

2014 ELECTRICAL**Wiring Systems and Power Management - Diagnostic Information and Procedures - Acadia, Enclave And Traverse****DIAGNOSTIC INFORMATION AND PROCEDURES****DTC B0005****Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor**DTC B0005 00**

In Park Switch Circuit

Circuit/System Description

The body control module (BCM) supplies the park enable signal circuit voltage when the vehicle transmission is in Park.

Conditions for Running the DTC

The system voltage is between 9-16 volts.

Conditions for Setting the DTC

The BCM detects there is a short to ground for greater than 5 seconds.

Action Taken When the DTC Sets

The BCM will not supply voltage to the circuit.

Conditions for Clearing the DTC

- The current DTC will clear when the malfunction is no longer present.
- A history DTC clears when the module ignition cycle counter reaches the reset threshold of 50, without a repeat of the malfunction.

Reference Information

Schematic Reference

Body Control System Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Testing

1. Ignition OFF, disconnect the X5 harness connector at the BCM.
2. Verify there is no aftermarket component wired to terminal 19.
 - If there is an aftermarket component wire, test the circuit terminal for a short to ground. If the circuit tests normal, replace the BCM.
3. If all circuits test normal, replace the BCM.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Body Control Module Replacement**
- **Control Module References** for module replacement, setup and programming

DTC B1370-B1379, B1380-B1389 OR B1440-B1443

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

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DTC B1370 01

Device Ignition 1 (ON and START) Circuit Short to Battery

DTC B1370 06

Device Ignition 1 (ON and START) Circuit Short to Ground or Open

DTC B1380 01

Device Ignition ACCESSORY Circuit Short to Battery

DTC B1380 06

Device Ignition ACCESSORY Circuit Short to Ground or Open

DTC B1440 00

Power Mode Master Input Circuits Mismatch

DTC B1441 01

Device Ignition OFF, RUN and CRANK Circuit Short to Battery

DTC B1441 06

Device Ignition OFF, RUN and CRANK Circuit Short to Ground or Open

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
B+ - Terminal 2	B1370 06, B1380 06, B1440 00, U0100-U0299, 1, 2	B1370 06, B1380 06, B1440 00, U0100-U0299	-	-
Ignition - Terminal 1	B1370 06, B1380 06, U0100-U0299, 1, 2	B1370 06	B1370 01, U0100-U0299, 1	-
Ignition - Terminal 3	B1370 06, B1380 06, U0100-U0299, 1, 2	B1380 06	B1380 01	-
	B1370 06,			

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Ignition - Terminal 4	B1380 06, B1440 00, U0100-U0299, 1, 2	B1440 00, B1441 06	B1440 00, B1441 06	-
Ignition - BCM terminal 21, X4	B1428, 1	B1370 06	-	-
Accessory Wakeup Serial Data, BCM terminal 19, X4	U1814, 3	U0100-U0299, P0513 00	-	-

1. This circuit/condition will cause B+ fuse to open and may cause a no start condition.
2. Scan Tool Does Not Communicate with High Speed GMLAN Device
3. This circuit is a pass through circuit in the BCM and will cause B+ fuse to open.

Circuit/System Description

The vehicle power mode master (PMM) is the body control module (BCM). The ignition switch is a low current switch with multiple discrete ignition switch signals to the PMM for determination of the power mode. The PMM receives the ignition switch signals and additionally a reference voltage signal from the BCM, through the ignition switch and back to the BCM. There are redundancies within the PMM system that can allow operation of certain subsystems when there are faults in the ignition switch circuits. Other information such as serial data input from other modules and DTCs is also used to determine what power mode signals and information is transmitted by the PMM. The BCM logic uses all this information to identify the operator's desired power mode and activate specific discrete signals and serial data messages for the operation of different subsystems as necessary. Other modules which have switched voltage inputs may operate in a default mode if the PMM serial data message does not match what the individual module can detect from its own connections.

The PMM will activate relays and other direct outputs of the PMM as needed according to the calculated power mode. Some relays controlled by the BCM are switched ignition voltage outputs that are pass through circuits within the BCM directly from the ignition switch. If these circuits short to ground, the B+ circuit fuse to the ignition switch will open.

Conditions for Running the DTC**B1370 01**

Ignition switch is in the OFF or ACC positions.

B1370 06, B1380 01, B1441 01 and B1441 06

Ignition switch is in the START position.

B1380 06 and B1440 00

Ignition switch is in the RUN position.

Conditions for Setting the DTC

B1370 01, B1380 01, B1441 01

The circuit is shorted to voltage.

B1370 06

- Ignition 1 voltage circuit is open.
- B+ circuit of the ignition switch open or shorted to ground.

B1380 06

- Accessory voltage circuit is open.
- B+ circuit of the ignition switch open or shorted to ground.

B1440 00

- BCM senses an open or short to voltage on the off/run/crank circuit when both ignition accessory/run and ignition run/crank parameters are active.
- BCM senses an open on the B+ circuit (to the ignition switch) while engine is running. An open on the B+ circuit can be caused by a short to ground on any of the following circuits:
 - B+
 - Accessory
 - Run/crank
 - Off/run/crank

B1441 06

Off/run/crank circuit is open.

Conditions for Clearing the DTC

A current DTC clears when the malfunction is no longer present.

Diagnostic Aids

- A short to ground in the ignition circuit of the run crank relay will cause the B+ circuit fuse to the ignition switch to open. DTC B1428 should be current.
- The power modes and controls are determined using BCM logic. Comparing the Body Control Module Power Mode data display parameters listed in Circuit/System Verification to the scan tool values of the vehicle will determine if there is a power mode fault.

Reference Information**Schematic Reference**

- Power Distribution Schematics
- Power Moding Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Mode Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC U1814 or B1428 is not set.
 - If any of the DTCs are set, refer to Diagnostic Trouble Code (DTC) List - Vehicle .
2. With a scan tool, access BCM, Power Mode data display list and compare all parameters listed with the corresponding ignition key position. The PMM Power Mode Parameters table below illustrates the correct state of these input parameters in correspondence to the ignition switch position. The circuits which the individual parameters are related to are in parentheses.
 - If any parameters are incorrect in any key position, refer to Circuit/System Testing or Component Testing.

PMM Power Mode Parameters

Ignition Switch Position	Current Power Mode	Ign. Off/Run/Crank (Terminal 4)	Ignition Accessory/Run (Terminal 3)	Ignition Run/Crank (Terminal 1)
Off Key Out	Off	Key Out/ACC	Inactive	Inactive
Off Key IN	Off	Key In/Off	Inactive	Inactive
Accessory	Accessory	Key Out/ACC	Active	Inactive
Run	Run	Run	Active	Active
Start	Crank Request	Crank	Inactive	Active

Circuit/System Testing

1. Connect a test lamp between each fuse test terminal of the ignition switch B+ circuit fuse and ground. The test lamp should illuminate.

IMPORTANT: You must perform Circuit/System Verification before proceeding with Circuit/System Testing.

- If the test lamp does not illuminate, test the circuits listed below for a short to ground. If all circuits test OK, replace the BCM.
 - B+ terminal 2
 - Ignition terminal 3
 - Ignition terminal 4
 - Ignition terminal 1
 - Ignition terminal, BCM terminal 19, X4
 - Ignition terminal, BCM terminal 21, X4
- 2. Disconnect the harness connector at the ignition switch.
- 3. Connect a test lamp between the B+ circuit terminal 2 and ground. The test lamp should illuminate.
 - If the test lamp does not illuminate, test the B+ circuit for an open/high resistance.
- 4. Perform the ignition switch component test.

IMPORTANT: The ignition switch component test must be performed before proceeding with this test to verify the integrity of the switch.

- If the ignition switch does not test normal, replace the ignition switch.
- 5. Disconnect the X1 harness connector at the BCM, test for less than 1.0 volt between the following circuit terminals of the BCM and ground.
 - Ignition terminal 4
 - Ignition terminal 2
 - Ignition terminal 21
 - Ignition terminal 14
 - If greater than specified, test the circuit for a short to voltage.
- 6. Test for less than 1.0 ohm between the BCM and the ignition switch on the circuits listed below:
 - Ignition terminal 4, X1 and ignition switch terminal 6
 - Ignition terminal 2, X1 and ignition switch terminal 4
 - Ignition terminal 21, X1 and ignition switch terminal 3
 - Ignition terminal 14, X1 and ignition switch terminal 1
 - If greater than specified, repair the circuit for open/high resistance
- 7. If all circuits test normal, replace the BCM.

Component Testing

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Ignition Switch

1. Ignition OFF, disconnect the harness connector at the ignition switch.
2. Verify the resistance between the terminals listed below match for each ignition switch position.
 - o If not the specified value, replace the ignition switch.

Resistance Test

Ignition Switch Position	Terminals 1 and 2	Terminals 2 and 3	Terminals 2 and 4	Terminals 2 and 6	Terminals 4 and 6
Off Key Out	Infinite	Infinite	Infinite	Infinite	Infinite
Off Key IN	Infinite	Infinite	< 5.0 ohms	Infinite	Infinite
Accessory	Infinite	< 5.0 ohms	Infinite	Infinite	Infinite
Run	< 5.0 ohms	< 5.0 ohms	Infinite	Infinite	< 5.0 ohms
Start	< 5.0 ohms	Infinite	Infinite	Infinite	1275-1325 ohms

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Ignition and Start Switch Replacement**
- **Control Module References** for BCM replacement, setup and programming

DTC B1428

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B1428

Ignition Switched Power Run/Crank Relay Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition Relay Coil Control	B1428	1	-	-
1. No power at multiple fuses in the RUN and CRANK position.				

Circuit/System Description

The body control module (BCM) controls the IGN relay by applying voltage to the circuit. The IGN relay is energized when the ignition switch is in RUN or START or when a remote start is requested.

Conditions for Running the DTC

- The system voltage is between 9-16 volts.
- The DTC can only run when the output is activated.

Conditions for Setting the DTC

DTC will set when the output is activated and there is a short to ground in the circuit.

Action Taken When the DTC Sets

The module output driver will be shut down and not supply voltage to the run/crank ignition 1 voltage circuit

Conditions for Clearing the DTC

- The current DTC will clear when the module request for the output is removed or the malfunction is no longer present.
- A history DTC clears when the module ignition cycle counter reaches the reset threshold of 50, without a repeat of the malfunction.

Reference Information

Schematic Reference

- **Power Moding Schematics**
- **Power Distribution Schematics**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information**Circuit/System Testing**

1. Ignition OFF, disconnect the IGN relay.
2. Connect a test lamp between the relay control circuit and ground.
3. Cycle the ignition ON and OFF. The test lamp should turn ON and OFF when changing ignition switch positions.
 - If the test lamp is always ON, test the control circuit for a short to voltage. If the circuit tests normal, replace the BCM.
 - If the test lamp is always OFF, test the control circuit for a short to ground or an open/high resistance. If the circuit tests normal, replace the BCM.
4. If all circuits test normal, test or replace the IGN relay.

Component Testing

1. Ignition OFF, disconnect the IGN relay.
2. Test for 70-150 ohms of resistance between terminals 85 and 86.
 - If the resistance is not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
 - 30 and 86
 - 30 and 87
 - 30 and 85
 - 85 and 87
4. Test for less than 2 ohms of resistance between terminals 30 and 87A.
 - If greater than the specified range, replace the relay.
5. Install a 3-amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Measure for less than 2 ohms of resistance between terminals 30 and 87.
 - If greater than 2 ohms, replace the relay.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for control module replacement, setup and programming.

DTC B1433**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B1433 00

Ignition Switched Power Relay 2 Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Run Relay Coil Control	B1433 00	1	-	-
1. No power at multiple fuses in the RUN position.				

Circuit/System Description

The body control module (BCM) controls the RUN relay through the run relay coil control circuit by applying voltage to the coil side of the relay. The RUN relay is energized when any of the following conditions are true:

- Ignition Switch is in ACC or RUN.
- The vehicle was remote started.
- The vehicle is in retained accessory power (RAP) mode.

Conditions for Running the DTC

- The system voltage is between 9-16 volts.
- The DTC can only set when the output is actively being requested by the module.

Conditions for Setting the DTC

The DTC will set only when the module requests the output and there is a short to ground in the run relay coil control circuit.

Action Taken When the DTC Sets

The module output driver will be shut down and not supply voltage to the circuit.

Conditions for Clearing the DTC

- The current DTC will clear when the module request for the output is removed or the malfunction is no longer present.
- A history DTC clears when the module ignition cycle counter reaches the reset threshold of 50, without a repeat of the malfunction.

Diagnostic Aids

A short to voltage may cause some accessories to operate with the ignition key out and cause a low battery after extended non vehicle use.

Reference Information

Schematic Reference

Power Moding Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Retained Accessory Power Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information.

Circuit/System Testing

1. With the ignition OFF, disconnect the RUN relay.
2. Connect a test lamp between the relay coil control circuit terminal and ground.
3. Cycle the ignition ON and OFF. The test lamp should turn ON and OFF when changing ignition switch positions.
 - If the test lamp is always ON, test the control circuit for a short to voltage. If the circuit tests normal, replace the BCM.
 - If the test lamp is always OFF, test the control circuit for a short to ground or open/high resistance. If the circuit tests normal, replace the BCM.
4. If the test lamp illuminates normal, test or replace the Run relay.

Component Testing**Rap Relay Test**

1. Ignition OFF, disconnect the RUN relay.
2. Test for 70-110 ohms of resistance between terminals 85 and 86.
 - If the resistance is not within the specified range, replace the relay.
3. Test for infinite resistance between the following terminals:
 - 30 and 86
 - 30 and 87
 - 30 and 85
 - 85 and 87
 - If less than the specified range, replace the relay.
4. Install a 20-amp fused jumper wire between relay terminal 85 and 12 volts. Install a jumper wire between relay terminal 86 and ground. Test for less than 5 ohms between terminals 30 and 87.
 - If greater than the specified range, replace the relay.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

Control Module References for BCM replacement, setup and programming

DTC B1475

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC B1475 00

Retained Accessory Power Circuit

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition I/II Voltage	B1475 00	1	1	-
1. Retained Accessory Power (RAP) Malfunction				

Circuit/System Description

The body control module (BCM) controls the wired retained accessory power (RAP) components by applying

voltage to the ignition I/II voltage circuit. Voltage is applied when any of the following is true:

- Ignition switch is in ACC or ON.
- The vehicle was remote started.
- The vehicle is in RAP mode.

Conditions for Running the DTC

- The system voltage is between 9-16 volts.
- The DTC can only set when the output is actively being requested by the module. Refer to **Circuit/System Description** for specific conditions.

Conditions for Setting the DTC

The DTC will set only when the module requests the output and there is a short to ground in the ignition I/II voltage circuit.

Action Taken When the DTC Sets

The module output driver will be shut down and not supply voltage to the circuit.

Conditions for Clearing the DTC

- The current DTC will clear when the malfunction is no longer present.
- A history DTC clears when the module ignition cycle counter reaches the reset threshold of 50, without a repeat of the malfunction.

Diagnostic Aids

- The radio RAP mode is separate function and will still operate properly.
- The ignition switch may not return to the OFF position if voltage is not applied to the ignition I/II voltage circuit.

Reference Information

Schematic Reference

IGN I/II in **Power Moding Schematics**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Retained Accessory Power Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Testing

1. Ignition ON, verify DTC B1475 is set as current.
 - If DTC B1475 is not set as current, operate the vehicle within the Conditions for Setting the DTC.
2. Disconnect each of the following components one at a time. The components may be disconnected in any order. After each component is disconnected, cycle the ignition and verify DTC B1475 remains set as current.

IMPORTANT: When cycling the ignition, keep ignition OFF for 5 seconds before checking for current DTC.

- Automatic transmission shift lever
 - Sunroof shade module (with RPO C3U)
 - Sunroof control module (with RPO C3U)
 - Inside rearview mirror (with RPO DD7/DD8)
 - Auxiliary power outlet - 115V AC (with RPO KVI)
 - Driver window switch (without RPO AXC/AXE)
 - Passenger window switch (without RPO AXC/AXE)
 - If DTC B1475 does not remain set as current, test or replace the last component that was disconnected.
3. With all components disconnected, cycle the ignition and verify DTC B1475 is not set as current.
 - If DTC B1475 remains set as current, test the ignition circuit terminal Z1 at the automatic transmission shift lever harness connector for a short to ground. If the circuit tests normal, replace the BCM.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- 120-Volt Accessory Power Receptacle Replacement
- Automatic Transmission Shift Lock Control Actuator Replacement (Push-to-Release Style Solenoid) , Automatic Transmission Shift Lock Control Actuator Replacement (Pull-to-Release

Style Solenoid)

- **Control Module References** for BCM, sunroof control module, sunroof shade module, inside rear view mirror or window switch replacement, setup and programming

DTC P2534 OR P2535

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC P2534

Ignition On/Start Switch Circuit Low Voltage

DTC P2535

Ignition On/Start Switch Circuit High Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition	P2534	P2534	P2535	-
Ground	-	P2534	-	-

Circuit/System Description

The transmission control module (TCM) samples the system voltage on the Ignition 1 voltage circuit every 0.1 s. Lower than normal voltage may be inadequate to operate the transmission control solenoids properly. Improper solenoid operation may cause erratic transmission operation, which may result in internal damage.

Conditions for Running the DTC

P2534

The TCM ignition voltage signal is valid, with the ignition ON.

P2535

The TCM ignition voltage signal is valid, with the ignition OFF.

Conditions for Setting the DTC

P2534

The TCM detects 6 V or less on the ignition voltage circuit, with the ignition turned ON.

P2535

The TCM detects greater than 6 V or greater on the ignition voltage circuit, with the ignition turned OFF.

Action Taken When the DTC Sets**P2534**

- DTC P2534 is a Type A DTC.
- The TCM turns the high side driver OFF.
- The TCM turns OFF all solenoids.
- The TCM commands maximum line pressure.
- The TCM freezes transmission adaptive functions.
- The TCM commands the TCC OFF.
- The TCM allows the vehicle to operate in transmission protection mode.
- The TCM disables Tap up and Tap down functions.

P2535

DTC P2535 is a Type A DTC.

Conditions for Clearing the DTC

DTCs P2534 and P2535 are Type A DTCs.

Diagnostic Aids

If all circuits test normal, ensure the transmission pass through connector and harness terminals are clean and not damaged and the charging system is functioning correctly.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Engine running.
2. Verify the scan tool TCM Ignition Voltage Signal parameter is between 12.6-15 V.
 - **If not between 12.6-15 V**

Refer to **Circuit/System Testing**.

- **If between 12.6-15 V**
3. Verify that the DTC does not set by operating the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions you observe from the Freeze Frame/Failure Records data. If the vehicle passes the Circuit/System Verification procedure, then STOP. Do not perform the Circuit/System Testing or Component Testing as this may result in an unnecessary part replacement. Refer to **Testing for Intermittent Conditions and Poor Connections**.

Circuit/System Testing

1. Ignition OFF and all vehicle systems OFF, disconnect the X1 harness connector at the T12 Automatic Transmission Assembly.
2. Test for less than 10 ohms between ground circuit terminal 1 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.

