alloy (81348) QQ-S-571	Lb.
3	0	6850-00-285-8011	Dry Cleaning Solvent, Type II (81348) P-D-680	Gal.
4	0	6850-00-192-8247	Cleaning Compound Solvent (81349) MIL-C-81302	Oz.
5	0	5970-00-102-4721	Sleeving, Insulation, Heat Shrink M23053/4-104-O	Ft.
6	0	9150-00-231-2356	Oil, Lubricating	Oz.

APPENDIX E
UNIT MAINTENANCE
REPAIR PARTS AND SPECIAL TOOLS LISTS

SECTION I. INTRODUCTION

1.Scope.

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of Unit Maintenance of the Simplified Test Equipment for Internal Combustion Engines (STE/ICE). It authorizes the requisitioning, issue, and disposition of spares, repair parts and special tools as indicated by the source, maintenance and recoverability (SMR) codes.

2.General

In addition to Section I Introduction, this Repair Parts and Special Tools List is divided into the following sections:

a. *Section II. Repair Parts List.* A list of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Bulk materials are listed in item name sequence. Repair kits are listed separately in their own functional group within Section II. Repair parts for repairable special tools are also listed in the section. Items listed are shown on the associated illustration(s)/figure(s).

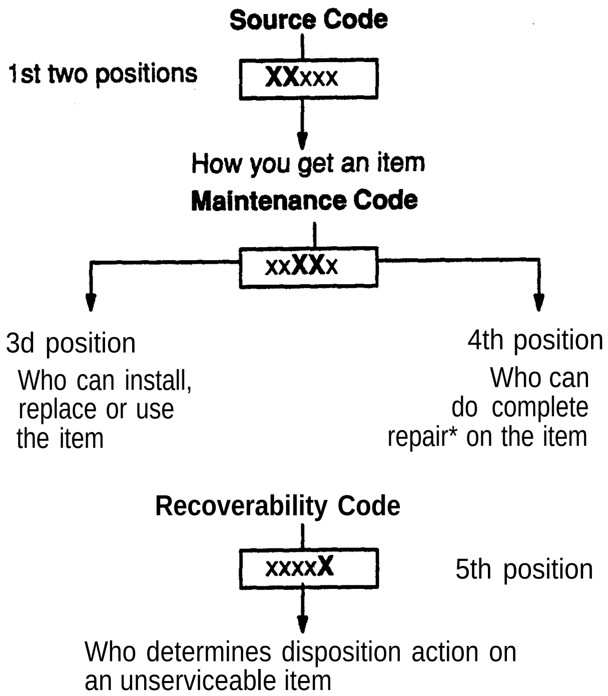
b. *Section III. Special Tools List.* A list of special tools, special TMDE, and other special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in DESCRIPTION AND USABLE ON CODE column) for the performance of maintenance.

c. *Cross-reference Indexes.* A list, in National Item Identification Number (NIIN) sequence, of all National stock numbered items appearing in the listing, followed by a list in alphanumeric sequence of all part numbers appearing; in the listings. National stock numbers and part numbers are cross-referenced to each illustration,figure and item number appearance. The figure and item number index lists figure and item numbers in alphanumeric sequence and cross-references NSN, FSCM and part numbers.

3. Explanation of Columns (Sections II and Ill).

a.ITEM NO. (Column (1)). Indicates the number used to identify items called out in the illustration.

b.SMR CODE (Column (2)). The Source, Maintenance, and Recoverability (SMR) code is a 5-position code containing supply/requisitioning information, maintenance category authorization criteria and disposition instructions, as shown in the following breakout:



**Complete Repair.* Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

(1) Source Code. The source code tells you how to get an item needed for maintenance, repair or overhaul of an end item/equipment. Explanations of source codes follows:

CODE	Application/Explanation
PA PB PC** PD PE PF PG	Stocked items; use the applicable NSN to request/requisition items with these source codes. They are authorized to the category indicated by the code entered in 3d position of the SMR code. **Items coded PC are subject to deterioration.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance category indicated in the 3d position of the SMR code. The complete kit must be requisitioned and applied.
MO- *(Made at UM AVUM Level)* MF-(Made *at DS/ AVUM Level)* ML -*(Made at Speclalized Repair Act (SRA))* MD -*(Made at Depot)*	Items with these codes are not to be requested/ requisitioned individually. They must be made from bulk material which is identi fied by the part number in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the Bulk Material group of the repair parts list in this RPSTL. If the item is authorized to you by the 3d position code of the SMR code, but if the source code indicates it is made at a higher level, order the item from the higher level of maintenance.
AO- *(Assembled by UM/AVUM Level)* AF- *(Assembled by DS/AVIM Level)* AH- *(Assembled by GS Category)* AL- *(Assembled by SRA)* AD-(Assembled *by Depot)*	Items with these codes are not to be requested/requisitioned individually The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3d position code of the SMR code by authorizes you to replace the item, but the source code indicates the item is assembled at a bled at a higher level, order the item from the higher level of maintenance.
XA -	Do not requisition an "XA"-coded Item.Order its next higher assembly. (Also, refer to the NOTE below.)
XB-	If an 'XB" item is not available from salvage order it using the CAGE and part number given
XC-	Installation drawing, diagram, instruction sheet, field service drawing, that is identified by the manufacturer's part number.
XD-	Item is not stocked. Order an "XD"-coded item through normal supply channels using the CAGE and part number given, if no NSN is available.

NOTE: Cannibalization or controlled exchange, when authorized, may be used as source of supply for items with the above source codes, except for those source coded 'XA" or those aircraft support items restricted by requirements of AR 700-42.

(2) Maintenance Code. Maintenance codes tell you the level(s) of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the SMR Code as follows:

(a) The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace and use an item. The maintenance code entered in the third position will indi cate authorization to one of the following levels of maintenance:

Code	Application/Explanation
C -	Crew or operator maintenance done within unit or aviation unit maintenance.
O -	Unit maintenance or aviation unit category can remove, replace and use the item.
F -	Direct support or aviation intermediate level can remove, replace and use the item.
H -	General support level can remove, replace and use the item.
L -	Specialized repair activity can remove, replace and use the item.

D – Depot level can remove, replace and use the item.

(b) The maintenance code entered in the fourth position tells whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (i.e., perform all authorized repair functions.) (NOTE: Some limited repair may be done on the item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.) This position will contain one of the following maintenance codes:

Code	Application/Exdanation
O -	Unit maintenance or Aviation unit is the low est level that can do complete repair of the item
F -	Direct support or aviation intermediate is the lowest level that can do complete repair of the item.
H -	General support is the lowest level that can do complete repair of the item.
L –	Specialized repair activity is the lowest level that can do complete repair of the item.
D -	Depot is the lowest level that can do complete repair of the item.
Z -	Nonreparable. No repair is authorized.
B -	No repair is authorized. (No parts or special tools are authorized for the maintenance of a “B” coded item). However, the item may be reconditioned by adjusting, lubrication, etc, at the user level.

(3) Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the SMR Code as follows:

Code	Application/Exdanation
Z -	Nonreparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in 3d position of the SMR code.
O-	Reparable item. When uneconomically reparable, condemn and dispose of the item at unit maintenance or aviation unit level.
F -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support or aviation intermediate level.
H -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level
D -	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item not authorized below depot ievel.
L –	Reparable item. Condemnation and disposal of item not authorized below specialized repair activity (SRA).
A –	item requires special handling or con–demnation procedures because of spe-cific reasons (e.g., precious metal con-tent, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. *FSCM (Cohumn* (3)). The Federal Supply Code for Manufacturer (FSCM) is a 5-digit numeric code which is used to identify the manufacturer, distributor or Government agency, etc., that supplies the item.

d. *PART NUMBER (Column* (4)). Indicates the primary number used by the manufacturer (individual, company, firm, corporation or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards and inspection requirements to identify an item or range of items.

NOTE: When you use a NSN to requisition an item, the item you receive may have a different part number from the part ordered.

e. *DESCRIPTION AND USABLE ON CODE (UOC) (Column (5)).* This column includes the following information:

(1) The Federal item name and, when required, a minimum description to identify the item.

(2) Physical security classification. Not applicable.

(3) Items that are included in kits and sets are listed below the name of the kit or set on Figure KIT.

(4) Spare/repair parts that make up and assembled item are listed immediately following the assembled item iine entry.

(5) Part numbers for bulk materials are referenced in this column in the line item entry for the item to be manufactured/fabricated.

(6) When the item is not used with all serial numbers of the same model, the effective serial numbers are shown on the last line(s) of the description (before UCIC). Not applicable.

(7) The usable on code, when applicable (see paragraph 5, Special information).

(8) In the Special Tools List section, the basis of issue (BOI) appears as the last line(s) in the entry for each special tool, special TMDE and other special support equipment. When density of equipments supported exceeds density spread indicated in the basis of issue, the total authorization is increased proportionately.

(9) The statement "END OF FIGURE" appears just below the last item description in Column 5 for a given figure in both Section II and Section Ill.

f. QTY (Column (6)). The QTY (quantity per figure column) indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group or an assembly. A "V" appearing in this column in lieu of a quantity indicates that the quantity is variable and the quantity may vary from application to application.

4. **Explanation of Columns** (Section IV).

a. *NATIONAL STOCK NUMBER (NSN) INDEX.*

(1) STOCK NUMBER column. This column lists the NSN by National item identification number (NIIN) sequence. The NIIN consists of the last nine

NSN

digits of the NSN (i.e., 5305-01-674-1467)

NIIN

When using this column to locate an item, ignore the first 4 digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

(2) FIG. column. This column lists the number of the Figure where the item is identified/located. The figures are in numerical order in Section II and Section Ill.

(3) ITEM column. The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

b. *PART NUMBER INDEX.* Part numbers in this index are listed by part number in ascending alphanumeric sequence (i.e., vertical arrangement of letter and number combination which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order.)

(1) FSCM column. The Federal Supply Code for Manufacturer (FSCM) is a 5 digit numeric code used to identify the manufacturer, distributor or Government agency, etc., that supplies the item.

(2) PART NUMBER column. Indicates the primary number used by the manufacturer (individual, firm, corporation or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements to identify an item or range of items.

(3) STOCK NUMBER column. This column lists the NSN for the associated part number and manufacturer identified in the PART NUMBER and FSCM columns to the left.

(4) FIG. column. This column lists the number of the figure where the item is identified/located in Section II and Ill.

(5) ITEM column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

c. *FIGURE AND ITEM NUMBER INDEX.*

(1) FIG. column. This column lists the number of the figure where the item is identified/located in Section II and Ill.

(2) ITEM column. The item number is that number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

(3) STOCK NUMBER column. This column lists the NSN for the item.

(4) FSCM column. The Federal Supply Code for manufacturer (FSCM) is a 5 digit numeric code used to identify the manufacturer, distributor or Government agency, etc., that supplies the item.

(5) PART NUMBER column. Indicates the primary number used by the manufacturer (individual, firm, corporation or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards and inspection requirements to identify an item or range of items.

5. Special Information.

Use the following subparagraphs as applicable:

a. *USABLE ON CODE.* Not Applicable.

b. *FABRICATION INSTRUCTIONS.* Bulk materials required to manufacture items are listed in the Bulk Material Functional Group of this RPSTL. Part numbers for bulk materials are also referenced in the description column of the line item entry for the item to be manufactured/fabricated.

c. *ASSEMBLY INSTRUCTION.* Items that make up the assembly are listed immediately following the assembly item entry or reference is made to an applicable figure.

d. *KITS.* Line item entries for repair parts kits appear in group 9401 in Section II.

e. *INDEX NUMBERS.* Items which have the word BULK in the figure column will have and index number shown in the item number column. This index number is a cross-reference between the National Stock Number/Part Number Index and the bulk material list in Section II.

f. *ASSOCIATEDPUBLICATIONS.The* publications listed below pertain to the Simplified Test Equipment for Internal Combustion Engines (STE/ICE), and its components:

Publication	Short Title
TM 9-4910-571-12&P	STE/ICE-R
TB 9-4910-555-35	STE/ICE-R
MWO 9-4910-571-35	STE/ICE-R
DMWR 9-4910-571	STE/ICE-R

6. How to Locate Repair Parts.

a. When National stock Number or Part Number is Not Known.

(1) First. Using the table of contents, determine the assembly group or subassembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and listings are divided into the some groups.

(2) Second. Find the figure covering the assembly group or subassembly group to which the item belongs.

(3) Third. Identify the item on the figure and use the Fgure and Item Number Index to find the NSN.

b. When National Stock Numbefor Part Number is Known.

(1) First. Using the National Stock Number or the Part Number Index, find the pertinent National Stock Number or Part Number. The NSN index is in National Item Identification Number (NIIN) sequence (see 4.a(1)). The part numbers in the Part Number index are listed in ascending alphanumeric sequence (see 4. b). Both indexes cross-reference you to the illustratiotiigure and item number of the item you are looking for.

(2) Second. Turn to the figure and item number, verify that the item is the one you're looking for, then locate the item number in the repair parts list for the figure.

7. Abbreviations.

For standard abbreviations see MIL-STD-12D, Military Standard Abbreviations For Use On Drawings, Specifications, Standards And In Technical Documents.

