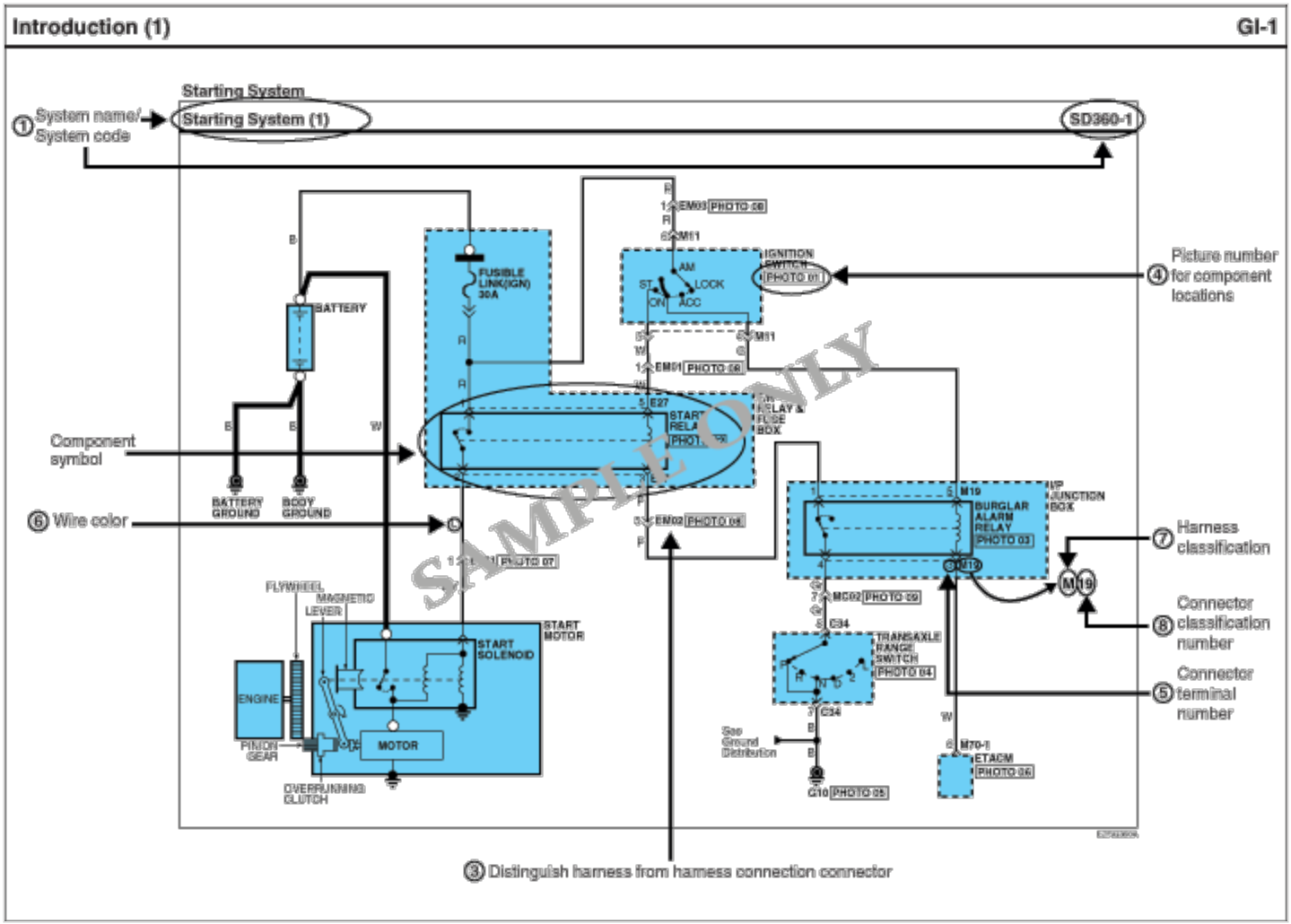
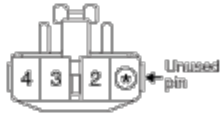
Introduction

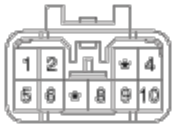


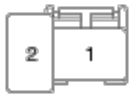
Starting System

Starting System (2) SD360-2

Connector configurations (components)