- **If less than 10 ohms**
- 3. Test for less than 10 ohms between ground circuit terminal 18 and ground.
 - **If 10 ohms or greater**
 1. Ignition OFF.
 2. Test for less than 2 ohms in the ground circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, repair the open/high resistance in the ground connection.
 - **If less than 10 ohms**
- 4. Ignition ON.
- 5. Verify a test lamp illuminates between B+ circuit terminal 10 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 ohms in the B+ circuit end to end
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, verify the fuse is not open and there is voltage at the fuse.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp.
 2. Test for infinite resistance between the B+ circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.
 - **If the test lamp illuminates**
- 6. Ignition OFF.
- 7. Test for less than 1 V between the ignition circuit terminal 13 and ground.
 - **If 1 V or greater**

Repair the short to voltage on the circuit.
 - **If less than 1 V**
- 8. Ignition ON.
- 9. Verify a test lamp illuminates between ignition circuit terminal 13 and ground.
 - **If the test lamp does not illuminate and the circuit fuse is good**
 1. Ignition OFF, remove the test lamp.
 2. Test for less than 2 ohms in the ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, refer to **Power Mode Mismatch**.
 - **If the test lamp does not illuminate and the circuit fuse is open**
 1. Ignition OFF, remove the test lamp.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground on the circuit.

- If the test lamp illuminates

10. Replace the K71 Transmission Control Module.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Refer to **Control Module References** for transmission control module replacement, programming and setup.

DTC P2537

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptor

DTC P2537

Ignition Accessory Switch Circuit Low Voltage

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
IGN	P2537	P2537	-
Ground	-	P2537	-

Circuit/System Description

The transmission control module (TCM) continuously monitors the voltage on the Ignition Accessory/Run circuit from the body control module (BCM). When the ignition is in the Accessory or Run position, the BCM sends a 12 V wake up signal to the TCM. This wake up signal allows the TCM to power up and start functioning before the engine is started.

Conditions for Running the DTC

The ignition is in the Accessory or Run position.

Conditions for Setting the DTC

The TCM detects the Ignition Accessory/Run circuit is less than 6 V for 1 minute.

Action Taken When the DTC Sets

DTC P2537 is a Type C DTC.

Conditions for Clearing the DTC

DTC P2537 is a Type C DTC.

Reference Information

Schematic Reference

Automatic Transmission Controls Schematics

Connector End View Reference

- **COMPONENT CONNECTOR END VIEWS - INDEX**
- **INLINE HARNESS CONNECTOR END VIEWS - INDEX**

Description and Operation

- **Transmission General Description**
- **Transmission Component and System Description**
- **Electronic Component Description**

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

DTC Type Reference

Powertrain Diagnostic Trouble Code (DTC) Type Definitions

Scan Tool Reference

Control Module References for scan tool information

Special Tools

DT-47825-10 Jumper Harness

For equivalent regional tools, refer to **Special Tools** .

Circuit/System Verification

1. Ignition in the ACCESSORY position.
2. Verify the scan tool BCM Accessory Relay Command parameter is Active.
 - **If the parameter is not Active**

Refer to **Power Mode Mismatch**.

- **If the parameter is Active**
3. Ignition ON.
 4. Verify the scan tool BCM Accessory Relay Command parameter is Active.
 - **If the parameter is not Active**

Refer to **Power Mode Mismatch**.

- **If the parameter is Active**
5. Ignition ON, clear all DTCs in the K9 Body Control Module and the Transmission Control Module, ignition OFF for 2 min.
 6. Engine Running for 1 min with the transmission in Park.
 7. Verify DTC P2537 is not set in the Transmission Control Module.
 - **If DTC P2537 is set**

Refer to **Circuit/System Testing**.

- **If DTC P2537 is not set**
8. After performing the above steps, verify that the DTC does not set by operating the vehicle within the Conditions for Running the DTC. You may also operate the vehicle within the conditions you observe from the Freeze Frame/Failure Records data. If the vehicle passes the Circuit/System Verification procedure, then STOP. Do not perform the Circuit/System Testing or Component Testing as this may result in an unnecessary part replacement. Refer to **Testing for Intermittent Conditions and Poor Connections**.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the T12 Automatic Transmission Assembly. Install the **DT-47825-10** Jumper harness to the X1 vehicle wire harness connector.
2. Ignition ON.
3. Verify a test lamp illuminates between the ignition circuit terminal 15 and ground.
 - **If the test lamp does not illuminate.**
 1. Ignition OFF remove the test lamp, disconnect the X4 harness connector at the K9 Body Control Module.
 2. Test for infinite resistance between the ignition circuit and ground.
 - If less than infinite resistance, repair the short to ground in the circuit.
 - If infinite resistance

3. Test for less than 2 ohms on the ignition circuit end to end.
 - If 2 ohms or greater, repair the open/high resistance in the circuit.
 - If less than 2 ohms, replace the K9 Body Control Module.
 - **If the test lamp illuminates**
4. Replace the K71 Transmission Control Module.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Refer to **Control Module References** for body control module or transmission control module replacement, programming and setup.

SYMPTOMS - WIRING SYSTEMS

NOTE: **The following steps must be completed before using the symptom tables.**

1. Perform the **Diagnostic System Check - Vehicle** before using the symptom tables in order to verify that all of the following are true:
 - There are no DTCs set.
 - The control modules can communicate via the serial data links.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to:
 - **Power Mode Description and Operation**
 - **Retained Accessory Power Description and Operation**

Visual/Physical Inspection

- Inspect for aftermarket devices which could affect the operation of the systems. Refer to **Checking Aftermarket Accessories**.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.

Intermittent

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to **Testing for Intermittent Conditions and Poor Connections**.

Symptom List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Power Mode Mismatch**
- **Retained Accessory Power Malfunction**

IGNITION CAN/CANNOT BE TURNED OFF WITH TRANSMISSION IN ANY GEAR**Diagnostic Instructions**

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Accessory Voltage	1	1	-	-
Ignition Lock Cylinder Control	1	1	2	-
Ground	-	1	-	-
1. Ignition key will not turn to OFF with vehicle in park. 2. Ignition key will turn to OFF with vehicle out of park.				

Circuit/System Description

If the vehicle is equipped with automatic transmission and a floor mounted console gear shift, it has an electronic park lock (EPL) system. The EPL system purpose is to prevent the ignition key from being turned to the OFF position when the transmission is in any position other than PARK and the vehicle may still be moving. The EPL system consists of an ignition lock cylinder solenoid and a park position switch that is located in the A/T shift lock control switch. The ignition lock cylinder solenoid contains a pin that is spring loaded to mechanically prevent the ignition key cylinder from being turned to the lock position when it is not energized. The park position switch receives voltage from the accessory voltage circuit when the ignition is turned ON. When the transmission shift selector is in PARK, the park position switch closes and energizes the ignition lock cylinder solenoid retracting the pin, allowing the ignition switch to be turned OFF. If vehicle power is lost, and/or the transmission is not in the Park position the operator will not be able to turn the ignition key to the lock position and will not be able to remove the ignition key from the column.

Diagnostic Aids

- Manually pushing in the ignition lock cylinder solenoid pin will allow the ignition key to be turned to OFF.
- The ignition lock cylinder control switch is part of the shift lock solenoid/switch assembly.
- The retained accessory circuit feeds the voltage to the automatic transmission shift lever.

Reference Information**Schematic Reference**

- **Ignition Lock Schematics**
- **Power Moding Schematics**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Electronic Park Lock Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Circuit/System Testing

1. If the retained accessory power system operation is incorrect, refer to **Retained Accessory Power Malfunction**.
2. Ignition OFF, disconnect the harness connector at the ignition lock cylinder control actuator.
3. Verify that a test lamp illuminates between the ground circuit terminal 1 and B+.
 - If the test lamp does not illuminate, test the ground circuit for an open/high resistance.
4. Connect a test lamp between the control circuit terminal 2 and ground.
5. Ignition ON, place the transmission shift selector in PARK then out of PARK. The test lamp should turn ON and OFF when changing between PARK then out of PARK.
 - If the test lamp is always ON, test the control circuit for a short to voltage. If the circuit tests normal, test or replace the ignition lock cylinder control switch.
 - If the test lamp is always OFF, test the control circuit and the ignition lock cylinder control switch accessory voltage circuit for a short to ground or open/high resistance. If the circuits test normal, test or replace the ignition lock cylinder control switch.
6. If all circuits test normal, test or replace the ignition lock cylinder control actuator.

Component Testing

Ignition Lock Cylinder Control Switch

1. Ignition OFF, disconnect the harness connector at the ignition lock cylinder control switch.
2. Test for infinite resistance between terminal A and terminal B with the switch in the open position.
 - If less than specified, replace the ignition lock cylinder control switch.
3. Test for less than 2 ohms between terminal A and terminal B with the switch in the closed position.
 - If greater than the specified range, replace the ignition lock cylinder control switch.

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

**Automatic Transmission Shift Lock Control Actuator Replacement (Push-to-Release Style Solenoid) ,
Automatic Transmission Shift Lock Control Actuator Replacement (Pull-to-Release Style Solenoid)**

POWER MODE MISMATCH

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC B1370 01

Device Ignition 1 (ON and START) Circuit Short to Battery

DTC B1370 06

Device Ignition 1 (ON and START) Circuit Short to Ground or Open

DTC B1380 01

Device Ignition ACCESSORY Circuit Short to Battery

DTC B1380 06

Device Ignition ACCESSORY Circuit Short to Ground or Open

DTC B1440 00

Power Mode Master Input Circuits Mismatch

DTC B1441 01

Device Ignition OFF, RUN and CRANK Circuit Short to Battery

DTC B1441 06

Device Ignition OFF, RUN and CRANK Circuit Short to Ground or Open

Diagnostic Fault Information

	Short to	Open/High	Short to	Signal
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Circuit	Ground	Resistance	Voltage	Performance
B+ - Terminal 2	B1370 06, B1380 06, B1440 00, U0100-U0299, 1, 2	B1370 06, B1380 06, B1440 00, U0100-U0299	-	-
Ignition - Terminal 1	B1370 06, B1380 06, U0100-U0299, 1, 2	B1370 06	B1370 01, U0100-U0299, 1	-
Ignition - Terminal 3	B1370 06, B1380 06, U0100-U0299, 1, 2	B1380 06	B1380 01	-
Ignition - Terminal 4	B1370 06, B1380 06, B1440 00, U0100-U0299, 1, 2	B1440 00, B1441 06	B1440 00, B1441 06	-
Ignition - BCM terminal 21, X4	B1428, 1	B1370 06	-	-
Accessory Wakeup Serial Data, BCM terminal 19, X4	U1814, 3	U0100-U0299, P0513 00	-	-
1. This circuit/condition will cause B+ fuse to open and may cause a no start condition. 2. Scan Tool Does Not Communicate with High Speed GMLAN Device 3. This circuit is a pass through circuit in the BCM and will cause B+ fuse to open.				

Circuit/System Description

The vehicle power mode master (PMM) is the body control module (BCM). The ignition switch is a low current switch with multiple discrete ignition switch signals to the PMM for determination of the power mode. The PMM receives the ignition switch signals and additionally a reference voltage signal from the BCM, through the ignition switch and back to the BCM. There are redundancies within the PMM system that can allow operation of certain subsystems when there are faults in the ignition switch circuits. Other information such as serial data input from other modules and DTCs is also used to determine what power mode signals and information is transmitted by the PMM. The BCM logic uses all this information to identify the operator's desired power mode and activate specific discrete signals and serial data messages for the operation of different subsystems as necessary. Other modules which have switched voltage inputs may operate in a default mode if the PMM serial data message does not match what the individual module can detect from its own connections.

The PMM will activate relays and other direct outputs of the PMM as needed according to the calculated power mode. Some relays controlled by the BCM are switched ignition voltage outputs that are pass through circuits within the BCM directly from the ignition switch. If these circuits short to ground, the B+ circuit fuse to the ignition switch will open.

Conditions for Running the DTC

B1370 01

Ignition switch is in the OFF or ACC positions.

B1370 06, B1380 01, B1441 01 and B1441 06

Ignition switch is in the START position.

B1380 06 and B1440 00

Ignition switch is in the RUN position.

Conditions for Setting the DTC**B1370 01, B1380 01, B1441 01**

The circuit is shorted to voltage.

B1370 06

- Ignition 1 voltage circuit is open.
- B+ circuit of the ignition switch open or shorted to ground.

B1380 06

- Accessory voltage circuit is open.
- B+ circuit of the ignition switch open or shorted to ground.

B1440 00

- BCM senses an open or short to voltage on the off/run/crank circuit when both ignition accessory/run and ignition run/crank parameters are active.
- BCM senses an open on the B+ circuit (to the ignition switch) while engine is running. An open on the B+ circuit can be caused by a short to ground on any of the following circuits:
 - B+
 - Accessory
 - Run/crank
 - Off/run/crank

B1441 06

Off/run/crank circuit is open.

Conditions for Clearing the DTC

A current DTC clears when the malfunction is no longer present.

Diagnostic Aids

- A short to ground in the ignition circuit of the run crank relay will cause the B+ circuit fuse to the ignition switch to open. DTC B1428 should be current.
- The power modes and controls are determined using BCM logic. Comparing the Body Control Module Power Mode data display parameters listed in Circuit/System Verification to the scan tool values of the vehicle will determine if there is a power mode fault.

Reference Information

Schematic Reference

- **Power Distribution Schematics**
- **Power Moding Schematics**

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Power Mode Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for scan tool information

Circuit/System Verification

1. Verify that DTC U1814 or B1428 is not set.
 - If any of the DTCs are set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. With a scan tool, access BCM, Power Mode data display list and compare all parameters listed with the corresponding ignition key position. The PMM Power Mode Parameters table below illustrates the correct state of these input parameters in correspondence to the ignition switch position. The circuits which the individual parameters are related to are in parentheses.
 - If any parameters are incorrect in any key position, refer to **Circuit/System Testing** or **Component**

Testing.

PMM Power Mode Parameters

Ignition Switch Position	Current Power Mode	Ign. Off/Run/Crank (Terminal 4)	Ignition Accessory/Run (Terminal 3)	Ignition Run/Crank (Terminal 1)
Off Key Out	Off	Key Out/ACC	Inactive	Inactive
Off Key IN	Off	Key In/Off	Inactive	Inactive
Accessory	Accessory	Key Out/ACC	Active	Inactive
Run	Run	Run	Active	Active
Start	Crank Request	Crank	Inactive	Active

Circuit/System Testing

1. Connect a test lamp between each fuse test terminal of the ignition switch B+ circuit fuse and ground. The test lamp should illuminate.

IMPORTANT: You must perform Circuit/System Verification before proceeding with Circuit/System Testing.

- If the test lamp does not illuminate, test the circuits listed below for a short to ground. If all circuits test OK, replace the BCM.
 - B+ terminal 2
 - Ignition terminal 3
 - Ignition terminal 4
 - Ignition terminal 1
 - Ignition terminal, BCM terminal 19, X4
 - Ignition terminal, BCM terminal 21, X4
- 2. Disconnect the harness connector at the ignition switch.
- 3. Connect a test lamp between the B+ circuit terminal 2 and ground. The test lamp should illuminate.
 - If the test lamp does not illuminate, test the B+ circuit for an open/high resistance.
- 4. Perform the ignition switch component test.

IMPORTANT: The ignition switch component test must be performed before proceeding with this test to verify the integrity of the switch.

- If the ignition switch does not test normal, replace the ignition switch.
- 5. Disconnect the X1 harness connector at the BCM, test for less than 1.0 volt between the following circuit terminals of the BCM and ground.
 - Ignition terminal 4
 - Ignition terminal 2

- Ignition terminal 21
 - Ignition terminal 14
 - If greater than specified, test the circuit for a short to voltage.
6. Test for less than 1.0 ohm between the BCM and the ignition switch on the circuits listed below:
- Ignition terminal 4, X1 and ignition switch terminal 6
 - Ignition terminal 2, X1 and ignition switch terminal 4
 - Ignition terminal 21, X1 and ignition switch terminal 3
 - Ignition terminal 14, X1 and ignition switch terminal 1
 - If greater than specified, repair the circuit for open/high resistance
7. If all circuits test normal, replace the BCM.

Component Testing

Ignition Switch

1. Ignition OFF, disconnect the harness connector at the ignition switch.
2. Verify the resistance between the terminals listed below match for each ignition switch position.
 - If not the specified value, replace the ignition switch.

Resistance Test

Ignition Switch Position	Terminals 1 and 2	Terminals 2 and 3	Terminals 2 and 4	Terminals 2 and 6	Terminals 4 and 6
Off Key Out	Infinite	Infinite	Infinite	Infinite	Infinite
Off Key IN	Infinite	Infinite	< 5.0 ohms	Infinite	Infinite
Accessory	Infinite	< 5.0 ohms	Infinite	Infinite	Infinite
Run	< 5.0 ohms	< 5.0 ohms	Infinite	Infinite	< 5.0 ohms
Start	< 5.0 ohms	Infinite	Infinite	Infinite	1275-1325 ohms

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Ignition and Start Switch Replacement**
- **Control Module References** for BCM replacement, setup and programming

RETAINED ACCESSORY POWER MALFUNCTION

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.

- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

Diagnostic Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Ignition I/II Voltage	B1475, 1	1	2	-
1. All or some BCM direct wired RAP functions inoperative, depending on the location of the open. 2. BCM direct wired RAP remains on past the timer limit after key out and will not turn off when a vehicle door is opened.				

Circuit/System Description

The retained accessory power (RAP) system allows specific vehicle functions to operate after the ignition is turned OFF for a predetermined time. The RAP function is directly controlled by the BCM through the ignition I/II voltage circuit. RAP is controlled by the BCM using inputs from the door ajar switches to determine control of the ignition I/II voltage circuit when the ignition is turned OFF. Radio RAP is controlled by a serial data message from the BCM using inputs from the driver door open switch. The ignition I/II voltage circuit from the BCM feeds the following:

- Automatic transmission shift lever
- Sunroof shade module (with RPO C3U)
- Sunroof control module (with RPO C3U)
- Inside rearview mirror (with RPO DD7/DD8)
- Auxiliary power outlet - 115V AC (with RPO KVI)
- Driver window switch (without RPO AXC/AXE)
- Passenger window switch (without RPO AXC/AXE)

Diagnostic Aids

- The radio RAP function is a separate RAP function controlled by serial data and the specific module. These functions are not effected by the BCM ignition I/II voltage circuit.
- An open/high resistance in the ignition I/II voltage circuit may cause only part of the RAP functions to be inoperative. Diagnose these symptoms within the respective system sections.
- A short to voltage on the ignition I/II voltage circuit would cause the RAP function to remain on past the designated time.

Reference Information

Schematic Reference

Power Moding Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Retained Accessory Power Description and Operation

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Control Module References for Scan Tool Information

Circuit/System Verification

IMPORTANT: Battery voltage must remain above 9.6 V for RAP to operate properly.

Radio RAP

1. With all passenger doors closed, observe the courtesy lamps while opening and closing the driver door. The courtesy lamps should illuminate when the door is opened and turn off approximately 30 seconds after closing the door.
 - If the courtesy lamp operation is incorrect from the drivers door, refer to **Courtesy Lamps Malfunction** .
2. If courtesy lamp operation is correct and the radio is the only RAP concern, replace the radio.