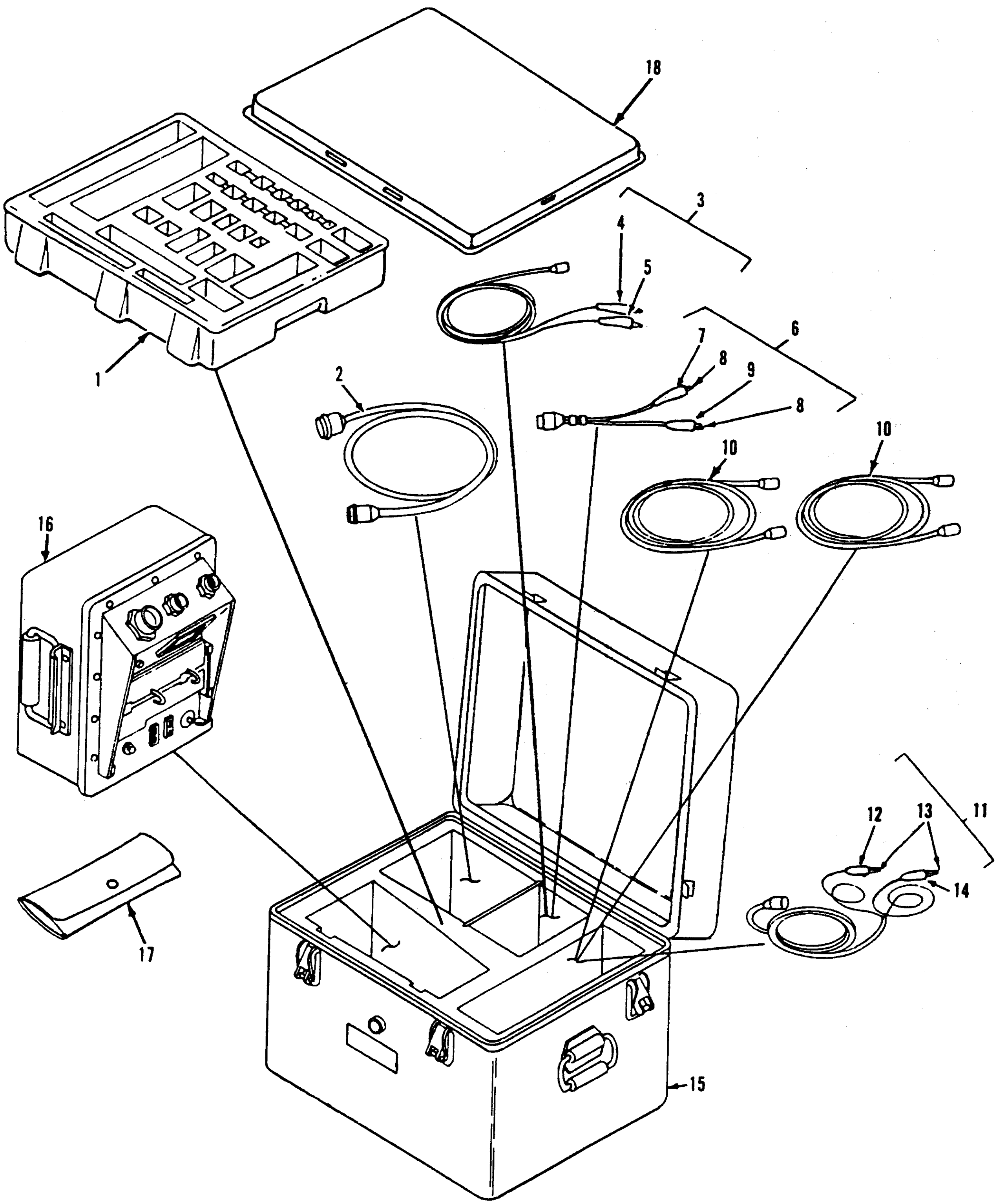


FIGURE 1. VTM/TRANSDUCER KIT ASSEMBLY.

F Repairable item. When uneconomically repairable, condemn and dispose at the direct support level.

H Repairable item. When uneconomically repairable, condemn and dispose at the general support level.

D Repairable item. When beyond lower level repair capability, return to depot. Condemnation and disposal not authorized below depot level.

L Repairable item. Repair, condemnation, and disposal not authorized below depot/specialized repair activity level.

A Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar value, critical material or hazardous material). Refer to appropriate manuals/directives for specific instructions.

c. **National Stock Number.** Indicates the National Stock Number assigned to the item and which will be used for requisitioning.

d. **Part Number.** Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of Its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

NOTE

When a stock numbered item is requisitioned, the item received may have a different part number than the part being replaced.

e. **Federal Supply Code for Manufacturer (FSCM).** The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

f. **Description.** Indicates the Federal item name and, if required, a minimum description to identify the item. The physical security classification of the item is indicated by the parenthetical entry (e.g., Phy Sec Cl (C)-Confidential, Phy Sec Cl (S)-Secret, Phy Sec Cl (T)-Top Secret). Items that are included in kits and sets are listed below the name of the kit or set with the quantity of each item in the kit or set indicated in the quantity incorporated in unit column. When the part to be used differs between serial numbers of the same model, the effective serial numbers are shown as the last line of the description. In the Special Tools List, the initial basis of issue (BOI) appears as the last line in the entry for each special tool, special TMDE, and other special support equipment. When density of equipments supported exceeds density spread indicated in the basis of issue, the total authorized is increased accordingly.

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g. Unit of Measure (U//M). Indtes the standard of the basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

h. Quantity Incorporated in Unit. Indicates the quantity of the item used in the breakout shown on the illustration figure. which is prepared for a functional group, subfunctional group, or an assembly. A “V” appearing in this column in lieu of a quantity indicates that no specific quantity of applicable, (e.g., shims, spacers, etc.).

E-4. SPECIAL INFORMATION

a. Action change codes indicated in the left hand margin of the listing page denote the following:

N - Indicates an added item
C - Indicates a change in data
R - Indicates a change In NSN only

b. The illustrations in this appendix are identical to those published in TM 9-4910-571-34&P. Only those parts assigned the third position SMR maintenance code C or O are listed in the tabular listing: therefore, there may be a break in the item number sequence. Only illustrations containing organizational authorized items appear in this appendix.

E-5. HOW TO LOCATE REPAIR PARTS

a. When National Stock Number or part Number is Unknown.

(1) Using the table of contents, determine the functional group within which the item belongs. This is necessary since illustrations are prepared for functional groups and listings are divided into the same groups. This manual contains only one functional group (6715).

(2) Find the illustration covering the applicable functional group to which the item belongs.

(3) Identify the item on the illustration and note the illustration figure and item number of the item.

(4) Using the Repair Parts Listing, find the figure and item number noted on the illustration.

b. When National Stock Number or Part Number is Known.

(1) Using the Index of National Stock Numbers and Part Numbers, find the pertinent National stock number or part number. This index is in NIIN

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sequence followed by a list of part numbers in alphanumeric sequence, cross-referenced to the illustration figure number and item number.

(2) After finding the figure and item number, locate the figure and item number in the repair parts list.

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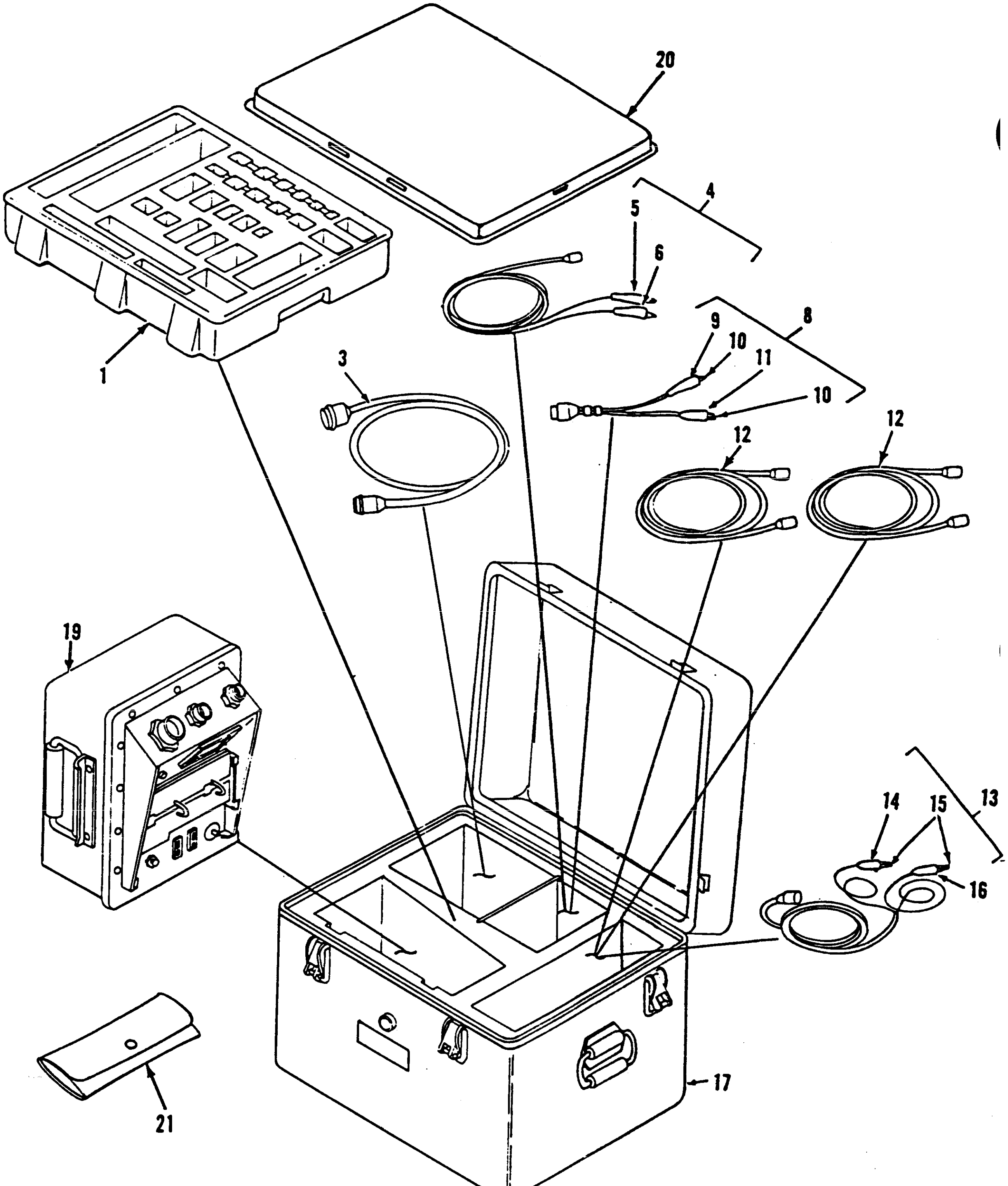

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SECTION II. REPAIR PARTS LIST

(1) ILLUSTRATION (a) FIG NO	(b) ITEM NO	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP 6715: VTM/TRANSDUCER KIT ASSEMBLY		
1	1	PBOZZ	4910-01-058-9998	12258874	19207	TRAY, TRANSDUCER KIT	EA	1
1	3	PAOZZ	4910-01-057-5818	12258784	19207	CABLE ASSEMBLY, POWER W1	EA	1
1	4	PEOOO	4910-01-054-9746	12259176	19207	CABLE ASSEMBLY, SPEC W2	EA	1
1	5	PAOZZ		12259302	19207	TEST CLIP ASSEMBLY (E1)	EA	1
1	6	PAOZZ		12259303	19207	TEST CLIP ASSEMBLY (E2)	EA	1
1	8	PEOOO	4910-01-054-9747	12258787	19207	CABLE ASSEMBLY, SPEC W3	EA	1
1	9	PAOZZ	5935-01-102-7268	11669230-3	19207	SHELL, ELECTRICAL CO	EA	1
1	10	PAOZZ	5999-01-102-6938	11669233	19207	CLIP, ELECTRICAL	EA	2
1	11	PAOZZ	5935-01-102-7269	11669230-4	19207	SHELL, ELECTRICAL CO	EA	1
1	12	PAOZZ	4910-01-057-5819	12258786	19207	CABLE ASSEMBLY, POWER W4	EA	2
1	13	PAOOO	4910-01-054-9744	12258788	19207	CABLE ASSEMBLY, POWER W5	EA	1
1	14	PAOZZ	5935-01-102-7270	11669230-5	19207	SHELL, ELECTRICAL CO	EA	1
1	15	PAOZZ	5999-01-124-0071	570431	21450	CLIP, ELECTRICAL	EA	2
1	16	PAOZZ	5935-01-102-7271	11669230-6	19207	SHELL, ELECTRICAL CO	EA	1
1	17	PAOZZ	4910-01-052-5647	12258873	19207	CASE, TEST SET	EA	1
1	19	PAOFD	4910-01-052-5643	12259265	19207	TEST METER ASSEMBLY STE/ICE-R	EA	1
1	20			12259316	19207	COVER ASSEMBLY , TRANSDUCER KIT	EA	1
1	21		6625-01-121-0510	12259310	5R542	TEST PROBE KIT	EA	1

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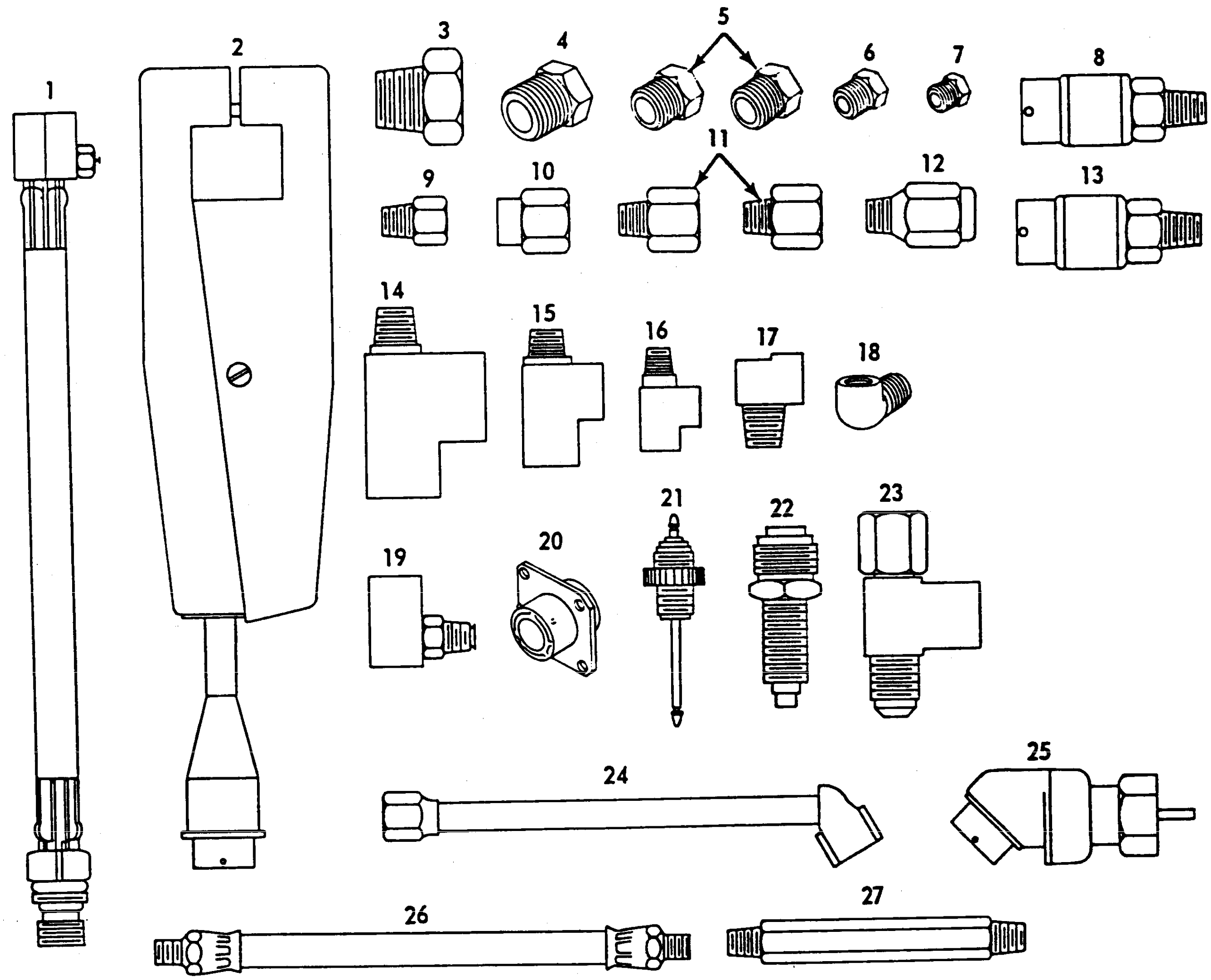

Figure 2. Transducer Kit (TK) Components.