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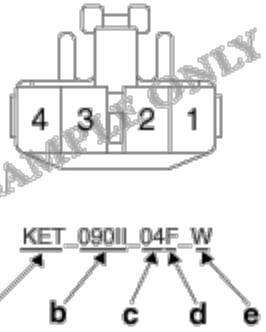
Explanation of connector code



a : Connector manufacturer
b : Terminal series number
c : The number of connector terminals
d : Connector distinguishing → Female Pin : F / Male Pin : M
e : Connector color abbreviations
- B (Black)
- Br (Brown)
- G (Green)
- Gr (Gray)
- L (Blue)
- R (Red)
- W (White)
- Y (Yellow)

① Pages by system/ Name of Schematic diagram

- Each page is consisted of circuits by system. This schematic diagram includes the path of electricity flow, connection condition for each switch, and the function of other relevant circuits at once. It is applicable to real service work.
- It is very important to understand relevant circuits exactly before troubleshooting diagnosis.
- Circuits by system depends upon part number and are indicated on schematic diagram index.

② Connector configuration (components)

- The connector figure of components in the schematic diagram by system is indicated on the last page of schematic diagram.
- It shows the front of the connector on the harness side when not to the harness connector. The terminal number on each connector can be obtained by following the pattern used in ⑤ connector view and numbering order. Unused terminals are marked with an asterisk (*).

③ Connector configurations (connection between harnesses)

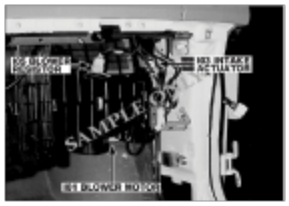
- When connecting the harness with connector between harnesses, it shows female and male connectors and indicates them on the connector configurations group.

EM02

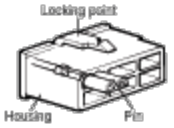
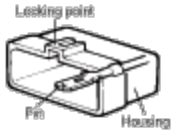
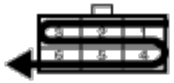
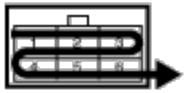
④ Component locations

- To find the components easily, a component locations diagram is indicated with "PHOTO NO" on the lower portion of the component name.
- To make it easy to distinguish connectors, the connector in the picture is indicated being installed in the vehicle.

PHOTO 03



⑤ CONNECTOR VIEW AND NUMBERING ORDER

Female	Male	Remarks
		It is not the shape of the connector housing, but the connector pin that distinguishes between male or female connectors. When numbering female and male connectors, refer to the numbering order in the following table. Some connectors may not follow this method of numbering order. For individual detailed numbering, refer to the CONNECTOR CONFIGURATIONS.
		
		Numbered in order from upper right to lower left Numbered in order from upper left to lower right

NOTE

UNLESS OTHERWISE STATED, ALL CONNECTOR VIEWS ARE FROM THE TERMINAL SIDE OF THE CONNECTOR.

⑥ WIRE COLOR ABBREVIATIONS

The following abbreviations are used to identify wire colors in the circuit schematics.

Symbol	Color of wire	Symbol	Color of wire
B	Black	O	Orange
Br	Brown	P	Pink
G	Green	R	Red
Gr	Gray	W	White
L	Blue	Y	Yellow
Lg	Light Green	LI	Light Blue

* (Y)/(B): Yellow wire with black stripe (2 colors)
  - (Y): the color of wire
  - (B): the color of stripe

⑦ HARNESS CLASSIFICATION

Electrical wiring connectors are classified according to the wiring parts in the Harness Layouts.

Symbol	Harness name	Location
C	Control, Injector, Ignition Coil, Oil Control Valve harness	Engine Compartment
D	Door harness	Door
E	Front, Front End Module harness	Engine Compartment
F	Floor, Rear Bumper harness	Floor, Rear Bumper
M	Main, Console EXT. harness	Passenger Compartment
R	Roof harness	Roof
S	Seat harness	Seat

* Depending on the vehicle, it is necessary to check the harness name symbol on the harness layouts for detailed symbol.

⑧ CONNECTOR IDENTIFICATION

A connector identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector.
These connector locations can be found in the HARNESS LAYOUTS.

For example:

E 10 -1
- -1: Number corresponding to sub-connector (Serial Number)
- 10: Number corresponding to main connector (Serial Number)
- E: Symbol indicating wiring harness (Engine wiring harness)

NOTE

Connectors which connect each wiring harness are represented by the following symbols.