BCM Direct Wired RAP

1. With a scan tool, verify that BCM DTC B1475 is not set.
 - If DTC B1475 is set, refer to **Diagnostic Trouble Code (DTC) List - Vehicle** .
2. Ignition ON, observe the appropriate scan tool parameters listed below while opening and closing each vehicle door. The reading should change between Door Closed/Door Ajar.

Parameter

- Driver Door Ajar Sw.
- Left Rear Door Ajar Sw.
- Passenger Door Ajar Sw.
- Right Rear Door Ajar Sw.

- If any parameter does not change as specified, refer to **Door Ajar Indicator Malfunction (Without AXE)** , **Door Ajar Indicator Malfunction (With AXE)** .
- 3. Command the scan tool Accy/RAP Relay OFF. Attempt to operate any BCM direct wired RAP controlled component within 5 seconds. The component should not operate.
- 4. Command the scan tool Accy/RAP Relay ON. Attempt to operate any BCM direct wired RAP controlled component within 5 seconds. The component should operate.
- 5. Ignition ON, all doors closed. Observe the scan tool parameter Accy/RAP Relay Command. Ignition OFF, key removed, the reading should be ON for approximately 10 minutes then change to OFF.
 - If the parameter does not respond as specified, replace the BCM.

Circuit/System Testing

1. Ignition OFF, disconnect the harness connector at the automatic transmission shift lever.
2. With the ignition key out of the ignition and the driver door open, verify a test lamp does not illuminate between the ignition I/II voltage circuit terminal Z1 at the automatic transmission shift lever harness connector and ground.
 - If the test lamp illuminates, test the ignition circuit for a short to voltage. If the circuit tests normal, test or replace the BCM

Repair Instructions

Perform the **Diagnostic Repair Verification** after completing the repair.

Control Module References for module replacement, setup and programming

GENERAL ELECTRICAL DIAGNOSIS

Basic Knowledge Required

Without a basic knowledge of electricity, it will be difficult to use the diagnostic procedures contained in the service manual. You should understand the basic theory of electricity and know the meaning of voltage (V), current (A) and resistance (ohms). You should also be able to read and understand a wiring diagram, as well as understand what happens in a circuit with an open or a shorted wire.

CHECKING AFTERMARKET ACCESSORIES

WARNING: Refer to **SIR Warning** .

CAUTION: The OBD II symbol is used on the circuit diagrams in order to alert the technician that the circuit is essential for proper OBD II emission control circuit operation. Any circuit which fails and causes the malfunction indicator lamp (MIL) to turn ON or causes emissions-related component damage, is identified as an OBD II circuit.

Do not connect aftermarket accessories into the following circuits:

- SIR circuits, all such circuits are indicated on circuit diagrams with the SIR symbol.
- OBD II circuits, all such circuits are indicated on circuit diagrams with the OBD II symbol.

Always check for aftermarket accessories (non-OEM) as the first step in diagnosing electrical problems. If the vehicle is so equipped, disconnect the system to verify that these add-on accessories are not the cause of the problems.

Possible causes of vehicle problems related to aftermarket accessories include:

- Power feeds connected to points other than the battery
- Antenna location
- Transceiver wiring located too close to vehicle electronic modules or wiring
- Poor shielding or poor connectors on antenna feed line
- Check for recent service bulletins detailing installation guidelines for aftermarket accessories.

CIRCUIT TESTING

The Circuit Testing section contains the following diagnostic testing information. Using this information along with the diagnostic procedures will identify the cause of the electrical malfunction.

- **Using Connector Test Adapters**
- **Probing Electrical Connectors**
- **Troubleshooting with a Digital Multimeter**
- **Troubleshooting with a Test Lamp**
- **Using Fused Jumper Wires**
- **Measuring Voltage**
- **Measuring Voltage Drop**
- **Measuring Frequency**
- **Testing Ground and Low Reference Circuits**
- **Testing for Continuity**
- **Testing for Short to Ground**
- **Testing for a Short to Voltage**
- **Testing for Intermittent Conditions and Poor Connections**
- **Inducing Intermittent Fault Conditions**
- **Testing for Electrical Intermittents**
- **Scan Tool Snapshot Procedure**
- **Circuit Protection - Fuses**
- **Circuit Protection - Circuit Breakers**
- **Circuit Protection - Fusible Links**

USING CONNECTOR TEST ADAPTERS

Special Tools

- EL-35616 Terminal Test Probe Kit
- EL-38125-550 Terminal Release Tool Kit

For equivalent regional tools, refer to Special Tools .

CAUTION: Do not insert test equipment probes (DMM etc.) into any connector or fuse block terminal. The diameter of the test probes will deform most terminals. A deformed terminal will cause a poor connection, which will result in a system failure. Always use the EL-35616 GM Approved Terminal Test Probe Kit in order to front probe terminals. Do not use paper clips or other substitutes to probe terminals. When using the EL-35616 GM Approved Terminal Test Probe Kit, ensure the terminal test adapter choice is the correct size for the connector terminal. Do not visually choose the terminal test adapter because some connector terminal cavities may appear larger than the actual terminal in the cavity. Using a larger terminal test adapter will damage the terminal. Refer to the EL-35616 GM Approved Terminal Test Probe Kit label on the inside of the EL-35616 GM Approved Terminal Test Probe Kit for the correct adapter along with the connector end view.

PROBING ELECTRICAL CONNECTORS

Special Tools

EL-35616 Terminal Test Probe Kit

For equivalent regional tools, refer to Special Tools .

NOTE: Always be sure to reinstall the connector position assurance (CPA) and terminal position assurance (TPA) when reconnecting connectors or replacing terminals.

Front Probe

Disconnect the connector and probe the terminals from the mating side (front) of the connector.

CAUTION: Refer to Test Probe Caution .

NOTE: When probing female 0.64 terminals, it is important to use the correct adapter. There have been some revisions to the test adapter for 0.64 terminals. The

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proper adapter for 0.64 terminals is the J-35616-64B which has a gold terminal and a black wire between the base and tip. Failure to use the proper test adapter may result in damage to the terminal being tested and improper diagnosis.

NOTE: The proper adapter for probing the terminals for fuses, relays or diodes in an electrical center is J-35616-35. Using any other tool or adapter may damage the terminal being tested.

Refer to the following table as a guide in selecting the correct test adapter for front probing connectors:

Test Adapter	Description
J-35616-2A	150 Male Probe Adapter (gray)
J-35616-3	150 Female Probe Adapter (gray)
J-35616-4A	280 Male Probe Adapter (purple)
J-35616-5	280 Female Probe Adapter (purple)
J-35616-6	100W Male (round) Probe Adapter (brown)
J-35616-7	100W Female (round) Probe Adapter (brown)
J-35616-8	Weather Pack Male Probe Adapter (orange)
J-35616-9	Weather Pack Female Probe Adapter (orange)
J-35616-10	100W Male (round) Probe Adapter (green)
J-35616-11	100W Female (round) Probe Adapter (green)
J-35616-12	130 Male Probe Adapter (blue)
J-35616-13	130 Female Probe Adapter (blue)
J-35616-14	150 Male Probe Adapter (green)
J-35616-16	100 Male Probe Adapter (lt green)
J-35616-17	100 Female Probe Adapter (lt green)
J-35616-18	220 Male Probe Adapter (black)
J-35616-19	220 Female Probe Adapter (black)
J-35616-21	950 Female Probe Adapter (red)
J-35616-22	950 Male Probe Adapter (red)
J-35616-31	500 Male Probe Adapter (orange)
J-35616-32	500 Female Probe Adapter (orange)
J-35616-33	160/180 Male Probe Adapter (yellow)
J-35616-34	160/180 Female Probe Adapter (yellow)
J-35616-35	280 Male Probe Adapter (violet)
J-35616-40	480 Male Probe Adapter (dk blue)
J-35616-41	480 Female Probe Adapter (dk blue)
J-35616-42	630 Male Probe Adapter (red)
J-35616-43	630 Female Probe Adapter (red)
J-35616-44	800 Male Probe Adapter (yellow)
J-35616-45	800 Female Probe Adapter (yellow)

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J-35616-54	280 Male (round) Probe Adapter (tan)
J-35616-55	280 Female (round) Probe Adapter (tan)
J-35616-64B	0.64 Male Probe Adapter (lt blue)
J-35616-65B	0.64 Female Probe Adapter (lt blue)
J-35616-66	150 Male (round) Probe Adapter (yellow)
J-35616-67	150 Female (round) Probe Adapter (yellow)

Backprobe

NOTE:

- Backprobe connector terminals only when specifically required in diagnostic procedures.
- Do not backprobe a sealed (Weather Pack®) connector, less than a 280 series Metri-Pack connector, a Micro-Pack connector or a flat wire connector.
- Backprobing can be a source of damage to connector terminals. Use care in order to avoid deforming the terminal, either by forcing the test probe too far into the cavity or by using too large of a test probe.
- After backprobing any connector, inspect for terminal damage. If terminal damage is suspected, test for proper terminal contact.

Do not disconnect the connector and probe the terminals from the harness side (back) of the connector.

TROUBLESHOOTING WITH A DIGITAL MULTIMETER

Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

CAUTION: Refer to **Test Probe Caution** .

Digital Multimeter (DMM) Basic Requirements

Service information is validated using digital multimeters that meet or exceed the following requirements. Using a multimeter that does not meet these basic requirements may give inaccurate readings which could lead to an incorrect diagnosis.

Display and Settings

1. Four digits displayed
2. Voltage, current, resistance, frequency, diode test settings and min-max function

3. Display positive and negative values

Voltage

1. Have at least 10 Mohms input impedance
2. Test a DC voltage range of 0.1-1000 V.
3. Test an AC voltage range of 0.1-1000 V.

Current

1. Test a DC current range of 0.1 μ A-10 A.
2. Test an AC current range of 0.1 μ A-10 A.

Resistance

Test a resistance range of 0.1 ohms-40 Mohms and displays infinite for a value greater than 40 Mohms (O.L. (Over-load))

Frequency

Test for a frequency range of 0.5 Hz-199 k Hz

Diode Test

1. Apply at least 1 mA when performing the diode bias test
2. Display the break over voltage drop (0-3 V) of a forward biased diode
3. Display infinite (O.L. (Over-load)) when a diode is reverse biased

Min-Max Readings

1. Can update at a 25 ms sample rate
2. Saves and displays minimum and maximum values

NOTE: **Circuits which include any solid state control modules, such as the engine control module (ECM), should only be tested with a 10 Mohms or higher impedance digital multimeter such as the EL-39200.**

The DMM instruction manual is a good source of information and should be read thoroughly upon receipt of the DMM as well as kept on hand for future reference.

A DMM should be used instead of a test lamp in order to test for voltage in high impedance circuits. While a test lamp shows whether voltage is present if the impedance is low enough, a DMM indicates how much voltage is present. In other words, if there is not enough current, the test lamp will not illuminate even though voltage is present.

The ohmmeter function on a DMM shows how much resistance exists between 2 points along a circuit. Low resistance in a circuit means good continuity.

NOTE: **Disconnect the power feed from the suspect circuit when measuring resistance with a DMM. This prevents incorrect readings. DMMs apply such a small voltage to measure resistance that the presence of voltages can upset a resistance reading.**

Diodes and solid state components in a circuit can cause a DMM to display a false reading. To find out if a component is affecting a measurement take a reading once, then reverse the leads and take a second reading. If the readings differ the solid state component is affecting the measurement.

Following are examples of the various methods of connecting the DMM to the circuit to be tested:

- Probe both ends of the connector and either hold the leads in place while manipulating the connector or tape the leads to the harness for continuous monitoring while you perform other operations or test driving. Refer to **Probing Electrical Connectors**.
- Disconnect the harness at both ends of the suspected circuit where it connects either to a component or to other harnesses.
- If the system that is being diagnosed has a specified pinout or breakout box, it may be used in order to simplify connecting the DMM to the circuit or for testing multiple circuits quickly.

TROUBLESHOOTING WITH A TEST LAMP

Special Tools

EL-35616-200 Test Light - Probe Kit

For equivalent regional tools, refer to **Special Tools** .

CAUTION: Refer to **Test Probe Caution** .

A test lamp can simply and quickly test a low impedance circuit for voltage. A Digital Multimeter (DMM) should be used instead of a test lamp in order to test for voltage in high impedance circuits. While a test lamp shows whether voltage is present if the impedance is low enough, a DMM indicates how much voltage is present. In other words, if there is not enough current, the test lamp will not illuminate even though voltage is present.

The **EL-35616-200** kit is Micro-Pack compatible and comprised of a 12 V light bulb with an attached pair of leads.

To properly operate this tool use the following procedures.

When testing for voltage:

1. Attach one lead to ground.
2. Touch the other lead to various points along the circuit where voltage should be present.
3. When the bulb illuminates, there is voltage at the point being tested.

When testing for ground:

1. Attach one lead to battery positive voltage.
2. Touch the other lead to various points along the circuit where ground should be present.
3. When the bulb illuminates, there is ground at the point being tested.

USING FUSED JUMPER WIRES

Special Tools

EL 35616-20F Fused Jumper Wire

For equivalent regional tools, refer to **Special Tools** .

NOTE: **A fused jumper may not protect solid state components from being damaged.**

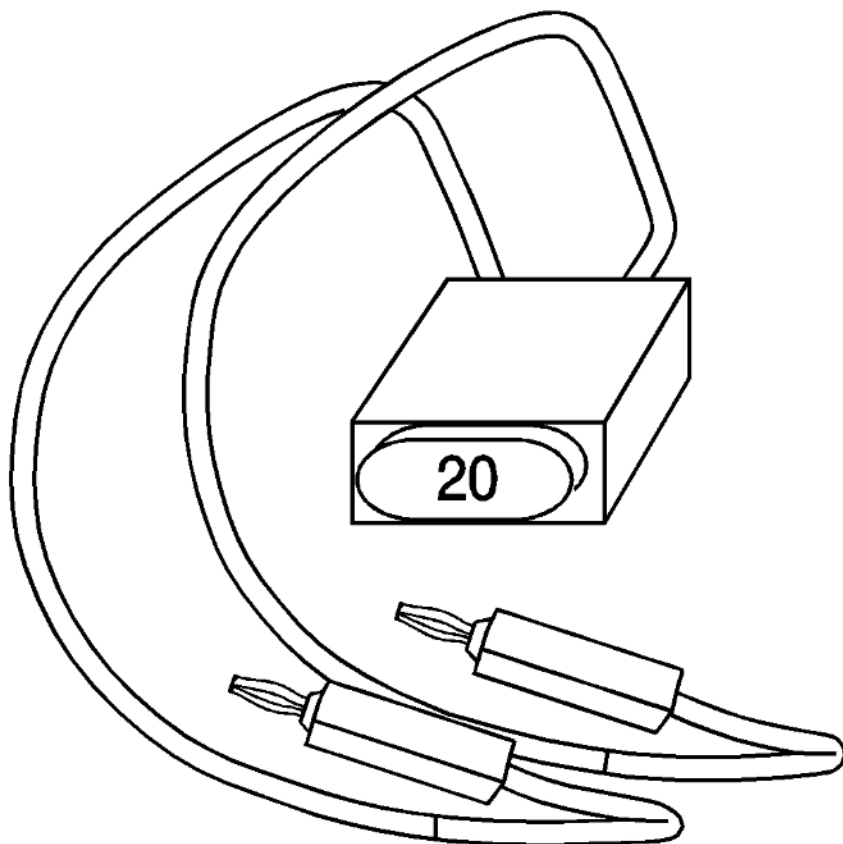


Fig. 1: X102 Forward Lamp Harness to Fan Control Module Harness
Courtesy of GENERAL MOTORS COMPANY

The **EL 35616-20F** Fused Jumper Wire includes banana jack connectors that provide adaptation to most connectors without damage. This fused jumper wire is supplied with a 20 A fuse which may not be suitable for some circuits. Do not use a fuse with a higher rating than the fuse that protects the circuit being tested.

MEASURING VOLTAGE

Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

CAUTION: Refer to **Test Probe Caution** .

The following procedure measures the voltage at a selected point in a circuit.

1. Disconnect the electrical harness connector for the circuit being tested, if necessary.
2. Enable the circuit and/or system being tested. Use the following methods:
 - Turn ON the ignition, with the engine OFF.
 - Turn ON the engine.
 - Turn ON the circuit and/or system with a scan tool in Output Controls.
 - Turn ON the switch for the circuit and/or system being tested.
3. Select the V (AC) or V (DC) position on the Digital Multimeter (DMM).
4. Connect the positive lead of the DMM to the point of the circuit to be tested.
5. Connect the negative lead of the DMM to a good ground.
6. The DMM displays the voltage measured at that point.

MEASURING VOLTAGE DROP

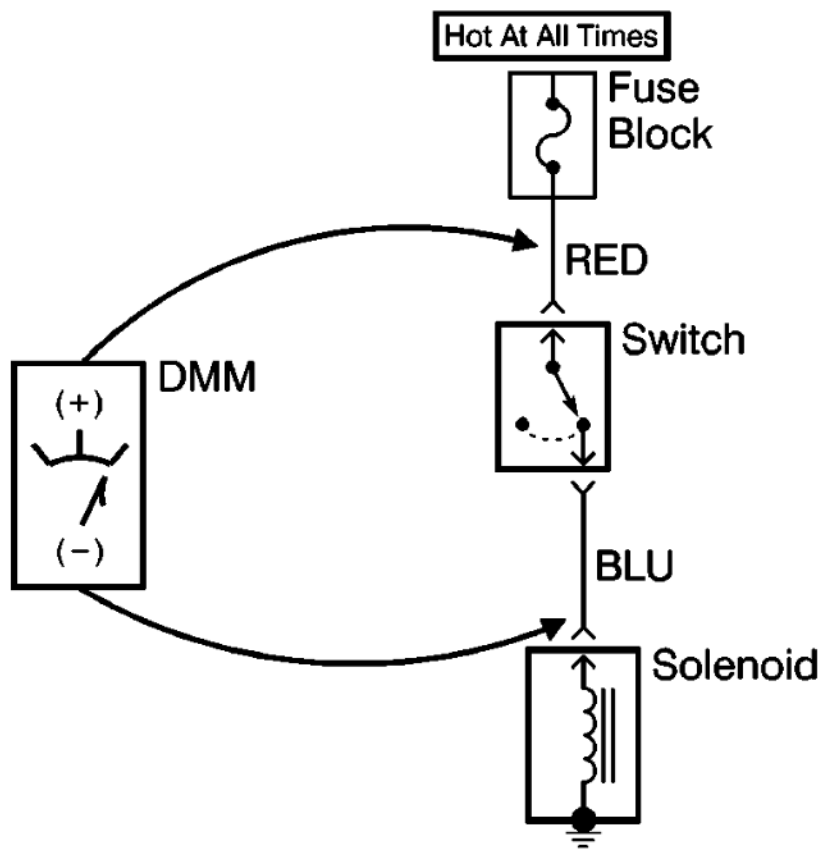
Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

CAUTION: Refer to **Test Probe Caution** .

The following procedure determines the difference in voltage potential between 2 points.

**Fig. 2: Measuring Voltage Drop**

Courtesy of GENERAL MOTORS COMPANY

1. Set the Digital Multimeter (DMM) to the V (DC) position.
2. Connect the positive lead of the DMM to one point of the circuit to be tested.
3. Connect the negative lead of the DMM to the other point of the circuit.
4. Operate the circuit.
5. The DMM displays the difference in voltage between the 2 points.