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(1) ILLUSTRATION (a) FIG NO	(b) ITEM NO	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP 6715: TRANSDUCER KIT (TK) COMPONENTS		
2	1	PAOZZ	4720-01-070-8806	11669227	19207	HOSE ASSEMBLY, NONMET: TK10	EA	1
2	2	PAOZZ	6625-01-059-4279	12258878	19207	PROD. TEST DC AND AC CURRENT: TK11	EA	1
2	3	PAOZZ	4730-01-070-2031	12258853-1	19207	REDUCER, SOIL PIPE: TK12	EA	1
2	4	PAOZZ	4730-01-069-3369	12258853-3	19207	REDUCER, SOIL PIPE: TK13	EA	1
2	5	PAOZZ	4730-01-069-3370	12258853-2	19207	REDUCER, SOIL PIPE: TK14	EA	2
2	6	PAOZZ	4730-00-132-4625	444620	93334	PLUG, PIPE: TK15	EA	1
2	7	PAOZZ	4730-00-287-3281	5327970	19207	PLUG, PIPE: TK16	EA	1
2	8	PAOZZ	5999-01-067-8954	12258876	19207	TRANSDUCER, PRESSURE 0 TO 1000 PSIG BLUE: TK17	EA	1
2	9	PAOZZ	4730-00-288-9953	187343	12204	ADAPTER, STRAIGHT: TK18	EA	1
2	10	PAOZZ	4730-01-109-2309	444104	24617	REDUCER, PIPE: TK19	EA	1
2	11	PAOZZ	2540-00-623-8303	444012	31007	REDUCER, PIPE: TK20	EA	2
2	12	PAOZZ	5340-01-069-3385	12258881	19207	DAMPENER, FLUID PRES: TK21	EA	1
2	13	PAOZZ	5999-014)67-8952	12258877	19207	TRANSDUCER, PRESSURE, MINUS 30 INCHES HG TO PLUS 25 PSIG RED: TK22	EA	1
2	14	PAOZZ	4730-00-540-2745	444152 444550	24617	TEE, PIPE: TK23	EA	1
2	15	PAOZZ	4730-01-090-7623	8366166	19207	TEE, PIPE: TK24	EA	1
2	16	PAOZZ	4730-00-263-2733	547002	19207	TEE, STREET: TK25	EA	1
2	17	PAOZZ	4730-01-070-2030	12258879-2	19207	ELBOW, PIPE: TK26	EA	1
2	18	PAOZZ	4730-01-069-3367	12258879-1	19207	ELBOW, PIPE: TK27	EA	1
2	19	PAOZZ	4730-01-075-2815	12258762	19207	TEE. PIPE TO TUBE: TK28	EA	1
2	20	PAOZZ	5935-00-879-8512	MS3119E-14-19PS	96906	ADAPTER, CONNECTOR: TK29	EA	1
2	21	PAOZZ	5935-01-094-6711	7540877	19204	ADAPTER, CONNECTOR	EA	1
2	22	PAOZZ	6680-00-462-2252	MS53099-2	96906	ADAPTER, SPEEDOMETER: TK31	EA	1
2	23	PAOZZ	4730-01-069-8853	12258880	19207	TEE, PIPE TO TUBE FUEL LINE: TK32	EA	1
2	24	PAOZZ	4730-00-174-4584	8840543	53477	CHUCK, AIR, INFLATING: TK33	EA	1
2	25	PAOZZ	4910-01-060-7175	12258875	19207	TACHOMETER, PULSE: TK34	EA	1
2	26	PAOZZ	4720-01-070-8805	11669236	19207	HOSE ASSEMBLY, NONMET FLEXIBLE: TK35	EA	1
2	27	PAOZZ	4730-01-075-2814	12258852	19207	NIPPLE, PIPE: TK36	EA	1

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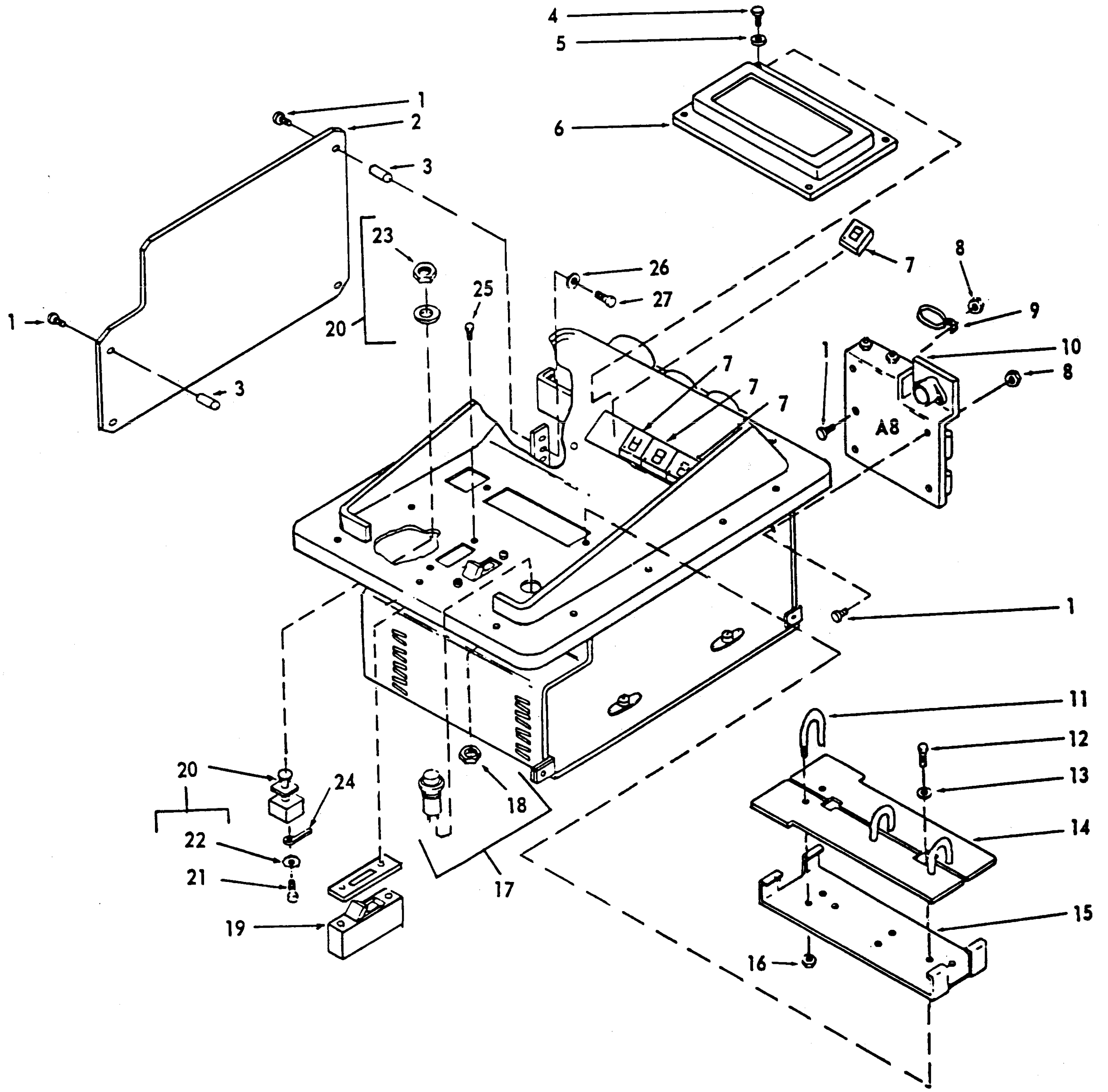

Figure 3. VTM Panel and Nest.

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(1) ILLUSTRATION (a) FIG NO	(b) ITEM NO	(2) SMR CODE	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION USABLE ON CODE	(7) U/M	(8) QTY INC IN UNIT
						GROUP 6715: VTM PANEL AND NEST		
3	4	PAOZZ	5305-00-459-4687	MS51957-14B	96906	SCREW, MACHINE PAN HEAD	EA	4
3	5	PAOZZ	5310-00-057-0573	NAS620C4	80205	WASHER, FLAT	EA	4
3	6	PAOZZ	7460-01-067-8946	12258827	19207	COVER , DISPLAY ASSEMBLY	EA	1
3	7	PAOZZ	5999-01-068-1084	11669222	19207	INDICATOR, DIGITAL	EA	4
3	11	PAOZZ	5315-01-069-3377	12258794	19207	PIN, CARD HOLDING	EA	3
3	12	PAOZZ	5305-00-448-6547	MS51957-27B	96906	SCREW, MACHINE	EA	2
3	13	PAOZZ	5310-00-773-7624	NAS620C6	80205	WASHER, FLAT	EA	2
3	14	PBOZZ		12259300	19207	CARD SET, INSTRUCTIONS	EA	1
3	15	PFOZZ	5340-01-102-6872	12258795	19207	BASE, CARD HOLDER	EA	1
3	16	PAOZZ	5310-00-845-2359	NAS1291C04M	80205	NUT, SELF-LOCKING	EA	3

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Section III. SPECIAL TOOLS LIST

(Not Applicable)

Section IV. NATIONAL STOCK NUMBER AND PART NUMBER INDEX

NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
4730-00-012-7951	2	6
4730-00-014-6763	2	15
5310-00-057-0573	3	5
4730-00-174-4584	2	24
4730-00-260-1483	2	10
4730-00-287-3281	2	7
5305-00-448-6547	3	12
5305-00-459-4687	3	4
6680-00-462-2252	2	22
4730-00-529-1487	2	11
4730-00-540-2745	2	14
5310-00-773-7624	3	13
5310-00-845-2359	3	16
5935-00-879-8512	2	20
4910-01-052-5643	1	19
4910-01-052-5647	1	17
4910-01-054-9744	1	13
4910-01-054-9746	1	4
4910-01-054-9747	1	8
4910-01-057-5818	1	3
4910-01-057-5819	1	12
4910-01-058-9998	1	1
6625-01-059-4279	2	2
4910-01-060-7175	2	25
7460-01-067-8946	3	6
5999-01-067-8952	2	13
5999-01-067-8954	2	8
5999-01-068-1084	3	7
4730-01-069-3367	2	18
4730-01-069-3369	2	4
4730-01-069-3370	2	5
5315-01-069-3377	3	11
5340-01-069-3385	2	12
4730-01-069-8853	2	23
4730-01-070-2030	2	17
4730-01-070-2031	2	3
4720-01-070-8805	2	26
4720-01-070-8806	2	1
4730-01-075-2814		27
4730-01-075-2815		19
5935-01-094-6711		21
5340-01-102-6872		15
5999-01-102-6938	1	7
5999-01-102-6938	1	10

REFERENCE NO.	MFG CODE	FIGURE NO.	ITEM NO.
MS3119E-14-19	96906	2	20
MS51957-14B	96906	3	4
MS51957-27B	96906	3	12
MS53099-2	96906	2	22
NAS1291C04M	80205	3	16
NAS620C4	80205	3	5
NAS620C6	80205	3	13
11669222	19207	3	7
11669227	19207	2	1
11669230-3	19207	1	5
11669230-3	19207	1	9
11669230-4	19207	1	6
11669230-4	19207	1	11
11669230-5	19207	1	14
11669230-6	19207	1	16
11669233	19207	1	7
11669233	19207	1	10
11669236	19207	2	26
12258762	19207	2	19
12258770	19207	1	19
12258784	19207	1	3
12258785	19207	1	4
12258786	19207	1	12
12258787	19207	1	8
12258788	19207	1	13
12258794	19207	3	11
12258795	19207	3	15
12258827	19207	3	6
12258852	19207	2	27
12258853-1	19207	2	3
12258853-2	19207	2	5
12258853-3	19207	2	4
12258873	19207	1	17
12258874	19207	1	1
12258875	19207	2	25
12258876	19207	2	8
12258877	19207	2	13
12258878	19207	2	2
12258879-1	19207	2	18
12258879-2	19207	2	17
12258880	19207	2	23
12258881	19207	2	12
12258948	19207	3	14
12259001	19207	1	2

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Section IV. NATIONAL STOCK NUMBER AND PART NUMBER INDEX (continued)

NATIONAL STOCK NUMBER	FIGURE NO.	ITEM NO.
7690-01-102-7177	3	14
5935-01-102-7268	1	5
5935-01-102-7268	1	9
5935-01-102-7269	1	6
5935-01-102-7269	1	11
5935-01-102-7270	1	14
5935-01-102-7271	1	16

REFERENCE NO.	MFG CODE	FIGURE NO.	ITEM NO.
2010918	10001	2	6
234x5	79470	2	9
3204x2	79470	2	11
3304x2	79470	2	10
3750X4	79470	2	15
444152	24617	2	14
5327970	19207	2	7
547002	24617	2	16
570431	21450	1	15
7540877	19207	2	21
8840543	53477	2	24

Appendix F - Vehicle Test Procedures

All test procedures can be found in the vehicle/equipment technical manuals.

Appendix G - Vehicle Test Cards

The Vehicle Test Card (VTC) is intended as a quick reference for those users already familiar with the STE/ICE-R operation. It provides hookup information for many of the most common VTM tests on the vehicle.

There are two different types of vehicle test cards, TK and DCA. The following discussion describes each type separately, and provides information on how to utilize the card for making measurements.

The front of the test card contains all of the information, in abbreviated format, needed to perform common measurements.

The top of the card describes the VTM power up sequence. Next, is a list of measurements useful in troubleshooting the vehicle. The table includes: the VTM test number, any offset test limits, operating condition of the engine, special connections required, the limits for pass or fail, and the units of measurement. Also included on the front of the card are hookup diagrams.

The order of listing allows measurements with the vehicle engine turned off to be performed first. This will insure that the starting system is in working order before proceeding. The order of the other measurements is as follows:

- Measurements with the engine running but not warm
- Measurements requiring the engine to be warm and running
- Measurements requiring the engine to be warm and not running
- Miscellaneous measurements

The VTC contains special hookups and hookups for measurements used to troubleshoot vehicle components. These hookups should be used with the procedures in the vehicle TM. A VTC for a DCA vehicle will have a separate table for each DCA connector.