For example:

M R 01
- 01: Number corresponding to main connector (Serial Number)
- R: Rear wiring harness
- M: Main wiring harness

JUNCTION BLOCK IDENTIFICATION

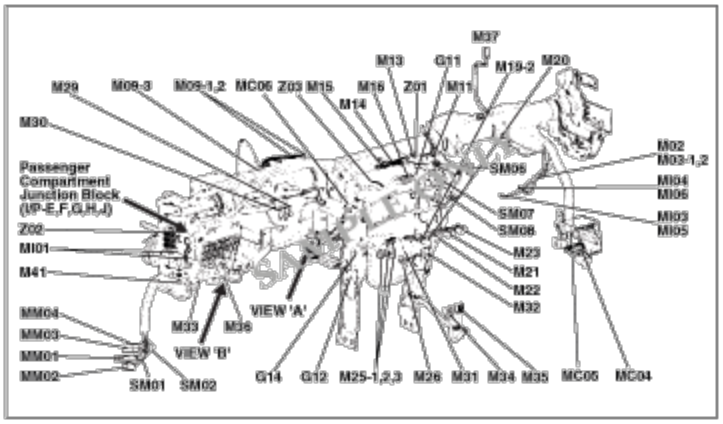
A junction block identification symbol consists of a wiring harness location classification symbol corresponding to a wiring harness location and number corresponding to the connector in the junction block.

For example:

I/P- A
- A: Connector name
- I/P: Abbreviation of the word "Passenger compartment junction block"

HARNESS LAYOUTS

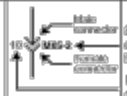
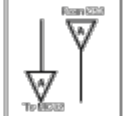
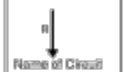
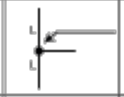
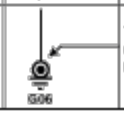
Harness layouts show the routing of the major wiring harnesses, the in-line connectors and the splices between the major harnesses. These layouts will make electrical troubleshooting easier.

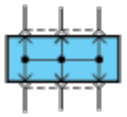
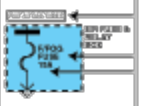
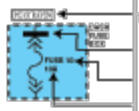


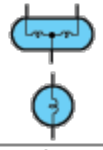
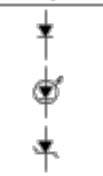
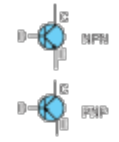
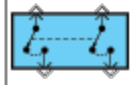
Symbols

Symbols (1)

Section	Symbol	Meaning
COMPONENT		A solid line means the entire component is shown.
		A broken line indicates only part of the component is shown.
		This means the connector connects directly to the component.
		This indicates the connector connects to a lead (pigtail), wired directly to the component.
		This indicates a screw terminal on the component.
		This ground symbol (dot and 3 lines overlapping the component) means the housing of the component is attached to a metal part of the vehicle.
		The name of the component appears next to its upper right corner. Shows the number of pictures for component location.

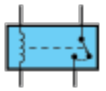
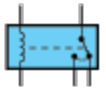
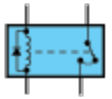
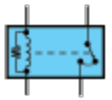
Section	Symbol	Meaning
CONNECTOR		Shows the name of each connector on the component location index for reference. Indicates the number of corresponding terminal. (Only relevant terminal on the corresponding schematic diagram).
		The dashed-line means each of the wires connect with same connector (E05)
WIRE		A wavy line means the wire is broken but is to be continued.
		Wire insulation is yellow with a red strip.
		Current path is continued on the same page or another page.The arrow shows the direction of current flow. You should look for the "A" in the marked position.
		A wire connects to another circuit. The wire is shown again on that circuit which the arrow is pointing.
		Wire choices for options or different models are labeled and shown with a "choice" bracket like this.
SPLICES		Splices are numbered and shown as a dot with circle. The exact location and connection of these splices may vary among vehicles.
GROUND		This symbol means the end of the wire is attached to a metal part of the vehicle.

Section	Symbol	Meaning
SHIELD WIRE		This represents RFI (Radio Frequency Interference) Shielding around a wire. The shielding is always connected to ground.
JOINT CONNECTOR		This is a connector showing the joining wires.
FUSE BOX		Power supplied at all times Name Capacity
FUSE		This means power is supplied with the ignition on position. This means the short bar connects to other fuses. Identification Current rating
CONTROL RELAY BOX		Control battery power at all times

Section	Symbol	Meaning
LAMP		Double filament Single filament
DIODE		Diode Led diode Zener diode
TR		NPN PNP
GENERAL COMPONENT SYMBOL		These switches move together; a dashed line shows a mechanical connection between them.
		Switch (1 contact point)
		Heater

Symbols (2) GI-7

Section	Symbol	Meaning
GENERAL COMPONENTS SYMBOL		Sensor
		Sender
		Injector
		Solenoid
		Motor
		Battery

Section	Symbol	Meaning
GENERAL COMPONENTS SYMBOL		Condenser
		Speaker
		Horn, Buzzer, Siren, Chime Bell
RELAY		Normally open contact
		This is a relay shown with no current flowing through its coil. When a current flows through coil, contact will toggle.
		Diode interior relay
		Resistance interior relay

Troubleshooting Instructions

TROUBLESHOOTING INSTRUCTIONS

TROUBLESHOOTING PROCEDURES

The following five-step troubleshooting procedure is recommended.