MEASURING FREQUENCY

Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

CAUTION: Refer to Test Probe Caution .

The following procedure determines the frequency of a signal.

NOTE: **Connecting the Digital Multimeter (DMM) to the circuit before pressing the Hz button will allow the DMM to autorange to an appropriate range.**

1. Apply power to the circuit.
2. Set the DMM to the V (AC) position.
3. Connect the positive lead of the DMM to the circuit to be tested.
4. Connect the negative lead of the DMM to a good ground.
5. Set to Hz on the DMM.
6. The DMM will display the frequency measured.

TESTING GROUND AND LOW REFERENCE CIRCUITS

Because a test lamp can light with up to 200 ohms in a ground or low reference circuit they are not recommended to be used for this type of test. A low impedance test lamp can light and indicate the circuit is good when there is as much as 20-30 ohms present, while a high impedance test lamp can light with up to 200 ohms present in the circuit. This is why the Digital Multi-Meter (DMM) is used when validating a ground or low reference circuit continuity.

When using the DMM there are many vehicle conditions that can affect the ground and low reference continuity testing. If these conditions are not met, a ground or low reference circuit test can fail on a good circuit. This may cause longer diagnosis time and incorrect component replacement.

Any current flow through a ground or low reference circuit, while being tested, will skew the DMM continuity reading or display a reading higher than when there is no current flowing. Performing a ground or low reference circuit continuity test, in reference to the vehicles battery negative terminal, will have the highest risk of failing a good ground or low reference circuit test than any other ground reference point. The best ground test points would be a control module housing (if the control modules housing is metal and grounded), under dash metal frame work, engine block or body ground studs (other than where the negative battery cable is attached).

A typical DMM ground or low reference circuit continuity reading can be as high as 100 ohms with the ignition ON and drop to 15-25 ohms after the ignition is turned OFF. The reading will drop below 10 ohms after 30-40 seconds, then below 5 ohms after 60 seconds. Once the vehicle completely goes to sleep (generally 3-10 minutes) the reading will drop below 0.3 ohms.

The following list of conditions may need to be met to ensure a valid continuity reading on a ground or low reference circuit:

- Ignition OFF
- Key out of the ignition switch (when not equipped with keyless entry and remote start)

- Retained Accessory Power (RAP) OFF (open and close the driver door after ignition OFF)
- Battery charger set at a 2 A or less charge rate
- Scan tool not communicating with any vehicle control module (in some cases it may need to be disconnected from the DLC)
- All entry doors closed
- Headlamps OFF (auto headlamps disabled)
- Any delay lighting OFF
- HVAC after blow OFF
- Any accessory that can work when the ignition is OFF
- Wait up to 60 seconds (after all other listed conditions are met)

Activating the DOOR LOCK function with a key fob can greatly reduce the time to achieve a valid ground or low reference continuity test result.

TESTING FOR CONTINUITY

Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

CAUTION: Refer to **Test Probe Caution** .

The following procedures verify good continuity in a circuit.

With a Digital Multimeter (DMM)

1. Set the DMM to the ohms position.
2. Disconnect the power feed (i.e. fuse, control module) from the suspect circuit.
3. Disconnect the load.
4. Select the MIN MAX function on the DMM.
5. Connect one lead of the DMM to one end of the circuit to be tested.
6. Connect the other lead of the DMM to the other end of the circuit.
7. If the DMM displays low or no resistance, the circuit has good continuity.

With a Test Lamp

NOTE: Only use the test lamp procedure on low impedance power and ground circuits.

1. Remove the power feed (i.e. fuse, control module) from the suspect circuit.

2. Disconnect the load.
3. Connect one lead of the test lamp to one end of the circuit to be tested.
4. Connect the other lead of the test lamp to battery positive voltage.
5. Connect the other end of the circuit to ground.
6. If the test lamp illuminates (full intensity), then the circuit has good continuity.

TESTING FOR SHORT TO GROUND

CAUTION: Refer to Test Probe Caution .

The following procedures test for a short to ground in a circuit.

With a Digital Multimeter (DMM)

1. Remove the power feed (i.e. fuse, control module) from the suspect circuit.
2. Disconnect the load.
3. Set the rotary dial of the DMM to the ohms position.
4. Connect one lead of the DMM to one end of the circuit to be tested.
5. Connect the other lead of the DMM to a good ground.
6. If the DMM does NOT display infinite resistance (OL), there is a short to ground in the circuit.

With a Test Lamp

1. Remove the power feed (i.e. fuse, control module) from the suspect circuit.
2. Disconnect the load.
3. Connect one lead of the test lamp to battery positive voltage.
4. Connect the other lead of the test lamp to one end of the circuit to be tested.
5. If the test lamp illuminates, there is a short to ground in the circuit.

Fuse Powering Several Loads

1. Review the system schematic and locate the fuse that is open.
2. Open the first connector or switch leading from the fuse to each load.
3. Connect a DMM across the fuse terminals (be sure that the fuse is powered).
 - When the DMM displays voltage the short is in the wiring leading to the first connector or switch.
 - If the DMM does not display voltage refer to the next step.
4. Close each connector or switch until the DMM displays voltage in order to find which circuit is shorted.

TESTING FOR A SHORT TO VOLTAGE

Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

CAUTION: Refer to Test Probe Caution .

The following procedure tests for a short to voltage in a circuit.

1. Remove the power feed (i.e. fuse, control module) from the suspect circuit.
2. Disconnect the load.
3. Set the Digital Multimeter (DMM) to the V (DC) position.
4. Connect the positive lead of the DMM to one end of the circuit to be tested.
5. Connect the negative lead of the DMM to a good ground.
6. Turn ON the ignition and operate all accessories.
7. If the voltage measured is greater than 1 V, there is a short to voltage in the circuit.

TESTING FOR INTERMITTENT CONDITIONS AND POOR CONNECTIONS**Special Tools**

EL-35616 Terminal Test Probe Kit

For equivalent regional tools, refer to **Special Tools** .

When the condition is not currently present, but is indicated in DTC history, the cause may be intermittent. An intermittent may also be the cause when there is a customer complaint, but the symptom cannot be duplicated. Refer to the Symptom Table of the system that is suspect of causing the condition before trying to locate an intermittent condition.

Most intermittent conditions are caused by faulty electrical connections or wiring. Inspect for the following items:

- Wiring broken inside the insulation
- Poor connection between the male and female terminal at a connector
- Poor terminal to wire connection - Some conditions which fall under this description are poor crimps, poor solder joints, crimping over the wire insulation rather than the wire itself and corrosion in the wire to terminal contact area, etc.
- Pierced or damaged insulation can allow moisture to enter the wiring causing corrosion. The conductor can corrode inside the insulation, with little visible evidence. Look for swollen and stiff sections of wire in the suspect circuits.

- Wiring which has been pinched, cut or its insulation rubbed through may cause an intermittent open or short as the bare area touches other wiring or parts of the vehicle.
- Wiring that comes in contact with hot or exhaust components
- Refer to **Inducing Intermittent Fault Conditions** in order to duplicate the conditions required, in order to verify the customer concern.
- Refer to **Testing for Electrical Intermittents** for test procedures to detect intermittent open, high resistance, short to ground and short to voltage conditions.
- Refer to **Scan Tool Snapshot Procedure** for advanced intermittent diagnosis and Vehicle Data Recorder operation.

Testing for Terminal Fretting

Some intermittent conditions can be caused by wire terminal fretting corrosion. Fretting corrosion is a build-up of insulating, oxidized wear debris that can form when there is a small motion between electrical contacts. The oxidized wear debris can pile up enough at the electrical contact spots that the electrical resistance across the connection increases. Movement between the contacting surfaces as small as 10 to 100 microns can cause fretting. To put this in perspective, a sheet of paper is about 100 microns thick, so fretting motion is small and hard to see. Vibration and thermal expansion/contraction are the main sources that create fretting motion. Since vehicles vibrate and can experience large temperature swings, they are a good source for fretting motion. Tin, copper, nickel and iron surfaces are all susceptible to fretting corrosion. Fretting corrosion can be difficult to see but it looks like small, dark smudges on the terminals contact surface.

To correct a fretting condition disconnect the suspect connector and add dielectric grease/lubricant (Nyogel 760G or equivalent, meeting GM specification 9986087) to both sides of the connector terminals. Then reconnect the connector and wipe away any excess lubricant. This will correct the additional terminal contact resistance due to the terminal fretting corrosion.

Testing for Proper Terminal Contact

It is important to test terminal contact at the component and any inline connectors before replacing a suspect component. Mating terminals must be inspected to ensure good terminal contact. A poor connection between the male and female terminal at a connector may be the result of contamination or deformation.

Contamination may be caused by the connector halves being improperly connected. A missing or damaged connector seal, damage to the connector itself or exposing the terminals to moisture and dirt can also cause contamination. Contamination, usually in the underhood or underbody connectors, leads to terminal corrosion, causing an open circuit or intermittently open circuit.

Deformation is caused by probing the mating side of a connector terminal without the proper adapter. Always use the **EL-35616** kit when probing connectors. Other causes of terminal deformation are improperly joining the connector halves or repeatedly separating and joining the connector halves. Deformation, usually to the female terminal contact tang, can result in poor terminal contact causing an open or intermittently open circuit.

Testing for Proper Terminal Contact in Bussed Electrical Centers

It is very important to use the correct test adapter when testing for proper terminal contact of fuses and relays in

a bussed electrical center. Use the **EL-35616** kit to test for proper terminal contact. Failure to use the **EL-35616** kit can result in improper diagnosis of the bussed electrical center.

Follow the procedure below in order to test terminal contact:

1. Separate the connector halves.
2. Visually inspect the connector halves for contamination. Contamination may result in a white or green build-up within the connector body or between terminals. This causes high terminal resistance, intermittent contact or an open circuit. An underhood or underbody connector that shows signs of contamination should be replaced in its entirety: terminals, seals and connector body.
3. Using an equivalent male terminal/terminated lead, verify that the retention force is significantly different between a known good terminal and the suspect terminal. Replace the female terminal in question.

Flat Wire Connectors

There are no serviceable parts for flat wire connectors on the harness side or the component side.

Follow the procedure below in order to test terminal contact:

1. Remove the component in question.
2. Visually inspect each side of the connector for signs of contamination. Avoid touching either side of the connector as oil from your skin may be a source of contamination as well.
3. Visually inspect the terminal bearing surfaces of the flat wire circuits for splits, cracks or other imperfections that could cause poor terminal contact. Visually inspect the component side connector to ensure that all of the terminals are uniform and free of damage or deformation.
4. Insert the appropriate adapter into the flat wire harness connector in order to test the circuit in question.

Control Module/Component Voltage and Grounds

Poor voltage or ground connections can cause widely varying symptoms.

- Test all control module voltage supply circuits. Many vehicles have multiple circuits supplying voltage to a control module. Other components in the system may have separate voltage supply circuits that may also need to be tested. Inspect connections at the module/component connectors, fuses and any intermediate connections between the voltage source and the module/component. A test lamp or a DMM may indicate that voltage is present, but neither tests the ability of the circuit to carry sufficient current. Operate the component to test the ability of the circuit to carry sufficient current. Refer to **Circuit Testing** and **Power Distribution Schematics**.
- Test all control module ground and system ground circuits. The control module may have multiple ground circuits. Other components in the system may have separate grounds that may also need to be tested. Inspect grounds for clean and tight connections at the grounding point. Inspect the connections at the component and in splice packs, where applicable. Operate the component to test the ability of the circuit to carry sufficient current. Refer to **Circuit Testing** and **Ground Distribution Schematics**.

Temperature Sensitivity

- An intermittent condition may occur when a component/connection reaches normal operating temperature. The condition may occur only when the component/connection is cold or only when the component/connection is hot.
- Freeze Frame, Failure Records, Snapshot or Vehicle Data Recorder data may help with this type of intermittent condition, where applicable.
- If the intermittent is related to heat, review the data for a relationship with the following:
 - High ambient temperatures
 - Underhood/engine generated heat
 - Circuit generated heat due to a poor connection or high electrical load
 - Higher than normal load conditions, towing, etc.
- If the intermittent is related to cold, review the data for the following:
 - Low ambient temperatures - In extremely low temperatures, ice may form in a connection or component. Inspect for water intrusion.
 - The condition only occurs on a cold start.
 - The condition goes away when the vehicle warms up.
- Information from the customer may help to determine if the trouble follows a pattern that is temperature related.
- If temperature is suspected of causing an intermittent fault condition, attempt to duplicate the condition. Refer to **Inducing Intermittent Fault Conditions** in order to duplicate the conditions required.

Electromagnetic Interference and Electrical Noise

Some electrical components/circuits are sensitive to electromagnetic interference or other types of electrical noise. Inspect for the following conditions:

- A mis-routed harness that is too close to high voltage/high current devices such as secondary ignition components, motors, generator etc. - These components may induce electrical noise on a circuit that could interfere with normal circuit operation.
- Electrical system interference caused by a malfunctioning relay or a control module driven solenoid or switch - These conditions can cause a sharp electrical surge. Normally, the condition will occur when the malfunctioning component is operating.
- Installation of non-factory or aftermarket add on accessories such as lights, 2-way radios, amplifiers, electric motors, remote starters, alarm systems, cell phones, etc. - These accessories may create interference in other circuits while operating and the interference would disappear when the accessory is not operating. Refer to **Checking Aftermarket Accessories**.
- Test for an open diode across the A/C compressor clutch and for other open diodes. Some relays may contain a clamping diode.
- The generator may be allowing AC noise into the electrical system.

Incorrect Control Module

- There are only a few situations where reprogramming a control module is appropriate:

- A new service control module is installed.
- A control module from another vehicle is installed.
- Revised software/calibration files have been released for this vehicle.
- Verify that the control module contains the correct software/calibration. If incorrect programming is found, reprogram the control module with the most current software/calibration. Refer to **Control Module References** for replacement, setup and programming.

NOTE: **DO NOT re-program the control module with the SAME software/calibration files that are already present in the control module. This is not an effective repair for any type of concern.**

INDUCING INTERMITTENT FAULT CONDITIONS

Special Tools

J-25070 Heat Gun

For equivalent regional tools, refer to **Special Tools** .

Many intermittent open or shorted circuits are affected by harness/connector movement that is caused by vibration, engine torque, bumps/rough pavement, etc. In order to duplicate the customer's concern, it may be necessary to manipulate the wiring harness if the malfunction appears to be vibration related. Manipulation of a circuit can consist of a wide variety of actions, including:

- Wiggling the harness
- Disconnecting a connector and reconnecting
- Stressing the mechanical connection of a connector
- Pulling on the harness or wire in order to identify a separation/break inside the insulation
- Relocating a harness or wires

All these actions should be performed with some goal in mind. For instance, with a scan tool connected, wiggling the wires may uncover a faulty input to the control module. The snapshot option would be appropriate here. Refer to **Scan Tool Snapshot Procedure**. Another option is, with the component commanded ON and OFF by the scan tool, to move related connectors and wiring and observe the component operation. With the engine running, move related connectors and wiring while monitoring engine operation. If harness or connector movement affects the data displayed, component/system operation or engine operation, inspect and repair the harness/connections as necessary.

You may need to load the vehicle in order to duplicate the concern. This may require the use of weights, floor jacks, jackstands, frame machines, etc. In these cases you are attempting to duplicate the concern by manipulating the suspension or frame. This method is useful in finding harnesses that are too short and their connectors pull apart enough to cause a poor connection. A DMM set to the Min/Max mode and connected to the suspect circuit while testing can yield desirable results. Refer to **Testing for Electrical Intermittents**.

Certainly, using the senses of sight, smell and hearing while manipulating the circuit can provide good results as well.

There may be instances where circuit manipulation alone will not meet the required criteria for the fault condition to appear. In such cases it may be necessary to expose the suspect circuit to other conditions while manipulating the harness. Such conditions would include high moisture conditions, along with exceptionally high or low temperatures. The following discusses how to expose the circuit to these kinds of conditions.

High Temperature Conditions

If the complaint tends to be heat related, you can simulate the condition using the **J-25070** heat gun.

Using the heat gun, you can heat up the suspected area or component. Manipulate the harnesses under high temperature conditions while monitoring the scan tool or DMM to locate the fault condition.

The high temperature condition may be achieved simply by test driving the vehicle at normal operating temperature. If a heat gun is unavailable, consider this option to enhance your diagnosis. This option does not allow for the same control, however.

Low Temperature Conditions

Depending on the nature of the fault condition, placing a fan in front of the vehicle while the vehicle is in the shade can have the desired effect.

If this is unsuccessful, use local cooling treatments such as ice or a venturi type nozzle (one that provides hot or cold air). This type of tool is capable of producing air stream temperatures down to -18°C (0°F) from one end and $+71^{\circ}\text{C}$ (160°F) from the other. This is ideally suited for localized cooling needs. In addition, circuit cooling spray can be used to cool down a component or circuit.

Once the vehicle, component or harness has been sufficiently cooled, manipulate the harness or components in an effort to duplicate the concern.

Duplicating Failure Conditions

- If none of the previous tests are successful, attempt to duplicate and/or capture the failure conditions.
- Freeze Frame/Failure Records data, where applicable, contains the conditions that were present when the DTC set.
 1. Review and record Freeze Frame/Failure Records data.
 2. Clear the DTCs using the scan tool.
 3. Turn the key to OFF and wait 15 seconds.
 4. Operate the vehicle under the same conditions that were noted in Freeze Frame/Failure Records data, as closely as possible. The vehicle must also be operating within the Conditions for Running the DTC. Refer to Conditions for Running the DTC in the supporting text if a DTC is being diagnosed.
 5. Monitor DTC Status for the DTC being tested. The scan tool will indicate Ran, when the enabling conditions have been satisfied long enough for the DTC to run. The scan tool will also indicate

whether the DTC passed or failed.

- An alternate method is to drive the vehicle with the DMM connected to a suspected circuit. An abnormal reading on the DMM when the concern occurs, may help you locate the concern.

TESTING FOR ELECTRICAL INTERMITTENTS

Special Tools

EL-39200 Digital Multimeter

For equivalent regional tools, refer to **Special Tools** .

Perform the following procedures while wiggling the harness from side to side. Continue this at convenient points (about 6 inches apart) while watching the test equipment.

- **Testing for Short to Ground**
- **Testing for Continuity**
- **Testing for a Short to Voltage**

If the fault is not identified, perform the procedure below using the MIN MAX feature on the **EL-39200** digital multimeter (DMM). This feature allows you to manipulate the circuit without having to watch the DMM. The DMM will generate an audible tone when a change is detected.

NOTE: **The DMM must be used in order to perform the following procedure since the DMM can monitor current, resistance or voltage while recording the minimum (MIN) and maximum (MAX) values measured.**

1. Connect the DMM to both sides of a suspected connector (still connected) or from one end of a suspected circuit to the other. Refer to **Troubleshooting with a Digital Multimeter** for information on connecting the DMM to the circuit.
2. Set the DMM to the V (AC) or V (DC) position.
3. Select the voltage range feature of the DMM in order to select the desired voltage range.
4. Select the MIN MAX function of the DMM. The DMM displays the 100 ms RECORD and emits an audible tone (beep).