The Vehicle Test Cards can be found in the vehicle/equipment technical manuals.

Appendix H - BATTERY TEST CARDS

The STE/ICE-R battery test procedures allow the user to evaluate the condition and state of charge of vehicle/equipment batteries. These procedures use the battery internal resistance and battery resistance change measurements. Battery internal resistance evaluates the state of charge of the battery. Battery resistance change evaluates the battery condition.

Battery state of charge is a measure of the amount of energy stored in the battery. A fully charged battery contains the maximum amount of energy stored. If the battery fails the battery state of charge evaluation, the battery may be recharged to return the battery to full charge.

The battery condition is a measure of the battery's ability to accept and maintain a good charge. A battery in poor condition may be able to be fully recharged. However, a battery in poor condition with a full charge will lose its charge more quickly than a battery in good condition with a full charge. If a battery fails the battery condition evaluation, then the battery should be replaced.

The procedures for testing batteries are listed on three battery test cards. Each card describes procedures for evaluating different combinations of batteries:

- Complete battery pack
- Series pair of batteries
- Individual batteries

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A. BATTERY PACKS

A battery pack is the combination of four of more batteries in a particular circuit of a vehicle/equipment, i.e. the starting circuit. Testing the batteries in a pack evaluates the general condition of the pack as a whole. Note, the results of a battery pack test may be misleading. A single battery from a pack of four may be bad even though the pack as a whole may pass the tests. This can happen if the other three batteries in the pack are in very good condition. In order to test a battery pack, the current probe must be clamped around a single cable carrying all of the starter current. If such a connection cannot be made, then test each series pair of batteries separately.

B. SERIES PAIRS

A series pair is one in which the negative terminal of one battery is connected by a cable to the positive terminal of another battery. This test configuration should be used when any of the following conditions exists:

- There are only two batteries (one series pair) in the vehicle/equipment.
- An evaluation of the pack is desired, but the current probe cannot measure the total starter current. This condition can occur if the cable is not readily accessible or if the cable is physically too large.
- The battery pack test has failed, and the user wants to further identify any bad battery pair.

  Note, testing each series pair yields a better evaluation than testing the pack as a whole.

C. INDIVIDUAL BATTERIES

An individual battery test refers to the process of testing one battery at a time. The battery could be part of a pack, a series pair, or a single battery. Test the batteries individually if a battery series pair failed the tests and it is desired to isolate to a single battery (or if there is only one battery in the circuit). Testing individual batteries gives the best evaluation.

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D. DESCRIPTION OF TEST CARDS

The front of each test card has three sections. The top of the card explains how to connect the VTM to the batteries being tested. The middle part of the card describes the procedure to follow in order to evaluate the batteries. The bottom of the card contains illustrations showing typical vehicle hookups.

The back of each card also has three sections. The upper left-hand block lists the possible VTM displays and explains their meanings. This block suggests corrective action for the user. The right-hand side of the card contains battery test limits for three common military batteries. These limits may be used if the vehicle/equipment TM does not provide limits. The lower left-hand portion of the card contains a table showing how to apply the limits to evaluate the battery condition and state of charge.

E. PROCEDURE TO MAKE A BATTERY EVALUATION

1. **Use procedure on battery test card to hook-up VTM.** The following information will enable the user to determine the correct tests to use:

   a. Use test series 73 and 75 for the following conditions:

      (1) Testing a battery pack that is also powering the VTM

      (2) Testing a battery series pair that is also powering the VTM

      (3) Testing an individual battery that is the only battery in the circuit and is powering the VTM

   b. Use test series 77 and 79 for the following conditions:

      (1) Testing a battery pack that is not powering the VTM

      (2) Testing a battery series pair that is not powering the VTM

      (3) Testing an individual battery that is not the only battery in a circuit or is not powering the VTM

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2. **Use test procedure on battery test card to complete evaluation.**

a. Evaluate battery condition using battery resistance change test (#75 or #79). Note the result.

b. Evaluate battery state of charge using the battery internal resistance test (#73 or #77). Note the result.

c. Compare test results to limits in vehicle/equipment TM. If vehicle/equipment TM does not have test limits, use test limits provided in this section. If the battery internal resistance test passes, then the batteries are fully charged. If the battery internal resistance test fails, then the batteries are not adequately charged. If the battery resistance change test passes, then the batteries are good and will retain their charge. If the battery resistance change test fails, then the batteries are bad and will not retain their charge.

d. If batteries are out of limits, perform one or all of the following:

(1) Check battery electrolyte level.

(2) Check battery connections and terminals. Clean or tighten if necessary. Check connections between VTM and batteries.

(3) Refer to vehicle/equipment TM to check battery specific gravity.

(4) Repeat battery resistance change and internal battery resistance tests one time. If internal battery resistance result (test #73 or #77) is out of limits, then charge batteries. If battery resistance change result (test #75 or #79) Is out of limits, then continue testing to isolate bad batteries.

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STE/ICE-R BATTERY PACK TEST CARD

The BATTERY INTERNAL RESISTANCE TEST (73 or 77) evaluates the state of charge of an Individual battery. The BATTERY RESISTANCE CHANGE TEST (75 or 79) evaluates whether the ballery is good or bad, even if It is discharged. A good battcry that is discharged bay be recharged, A bad battery may hold a charge for a short time.

STE/ICE HOOKUP

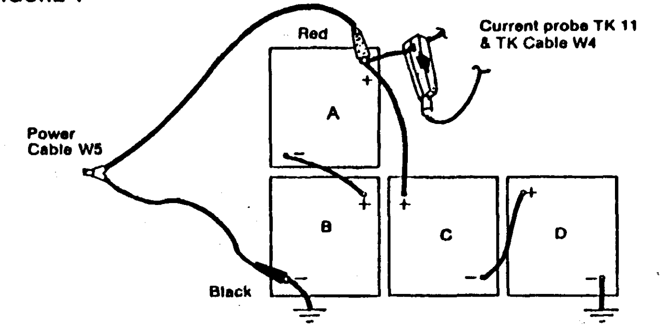
1. The power to operate the STE/fCE-R VTM maybe taken from the batteries bolng tested as shown in the appropriate figure below or from an alternate power source (such as another vehicle's batteries).
2. Perform VTM general setup; run confidence test.
3. n. If power to the VTM comes from a different sot of batteries then the battery pack under test. use tests 77 and 79. Connect test probe cable W2 to the battery pack under lost. Connect the red clip to the positive termlnal Closest to the starter. Connect the black clip to the negative terminal closest to vehicle/equipment ground.

   b. If power to the VTM comes from the battery peck under tests, use tests 73 and 75. The test probe cable W2 is not used.
4. Clamp the current probe around the positive cable connected to the starter. Point the arrow on the current probe along the cable leading towards the starter as shown in figure 1.

TEST PROCEDURE

1. Condition the current probe before running these tests.
2. Measure the battery resistance change by entering test number 75 or 79 (as described in the hookup procedure). Then engage the starter for about 5 seconds.
3. Measure the battery internal resistance by entering test number 73 or 77 (as described in the hookup procedure). Then engage the starter for about 5 seconds
4. Compare the results of both measurements to limits in the vehicle/equipment TM or to limits on the reverse side of this card.
5. If either measurement is out side of normal limits, check battery terminals and connections. and check battery electrolyte level. Then perform both measurements a second time,
6. If the battery resistance change test (75 or 79) fails after the second measurement, then the battery pack is in bad condition. Test each series pair to determine which is good and which is bad.
7. If the battery internal resistance test (73 or 77) falls after the second measurement, then the battery should be recharged.

FIGURE 1



STE/ICE-R BATTERY PACK TEST CARD

BATTERY TEST RESULTS

STE/ICE DISPLAY AFTER TEST	WHAT IT MEANS
GO.	1. The battery in series with the battery under test may be bad. Check that battery next. 2. There is a bad connection in the starter circuit somewhere. Check the battery negative cables, and cables to the starter for corroded or loose connections. If all of the cables and connections are o.k., then the starter Is possibly faulty.
.9.9.9.9.	1. There Isa bad connection on the battery being tested. Clean and tighten the posts and clamps, and check the cable between the batteries. 2. The battery under test Is In extremely poor condition.
14.2.	If any number is displayed, then the number is a STE/CE-R test result. Compare the lest result to the values shown along the right edge of this card to determine a pass or fail. See table below to determine the condition of the battery,
E013	1. The battery being tested may be in a discharged state. Check battery electrolyte level; charge battery, and then retest. 2. If display shows E013 after battery has been charged, then the battery is in poor condition.
E002	The current probe is not connected. Connect current probe.
E005	Offset lest for current probe has not been performed. Perform current probe offset test.
E008	Test leads are Improperly connected, Check test teads.

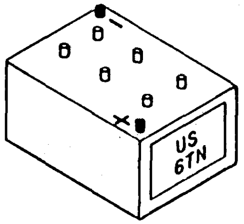
BATTERY CONDITION

TEST 77 BATTERY INTERNAL RESISTANCE TEST RESULT	TEST 79 BATTERY RESISTANCE CHANGE TEST RESULT	BATTERY CONDITION
PASS	PASS	The battery tested is o.k. and in good state of Charge.
PASS	FAIL	The battery tested is in poor condition, but has a fresh charge
FAIL	PASS	The battery tested is o.k., but need a to be recharged.
FAIL	FAIL	The battery tested is in poor condition and in a state of discharge.

TEST LIMITS

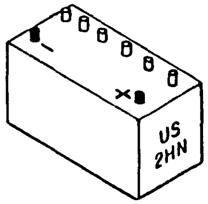
Battery Test Limits for a Four Battery Pack

For Type 6TN Batteries



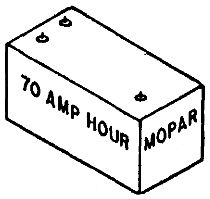
STE/ICE-RTest No.	Maximum Acceptable Value 10 Pass Tesl
Battery Internal Resistance Test 77	13 Millohms max
Battery Resistance Change Test 79	25 Millohms/Sec max

For Type 2HN Batteries



STE/ICE-R TEST No.	Maximum Acceptable Value to Pass Test
Battery Internal Resisance Test 77	25 Millohms max
Battery Resistance Change Test 79	70 Millohms/Sec max

For Commerlcal 12 volt batteries in M880 vehicles



STE/ICE TEST No.	Maximum Acceptable Value to Pass Test
Battery Internal Resistance Test 77	13 Milliohms max
Battery Resistance Change Test 79	50 Milliohms/Sec max

When a vehicle has more than four batteries In a pack, it is usually easier to test each series pair separately.

STE/ICE-R BATTERY SERIES PAIR TEST CARD

THE BATTERY INTERNAL RESISTANCE TEST (73 or 77) evaluates the state of charge of the battery series pair. The BATTERY RESISTANCE CHANGE TEST (75 or 79) evaluates whether the battery is good or bad, even if it is discharged. A good battery that is discharged may be recharged. A bad battery may hold a charge for a short time.

STE/ICE HOOKUP

1. The power to operate the STE/ICE-R VTM may be taken from the batteries being tested as shown in the appropriate figure below or from a alternate power source (such as another vehicle's batteries).
2. Perform VTM general setup; run confidence test.
3. Find a series pair of batteries. A battery series pair has the negative terminal of one battery connected to the positive terminal of another battery by a cable. For example, in figures 1 and 2 below, batteries A and B are a series pair; and in figure 1 below batteries C and D are a series pair.
4. a. If power to the VTM comes from a different set of batteries than the batteries under test, use tests 77 and 79 instead of tests 73 and 75. Connect test probe cable W2 to the batteries under test. Connect the red clip to the positive terminal closest to the starter and the black clip lead to the negative terminal closest to the ground.

   b. If power to the VTM comes from the same set of batteries as the batteries under test, use tests 73 and 75. The test probe cable W2 is not used
5. Clamp the current probe around the cable connecting the two batteries. Point the arrow of the current probe along the cable leading towards the negative battery terminal as shown below in figures 1 and 2 for batteries A and B.

TEST PROCEDURE

1. Condition the current probe before running these tests.
2. Measure the battery resistance change by entering test number 75 or 79 (as described in the hookup procedure). Then engage the starter for about 5 seconds.
3. Measure the battery internal resistance by entering test number 73 or 77 (as described in the hookup procedure). Then engage the starter for about 5 seconds.
4. Compare the results of both measurements to limits in the vehicle/equipment TM or to limits on the reverse side of this card.
5. If either measurement is outside of normal limits, check battery terminals and connections, and check battery electrolyte level. Then perform both measurements a second time.
6. If the battery resistance change test (75 or 79) fails after the second measurement, then the battery series pair is in bad condition. Test each battery individually to determine which is good and which is bad, or replace the battery series pair.
7. If the battery internal resistance test (73 or 77) fails after the second measurement, then the batteries should be recharged.

FIGURE 1

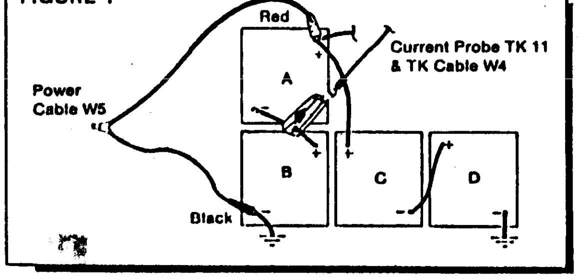
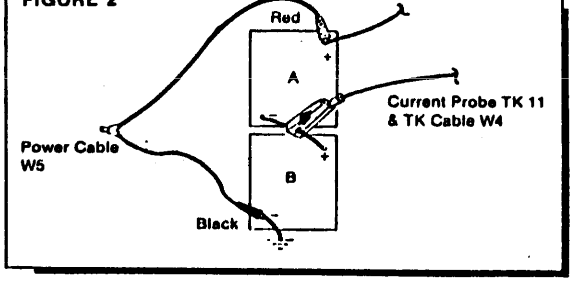


FIGURE 2



iSTE/ICE-R BATTERY SERIES PAIR TEST CARD

BATTERY TEST RESULTS

STE/ICE DISPLAY AFTER TEST	WHAT IT MEANS
GO	1. The battery in series with the battery under test may be bad. Check that battery next. 2. Check the battery negative cables and cables to the starter for corroded or loose connections. If all of the cables and connections are o.k., then the starter is possibly faulty. connections are o.k., it is possible that the starter is faulty.
.9.9.9.9	1. There is a bad connection on the battery being tested. Clean and tighten the posts and clamps, and check the cable between the batteries. 2. The battery under test is in extremely poor condition.
14.2	If any number is displayed, then the number is a STE/ICE-R test result. Compare the test result to the values shown along the right edge of this card to determine a pass or fail. See table below to determine the condition of the battery.
E013	1. The battery being tested may be in a discharged state. Check battery electrolyte level; charge battery, and then retest. 2. If display shows E013 after battery has been charged, then the battery is in poor condition.
E002	The current probe is not connected. Connect current probe.
E005	Offset test for current probe has not been performed. Perform current probe offset test.
E008	Test leads are improperly connected. Check test leads.