1. Verify the customer's complaints

Turn on all the components in the problem circuit to check the accuracy of the customer's complaints. Note the symptoms.
Do not begin disassembly or testing until you have narrowed down the probable causes.

2. Read and analyze the schematic diagram

Locate the schematic for the problem circuit. Determine how the circuit is supposed to work by tracing the current paths from the power source through the system components to ground. If you do not understand how the circuit should work, read the circuit operation text. Also check other circuits that share with the problem circuit. The name of circuits that share the same fuse, ground, or switch, for example, are referred to on each diagram. Try to operate any shared circuits you did not check in step 1. If the shared circuit works, the shared wiring is okay, and the cause must be within the wiring used only by the problem circuit.
If several circuits fail at the same time, the fuse or ground is a likely cause.

3. Inspect the circuit/ component with the problem isolated

Make a circuit test to check the diagnosis you made in step 2. Remember that a logical, simple procedure is the key to efficient troubleshooting. Narrow down the probable causes using the troubleshooting hints and system diagnosis charts. Test for the most likely cause of failure first.
Try to make tests at points that are easily accessible.

4. Repair the problem

Once the problem is found, make the necessary repairs.

5. Make sure the circuit works

Repeat the system check to be sure you have repaired the problem. If the problem was a blown fuse, be sure to test all of the circuits on that fuse.

TROUBLESHOOTING EQUIPMENT

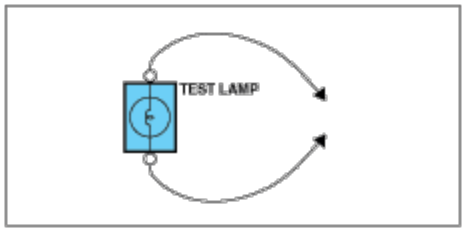
VOLTMETER AND TEST LAMP

Use a test lamp or a voltmeter on circuits without solidstate units and use a test lamp to check for voltage. A test lamp is made up of a 12-volt light bulb with a pair of leads attached. After grounding one lead, touch the other lead to various points along the circuit where voltage should be present.
When the bulb goes on, there is voltage at the point being tested.

CAUTION

A number of circuits include solid-state modules, such as the Engine Control Module(ECM), used with computer command control injection. Voltage in these circuits should be tested only with a 10-megaohm or higher impedance digital multimeter. Never use a test lamp on circuits that contain solid state modules. Damage to the modules may result.

A voltmeter can be used in place of a test lamp. While a test lamp shows whether the voltage is present or not, a voltmeter indicates how much voltage is present.



SELF-POWERED TEST LAMP AND OHMMETER

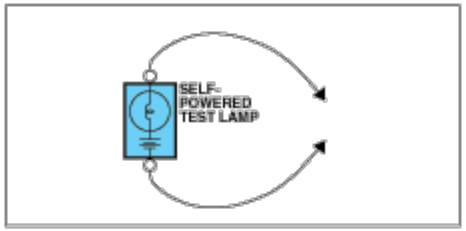
Use a self-powered test lamp or an ohmmeter to check for continuity.
The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

CAUTION

Never use a self-powered test lamp on circuits that contain solid state modules. Damage to these modules may result.

An ohmmeter can be used in place of a self-powered test lamp.
The ohmmeter shows how much resistance there is between two points along a circuit. Low resistance means good continuity.

Circuits which include any solid-state devices should be tested only with a 10-megaohm or higher impedance digital multimeter. When measuring resistance with a digital multimeter, the battery negative terminal should be disconnected. Otherwise, there may be incorrect readings. Diodes and solid-state devices in a circuit can make an ohmmeter give a false reading. To find out if a component is affecting a measurement, take one reading, reverse the leads and take a second reading.
If different the solid-state device is affecting the measurement.