NOTE: **The 100 ms RECORD mode is the length of time an input must stay at a new value in order to record the full change.**

5. Simulate the condition that is potentially causing the intermittent connection, either by wiggling the connections or the wiring, test driving or performing other operations. Refer to **Inducing Intermittent Fault Conditions**.
6. Listen for the audible Min Max Alert which indicates that a new minimum or maximum value has been recorded.
7. Press the MIN MAX button until the MAX value is displayed and note the value.

8. Press the MIN MAX button until the MIN value is displayed and note the value.
9. Determine the difference between the MIN and MAX values.
 - If the variation between the recorded MIN and MAX voltage values is 1 V or greater an intermittent open or high resistance condition exists. Repair the condition as necessary.
 - If the variation between the recorded MIN and MAX voltage values is less than 1 V, an intermittent open or high resistance condition does not exist.

SCAN TOOL SNAPSHOT PROCEDURE

Using Snapshots in Global Diagnostic System (GDS)

Overview

A snapshot is a recording of what a control module on the vehicle was receiving for information while the snapshot is being made. A snapshot may be used to analyze the data during the time a vehicle condition is current. This allows you to concentrate on making the condition occur, rather than trying to view all the data in anticipation of the fault. In GDS 2, snapshots are automatically recorded whenever the user views Module Diagnostics, Vehicle Diagnostics and/or Systems Diagnostics. Module Diagnostics includes DTC Data, Identification Information, Data Display, Control Functions and Configuration/Reset Functions. Vehicle Diagnostics includes Vehicle Wide DTCs. Systems Diagnostics includes Inspection/Maintenance Status and Inspection/Maintenance Information.

Snapshot Replay

The Snapshot Replay function allows reviews of previously recorded vehicle snapshot data. This information can be used in analysis of vehicle problems and detection of trigger error conditions. The graph function can be used to compare parameters to see if a component is functioning properly. Recorded snapshots can be selected for viewing by the following two methods:

- From the Home Page, click on Review Stored Data. In the Snapshot Select Page, highlight the vehicle in the upper pane and highlight the desired snapshot in the lower pane, then click the Select Snapshot button.
- The user can view a snapshot without ending a current on-vehicle diagnostic session by clicking the Module button (when active) or Back button until the Session Manager is displayed in the menu. This is used when a user is viewing live data and wants the quickest way to review the data. Click on the Session Manager button. Highlight the desired snapshot in the lower pane and click Select Snapshot

View Selections

The following information can be selected in the tabs at the top of the screen:

- Line Graph - Displays information from the snapshot file in graph view. The current value of the parameters is displayed on the screen. Use the buttons on the right side to modify the graph data.
- Diagnostic Data Display - Displays incoming information from the snapshot file. The current value of the parameters is displayed on the screen. Use the buttons on the right side to modify the data.

- DTC Display - This tab will be displayed when a DTC is current or the status has changed. The tab will not be displayed when there are no DTCs.
- Bookmarks - If bookmarks are present, this displays the Type, Description and Time of automatic and manually generated bookmarks.
- System Information - Displays the GDS 2 Software Version and MDI Serial Number used when the snapshot was recorded.
- Selected Vehicle Configuration - Displays vehicle options information.

Snapshot Replay Functions

To review the snapshot there are buttons at the bottom of the window to control the cursor. From left to right the buttons are:

- Return to Frame 0 - This button returns the cursor to frame 0.
- Stop - This button pauses or stops the cursor. Click the Play button to resume.
- Play - This button starts the replay of the data.
- Play Speed - This button changes the speed between 1x, 2x, 4x and 8x.
- Back 1 Frame - This button moves the cursor back 1 frame.
- Forward 1 Frame - This button moves the cursor forward 1 frame.
- Previous Bookmark - This button moves the cursor to the previous bookmark.
- Next Bookmark - This button moves the cursor forward 1 bookmark.

CIRCUIT PROTECTION - FUSES

Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

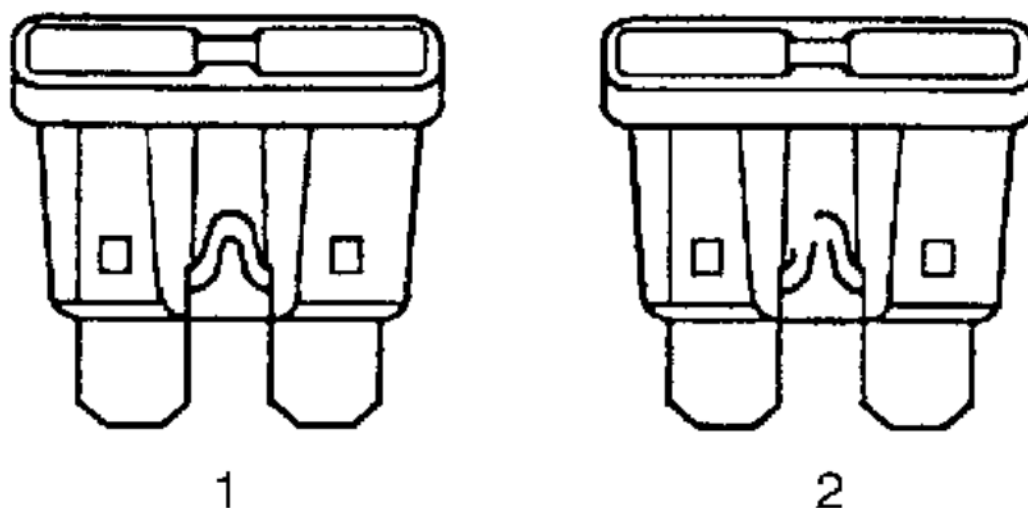


Fig. 3: Identifying Open Fuse Element
 Courtesy of GENERAL MOTORS COMPANY

The fuse is the most common method of an automotive wiring circuit protection. Whenever there is an excessive amount of current flowing through a circuit the fusible element will melt and create an open or incomplete circuit. Fuses are a one time protection device and must be replaced each time the circuit is overloaded. To determine if a fuse is open, remove the suspected fuse and examine if the element in the fuse is broken (2). If not broken (1), also check for continuity using a Digital Multimeter (DMM) or a continuity tester. If the element is broken or continuity is suspect, replace the fuse with one of equal current rating.

Fuse Types

Current Rating Amperes	Color
Auto Fuses, Mini Fuses	
2	Gray
3	Violet

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5	Tan
7.5	Brown
10	Red
15	Blue
20	Yellow
25	White or Natural
30	Green
Maxi Fuses	
20	Yellow
30	Light Green
40	Orange or Amber
60	Blue
50	Red
J-Case Fuses	
20	Blue
30	Pink
40	Green
50	Red
60	Yellow
Midi Fuses	
80	Black
Mega Fuses	
100	Black
150	Black
200	Black

CIRCUIT PROTECTION - CIRCUIT BREAKERS

A circuit breaker is a protective device that is designed to open the circuit when a current load is in excess of the rated breaker capacity. If there is a short or other type of overload condition in the circuit, the excessive current will open the circuit between the circuit breaker terminals. Two types of circuit breakers are used.

Circuit Breaker

This type opens when excessive current passes through it for a period of time. It closes again after a few seconds and if the cause of the high current is still present, it will open again. The circuit breaker will continue to cycle open and closed until the condition causing the high current is removed.

Positive Temperature Coefficient (PTC) Circuit Breaker

This type greatly increases its resistance when excessive current passes through it. The excessive current heats the PTC device, as the device heats its resistance increases. Eventually the resistance gets so high that the circuit is effectively open. Unlike the ordinary circuit breaker the PTC unit will not reset until the

circuit is opened, by removing the voltage from its terminals. Once the voltage is removed the circuit breaker will re-close within a second or 2.

CIRCUIT PROTECTION - FUSIBLE LINKS

Special Tools

EL-39200 Digital Multimeter (DMM)

For equivalent regional tools, refer to **Special Tools** .

NOTE: **When repairing a fusible link, fusible links cut longer than 225 mm (approximately 9 in) will not provide sufficient overload protection.**

Fusible link is wire designed to melt and break continuity when excessive current is applied. It is often located between or near the battery and starter or electrical center. Use a continuity tester or a Digital Multimeter (DMM) at each end of the wire containing the fusible link in order to determine if it is broken. If broken, it must be replaced with fusible link of the same gauge size.

WIRING REPAIRS

The Wiring Repairs section contains the following types of wiring repair information. Using these elements together will make wiring repair faster and easier:

- **Testing for Intermittent Conditions and Poor Connections**
- **Flat Wire Repairs**
- **GMLAN and Media Oriented Systems Transport (MOST) Wiring Repairs**
- **High Temperature Wiring Repairs**
- **Heated Oxygen Sensor Wiring Repairs**
- **Splicing Copper Wire Using Splice Sleeves**
- **Splicing Twisted or Shielded Cable**
- **Splicing Inline Harness Diodes**
- **SIR/SRS Wiring Repairs**

REPAIRING DAMAGED WIRE INSULATION

If the wire insulation has been chafed or broken, enough to show the conductive portion of the wire and the wire is not damaged, determine the length of insulation that needs to be repaired. If the repair is less than 280 mm (11 in), cut the wire within the damaged area. Then slide the appropriate heat shrink tubing (listed below) over the wire and repair the wire by splicing the wires together. Refer to **Splicing Copper Wire Using Splice Sleeves**. Once the wire is spliced together slide heat shrink tubing over the damaged area and apply heat to seal the repaired wire.

If the wire is damaged or the damaged area is larger than 280 mm (11 in), then replace the damaged wire by

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splicing in a new section of wire. Refer to **Splicing Copper Wire Using Splice Sleeves**.

Heat Shrink Tubing Selection

GM Part Number	Diameter		Description	Color	Length	
	Metric	English			Metric	English
12355003	9.5 mm	0.375 in	Tubing, Shrink 3/8	Black	305 mm	12 in
12355005	12.7 mm	0.5 in	Tubing, Shrink 1/2	Black	305 mm	12 in
12355011	19.1 mm	0.75 in	Tubing, Shrink 3/4	Black	305 mm	12 in
12355008	25.4 mm	1.0 in	Tubing, Shrink 1.00	Black	305 mm	12 in

Wire Size Conversion

Metric Wire Sizes (mm 2)	AWG Sizes
0.13	26
0.21	24
0.32	22
0.52	20
0.83	18
1.31	16
2.09	14
3.31	12
5.27	10
8.37	8
13.3	6
21.2	4
33.6	2
53.5	1/0

COAXIAL CABLE REPAIRS

The GM global coaxial cable repair strategy uses coaxial cables, connectors and jumpers to repair coaxial cables. The intent is to install the new service cable in vehicle, but removal of the old cable is not necessary. There are several repair scenarios:

- New cables, jumpers and connector housing are required.
- Only new cables are required while it is possible to reuse the existing connector housing in vehicle. A jumper may or may not be needed.
- Only new connector housing are required, while it is possible to reuse the existing cable in the vehicle.
- A new cable would need to be installed from source to destination and by-pass the inline connector in some cases when an inline connector is unrepairable (Example: a cracked male end of a 1-way

connector).

Coaxial Cable Kits

Four different kits will be available to repair coaxial cables. Components of each kit cannot be ordered separately from the kit.

- **Communication Interface Module Antenna Cable Kit** (Kit #13581174) is used to repair Cellular coaxial cables. This kit uses RG58 low loss coaxial cables that are available in four lengths. The coaxial cables can be attached together in various lengths to closely match the length of the faulty/damaged coaxial cable.
- **Digital Radio and Vehicle Locator Antenna Coaxial Cable Kit** (Kit #13581173) is used to repair XM and GPS coaxial cables. For vehicles that have a combined GPS and Cellular/OnStar signal on one cable, use Kit #13581174. This kit uses RG316 low loss coaxial cables that are available in three lengths. The coaxial cables can be attached together in various lengths to closely match the length of the faulty/damaged coaxial cable.
- **Digital Radio, Mobile Telephone and Vehicle Locator Antenna Coaxial Cable Kit** (Kit #19119056) is used with OnStar, XM and GPS cables. This kit consists of jumpers and connectors. The jumpers are used to adapt different types of connectors together (to attach 2-way and 3-way connector onto the long 7, 5 and 3 foot cables). The connectors are used to replace existing connectors. The 1-way and 2-way connectors in the kit are in water-blue color (different than what the vehicle is built with) and are non-keyed (universal fit). The 3-way connectors in the kit are in the same color as in the vehicle.
- **Communication Interface Module Antenna Cable Kit** (Kit # 22803854) is used for the OnStar module on some vehicles built before the 2011 model year.

Coaxial Cable Repair Kits

Repair Kit Name	Description
Communication Interface Module Antenna Cable Kit (Kit # 13581174)	RG58 coaxial cable with female/female connectors - 7ft/2.1m
	RG58 coaxial cable with female/male connectors - 5ft/1.5m
	RG58 coaxial cable with female/male connectors - 3.5ft/1.1m
	RG58 coaxial cable with female/male connectors - 3.5ft/1.1m
Digital Radio and Vehicle Locator Antenna Coaxial Cable Kit (Kit # 13581173)	RG316 coaxial cable with female/female connectors - 7ft/2.1m
	RG316 coaxial cable with female/male connectors - 5ft/1.5m
	RG316 coaxial cable with female/male connectors - 3.5ft/1.1m
	1-way to 3-way Gen 1 jumper for female connector - Part # 13581154 - 4in/10cm 1-way to 3-way Gen 1 jumper for

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Digital Radio, Mobile Telephone and Vehicle Locator Antenna Coaxial Cable Kit (Kit # 19119056)	3-way Gen 1 sub-kit	male connector - Part # 19119052 - 4in/10cm
		White female connector
		White male connector
		Blue female connector
		Blue male connector
	3-way Gen 2 sub-kit	1-way to 3-way Gen 2 jumper for female connector - Part # 13581155 - 4in/10cm
		1-way to 3-way Gen 2 jumper for male connector - Part # 19119058 - 4in/10cm
		Tan female connector
		Tan male connector
		Gray female connector
		Gray male connector
	2-way Gen 1 sub-kit	1-way to 2-way Gen 1 jumper for female connector - Part # 13581156 - 4in/10cm
		Water-blue female connector
	2-way Gen 2 sub-kit (wide)	1-way to 2-way Gen 2 jumper for female connector - Part # 13581157 - 4in/10cm
		1-way to 2-way Gen 2 jumper for male connector - Part # 13581158 - 4in/10cm
		Water-blue female connector
		Water-blue male connector
	2-way Gen 2 and 3 sub-kit (narrow)	1-way to 2-way Gen 2 and 3 jumper for female connector - Part # 13582468 - 4in/10cm
		Use the 1-way to 2-way Gen 2 jumper for female connector 19119058 - 4in/10cm from the 2- way Gen 2 sub-kit.
		Water-blue female connector
		Water-blue male connector
	Right-angle jumper with water-blue universal 1-way connector - 4in/10cm	
Communication Interface Module Antenna Cable Kit (Kit # 22803854)		1-way to mini UHF jumper - 4in/10cm

Connector Housing Repair Procedure

The connector housings (available in Digital Radio, Mobile Telephone and Vehicle Locator Antenna Coaxial Cable Kit) are available for 1-way housings, 2-way housings and 3-way housings. Determine the connector housing required:

1-way housing

No change to the service coaxial cable is necessary in order to install the new coaxial cable into the vehicle.

2-way housing

A 4-inch jumper is required.

1. Determine the appropriate generation (1, 2 or 3) and/or size (12.7 mm or 8 mm) of the 2-way housing that is in the vehicle.
2. Remove the faulty/damaged coaxial cable from the 2-way connector housing by removing the terminal position assurance (TPA) from the connector housing and then slide the cable out of the connector.
3. Install the new service coaxial cable into the vehicle. Use the 4-inch jumper for the appropriate 2-way connector housing to connect the new service coaxial cable to the connector housing.

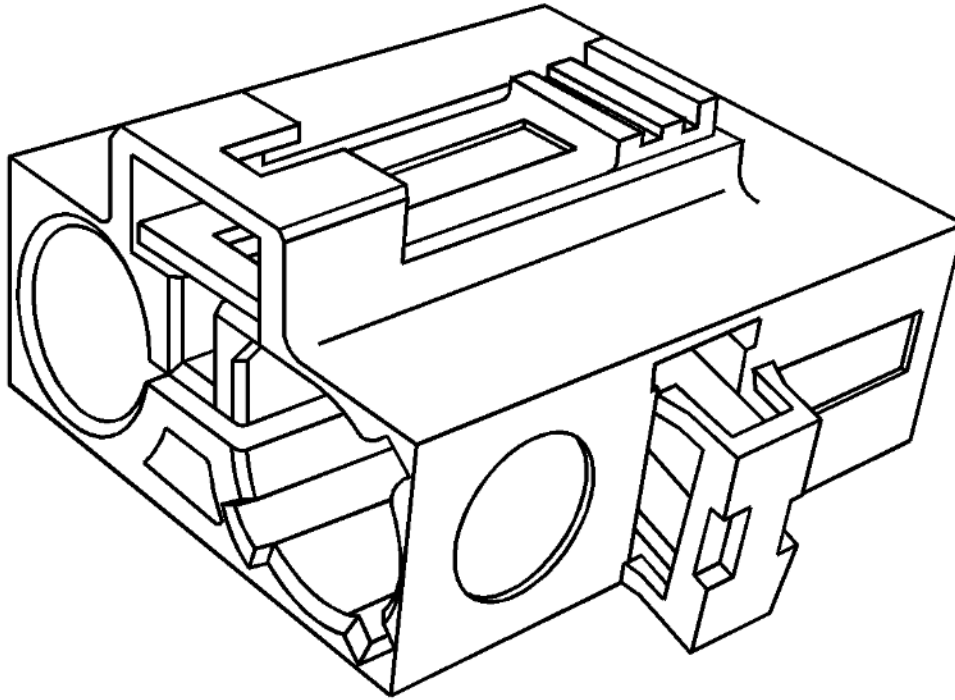


Fig. 4: Connector Housing

Courtesy of GENERAL MOTORS COMPANY

4. If the issue is found to be the connector housing and not cable, a new connector housing may be installed while reusing all other components.

3-way housing

A 4-inch jumper is required.

1. Determine the appropriate generation (1 or 2) and keyed 3-way connector housing based on the connector housing color.
2. Note the locations of each of the cables in 3-way housing, as it is important for new cables be placed in the appropriate terminal location in the new connector. The connector housing colors are not interchangeable.
3. Remove the faulty/damaged coaxial cable from the 3-way connector housing by using a pair of side/diagonal cutters to nip and break away the housing.
4. Use caution not to damage the conductive ends of the coaxial cables inside the connector housing. Do not

bend or force the terminal out or it could be damaged.