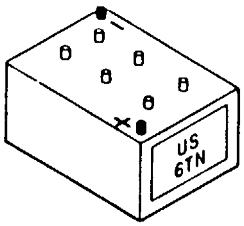
BATTERY CONDITION

TEST 77 BATTERY INTERNAL RESISTANCE TEST RESULT	TEST 79 BATTERY RESISTANCE CHANGE TEST RESULT	BATTERY CONDITION
PASS	PASS	The battery tested is o.k. and in good state of charge.
PASS	FAIL	The battery tested is in poor condition, but has a fresh charge
FAIL	PASS	The battery tested is o.k., but needs to be recharged.
FAIL	FAIL	The battery tested is in poor condition and in a state of discharge.

TEST LIMITS

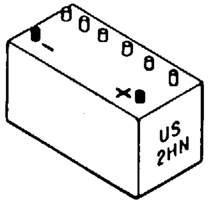
Battery Test Limits for a Series Pair

For Type 6TN Batteries



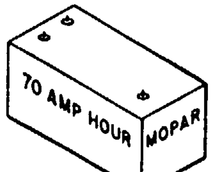
STE/ICE-R Test No.	Maximum Acceptable Value to Pass Test
Battery Internal Resistance Test 77	25 Milliohms max
Battery Resistance Change Test 79	50 Miliohms/Sec max

For Type 2HN Batteries



STE/ICE-R Test No.	Maximum Acceptable Value to Pass Test
Battery Internal Resistance Test 77	50 Milliohms max
Battery Resistance Change Test 79	140 Milliohms/Sec max

For Commerical 12 volt batteries in M880 vehicles



STE/ICE-R Test No.	Maximum Acceptable Value to Pass Test
Battery Internal Resistance Test 77	25 Milliohms max
Battery Resistance Change Test 79	100 Milliohms/Sec max

STE/ICE-R INDIVIDUAL BATTERY TEST CARD

The BATTERY INTERNAL RESISTANCE TEST (73 or 77) evaluates the state of charge of an individual battery. The BATTERY RESISTANCE CHANGE TEST (75 or 79) evaluates whether the battery is good or bad, even if it is discharged. A good battery that is discharged bay be recharged. A bad battery may hold a charge for a short time.

STE/ICE HOOKUP

1. The power to operate the STE/ICE-R VTM may be taken from the batteries being tested as shown in the appropriate figure below or from an alternate power source (such as another vehicle's batteries).
2. Perform VTM general setup; run confidence test.
3. If there is more than one battery in the vehicle/equipment, then find the battery series pair that includes the battery under test. A battery series pair is a pair of batteries for which the negative terminal of one battery is connected by a cable to the positive terminal of another battery. For example, in figure 1 and 2 below, batteries A and B are a series pair; and in figure 1 below, batteries C and D are a series pair.
4. a. If the vehicle/equipment under test has more than one battery or if the VTM is powered from an alternate power source, then use tests 77 and 79. Connect the red clip of test probe cable W2 to the positive terminal of the battery under test. Connect the black clip of test probe cable W2 to the negative terminal of the battery under test.

   b. If the vehicle/equipment under test has only one battery which is also supplying power to the VTM, use tests 73 and 75. The test probe cable W2 is not used.
5. a. If the vehicle/equipment under test has more than one battery, then the battery under test is part of a series pair of batteries. Clamp the current probe around the cable connecting the series pair. Point the arrow on the current probe along the cable leading towards the negative terminal as shown in figures 1 and 2.

   b. If the vehicle/equipment under test has only one battery, then clamp the current probe around the positive battery cable connected to the starter. Point the arrow on the current probe along the cable in the direction leading towards the starter as shown in figure 3.

TEST PROCEDURE

1. Condition the current probe before running these tests.
2. Measure the battery resistance change by entering test number 75 or 79 (as described in the hookup procedure). Then engage the starter for about 5 seconds.

   Measure the battery internal resistance by entering test number 73 or 77 (as described in the hookup procedure). Then engage the starter for about 5 seconds.

   Compare the results of both measurements to limits in the vehicle/equipment TM or to limits on the reverse side of this card.

   If either measurement is outside of normal limits, check battery terminals and connections, and check battery electrolyte level. Then perform both measurements a second time.
3. If the battery resistance change test (75 or 79) fails after the second measurement, then the battery is in bad condition. The battery may be able to accept and hold a charge, but it will quickly become discharged during use. A battery in bad condition should be replaced.
4. If the battery internal resistance test (73 or 77) fails after the second measurement, then the battery should be recharged.

FIGURE 1

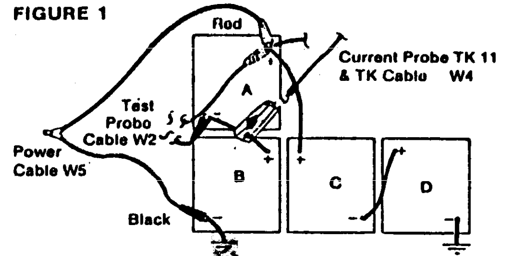


FIGURE 2

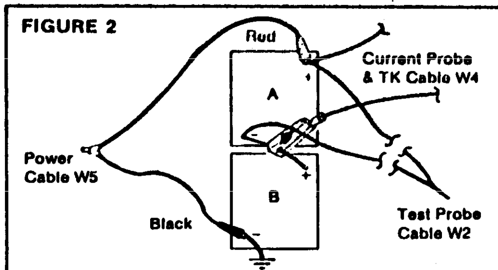
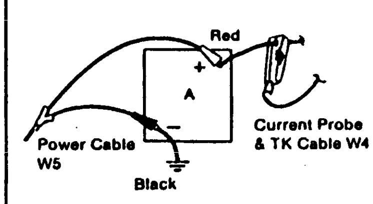


FIGURE 3



STE/ICE-R INDIVIDUAL BATTERY TEST CARD

BATTERY TEST RESULTS

STE/ICE DISPLAY AFTER TEST	WHAT IT MEANS
GO	1. The battery in series with the battery under test may be bad. Check that battery next. 2. There is a bad connection in the starter circuit somewhere. Check the battery negative cables, and cables to the starter for corroded or loose connections. If all of the cables and connections are o.k., then the starter is possibly faulty.
.9.9.9.9	1. There is a bad connection on the battery being tested. Clean and tighten the posts and clamps, and check the cable between the batteries. 2. The battery under test is in extremely poor condition.
14.2	If any number is displayed, then the number is a STE/ICE-R test result. Compare the test result to the values shown along the right edge of this card to determine a pass or fail. See table below to determine the condition of the battery.
E013	1. The battery being tested may be in a discharged state. Check battery electrolyte level; charge battery, and then retest. 2. If display shows E013 after battery has been charged, then the battery is in poor condition.
E002	The current probe is not connected. Connect current probe.
E005	Offset test for current probe has not been performed. Perform current probe offset test.
E008	Test leads are improperly connected. Check test leads.

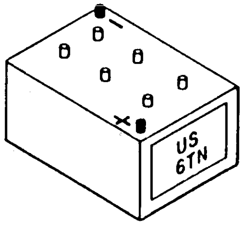
BATTERY CONDITION

TEST 77 BATTERY INTERNAL RESISTANCE TEST RESULT	TEST 79 BATTERY RESISTANCE CHANGE TEST RESULT	BATTERY CONDITION
PASS	PASS	The battery tested is o.k. and in good state of charge.
PASS	FAIL	The battery tested is in poor condition, but has a fresh charge.
FAIL	PASS	The battery tested is o.k., but needs to be recharged.
FAIL	FAIL	The battery tested is in poor condition and in a state of discharge.

TEST LIMITS

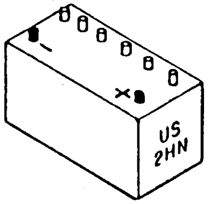
Individual Battery Test Limits

For Type 6TN Batteries



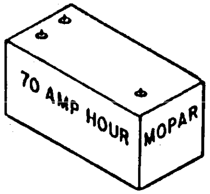
STE/ICE-R Test No.	Maximum Acceptable Value to Pass Test
Battery Internal Resistance Test 77	13 Millohms max
Battery Resistance Change Test 79	25 Miliohms/Sec max

For Type 2HN Batteries



STE/ICE-R Test No.	Maximum Acceptable Value to Pass Test
Battery Internal Resistance Test 79	25 Miliohms max
Battery Resistance Change Test 79	70 Milliohms/Sec max

For Commerical 12 volt batteries in M880 vehicles



STE/ICE-R Test No.	Maximum Acceptable Value to Pass Test
Battery Internal Resistance Test 77	13 Milliohms max
Battery Resistance Change Test 79	50 Milliohms/Sec max

Appendix I - ACCURACIES

The accuracy of STE/ICE-R is adequate to perform the test procedures outlined in this manual. The accuracy table is provided for the user of STE/ICE-R as a troubleshooting tool to make general measurements where STE/ICE-R limits are not specified.

The accuracy table gives the typical accuracies of various STE/ICE-R tests at room temperature. During the first 5-10 minutes of operation, it is important to perform the offset test within 30 seconds of each and every measurement that requires an offset test. After a 5-10 minute warm up period, the offset test must be performed within 2 minutes of making a measurement to achieve the accuracy stated in the table.

The accuracy table has six columns. The first two columns give the test numbers and test name. The third column gives a range of values. The fourth and fifth columns give the typical accuracy limits for the range in column three. The percent of reading accuracy of a measurement is useful for comparisons of accuracy with test equipment whose accuracy is given in %. The sixth column gives the units for the test. The following example illustrates how to use the accuracy table to determine the STE/ICE-R system typical accuracy for a measurement.

A battery is measured using test 89, dc voltage test. The display reads 12.5 volts. To determine how accurately STE/ICE-R will measure the battery volts, the range of values in column three is found for test 89 which contains 12.5. The typical error for that range of values is + or - .1 volts. STE/ICE-R will then typically measure 12.5 volts to an accuracy of + or - .1 volts, or .5% of reading at room temperature.

Room Temperature Accuracy Table

Test	Test Name	Range	Percent of Reading	Within + or -	Units
10	Engine RPM	50 to 499	.2	1	RPM
		500 to 5000	.04	2	
11	Cranking RPM	50 to 499	.2	1	RPM
		500 to 5000	.07	2	
16	Dwell Angle	10 to 72	1.4	1	Degrees
17	Points Voltage	0 to 2	.5	.01	volts
45	Vacuum	0 to 4.9	4	.2	Inch
		5 to 9.9	3	.3	MERcury
		10 to 19.9	1	.3	
		20 to 30	1.7	.5	
47	Pressure	0 to 4.9	4.1	.2	Inch
		5 to 9.9	4	.4	Mercury
		10 to 19.9	2.5	.5	
		20 to 34.9	1.7	.6	
		35 to 50	1.8	.9	

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Room Temperature Accuracy Table (cont)

Test	Test Name	Range	Percent of Reading	Within + or -	Units
48	Pressure	0 to 14	7.1	1	Inch Water
		15 to 49	6.1	3	
		50 to 99	4	4	
		100 to 150	3.3	5	
49	Pressure	0 to 1.9	5.3	.1	PSIG
		2 to 4.9	4.1	.2	
		5 to 9.9	3	.3	
		10 to 17.5	1.7	.3	
		17.6 to 25	2	.5	
50	Pressure	0 to 49	4	2	PSI
		50 to 199	1.5	3	
		200 to 399	1.3	5	
		400 to 699	.9	6	
		700 to 1000	.8	8	
67	Battery Voltage	10 to 14.9	.7	.1	volts
		15 to 22.4	.5	.1	
		22.5 to 32	.3	.1	
89	DC Voltage	0 to .19	5.3	.01	volts
		.2 to 49	2	.01	
		.5 to 99	1	.01	
		1 to 1.99	1	.02	
		2 to 2.99	1	.03	
		3 to 4.49	.67	.03	
		5 to 9.9	1	.1	
		10 to 19.9	.5	.1	
		20 to 29.9	.67	.2	
		30 to 45	.44	.2	
90	DC Amps	0 to 4.9	8.2	.4	Amps
		5 to 9.9	11.1	1.1	
		10 to 19.9	10.1	2	
		20 to 39.9	8.3	3.3	
		40 to 69.9	7.2	5	
		70 to 99.9	7	7	
		100 to 149.9	6.7	10	
		150 to 299	4.3	13	
		300 to 499	3	15	
		500 to 749	2.7	20	
		750 to 999	3.4	34	
		1000 to 1199	5.3	63	
		1200 to 1500	8	120	

GO TO NEXT PAGE

Room Temperature Accuracy Table (cont)

Test	Test Name	Range	Percent of Reading	Within + or -	Units
91	Resistance	0 to 9	11.1	1	Ohms
		10 to 24	8.3	2	
		25 to 49	4.1	2	
		50 to 99	3	3	
		100 to 199	1.5	3	
		200 to 299	1.3	4	
		300 to 599	.7	4	
		600 to 999	.5	5	
		1000 to 1500	.4	6	
92	Resistance	0 to .49	8.2	.04	Kohms
		.50 to 2.49	2.4	.06	
		2.50 to 7.49	.8	.06	
		7.50 to 14.99	.5	.07	
		15 to 24.90	.3	.07	
		25 to 40	.2	.08	
93	AC Voltage	0 to 2.4	8.3	.2	Volts RMS
		2.5 to 7.4	2.7	.2	
		7.5 to 14.9	1.3	.2	
		15 to 24.9	.8	.2	
		25 to 35	.6	.2	
95	AC Current	5 to 29.9	4.3	1.3	Amps
		30 to 69.9	5	3.5	
		70 to 199	5	10	
		200 to 399	5.8	23	
		400 to 700	6	42	
96	AC Frequency (cable W2)	40 to 99	.4	.2	Hertz
		100 to 199	.1	.2	
		200 to 349	.1	.3	
		350 to 500	.05	.3	
97	AC Frequency (current probe)	40 to 99	.2	.2	Hertz
		100 to 199	.1	.2	
		200 to 349	.05	.2	
		350 to 500	.06	.3	

Appendix J - Background Information for Tests

This appendix contains background information for special tests, offset tests, and conditioning the current probe.

This appendix is for reference only, and is not needed to perform any measurement.

This appendix contains the following paragraphs:

A. OFFSET TESTS

The offset test is a method of zero adjusting the VTM. It determines what effect the transducer cable W4 and/or a transducer have on the measurement. This effect is then subtracted from the resulting measurement before the value is displayed.