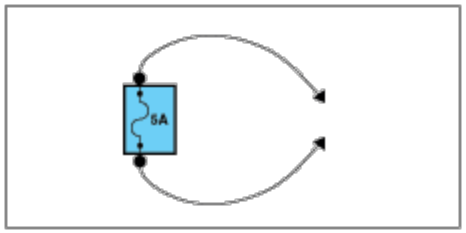
JUMPER WIRE WITH FUSE

Use a jumper wire with a fuse to by-pass an open circuit.

A jumper wire is made up of an in-line fuse holder connected to a set of test leads. This tool is available with small clamp connectors providing adaption to most connectors without damage.

CAUTION

Do not use a fuse with a higher rating than the specified fuse that protects the circuit being tested. Do not use this tool in any situation to substitute an input or output at the solid-state control module, such as ECM, TCM, etc.



SHORT FINDER

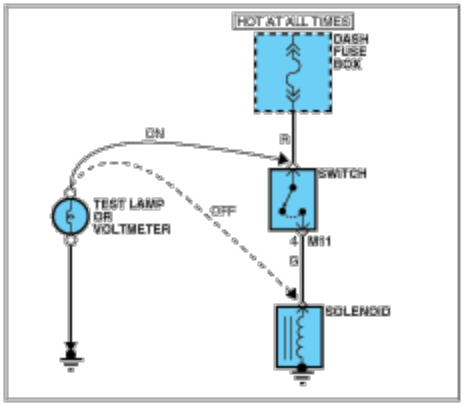
A short finder is available to locate a short to ground. The short finder creates a pulsing magnetic field in the shorted circuit and shows you the location of the short through body trim or sheet metal.

TROUBLESHOOTING TEST

1. TESTING FOR VOLTAGE

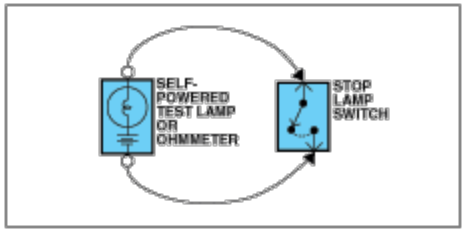
This test measures voltage in a circuit. When testing for voltage at a connector, you do not have to separate the two halves of the connector. Instead, probe the connector from the back(backprobe). Always check both sides of the connector because dirt and corrosion between its contact surfaces can cause electrical problems.

A. Connect one lead of a test lamp or voltmeter to a ground. If you are using a voltmeter, be sure it is the voltmeter's negative test lead you have connected to ground.
B. Connect the other lead of the test lamp or voltmeter to a selected test point(connector or terminal).
C. If the test lamp glows, there is voltage present. If you are using a voltmeter, note the voltage reading. A loss of more than 1 volt from specification indicates a problem.



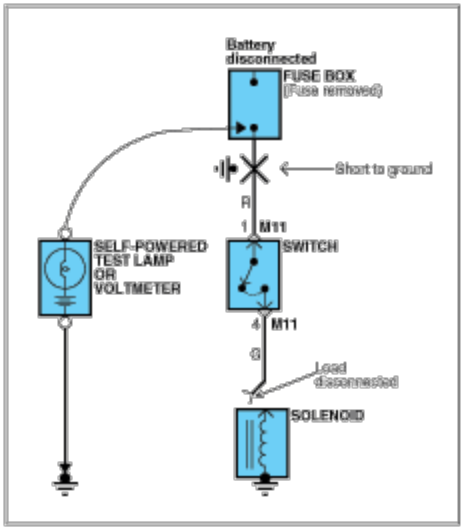
2. TESTING FOR CONTINUITY

A. Disconnect the battery negative terminal.
B. Connect one lead of a self-powered test lamp or ohmmeter to one end of the part of the circuit you wish to test. If you are using an ohmmeter, hold the leads together and adjust the ohmmeter to read zero ohms.
C. Connect the other lead to the other end.
D. If the self-power test lamp glows, there is continuity. If you are using an ohmmeter, low or zero resistance means good continuity.