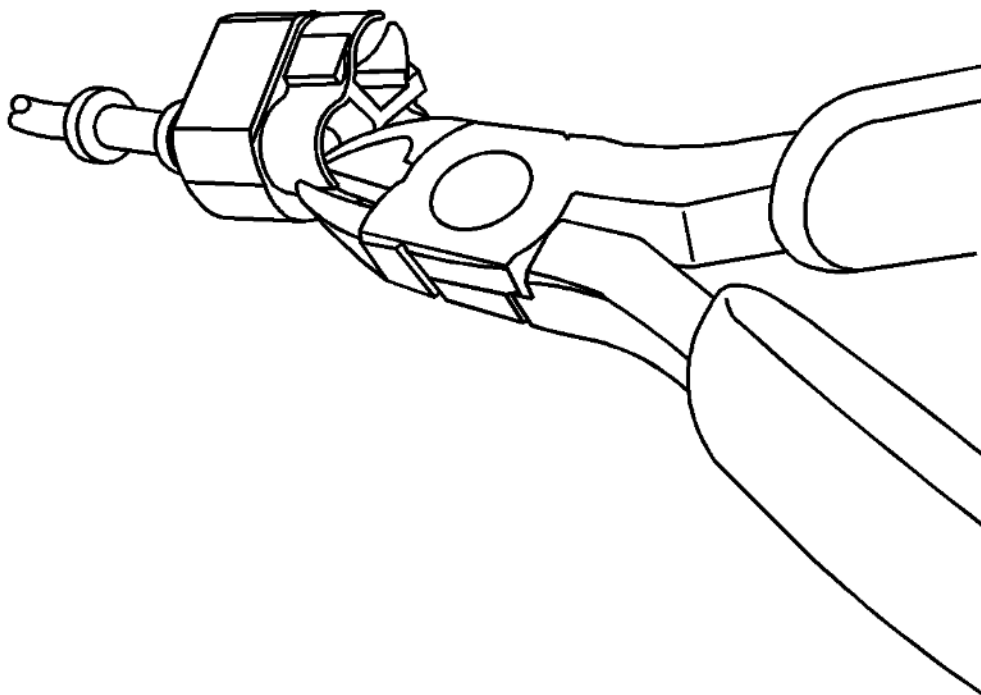


Fig. 5: Using Side/Diagonal Cutters To Nip And Break Away Connector Housing
Courtesy of GENERAL MOTORS COMPANY

5. Install the new service coaxial cable into the vehicle. Use the 4-inch jumper for the appropriate color 3-way connector housing to connect the new service coaxial cable to the new 3-way connector housing.

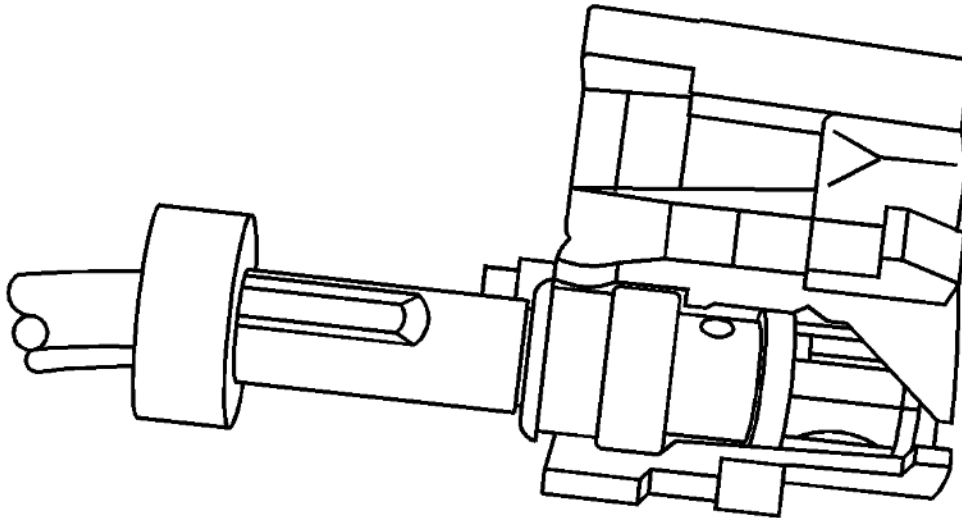


Fig. 6: Service Coaxial Cable And 3-Way Connector Housing
Courtesy of GENERAL MOTORS COMPANY

6. If the issue is found to be the connector housing and not cable, a new connector housing may be installed while reusing all other components.

Coaxial Cable Repair Procedure

1. Identify the faulty/damaged coaxial cable.
2. Disconnect the faulty/damaged coaxial cable and leave it in the vehicle.
3. Identify the type of coaxial cable to be replaced and match up with the appropriate pieces to repair the damaged coaxial cable. Match up the type of coaxial cable, cable length and connector types. In some cases there may be extra length of cable left over.
4. Install the new coaxial cable in the vehicle.

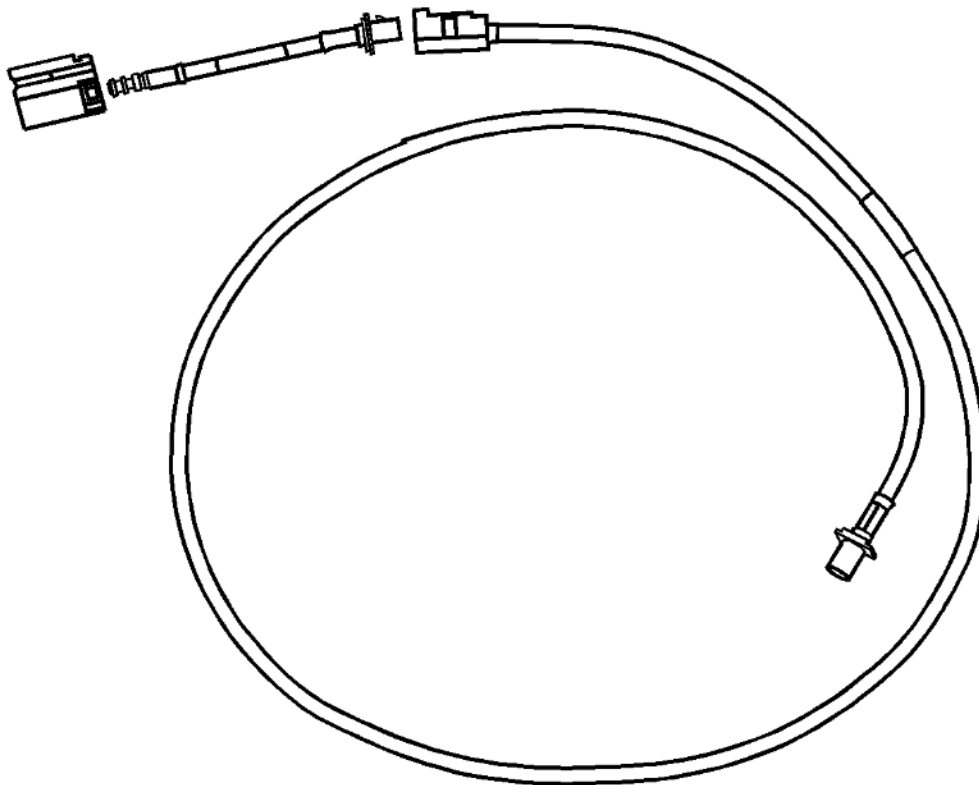


Fig. 7: Coaxial Cable

Courtesy of GENERAL MOTORS COMPANY

NOTE: Avoid routing the new coaxial cable near sharp edges that can damage the new coaxial cable.

Use tie-straps to attach the new service coaxial cable to existing harnesses or brackets. Use felt tape/foam to reduce rattles, as necessary.

5. Remove the faulty/damaged connectors, if applicable.

NOTE: To avoid permanent damage, do not pinch the cable or bend it tighter than a 2 inch (5 centimeter) radius.

6. Install new connectors or jumpers, as needed. Refer to Connector Housing Repair Procedure.
7. Verify the repair by operating the system with the engine running.

FLAT WIRE REPAIRS

The flat wire within the flex wiring harness is not serviceable. If an open or short exists within the flex wiring harness the complete harness must be replaced.

FOLDED-OVER WIRE REPAIR**Special Tools****EL-38125-10** Splice Sleeve Crimping Tool

For equivalent regional tools, refer to **Special Tools** .

The GM global wire repair strategy uses connector assemblies (pigtails) and terminated leads to repair wiring harnesses.

To reduce and manage GM Service Parts proliferation, the service pigtails and terminated leads are designed with the largest wire gauge size that can be held by either the terminal or the connector housing.

The folded over wire repair technique, in which the copper wire strands are folded over before being installed into a splice sleeve, allows the service part to be used when repairing a smaller gauge size wire in a vehicle. This technique has passed all GM testing standards.

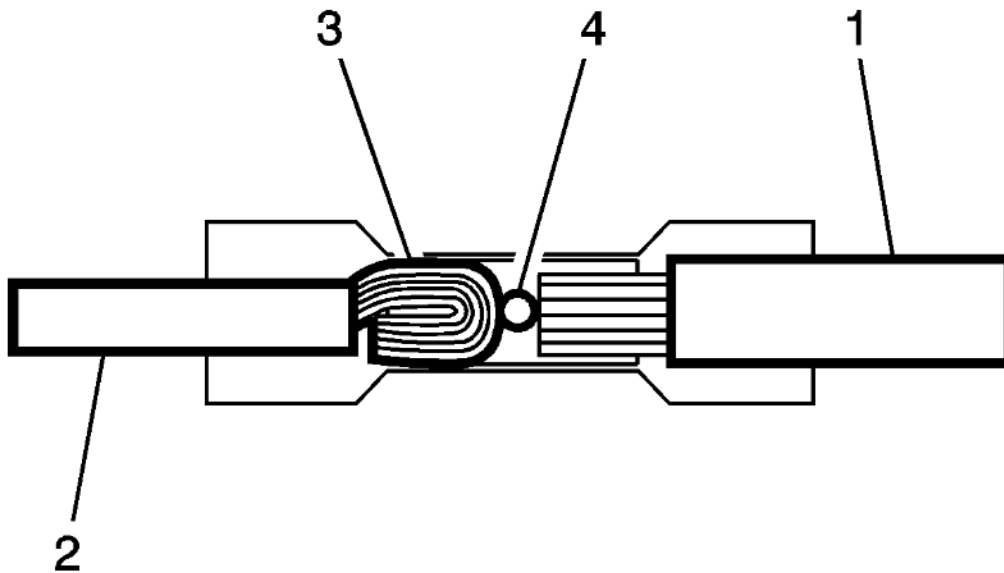


Fig. 8: View Of Stripped Wires In Splice Sleeve Connector
Courtesy of GENERAL MOTORS COMPANY

The larger harness size wires (1) will be placed in one side of the splice sleeve and match the splice sleeve closely in size. The wires are moved into the splice sleeve until they hit the stop (4) in the splice sleeve. The smaller harness size wires (2) will be placed in the other side of the splice sleeve. The smaller harness size wires will be folded over (3) to match up with the splice sleeve size.

Use the folded over wire repair for:

- Splicing wires of 0.35 mm or less (22, 24, 26 gauge sizes)

NOTE: Increasing the amount of copper strands in the smaller gauge size will allow for a better crimp

- Splicing wires of different gauges

NOTE: Vehicle side needs to be of same or less gauge size (not greater than the

service part's gauge size)

Use the Service Information (SI) connector end-views to determine:

- Gauge size of wiring harness
- Recommended Repair: Terminated Lead or Pigtail

The following table lists the acceptable variance within the gauge size

Folded-Over Wire Selection Table

Harness Wire Gauge		Connector Assembly (Pigtail) or Terminated Lead Wire Gauge Size			
-		Salmon Color Splice Sleeve		Blue Color Splice Sleeve	Yellow Color Splice Sleeve
Metric	-	0.35 mm	0.5-0.8 mm	1.0-2.0 mm	3.0-5.0 mm
-	Wire Gauge (AWG)	22	20-18	16-14	12-10
0.13 mm	26	Fold Over Wire	Fold Over Wire	Fold Over Wire	Not Acceptable
0.22 mm	24	Fold Over Wire	Fold Over Wire	Fold Over Wire	Not Acceptable
0.35 mm	22	Fold Over Wire	Fold Over Wire	Fold Over Wire	Not Acceptable
0.5 mm	20	Not Acceptable	Wire to Wire	Fold Over Wire	Not Acceptable
0.75 mm	-	Not Acceptable	Wire to Wire	Fold Over Wire	Not Acceptable
0.8 mm	18	Not Acceptable	Wire to Wire	Fold Over Wire	Not Acceptable
1.0 mm	16	Not Acceptable	Wire to Wire	Fold Over Wire	Not Acceptable
1.5 mm	-	Not Acceptable	Not Acceptable	Wire to Wire	Fold Over Wire
2.0 mm	14	Not Acceptable	Not Acceptable	Wire to Wire	Fold Over Wire
2.5 mm	-	Not Acceptable	Not Acceptable	Wire to Wire	Fold Over Wire
3.0-5.0 mm	12-10	Not Acceptable	Not Acceptable	Not Acceptable	Wire to Wire

Example

For an IP Harness of 0.22 mm (24 gauge on left side of table) wire size, the SI connector end-view recommends a pigtail with leads of 0.8 mm (18 gauge on the top of the table) with a salmon colored DuraSeal splice sleeve of 0.5-1.0 mm (20-16 gauge).

Follow these steps to use the folded over wire (1) technique on an IP Harness.

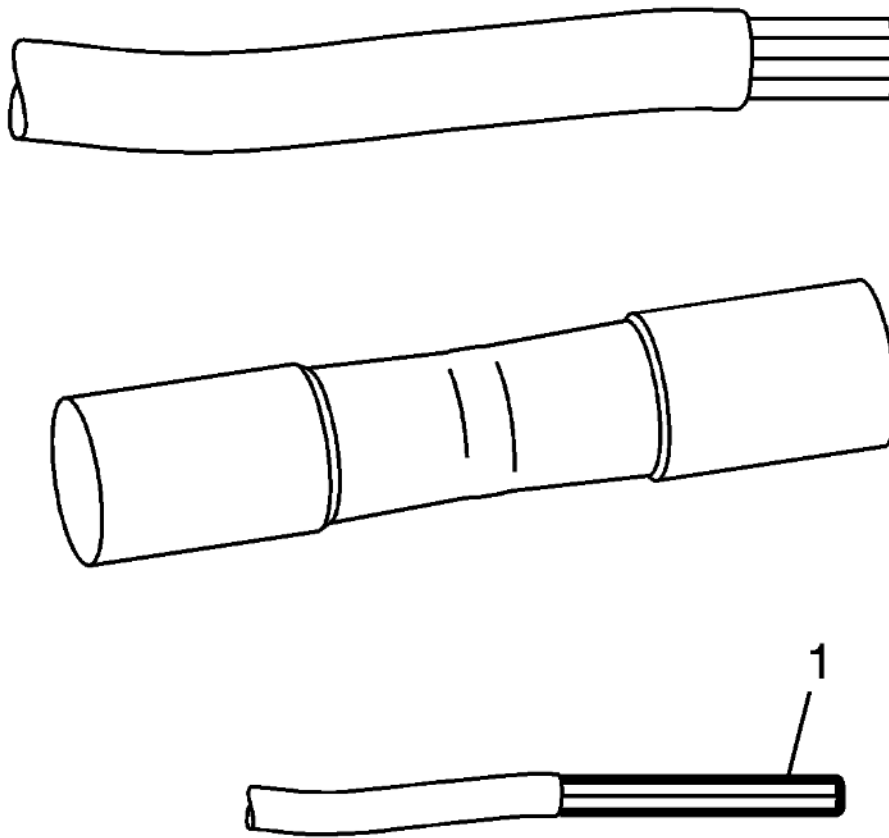


Fig. 9: View Of Stripped Wires

Courtesy of GENERAL MOTORS COMPANY

Strip twice the amount of insulation on the smaller (1) wire (IP Harness is the lower wire) than normally required. Normally, the terminated leads have 5 mm of insulation stripped off the wire.

1. For wiring repair, refer to Splicing Copper Wire Using Splice Sleeves.

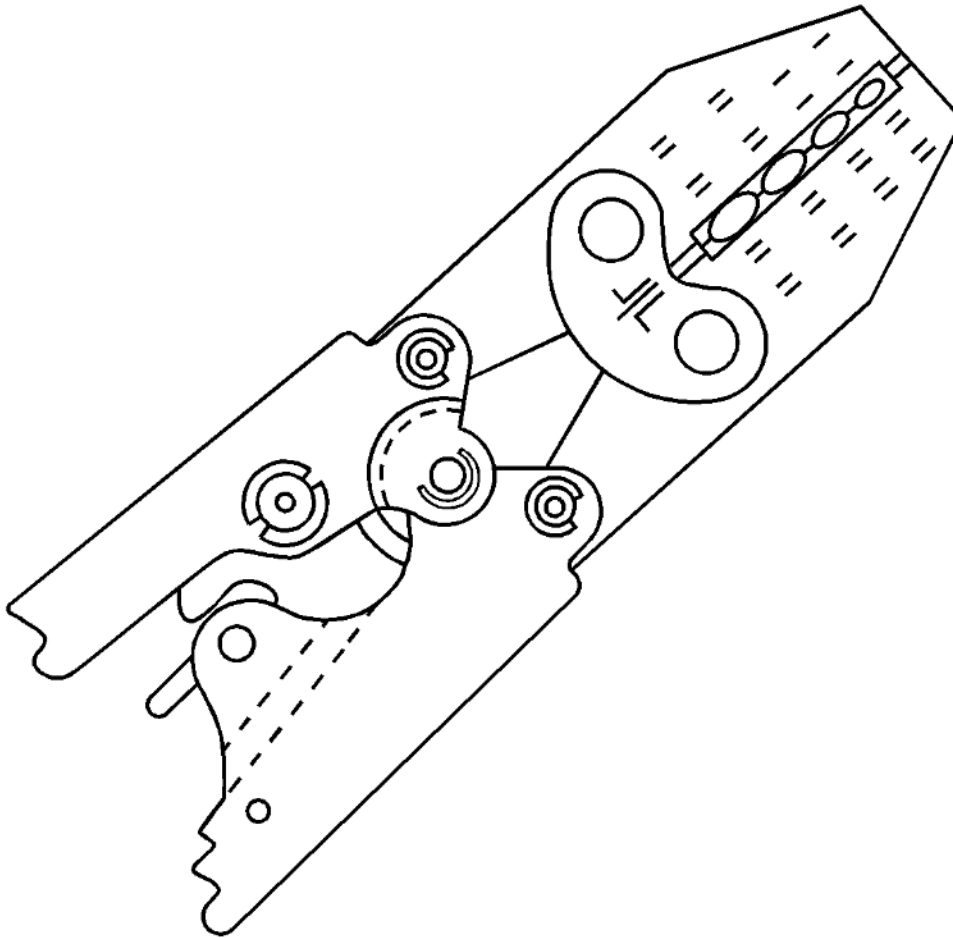


Fig. 10: Splice Sleeve Crimping Tool
Courtesy of GENERAL MOTORS COMPANY

NOTE: Use EL-38125-10 splice sleeve crimping tool.

2. Twist the wires before you fold them over to prevent the wire strands from opening up. Fold over the copper wire strands of the smaller (1) gauge wire so that it is the same length as the non-folded wire.