The test selection guide, table 2-5, includes a column indicating if an offset test is required for each test. The offset, if required, will be performed as part of the measurement procedure.

B. CONDITIONING THE CURRENT PROBE

Conditioning the current probe consists of two operations:

Expose current probe to maximum expected current to establish the range of operation

Offset test for the current probe

1. **Establish range of operation.** The maximum current information is required so that the test equipment (VTM and current probe) can establish an operating measurement range for greatest accuracy.

Measurements which display negative values will contain errors of several amperes. Probe must be reversed and reconditioned.

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2. **Offset test.** The offset test is required so that the VTM can subtract out the value of any stored magnetism remaining in the current probe after a measurement. This correction is done after the maximum current exposure to prepare the VTM for the next current measurement. This offset correction should also be done between measurements when measuring very low currents to insure a zero starting condition for all measurements.

3. **Procedure to condition current probe.**

   a. Allow the probe to warm up and stabilize 5 to 7 minutes before use. If you must use the probe before it is fully warmed up, you must perform an offset test within 30 seconds before each and every current measurement.

   b. Establish range of operation. Attach the current probe to the cable with the highest current to be measured. In vehicles with a starter, the cable from the battery to starter will give the highest current when the starter is energized for a few seconds. Energize the circuit; read the display. If you have attached the current probe with the arrow pointing in the direction of current flow, the readout will be positive (+). If the readout is negative (-), reverse the probe. If the probe is accidentally connected backwards for any test, the above procedure should be repeated, and the offset test rerun. This procedure corrects for a possible error in readout.

   c. Offset Test. Always do an offset test after conditioning the probe. For accuracy, it is best to do an offset test before each low current measurement. Before performing an offset test, make sure that circuit is de-energized. Press and hold TEST button until CAL is displayed. Release TEST button; observe that the displayed value is within limits.

C. POWER TESTS

There are two power measurements. Test #12 does not need a VID, and gives results in units of acceleration which can be compared to limits given in the vehicle/equipment TM. Test #13 requires a VID, and gives results in units of percent of rated power. Each of the power measurements can be performed on either S1 or CI engines. The VTM determines the type of engine by checking the type of speed transducer or the DCA ID. If a conflict of VID and speed transducer attached is detected, the VTM will display E030 and stop. The error must be corrected before the VTM will run any power test. Table J-1 defines the relation between SI/CI to VIDs/TK speed transducers and DCA IDs.

Table J-1

VID	Type	DCAID	Type	Speed Transducer	Type
1,5	S1	10	SI	Ignition adapter	S1
2,3,4,6-16,18	CI	1-9	CI	Pulse tachometer	CI
17,19-99	NA	11-14	NA		

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Power measurements provide an indication of the power producing capability of the engine under test. CI power measurements accomplish this by measuring the average power produced from CI power rpm ranges as shown in Table J-2. This power is not measured directly, but is derived from measurements of the engine's acceleration and deceleration rates.

Table J-2 shows the required Po-3 entry for test #12 only. Test #13 has this information already incorporated in the Po-2 entry value. If no Po-3 prompting message is displayed when" performing test #12, then the CI power range used is 1000-2000 rpm.

The CI power range shown in Table J-2 consists of two rpm numbers which the VTM uses to start/stop taking data. The first is the signal to start taking data, and the second is the signal to stop taking data. These limits are used twice, once during engine acceleration, and once during engine deceleration. For example, if the range is 600-1000, the VTM will start taking data when it senses 600 rpm at engine acceleration and stop taking data when it senses 1000 rpm. On deceleration, the limits are reversed. The VTM starts taking data when it senses 1000 rpm and stops when it senses 600 rpm. Some VIDS have known CI power limits and are set by the VTM automatically. Others do not, and the limits must be encoded into the VTM by the operator. This is done by responding to a Po-3 prompt message from the VTM. Table J-2 outlines what range is decoded from the valid entries to prompt message Po-3.

Table J-2. CI Power Test Range Limits, In RPM, CI Engines Only

Po-3 Entry (Test #12 only)	CI Power Range (rpm)
1	600-1000
2	1000-2000
3	1100-1600
4	2000-3000

S1 power measurements are accomplished by taking measurements with ,the engine running at 20 percent of its capability. The engine's torque at this speed is determined from measurements of its deceleration. The power is determined from the product of engine speed and engine torque.

1. SI Engines

The VTM performs a power measurement on SI engines by interrupting the firing on four out of every five cylinders. This is done with the throttle wide open. The procedure allows each cylinder to receive a full flow of fuel and air while the engine is operating at a point where the developed power just equals the load (i.e. engine friction, pumping losses, and accessory loads). The SI power measurement will run in this mode for about 40 seconds to stabilize the operation and to make measurements. The engine will work hard, and may even backfire while it is stabilizing.

After entering the test number for the power measurement, the VTM will display SIP.

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This is a signal to the operator to press the accelerator quickly to the floor. As the engine accelerates, the VTM monitors the engine speed. At 3500 RPM, the VTM will begin to inhibit four out of every five spark firings. The engine is working at approximately 20 percent of its normal power. At this power rating, the power produced by the engine will balance friction and accessory loads and engine speed will settle to some steady value. During this interrupt mode, fuel continues to be pumped through the interrupted cylinders and into the exhaust system. The engine will be running rough and may backfire, which is normal for this test. The interrupt mode will continue for approximately 40 seconds. This allows the carburetor feed mechanism to operate and, if faulty, affect the test result. At the end of 40 seconds, the VTM measures the engine speed and allows all cylinders to fire normally. The engine will briefly accelerate. When engine speed reaches a level that is 600 RPM greater than the measured interrupt speed, the VTM will kill all spark firings, and the engine will stall. As the engine stalls, the VTM measures the average deceleration rate between an engine speed of 500 RPM greater and 500 RPM less than the interrupt speed. The VTM continues to cause the engine to stall until it stops turning. Once the engine has completely stopped, it may be restarted.

In test #12, two results will be displayed. The first is the interrupt speed in RPM, and the second is the deceleration in RPM/see. Refer to the vehicle/equipment TM for the proper interpretation of these results. In test #13, the result is in units of percent power. This compares the engine under test to an average engine. Since the comparison is to an average engine, it is possible that very good engines will give a reading higher than 100 percent.

If the SI ignition adapter becomes disconnected during the test, the VTM will lose control of the engine. If this happens, the operator should release the accelerator and restart the test. The operator must be careful to notice such a situation to prevent engine damage.

The SI power test should not be performed on vehicles equipped with catalytic converters. The test allows unburned fuel and heated gases to enter the exhaust system. The presence of this mixture and the routine backfiring will damage the catalytic converter.

2. CI Engines

CI Power test may be run in different modes (TK or DCA). TK mode means the speed signal to measure engine power is entering the VTM from a pulse tachometer attached to J2 or J3. DCA mode means the speed signal is coming in through the DCA connector J1. If both are attached, the speed signal will be nullified. This is an illegal condition and should be avoided. A special case may arise where it is permissible to run in this mixed TK and DCA mode. If the operator positively knows that the pulse tachometer is missing from the DCA harness wiring, it is all right to attach a pulse tachometer to a TK channel and use it to measure engine speed when the VTM is being powered from the DCA connector J1. The pulse tachometer on the TK channel has a higher precedence than the DCA cable. Therefore, the TK channel will be used by the VTM.

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MARNIN6: In NO case is the operator allowed to attach two pulse tachometers to the VTM, one on each TK channel (J2 and J3). The speed signal will be grounded out, and the VTM will sense zero rpm.

NOTE: After the operator enters vehicle information via a prompt message from the VTM, that information, if valid, remains in the VTM. The operator need only enter the information once. It will remain in the VTM for all CI Power test runs.

Test #12 CI Power (rpm/see)

This test does not require a VID, but it will make use of it if one has already been entered. The VIO information (or lack of it) determines the acceleration and deceleration limits, in rpm, used by the CI power test to take data. See Table J-2 to determine what range is used for all cases of VID information available. The two numbers represent rpm values which the VTM is testing for to,take data.

Test #13 CI Percent Nominal Power

This test requires vehicle specific information so that it can display a result that is a percent rating of a known good (baselined) engine. Again, some VIDS have this information stored in the VTM and some do not. If the information is known to the VTM, it will automatically display the result in percent of rated power. Otherwise, the information must be entered by the operator. This is accomplished by responding to Po-1 and Po-2 prompt messages from the VTM. Note that the information for Po-3(see Table J-2) is encoded into the entry for Po-2. The VTM automatically decodes the Po-2 entry and stores the information just as though the operator responded to a Po-3 prompt message. With the entries completed for Po-1 and Po-2, the VTM can display a result in percent rated power.

To perform a power measurement on a CI engine, load the engine against its own inertia by accelerating at maximum fuel delivery up to governor speed. The acceleration and deceleration rates are measured. The VTM equates the result of this measurement to friction, pumping losses, and accessory loads, and determines engine power.

Before running the CI power test, the engine must be warmed up to its normal operating temperature. The operator should check the governor to assure that the engine will not overspeed while it is being accelerated.

Both CI power tests measure acceleration and deceleration rates between fixed engine speeds. The acceleration between rpm ranges (shown in Table J-2) is determined by the average net power produced over that speed range. Net power is the total power minus any power expended overcoming friction, pumping losses, and enqine accessories. The deceleration is determined by the power consumed by friction, pumping losses and engine accessories. The sum of the acceleration and deceleration is the total power developed by the engine.

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Since the CI power test.measures acceleration between fixed limits, the operating range of the engine must contain these limits. If an engine has a maximum governor speed less than the high limit shown in Table J-2, then the CIP message will remain on the VTM display when the engine is accelerated. The CI power test cannot be applied to these vehicles.

Some turbocharged engines have fuel limiters to avoid overfueling the engine when the turbocharger is not providing its rated amount of boost. This condition occurs during the acceleration burst of the CI power test. The effect of this fuel limiting is not repeatable from test to test. Therefore, the CI power test gives erratic readings on engines equipped with fuel limiters. Not all engines with turbochargers have this problem. Turbocharged engines that do not have fuel limiters may display values less than 100 percent for a good engine. For example, turbocharged versions of the M35 2 1/2 ton truck in top condition may give a result of 80 percent for the power test. The action of the accelerator during the CI power measurement must be quick enough so that the engine is at low idle for one instant and full fuel the next instant. If the accelerator action is not quick enough, then the full potential of the developed engine power is not realized and E011 will be displayed.

The measurement of deceleration depends on no fuel burning so that an accurate assessment of engine friction, pumping, and accessory loads can be made. Fuel burning during coast down will cause the VTM readings to be low.

D. **COPRESSION UNBALANCE** TESTS

The compression unbalance test requires that the operator enter a VID. As in CI power test, some VIDS give vehicle information to the VTM; others do not. The ones that do give information to the VTM are the same that give CI power test information to the VTM. The vehicle information for compression unbalance supplies the same kind of information about the vehicle as the CI power test vehicle information. That is, it gives the VTM information about a baselined vehicle to represent a known good engine so that the VTM can display a result as a percent of a known baselined engine. For those VIDS that do not have this vehicle information available, the VTM will prompt the operator with messages Cu-1 to CU-5 . This information does not allow the VTM t~ display a result in percent unbalance. The result must be compared to a value given by the vehicle/equipment TM. Note that the number of cylinders information is not a part of this discussion and is not considered a part of this kind of vehicle information on baselined engines. Operator entries made to prompt messages in compression unbalance test will remain in the VTM for all test runs.

The compression unbalance procedure measures the difference in compression between the cylinder with the highest compression and the cylinder with the lowest compression in a CI engine. The result is in either percent of difference or a value to be compared to a limit in the vehicle/equipment TM. For example, when the

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displayed result is in percent unbalance, a displayed result of 10 indicates a 10 percent difference in compression between the highest and the lowest cylinders. The lower the value of the result, the healthier the engine. When the result is a value to be compared with a TM limit, the closer the value is to the limit, the healthier the engine. If the result exceeds the limit, the engine under test is in exceptional condition, and is said to have better performance than a typically healthy engine of that type.

There are two compression unbalance tests. Usually, test #14 is more convenient because it makes its nleasurements on the same cable that provides power to the VTM, either DCA cable W1 or power cable W5. Test #15 makes its measurements on the test probe cable W2 while the VTM is powered through either DCA cable W1 or power cable W5. The test probe cable must be attached to the engine batteries, and a separate power connection must be provided. Test #15 is useful if the VTM is powered from one source and the engine under test is powered from a second source.

The compression unbalance test measures the battery voltage of the starting system while the engine under test is cranking. In theory, the change in battery voltage is a measure of how hard the starter motor is working to drive each piston up on its compression stroke. The starter draws a large current from the batteries to drive the piston. This current reduces the battery voltage during the compression stroke. After the compression stroke, the starter current is reduced and the battery voltage increases. This battery voltage continually varies as each cylinder is compressed during cranking. The compression difference between cylinders is computed by measuring the difference in battery voltage from one cylinder to the next.

The compression unbalance test measures battery voltage for a minimum of two complete engine cycles. This allows the VTM to obtain compression information from each cylinder twice. If the VTM does not collect this amount of data during the first crank, then the VTM will display a second GO message so it can collect additional compression information.

To ensure accurate compression unbalance results, the following conditions must exist:

1. Only the starter should be turning the engine. If the engine is burning fuel, then the results will be inaccurate. The operator should watch for exhaust smoke and listen for noises during cranking to determine if the engine is attempting to start. All fuel should be cut off from the engine during the compression unbalance measurement.

2. The varying of the battery voltage during cranking is only caused by the compression of cylinders. If anything else is causing a varying load on the starter motor such as a pump or a compressor, then the test will give inaccurate results. Disable or stabilize any engine accessories that might be activated during a compression unbalance measurement. This may be accomplished by cranking the engine for a few seconds before beginning the compression unbalance measurement.

3. The engine is at Its normal operating temperature and has a fully tested starting system. The first peak series, tests #72 through #75 or tests #76 through #79, should be run before a compression unbalance measurement is performed.

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The following messages may be encountered while performing a compression unbalance measurement:

FAIL A fail message during compression unbalance testing may occur when any of three conditions exist:

- Batteries discharged or in poor condition.
- The starter is used as a transducer for compression. It could be good to start the engine, but electrically noisy for unbalanced testing purposes.
- The compression unbalance may be so far outside of its limits that the STE/ICE-R set cannot calculate a value.

When FAIL appears during compression unbalance testing, any of the three conditions above applies. You cannot use the STE/ICE-1? set to measure compression unbalance on this engine at this time.

E013 An E013 message during compression unbalance testing may occur when any of three conditions exist:

- Batteries discharged or in poor condition.
- Engine cranking interrupted during testing
- Battery voltage suddenly and repeatedly changes its level in a manner that is independent of engine compression. The VTM cannot compensate for these variations.