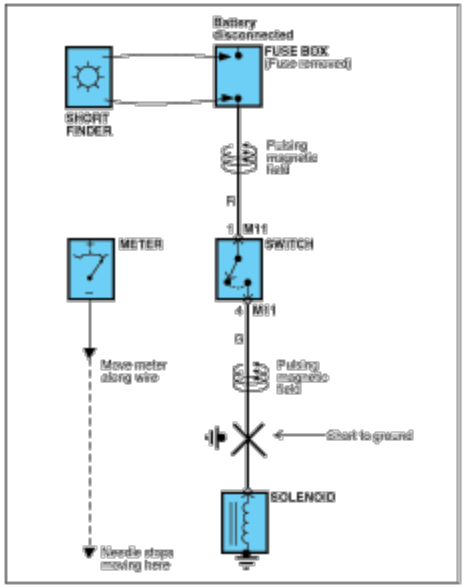
3. TESTING FOR SHORT TO GROUND

A. Disconnect the battery negative terminal.
B. Connect one lead of a self-powered test lamp or an ohmmeter to the fuse terminal on the load side.
C. Connect the other lead to a ground.
D. Beginning near the fuse block move the harness from side to side. Continue this proceedure(about six inches apart) while watching the self-powered test lamp or ohmmeter.
E. When the self-powered test lamp glows, or ohmmeter registers, there is a short to a ground in the wiring near that point.



4. TESTING FOR A SHORT WITH A SHORT FINDER

A. Remove the blown fuse. Leave the battery connected.
B. Connect the short finder across the fuse terminals.
C. Close all switches in series in the circuit that is being testing.
D. Turn on the short circuit locator. It sends pulses of current to the short. This creates a pulsing magnetic field around the wiring between the fuse box and the short.
E. Beginning at the fuse box, slowly move the short finder along the circuit wiring. The meter will show current pulses through sheet metal and body trim. As long as the meter is between the fuse and the short, the needle will move with each current pulse. Once the meter is moved past the point of the short, the needle will stop moving. Check around this area to locate the cause of the short circuit.



Wiring Repair

*** WRK II Standardd Kit "GHWRK2"**
Total 117 connectors well designed to repair automotive wiring harness instead of whole parts with wiring harness replacement (1 set of connector = 5 connectors each)

* Effective to save the labor & parts cost and reduce time to complete the service on vehicle

WRK II Tool Set (GHWRK2T)

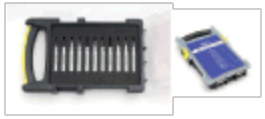
No.	Part No.	Part Name	Q'ty
1	GHWRK2T-MPC01	Multi Purpose Crimper	1
2	GHWRK2T-WRS01	Wire Stripper	1
3	GHWRK2T-STS03	Shrink Tube Set	5
4	GHWRK2T-STS05		5
5	GHWRK2T-STS09		5
6	GHWRK2T-STS12		5
7	GHWRK2T-SDR01	Solder	1
8	GHWRK2T-SHT01	Shield Tape	1
9	GHWRK2T-TLB01	Tool Box	1

Crimper

Stripper

WRK II Reference Service Tools

WRK II Tool Set



WRK II Removable Tools

WRK II Cabinet Set

WRK II Removable Tools (WRKRT10000)

- Total 11 Removable Tools cover all 117 connectors

Removable Tool			
			
WRKRT00001	WRKRT00002	WRKRT00003	WRKRT00004
			
WRKRT00005	WRKRT00006	WRKRT00007	WRKRT00008
			
WRKRT00009	WRKRT00010	WRKRT00011	

WRK II Cabinet Set (WRKCB60000)

- Twelve drawer cabinets X 6 EA with WRK all connectors Numbers

- Total 72 slots with enough space for 10 connectors in each slot except big size connectors

REWORK PROCEDURE

1. Use of WRKII Tool Set (GHWRK2T)

1) Disconnect the battery cable.

2) Choose the correct clamping slot for the wire and strip off the wire coat.

◉ If the incorrect crimping slot is used, the terminal may be damaged and may not fitt into the connector.

2. Use of In-line solder (GHWRK2T-SDR01) and Shrink tube set (GHWRK2T-STS03, 05, 09, 12)

1) Strip off about 5mm of the wire coat at the end of the wires.

2) Insert each wire into the opposite ends of the in-line solder and crimp using a wire stripper.

3) Put the shrink tube over the connection area and shrink the tube using an electrical hot gun.

4) The shrink tube should be securely wrapped around the soldering area and exposed wiring.

3. Use of WRKII Removable Tool (WRKRT10000)

▶ **Flat tip type** : Removal of single locking male/ female terminal from the connector

1) Remove the front or rear retainer (holder, stopper) of the connector.

2) Ensure that the tip of the tool is inserted into the gap between the elastic arm of key and terminal.

3) Remove the terminal and check the terminal condition, if it is damaged, replace it with a new terminal

▶ **Double tip type** : Removal of double locking male/ female terminal from the connector.