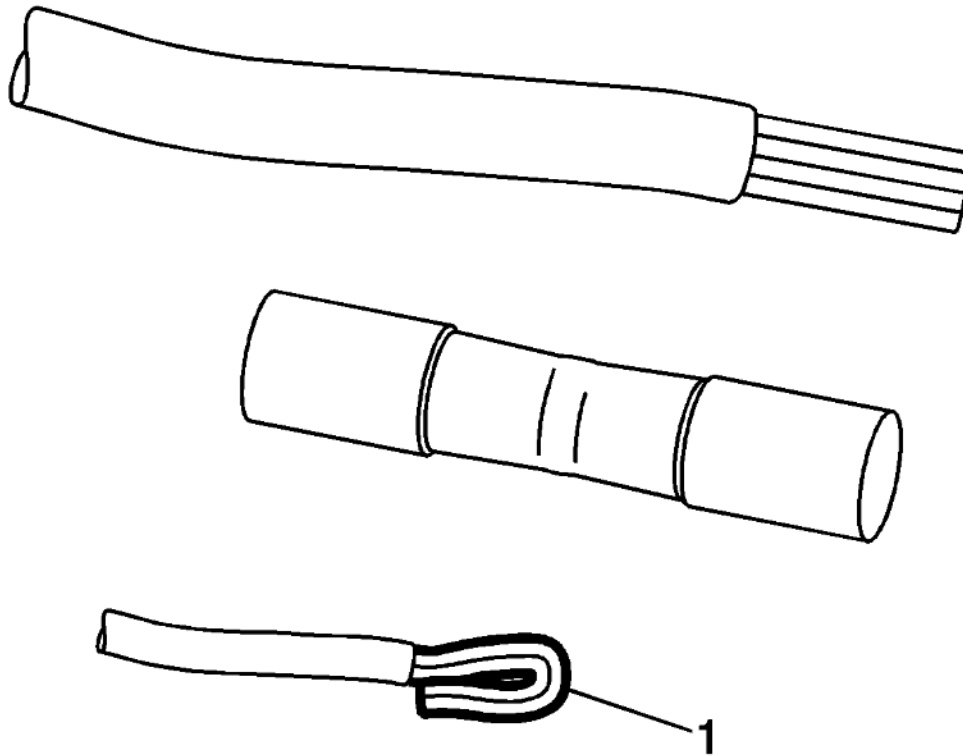


Fig. 11: View Of Twisted And Folded Wire To Length
Courtesy of GENERAL MOTORS COMPANY

3. Insert the folded over wire (1) into the splice sleeve.

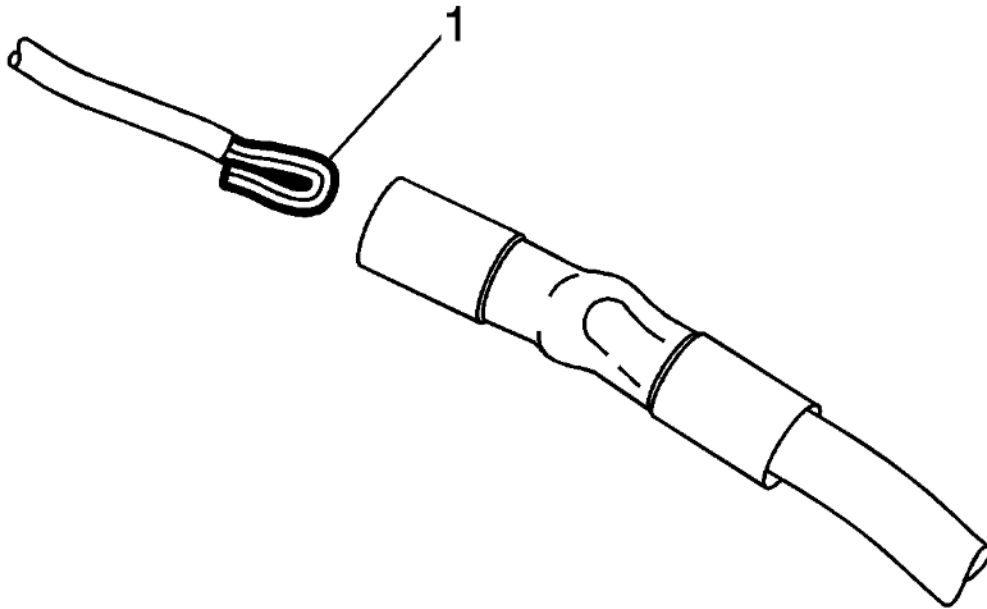


Fig. 12: View Of Folded Wire & Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

4. Use the proper crimp tool to crimp the splice sleeve to the smaller wire (harness side of repair). Complete the crimp as usual (using the heat tool to shrink the tube).

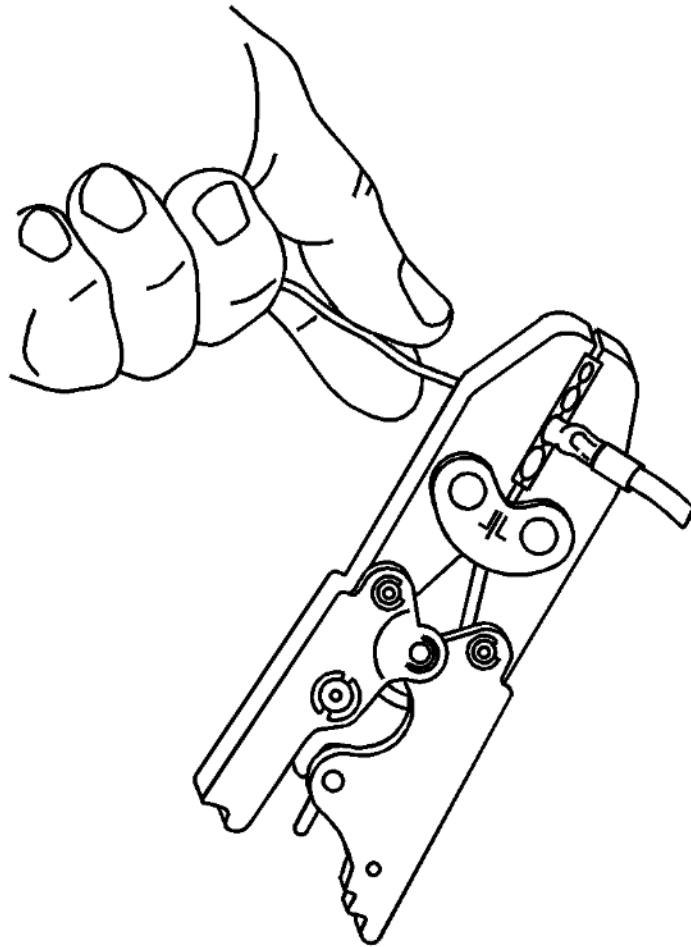


Fig. 13: Crimping The Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

HIGH TEMPERATURE WIRING REPAIRS

NOTE: All wiring repairs need to be 200 mm from the heat zone. Areas of consideration would be any area located near the exhaust manifolds, catalytic converter, exhaust pipes and turbocharged engines.

Items Required

- DuraSeal splice sleeves to crimp and seal connections
- High temperature SCT1 shrink tubing to protect the splice sleeves
- Terminated leads or pigtails
- The correct tools to remove the terminals from the connectors

Use high temperature bulk wire rated at 150°C (302°F) continuous temperature of the same or larger gauge size

as the original wire when repair damage wire. Also replace any reflective tape that you remove during the repair.

High Temperature Wiring

Wiring that is exposed to high temperatures, 135°C (275°F) or higher, for prolonged periods of time may use materials i.e. wires, connectors and shielding that has a higher heat rating than typical wiring. When making a repair in a high temperature area observe the following:

- Use high temperature bulk wire rated at 150°C (302°F) continuous temperature to replace any damaged wire.
- Replace any heat shielding that is removed.
- Cover any DuraSeal splice sleeves with SCT1 shrink tubing.
- After making a wiring repair, ensure that the location of the wiring is not moved closer to the heat source.

Identifying High Temperature Wiring

NOTE: **High temperature areas would be areas located near exhaust manifolds, catalytic converters, exhaust pipes and turbocharged engines.**

Wiring that is exposed to high temperature, 135°C (275°F) or higher, for prolonged periods of time need special considerations when making wiring repairs. Areas that may be exposed to higher temperatures can be identified by heat resistant materials that are being used in those areas. These materials may include heat reflective tape, moon tape and high temperature shrink tubing. Also conduit and other protective coverings may be used. Because conduit or similar coverings are used throughout the vehicle regardless of the temperature, it may be necessary for the technician to determine if an area is exposed to excessive heat before making a wiring repair.

HEATED OXYGEN SENSOR WIRING REPAIRS

CAUTION: Do not solder repairs under any circumstances as this could result in the air reference being obstructed.

If the heated oxygen sensor pigtail wiring, connector or terminal is damaged the entire oxygen sensor assembly must be replaced. Do not attempt to repair the wiring, connector or terminals. In order for the sensor to function properly it must have a clean air reference. This clean air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, connectors or terminals could result in the obstruction of the air reference and degrade oxygen sensor performance.

The following guidelines should be used when servicing the heated oxygen sensor:

- Do not apply contact cleaner or other materials to the sensor or vehicle harness connectors. These materials may get into the sensor, causing poor performance. Also, the sensor pigtail and harness wires must not be damaged in such a way that the wires inside are exposed. This could provide a path for foreign materials to enter the sensor and cause performance problems.
- Neither the sensor nor vehicle lead wires should be bent sharply or kinked. Sharp bends, kinks, etc., could

block the reference air path through the lead wire.

- Do not remove or defeat the oxygen sensor ground wire (where applicable). Vehicles that utilize the ground wire sensor may rely on this ground as the only ground contact to the sensor. Removal of the ground wire will also cause poor engine performance.
- To prevent damage due to water intrusion, be sure that the peripheral seal remains intact on the vehicle harness connector.

SPLICING COPPER WIRE USING SPLICE SLEEVES

Special Tools

- **EL-38125-10** Splice Sleeve Crimping Tool
- **J-38125-5A** Ultra Torch Special Tool
- **J-38125-8** Splice Sleeve Crimping Tool

For equivalent regional tools, refer to **Special Tools**.

NOTE: The DuraSeal splice sleeves have the following 2 critical features:

- A special heat shrink sleeve environmentally seals the splice. The heat shrink sleeve contains a sealing adhesive inside.
- A cross hatched (knurled) core crimp provides the necessary low resistance contact integrity for these sensitive, low energy circuits.

Use only DuraSeal splice sleeves to form a one-to-one splice on all types of insulation except Tefzel and coaxial. Use DuraSeal splice sleeves where there are special requirements such as moisture sealing. Follow the instructions below in order to splice copper wire using DuraSeal splice sleeves.

Splice Sleeve Selection

Splice Sleeve Color	Crimp Tool Nest Color		Wire Gauge mm ² / (AWG)
	3 Crimp Nests	4 Crimp Nests	
Salmon (Yellow-Pink) 19168446	Red (1) or Red/Green (1)	Red (2)	0.5-0.8/(18-20)
Blue 19168447	Blue (2)	Blue (3)	1.0-2.0/(14-16)
Yellow 19168448	Yellow (3)	Yellow (4)	3.0-5.0/(10-12)

1. Open the harness by removing any tape:

NOTE: You must perform the following procedures in the listed order. Repeat the procedure if any wire strands are damaged. You must obtain a clean strip with all of the wire strands intact.

- Use a sewing seam ripper, available from sewing supply stores, in order to cut open the harness in order to avoid wire insulation damage.
 - Use the DuraSeal splice sleeves on all types of insulation except Tefzel and coaxial.
 - Do not use the crimp and DuraSeal splice sleeve to form a splice with more than 2 wires coming together.
2. Cut as little wire off the harness as possible. You may need the extra length of wire in order to change the location of a splice.

Adjust splice locations so that each splice is at least 40 mm (1.5 in) away from the other splices, harness branches or connectors.

3. Strip the insulation:
- When adding a length of wire to the existing harness, use the same size wire as the original wire.
 - Perform one of the following items in order to find the correct wire size:
 - Find the wire on the schematic and convert to regional wiring gauge size.
 - If you are unsure of the wire size, begin with the largest opening in the wire stripper and work down until achieving a clean strip of the insulation.
 - Strip approximately 5.0 mm (0.20 in) of insulation from each wire to be spliced.
 - Do not nick or cut any of the strands. Inspect the stripped wire for nicks or cut strands.
 - If the wire is damaged, repeat this procedure after removing the damaged section.
4. For high temperature wiring, slide a section of high temperature SCT1 shrink tubing down the length of wire to be spliced. Ensure that the shrink tubing will not interfere with the splice procedure.
5. Select the proper DuraSeal splice sleeve according to the wire size. Refer to the above table at the beginning of the repair procedure for the color coding of the DuraSeal splice sleeves and the crimp tool nests.
6. The **EL-38125-10** splice sleeve crimping tool has four crimp nests. The largest crimp nest (4) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (3) is used for crimping 14 and 16 gauge wires. The third largest crimp nest (2) is used for crimping 18 and 20 gauge wires. The smallest crimp nest (1) is used for crimping 22 to 26 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

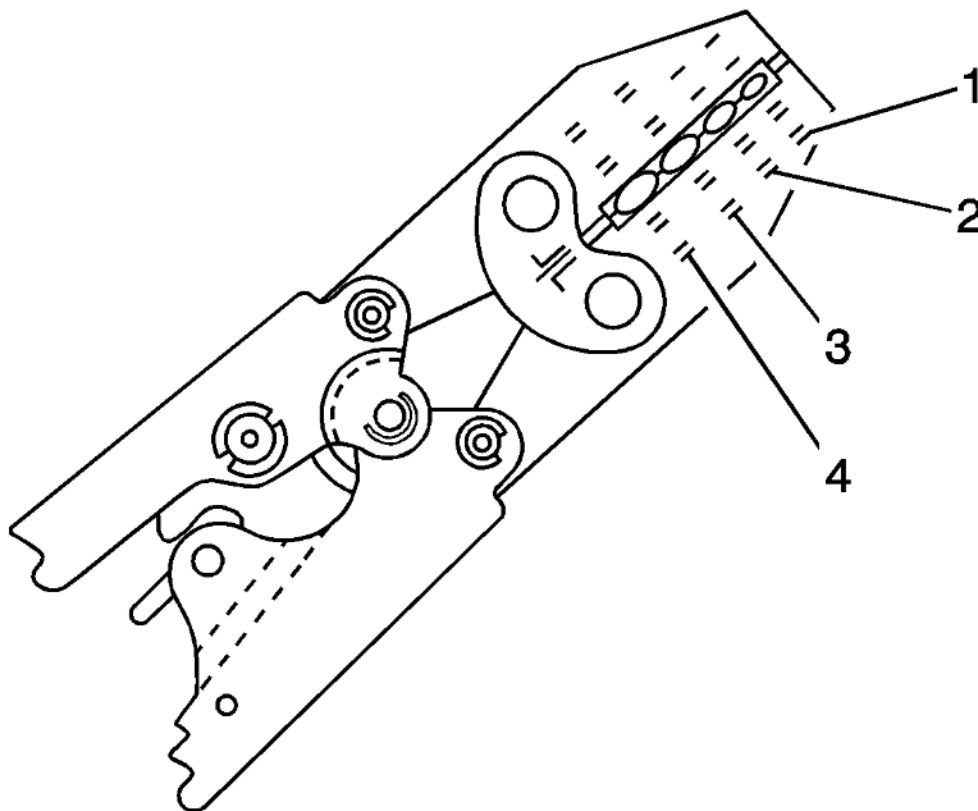


Fig. 14: View Of Crimping Tool

Courtesy of GENERAL MOTORS COMPANY

7. The **J-38125-8** splice sleeve crimping tool has three crimp nests. The largest crimp nest (3) is used for crimping 10 and 12 gauge wires. The second largest crimp nest (2) is used for crimping 14 and 16 gauge wires. The smallest crimp nest (1) is used for crimping 18 to 20 gauge wires. The crimp nests are referenced in the table (farther above) under the crimp tool nest color.

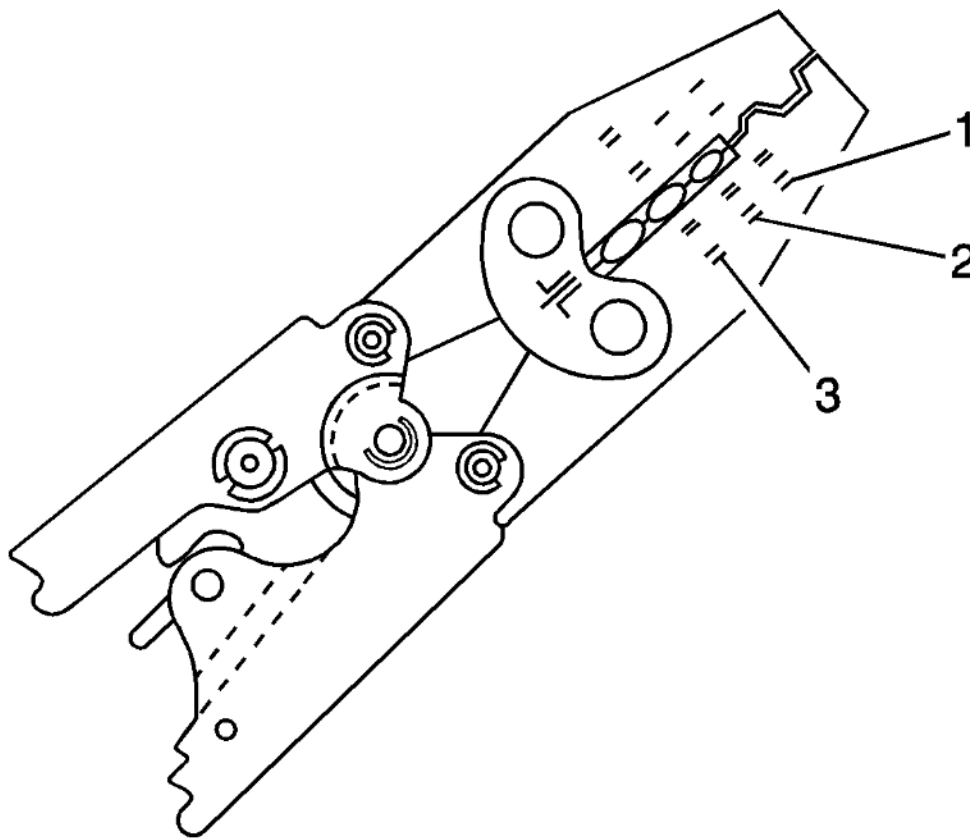


Fig. 15: Identifying Splice Crimp Tool Nests Terminal Identification
Courtesy of GENERAL MOTORS COMPANY

8. Use the splice sleeve crimp tool in order to position the DuraSeal splice sleeve in the proper color nest of the splice sleeve crimp tool. For the four crimp nest tool, use the three largest crimp nests to crimp the splice sleeves. For the three crimp nest tool, use all three crimp nests to crimp the splice sleeves. Use the four and three crimp tool diagrams (above) and the table (farther above) to match the splice sleeve with the correct crimp nest. The crimp tool diagram callout numbers match the numbers in the table (under crimp tool nest color).
9. Place the DuraSeal splice sleeve in the nest. Ensure that the crimp falls midway between the end of the barrel and the stop. The sleeve has a stop (3) in the middle of the barrel (2) in order to prevent the wire (1) from going further. Close the hand crimper handles slightly in order to firmly hold the DuraSeal splice sleeve in the proper nest.