When E013 appears, You should check the batteries and connections and repeat the test taking care that no interruptions occur. If E013 persists, you cannot use the STE/ICE-R set to measure compression unbalance on this engine at this time.

FIRST PEAK TESTS

First peak tests and test #12, CI power rpm/see, react alike to VIDS. If a VID was previously entered by the operator, first peak test will use it to determine engine configuration. If no VID was entered, the VTM will use a set of default engine configuration items. Table J-3 shows the effects VIDS have on first peak tests.

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Table J-3 Battery Voltage Trigger Senses For First Peak Tests

VID	Charging System	Trigger Sense
none	12 v	sensitive
none	24 V	not sensitive
1	12, 24 V	sensitive
2-99	12, 24 V	not sensitive

What the table implies by trigger sense is the amount of battery voltage drop (when the engine is cranking) that is required to start the VTM data-taking. A sensitive trigger sense means that a smaller voltage drop during cranking will start the data taking. A not-sensitive trigger sense means that a larger voltage drop is required.

The first peak tests have a unique procedure for taking data and displaying results. The VTM will take one set of battery data to display all four first peak tests that are in the same series (i.e., tests #72 to #75 or tests #76 to #79). After taking a set of data, the VTM will allow the operator to display the results of each test in the series, once only, in any order, without any interruption of the series. Interruptions occur when:

1) any test in the series is repeated twice
2) any CAL test is performed
3) any non-first peak test is performed
4) an error message is displayed on the VTM
5) the first peak series is changed
6) the transducer used to sense battery current is changed

If any of these interruptions occur, the next first peak test will result in the VTM prompting the operator(by displaying the GO message) to take a new set of battery data.

First peak tests are used to troubleshoot the starting system of the vehicle/equipment under test. There are two series of first peak tests, tests #72 through #75 and tests #76 through #79. Tests #72 through #75 are more convenient because they make measurements on batteries that power the VTM. Tests #76 through #79 make measurements on batteries of the vehicle/equipment under test while the VTM is powered from batteries of another vehicle/equipment. This is useful if the batteries of the vehicle/equipment under test are too weak to power the VTM while cranking the engine.

All first peak tests work on the same principle. A measurement is made at the moment the starter is engaged and prior to armature movement. The electrical current flowing into the starter and the voltage at the battery terminals are measured, and a value is calculated corresponding to the particular test. Results of these measurements are compared to test limits in the vehicle/equipment TM (or vehicle test card).

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As the starter is energized, electric current flows from the battery to the starter. As the starter turns, it develops a back voltage which works against battery voltage and is higher at higher starter motor speeds. Battery voltage pushes current into the starter while the back voltage tries to resist current movement. The amount of current flowing from battery to starter depends upon battery voltage, circuit resistance, and cranking speed. A low circuit resistance or a high battery voltage will tend to increase current. Circuit resistance that must be considered includes: internal battery resistance, resistance of cables and connections, and internal resistance of the starter motor.

The VTM makes its measurements at the exact instant that battery voltage is at its lowest value and starter current is at its highest. This point comes and goes so quickly that traditional automotive test equipment cannot measure the value. The STE/ICE-R set uses a microprocessor and a current probe to make these measurements. The current probe allows the operator to perform tests without disconnecting vehicle/equipment cables. However, there are some precautions that should be taken to assure accurate readings with the current probe.

The current probe senses electromagnetic fields generated around a cable whenever electricity flows through it. It is designed to be most accurate when the cable to which it is clamped is fairly straight, and it will be less accurate if it is clamped near a tight kink in the cable. Stray magnetic fields exist within a foot or so of operating vehicle generators and alternators, motor generators under load, and electric motors, and they may affect current readings. If possible, make sure current probe is at least one foot away from any operating generators, alternators, or motors.

The current probe contains electronic circuits which work best after being warmed up. See paragraph B (Conditioning The Current Probe).

The first peak current tests can display results as high as 3,000 amps even though the current probe can only measure as high as 1,500 amps.

An E013 message during first peak series testing may occur when any of three conditions exist:

- Batteries discharged or in poor condition.
- An electrically-powered vehicle accessory is activated before the starter is engaged.
- A problem is developing in the starting system.

When E013 appears, you should repeat the procedure for a total of three tests. If E013 persists, you cannot use the STE/ICE-R set to perform first peak series on this engine at this time.

The remainder of this discussion will describe unique aspects of individual tests.

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1. **Current first peak test** (#72 and #76). Measures, at starting time, maximum battery current drawn by the starting system and displays the value. This test allows the operator to make an overall assessment of the startinq system. It tests the ability of the battery to deliver starting current, aid it evaluates the condition of the starter circuit.

   A test failure could be caused by one of the following:

   - Results below test limits

     a. Battery discharged
     b. Vehicle/equipment wiring bad
     c. Poor circuit connections

   - Results above test limits

     a. Shorted winding inside starter

2. **Battery internal resistance test** (#73 and #77). Simultaneously measures, at starting time, battery current and voltage and displays internal resistance of the batteries. This test, used in conjunction with battery resistance change tests (#75 or #79), will determine battery condition.

   A test failure could be caused by one of the following:

   a. Weak battery
   b. Poor battery connections
   c. Low electrolyte level
   d. Cold battery (cranking engine for a few seconds might remedy the problem)

3. **Starter circuit resistance test (#74 and #78).** Measures, at starting time, electrical current flowing into the starter and voltage at the battery terminals, and displays starter circuit resistance. This test allows the operator to evaluate the combined starter, cable, connections and solenoid.

A test failure could be caused by one of the following:

- Results below test limits

  a. Shorted winding in starter motor

- Results above test limits

  a. Starter motor
  b. Battery
  c. Cables and connections

4. **Battery resistance change test (#75 and #79).** Simultaneously measures, at starting time, battery current and voltage and displays battery resistance change value. This test, used in conjunction with battery internal resistance tests (#73 or #77), will determine battery condition.

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A test failure could be caused by one of the following:

a. Weak battery
b. Poor battery connections
Low electrolyte level
c. Cold battery (cranking engine for a few seconds might remedy the problem)

END OF APPENDIX

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 67 PRECISION INSTRUMENTS AND SYSTEMS, MECHANICAL, ELECTRICAL, ELECTRONIC	
				GROUP 6715 SPECIAL ELECTRONIC TESTING EQUIPMENT, MOUNTED OR PORTABLE	
				FIG. 1 VTM/TRANSDUCER KIT ASSEMBLY	
1	PBOZZ	19207	12258874	TRAY, TRANSDUCER KIT	1
2	PAOZZ	19207	12258784	CABLE ASSEMBLY, POWE	1
3	PEOOF	19207	12258785	CABLE ASSEMBLY, SPEC W2.	1
4	PAOZZ	19207	12259302	CLIP, ELECTICAL PART OF KIT P/A 5705630	1
5	PAOZZ	19207	12259303	CLIP, ELECTRICAL PART OF KIT F/N 5765630	1
6	PEOOF	19207	12258787	CABLE ASSEMBLY, SPEC W3	1
7	PAOZZ	19207	11669230-3	SHELL, ELECTRICAL CO.	1
8	PAOZZ	19207	11669233	CLIP, ELECTRICAL	2
9	PAOZZ	19207	11669230-4	SHELL, ELECTRICAL CO	1
10	PAOZZ	19207	12258786	CABLE ASSEMBLY, POWE W4.	2
11	PAOOO	19207	12258788	CABLE ASSEMBLY, POWE W5	1
12	PAOZZ	19207	11669230-5	SHELL, ELECTRICAL CO	1
13	PAOZZ	76545	25A	CLIP, LTRICAL	2
14	PAOZZ	19207	11669230-6	SHELL, EECTRICAL CO.	1
15	PAOZZ	19207	12258873	CASE, TEST SET	1
16	XAOFD	19207	12259265	MULTIMETER.	1
17	PAOZZ	98750	PD-SANE-70-6625-A33	LEAD SET, TEST	1
18	PAOOO	19207	12259316	COVER, TRANSDUCER KI PART OF KIT P/N 5705630	1

END OF FIGURE

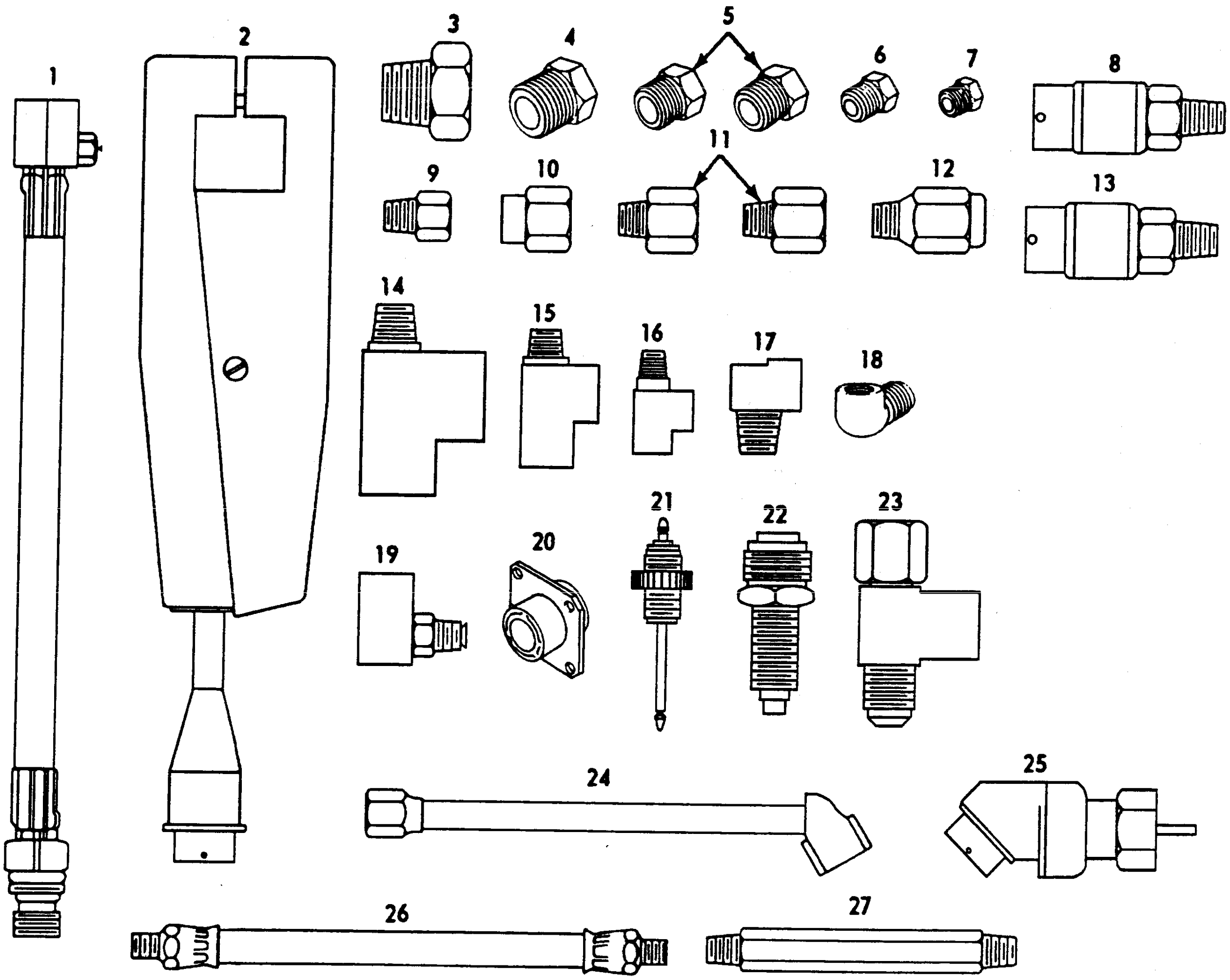

FIGURE 2. TRANSDUCER KIT (TK) COMPONENTS.

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 6715 SPECIAL ELECTRONIC TESTING EQUIPMENT, MOUNTED OR PORTABLE	
				FIG. 2. TRANSDUCER KIT (TK) COMPONENTS	
1	PAOZZ	19207	11665227	HOSE ASSEMBLY, NCNME TK10	1
2	PAOZZ	19207	12258878	PROBE, TEST DC AND AC CURRENT:TK11. .	1
3	PAOZZ	19207	12258853-1	REDUCER, PIPE TK12	1
4	PAOZZ	96906	MS5Z887–10	BUSHING, PIPE TK13.	1
5	PAOZZ	19207	12258853-2	REDUCER, SOIL PIPE TK14	2
6	PAOZZ	6N299	0917425	PLUG, PIPE TK15	1
7	PAOZZ	19207	5327970	PLUG, PIPE TK16	1
8	PAOZZ	19207	12258876	TRANSDUCER, PRESSURE C TC 1000 PSIG BLUE:TK17	1
9	PAOZZ	12204	187343	ADAPTER, STRAIGHT, PI TK18	1
10	PAOZZ	79470	3304X2	REDUCER, PIPE TK19	1
11	PAOZZ	05415	441MAM1	REDUCER, PIPE TK20	2
12	PAOZZ	19207	12258881	DAMPENEP, FLUID PRES TK21	1
13	PAOZZ	19207	12258877	TRANSDUCER, PRESSURE MINUS 30 INCHES HG TO PLUS 25 PSIG RED:TK22. .	1
14	XDOZZ	24617	444152	TEE, PIPE TK23	1
15	PAOZZ	20969	444552	TEE, PIPE TK24	1
16	PAOZZ	19207	547002	TEE, PIPE TK25	1
17	PAOZZ	93061	2232PA-4-4	ELBOW, PIPE TK26	1
18	PAOZZ	19207	12258879-1	ELBOW, PIPE TK27	1
19	PAOZZ	19207	12258762	TEE, PIPE TO TUBE TK28	1
20	PAOZZ	96906	MS3119E14-19	ADAPTER, CONNECTOR TK29	1
21	PAOZZ	19204	7540877	ADAPTER, CONNECTOR PRIMARY CKT:TK30.	1
22	PAOOO	96906	MS53099-2	ADAPTER, SPEEDOMETER TK31	1
23	PAOZZ	19207	12258880	TEE, PIFE TO TUBE FUEL LINE:TK32. . . .	1
24	PAOZZ	06853	221124	CHUCK, AIR, INFLATING TK33	1
25	PAOZZ	19207	12258875	TACHOMETER, PULSE TK34	1
26	PAOZZ	19207	11669236	HOSE ASSEMBLY, NCNME FLEXIBLE:TK35..	1
27	PAOZZ	19207	12258852	NIPPLE, PIPE TK36.	1

END OF FIGURE

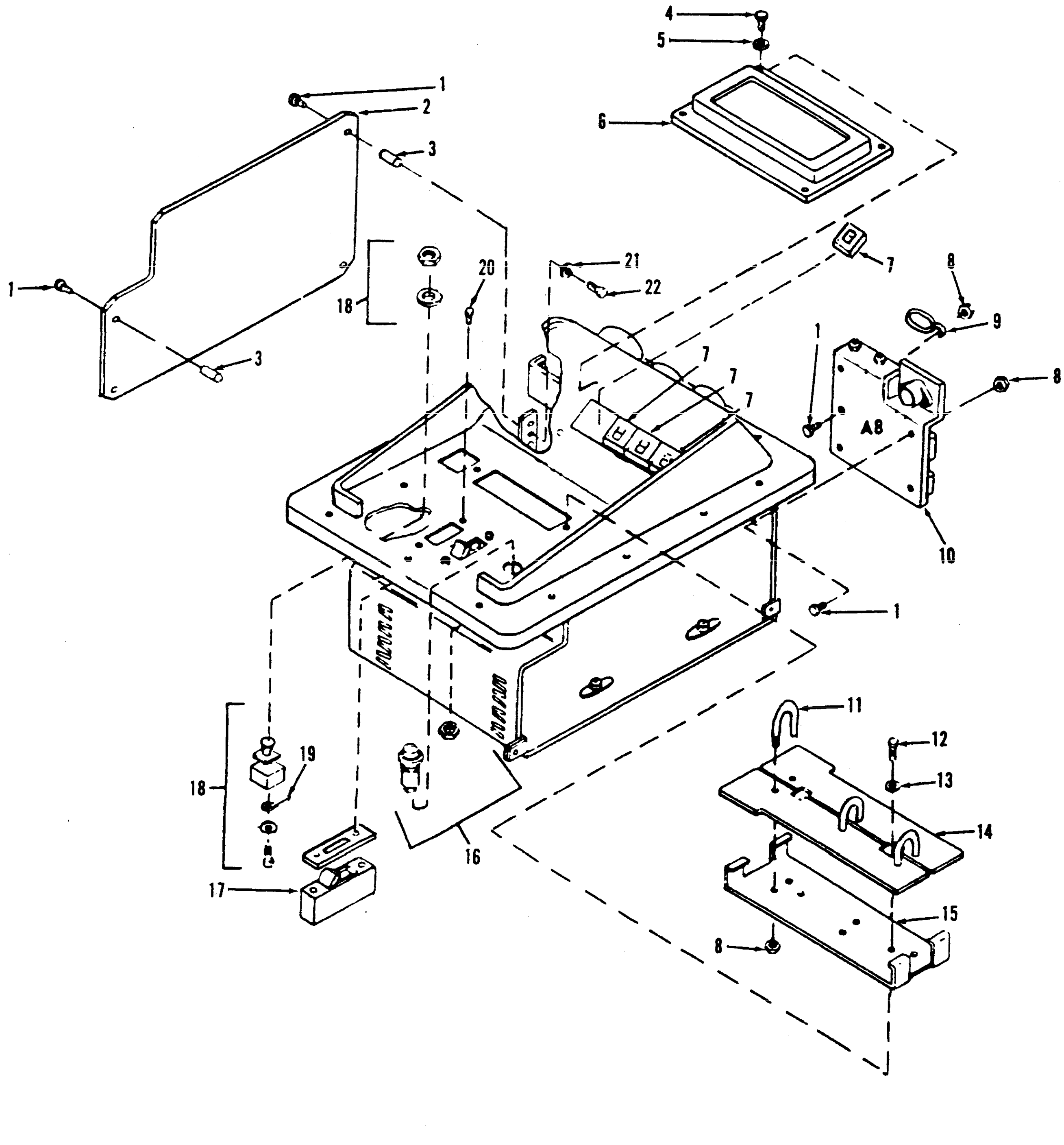

FIGURE 3. VTM PANEL AND NEST.

(1) ITEM NO	(2) SMR CODE	(3) CAGEC	(4) PART NUMBER	(5) DESCRIPTION AND USABLE ON CODES (UOC)	(6) QTY
				GROUP 6715 SPECIAL ELECTRONIC TESTING EQUIPMENT, MOUNTED OR PORTABLE	
				FIG. 3. VTM PANEL AND NEST	
4	PAOZZ	96906	MS51957-14B	SCREW, MACHINE PAN HEAD	4
5	PAOZZ	80205	NAS62004	WASHER, FLAT.	4
6	PAOZZ	19207	12258827	COVER, DISPLAY ASSEM	1
7	PAOZZ	19207	116699222	DISPLAY, CPTOELECTRC	4
8	PAOZZ	80205	NAS1291C04M	NUT, SELF-LOCKING, EX	3
11	PAOZZ	19207	12258794	PIN, CARD HOLDING	3
12	PAOZZ	96906	MS51957-27B	SCREW, MACHINE	2
13	PAOZZ	80205	NAS62006	WASHER. FLAT	2
14	PAOZZ	19207	12258948	CARD SET, INSTRUCTIO	1
15	PFOZZ	19207	12258795	BRACKET, MOUNTING	1

END OF FIGURE

CROSS-REFERENCE INDEXES

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM
5310-00-057-0573	3	5
4730-00-132-4625	2	6
4730-00-174-4584	2	24
4730-00-263-2733	2	16
4730-00-277-9615	2	15
4730-00-287-0706	2	10
4730-00-287-3281	2	7
4730-00-288-9953	2	9
5305-00-448-6547	3	12
5305-00-459-4687	3	4
6680-00-462-2252	2	22
4730-00-529-1487	2	11
5210-00-773-7624	3	13
5310-00-845-2359	3	8
5935-00-879-8512	2	20
6625-01-352-5647	1	15
5995-01-054-9744	1	11
6150-01-054-9746	1	3
6150-01-354-9747	1	6
6150-01-057-5818	1	2
6150-001-057-5819	1	10
4910-01-058-9998	1	1
6625-01-059-4279	2	2
6680-01-060-7175	2	25
6650-01-367-8546	3	6
6620-01-067-8952	2	13
6670-01-067-8954	2	8
5980-01-068-1084	3	7
4730-01-069-3367	2	18
4730-01-069-3370	2	5
5998-01-069-3377	3	11
6685-01-069-3385	2	12
4730-01–069-8853	2	23
4730-01-070-2031	2	3
4720-01-070-8805	2	26
4720-01-070-8806	2	1
4730-01-075-2814	2	27
4730-01-075-2815	2	19
5935-01-094-6711	2	21
5340-01-102-6872	3	15
5995-01-102-6938	1	8
7690-01-102-7177	3	14
5935-01-102-7268	1	7
5935-01-102-7269	1	9
5935-01-102-7270	1	12
5935-01-102-7271	1	14
5999-01-124-0071	1	13
4730-01-240-6108	2	17
5340-01-248-76516	1	19
5999-01-330-1995	1	4
5999-01-330-1996	1	5

CROSS-REFERENCE INDEXES

PART NUMBER INDEX

CAGEC	PART NUMBER	STOCK NUMBER	FIG.	ITEM
96906	MS3119E14-19	5935-00-879-8512	2	20
96906	MS5Z887-10		2	4
96906	MS519557-140	5305-00-459-4687	3	4
96506	MS51957-278	5305-00-448-6547	2	12
96906	MS553099-2	6680-00-462-2252	2	22
80205	NAS1291004M	5310-00-845-2359	3	8
80205	NAS62004	5310-00-057-3573	2	5
80205	NAS62006	5310-00-773-7624	2	13
98750	PD-SANE-70-6625-A33		1	17
6N299	0917425	4730-00-132-4625	2	6
19207	1166$222	5980-01-068-1084	3	7
19207	11669227	4720-01-070-8806	2	1
19207	1166923C-3	5935-01-102-7268	1	7
19207	1166923C-4	5935-01-102-7269	1	9
19207	1166923C-5	5935-01-102-7270	1	12
19207	11669230-6	5935-01-102-7271	1	14
19207	116613233	5999-01-102-6438	1	8
19200	11669236	4720-01-070-8805	2	26
19207	12258762	4730-01-075-2815	2	19
19220	12258784	6150-01-057-5818	L	2
19207	12258785	6150-01-054-9746	1	3
19207	12258786	6150-01-057-5819	1	10
19207	12258787	6150-01-054-9747	1	
19207	12258788	5995-01–754-9744	1	11
19207	12258794	5998-01-069-3377	3	AI
19207	12258795	5340-01-102-6872	3	15
19207	12258827	6650-01-067-8946	2	6
19207	12258852	4730-01-075-2814	2	27
19207	12258853-1	4730-01-070-2031	2	3
19207	12258853-2	4730-01-069-3370	2	5
19207	12258873	6625-01-052-5647	1i	15
19207	12258874	4910-01-058-9998	1	1
19207	12258875	6680-01-060-7175	2	25
19207	L2258876	6670-01-067-8954	2	8
19207	12258877	6620-01-067-8952	2	13
19207	122588728	6625-01-059-+4279	2	2
19207	12258879-1	4730-01-069-3367	2	18
19207	12258880	4730-01-069-8853	2	23
19207	12258881	6685-01-069-3385	2	12
19221	12258948	7690-010-102-7177	2	14
19207	12259265		1	16
19207	12259302	5999-01-330-1995	1	4
19207	12255303	5999-01-330-1996	1	5
19207	12259316	5340-01-248-7616	1	18
12204	1E7343	4733-00-288-9953	2	9
93061	2202PA-4-4	4730-01-24C-6108	2	17
06853	221124	4733-43-174-4584	2	24
76545	25A	5999-01-124-0071	1	13
79479	3304x2	4730-00-287-0706	2	10
05415	441MAM1	4730-00-529-14E8	2	11

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20969	444552	4733-02-277-9615	2	15
19207	5327570	4730-00-287-3281	2	7
19207	547C02	4730-00-263-2733	2	16
19204	7549877	5935-01-094-6711	2	21

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1	1	4910-01-058-9998	19207	12258874
1	2	6150-01-057-5818	19207	12258784
1	3	6150-01-054-9746	19207	12258785
1	4	5999-31-3349-1995	19207	12259302
1	5	5999-01-330-1994	19207	12259303
1	6	6150-01-054-9747	19207	12258787
1	7	5935-31-192-7268	19207	11669230-2
1	8	5999-01-102-6938	19207	11669233
1	9	5935-01-102-7269	19207	I1669230-4
1	10	6150-01-057-5819	19207	12258786
1	11	5995-01-054-9744	19207	12258788
1	12	5935-01-102-7270	19207	1166923C-5
1	13	5999-01-124-0071	76545	25A
1	14	5935-01-102-7271	19207	11669230-6
1	15	6625-01-052-5647	19207	12258873
1	16		19207	12259265
1	17		98750	PC-SANE-70-6625-A33
1	18	5340-01-248-7616	19207	12259216
2	1	4720-01-070-8806	I9207	11669227
2	2	6525-01-059-4279	19207	12258878
2	3	4730-01-070-2031	19207	12258852-1
2	4		96906	MS5Z887-10
2	5	4730-01-069-3370	19207	12258853-2
2	b	4730-00-132-4625	6N299	0917425
2	7	4730-00-287-3281	19207	5327971
2	8	6670-01-067-8954	19207	12258876
2	9	4730-00-288-9953	12204	18734?
2	10	4730-00-287-0706	79470	33C4X2
2	11	4730-00-529-1487	05415	441MAM1
2	12	6685-01-069-3385	19207	12258881
2	13	6620-01-067-8952	19207	12258877
2	14		24617	444152
2	15	4730-00-277-9615	20969	444552
2	16	4730-00-263-2733	19207	547002
2	17	4730-01-240-6108	93061	2202PA-4-4
2	18	4730-01-069-3367	19207	12258879-1
2	19	4730-01-075-2815	19207	12258762
2	20	5935-00-879-8512	96906	MS3119E14-19
2	21	5935-01-094-6711	19204	754C877
2	22	6680-00-462-2252	96906	MS53099-2
2	23	4730-01-069-8853	19207	1225888C
2	24	4730-00-174-4584	06853	221124
2	25	6680-01-060-7175	19207	12258875
2	26	4720-01-070-8805	19207	11669236
2	27	4730-01-075-2814	19207	12258852
3	4	5305-00-459-4687	96906	MS1957-14B
3	5	5310-00-057-0573	80205	NAS62004
3	6	6650-01-267-8946	19207	12258827
3	7	5980-01-068-1084	19207	*11669222*
3	8	5310-00-845-2359	90205	NAS1291004M

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FIGURE AND ITEM NUMBER INDEX

FIG.	ITEM	STOCK NUMBER	CAGEC	PART NUMBER
3	11	5998-01-069-3377	19207	12258794
3	12	5305-00-448-6547	96906	MS51957-278
3	13	5310-00-773-7624	80205	NAS62006
3	14	7690-01-102-7177	19207	12258948
-\	15	5340-01-102-6872	19207	12258795

GLOSSARY

TERM	DEFINITION
Condition the Current Probe	A method of calibrating the current probe, TK Item 11. See Appendix J.
Continuity Test	A means of determining if a wire cable is broken by measuring for zero resistance. See paragraph 2-3-35.
DCA	Diagnostic Connector Assembly. A connector mounted in vehicle/equipment which is used to make measurements. See paragraph 2-3-54, DCA Tests.
DCA ID	Diagnostic Connector Assembly Identification Number. Each DCA harness has a resistor installed in it. This resistor value determines the DCA ID.
Ignition Adapter	A device used with the ignition adapter cable W3 to make speed measurements on SI engines. See paragraph 1-2-3 for TK Item 30.
Offset Test	A method of zero adjusting the VTM. See Appendix J.
Pulse Tachometer	A device used to make speed measurements on CI engines. See paragraph 1-2-3 for TK Item 34.
TK ID	Transducer Identification Number. Each transducer has a resistor inside which determines the TK ID.
Transducer	Transducers are devices which convert physical quantities to electrical energy.
VID	Vehicle Identification Number assigned to a vehicle/equipment to identify information stored in the VTM for special tests.

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By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

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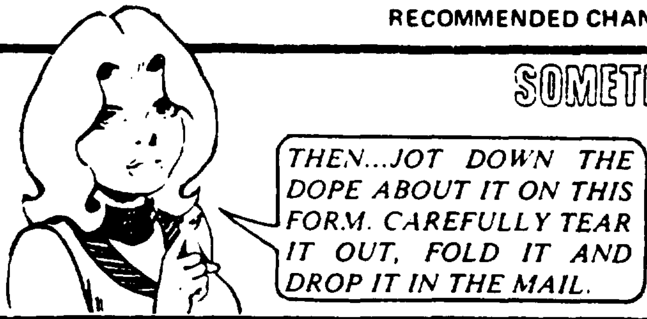

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