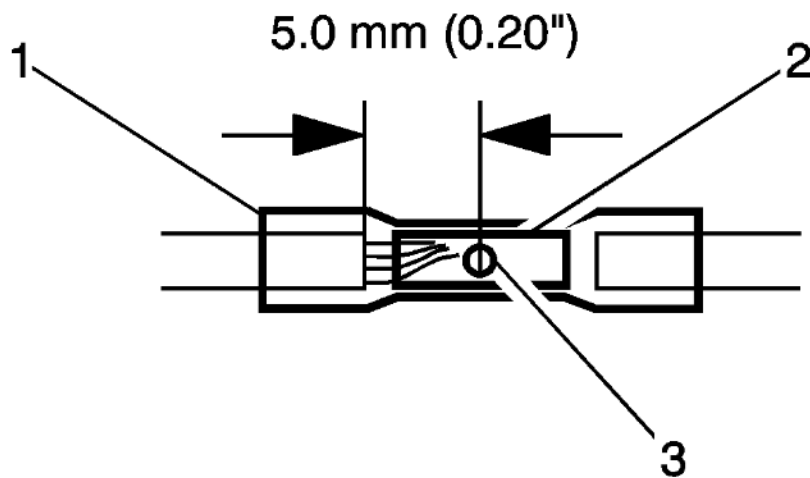


Fig. 16: Identifying Duraseal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

10. Insert the wire into the splice sleeve barrel until the wire hits the barrel stop.



Fig. 17: Identifying Crimped Duraseal Splice Sleeve
Courtesy of GENERAL MOTORS COMPANY

11. Tightly close the handles of the crimp tool until the crimper handles open when released.

The crimper handles will not open until you apply the proper amount of pressure to the DuraSeal splice sleeve. Repeat steps 4 and 6 for the opposite end of the splice.

12. Using the heat torch, apply heat to the crimped area of the barrel.



Fig. 18: Identifying Heated Splice Sleeve

Courtesy of GENERAL MOTORS COMPANY

13. Start in the middle and gradually move the heat barrel to the open ends of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.

High Temperature Wiring Repairs

Use the following procedures to perform high temperature wiring repairs:

1. Center the high temperature SCT1 shrink tube over the DuraSeal splice sleeve.
2. Using the heat torch, apply heat to the high temperature heat shrink tubing.

3. Gradually move the heat from the center to the open end of the tubing:
 - The tubing will shrink completely as the heat is moved along the insulation.
 - A small amount of sealant will come out of the end of the tubing when sufficient shrinkage is achieved.
4. Replace any reflective tape and clips that may have been removed during the repair.

SPLICING TWISTED OR SHIELDED CABLE

Twisted/shielded cable is used in order to protect wiring from electrical noise. Two-conductor cable of this construction is used between the radio and the Delco-Bose® speaker/amplifier units and other applications where low level, sensitive signals must be carried. Follow the instructions below in order to repair the twisted/shielded cable.

1. Remove the outer jacket (1). Use care not to cut into the drain wire of the mylar tape.

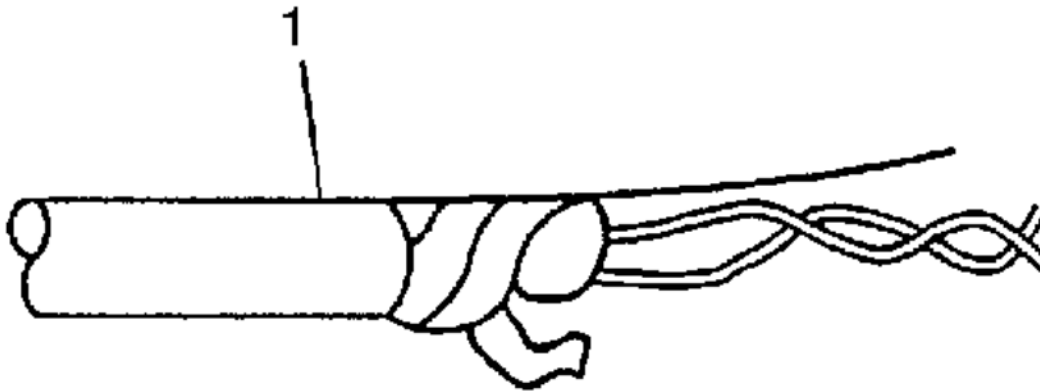


Fig. 19: View Of Outer Wiring Jacket

Courtesy of GENERAL MOTORS COMPANY

2. Unwrap the tape. Do not remove the tape. Use the tape in order to rewrap the twisted conductors after the splice is made.
3. Prepare the splice. Untwist the conductors and follow the instructions for **Splicing Copper Wire Using Splice Sleeves**. Staggering the splices by 65 mm (2.5 in) is recommended.



Fig. 20: Preparing The Splice

Courtesy of GENERAL MOTORS COMPANY

4. Re-assemble the cable.

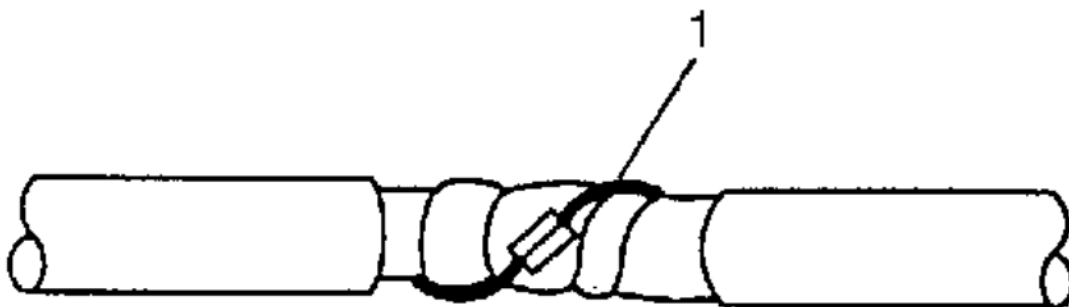


Fig. 21: Identifying Diode On Wire

Courtesy of GENERAL MOTORS COMPANY

NOTE: Apply the mylar tape with the aluminum side inward. This ensures good electrical contact with the drain wire.

- Rewrap the conductors with the mylar tape. If the mylar tape is damaged, use 3M product AL-36FR to replace the damaged mylar tape.
- Use caution not to wrap the drain wire in the tape (1).
- Follow the splicing instructions for copper wire and splice the drain wire.
- Wrap the drain wire around the conductors and tape with electrical tape to replace the outer insulation.

5. Tape over the entire cable. Use a winding motion when you apply the tape.



Fig. 22: View Of Repaired Wire Covered With Electrical Tape
Courtesy of GENERAL MOTORS COMPANY

SPLICING INLINE HARNESS DIODES

Many vehicle electrical systems use a diode to isolate circuits and protect the components from voltage spikes. When installing a new diode use the following procedure.

1. Open the harness.
 - If the harness is taped, remove the tape.
 - To avoid wiring insulation damage, use a sewing seam ripper (available from sewing supply stores) in order to cut open the harness.
 - If the harness has a black plastic conduit, pull out the diode.
2. If the diode is taped to the harness, remove all of the tape.

3. Check and record the current flow direction and orientation of diode.
4. Remove the inoperative diode from the harness with a suitable soldering tool.

NOTE: If the diode is located next to a connector terminal remove the terminal(s) from the connector to prevent damage from the soldering tool.

5. Carefully strip away a section of insulation next to the old soldered portion of the wire(s). Do not remove any more than is needed to attach the new diode.
6. Check current flow direction of the new diode, being sure to install the diode with correct bias. Reference the appropriate service manual wiring schematic to obtain the correct diode installation position.
7. Attach the new diode to the wire(s) using 60/40 rosin core solder. Before soldering attach some heat sinks (aluminum alligator clips) across the diode wire ends to protect the diode from excessive heat. Follow the manufacturer's instruction for the soldering equipment.
8. Reinstall terminal(s) into the connector body if previously removed.
9. Tape the diode to the harness or connector using electrical tape.

NOTE: To prevent shorts to ground and water intrusion, completely cover all exposed wire and diode attachment points with tape.

SIR/SRS WIRING REPAIRS

NOTE: Refer to SIR Service Precautions .

For **European** regions - If the SIR/SRS wiring, connector or terminal is damaged, the affected wiring harness must be replaced. Do not attempt to repair the wiring, connector or terminals. Any attempt to repair the wires, connectors or terminals could result in performance problems of the SIR/SRS System. Operations on restraint systems must only be performed by trained and qualified personnel.

Special Tools

EL-38125-10 Splice Sleeve Crimping Tool

For equivalent regional tools, refer to Special Tools .

The Supplemental Inflatable Restraint (SIR) System/Supplemental Restraint System (SRS) requires special wiring repair procedures due to the sensitive nature of the circuitry. Follow the specific procedures and instructions when working with the SIR/SRS and the wiring components, such as connectors and terminals.

SIR/SRS Connector Repair (Plastic Body and Terminal Metal Pin)

NOTE: Do not use the terminals in the kit in order to replace damaged SIR/SRS system terminals. Use either an SIR/SRS pigtail or a terminated lead from the SIR Repair Kit Tray.

The terminals in the SIR/SRS system are made with a special plating. This plating provides the necessary contact integrity for the sensitive, low energy circuits.

Pigtail repair packs are available for SIR/SRS connectors with eight or less terminals. Only the connector body is available for connectors with more than eight terminals. Terminated leads can be used to replace damaged terminals when replacing the connector body.

SIR/SRS Component Wire Pigtail Repair

NOTE: Do not make wire, connector or terminal repairs on components with wire pigtails.

A wire pigtail is a wire or wires attached directly to the device, not by a connector. If a wiring pigtail is damaged, you must replace the entire component, with pigtail. The inflatable restraint steering wheel module coil is an example of a pigtail component.

SIR/SRS Wire Repair

CAUTION: Do not install more than 2 DuraSeal splice sleeves per SIR deployment loop. A deployment loop consists of both wires from the K36 Inflatable Restraint Sensing and Diagnostic Module to the deployable component. If more than 2 DuraSeal splice sleeves are required for any SIR deployment loop, the complete circuit of the loop must be replaced. More than 2 DuraSeal splice sleeves per deployment loop may increase the resistance in the circuit causing a DTC to be set.

NOTE: Refer to Wiring Repairs in the service information connector end views or the vehicle schematics in order to determine the correct wire size for the circuit you are repairing. You must obtain this information in order to ensure circuit integrity.

If any wire except the pigtail is damaged, repair the wire by splicing in a new section of wire of the same gauge size (0.5 mm, 0.8 mm, 1.0 mm etc.). Use the DuraSeal splice sleeves and **EL-38125-10** splice sleeve crimping tool. For wiring repair, refer to Splicing Copper Wire Using Splice Sleeves.

For connector position assurance (CPA), refer to Connector Position Assurance Locks.

For terminal position assurance (TPA), refer to Terminal Position Assurance Locks.

CONNECTOR REPAIRS

Connector Repairs contains a list of all connector repairs. The connector repairs are listed by the connector manufacturer and then by connector type. If the technician cannot identify the manufacturer of the connector, refer to **Identifying Connectors** below. Knowing the connector manufacturer will assist in finding the correct connector repair from the following list:

- Connector Position Assurance Locks
- Terminal Position Assurance Locks
- AFL/EPC Connectors
- Bosch Connectors (BSK), Bosch Connectors (0.64), Bosch Connectors (2.8 JPT), Bosch Connectors (ECM)
- Delphi Connectors (Weather Pack), Delphi Connectors (Pull To Seat), Delphi Connectors (Push To Seat), Delphi Connectors (12-Way), Delphi Connectors (Micro.64), Delphi Connectors (Steering Gear), Delphi Connectors (Micro-Pack 100W)
- FCI Connectors (Lever Lock), FCI Connectors (SIR)
- FEP Connectors (Steering Gear)
- JST Connectors
- Kostal Connectors (Glow Plug Control Module), Kostal Connectors (Transmission)
- Molex Connectors, Molex Connectors (SIR)
- Sumitomo Connectors
- Tyco/AMP Connectors (Sensor), Tyco/AMP Connectors (SIR), Tyco/AMP Connectors (Door Module), Tyco/AMP Connectors (102-Way Inline), Tyco/AMP Connectors (0.25 Cap), Tyco/AMP Connectors (Seat), Tyco/AMP Connectors (CM 42-Way), Tyco/AMP Connectors (43-Way)
- Yazaki Connectors (2-Way), Yazaki Connectors (16-Way)
- Repairing Connector Terminals (Terminated Lead Repair), Repairing Connector Terminals (Terminal Repair)

Connector Anatomy

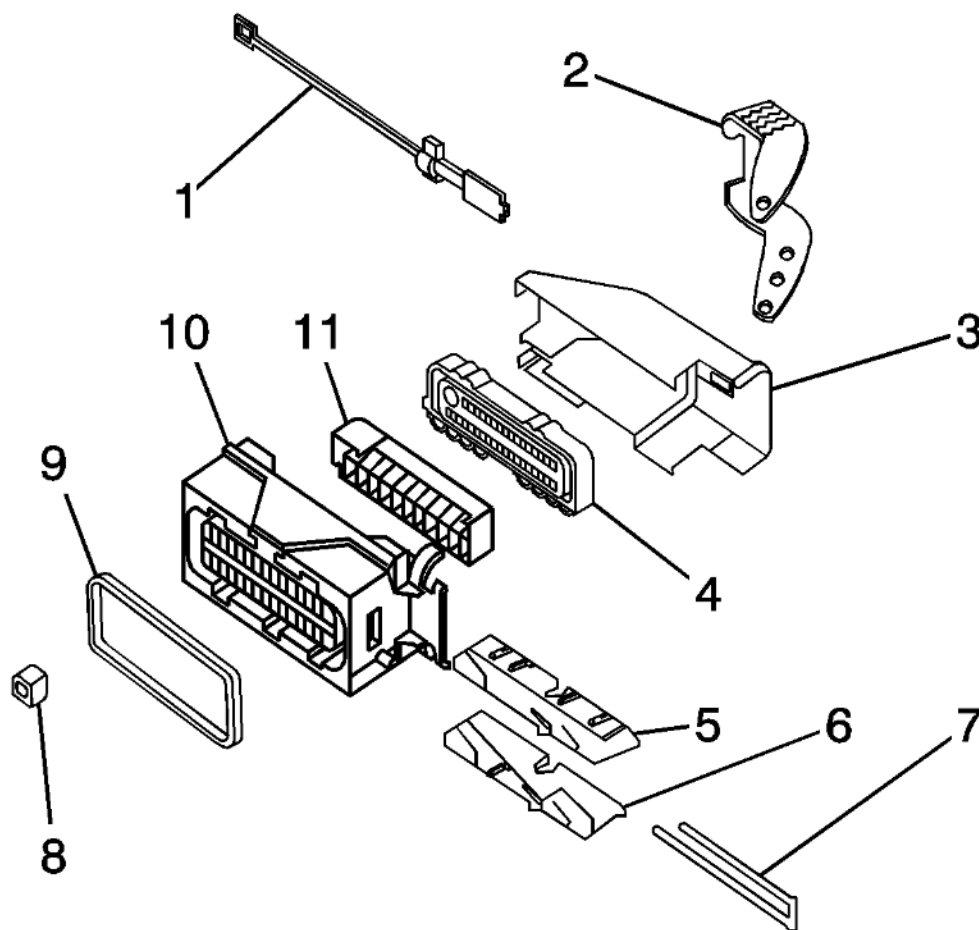


Fig. 23: Connector Components

Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Connector Positive Assurance (CPA)
2	Assist Lever
3	Wire Dress Cover
4	Seal Strain/Relief
5	Slide Left Hand
6	Slide Right Hand
7	Terminal Positive Assurance (TPA)
8	Terminal Positive Assurance (TPA)
9	Connector Seal
10	Connector Housing
11	Inner Connector

Identifying Connectors

Knowing the connector manufacturer is helpful when trying to locating the correct connector repair procedure. There are many different connector designs used on GM vehicles and it is sometimes difficult to identify the connector manufacturer. The information in this document should help with the identification of connector manufactures.

The following connector manufacturers make most of the connectors found in GM vehicles:

- AFL/EPC (Alcoa Fujikura Ltd./Engineered Plastics Components)
- Bosch
- Delphi
- FCI (Framatome Connectors International)
- JAE (Japan Aviation Electronics)
- JST (Japan Solderless Terminals)
- Kostal
- Molex
- Sumitomo
- Tyco/AMP
- Yazaki

Identifying the manufacturer of a connector is often difficult. When trying to determine the manufacturer of a connector, look for specific identifying marks that are unique to that connector supplier. Most of these identify marks are hard to find or see. Check the connector carefully and refer to the information below for pictures and descriptions of connector identification markings.

- Most of AFL's connectors have EPC on their connector body. Some of the smaller connectors will not have any markings on them.

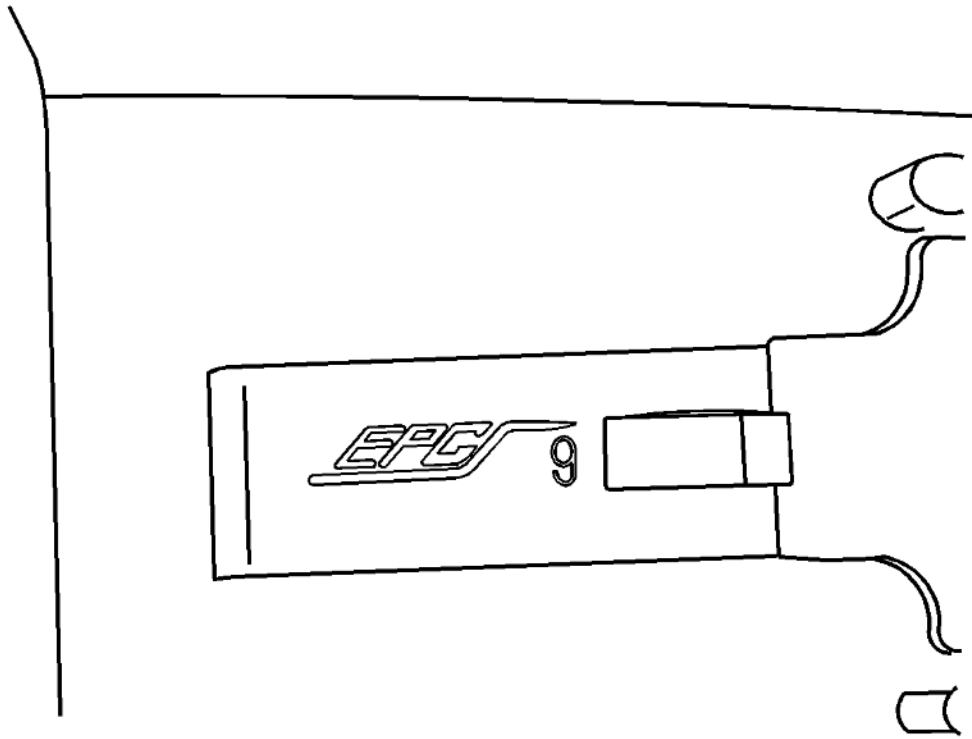


Fig. 24: View Of EPC Identification On Connector Body
Courtesy of GENERAL MOTORS COMPANY

- In some cases Bosch will actually be printed on the connector. If Bosch does not appear on the connector, look for the Bosch logo. The Bosch logo is a circle with a blunted arrow inside. This logo can appear anywhere on the connector and is often very small.

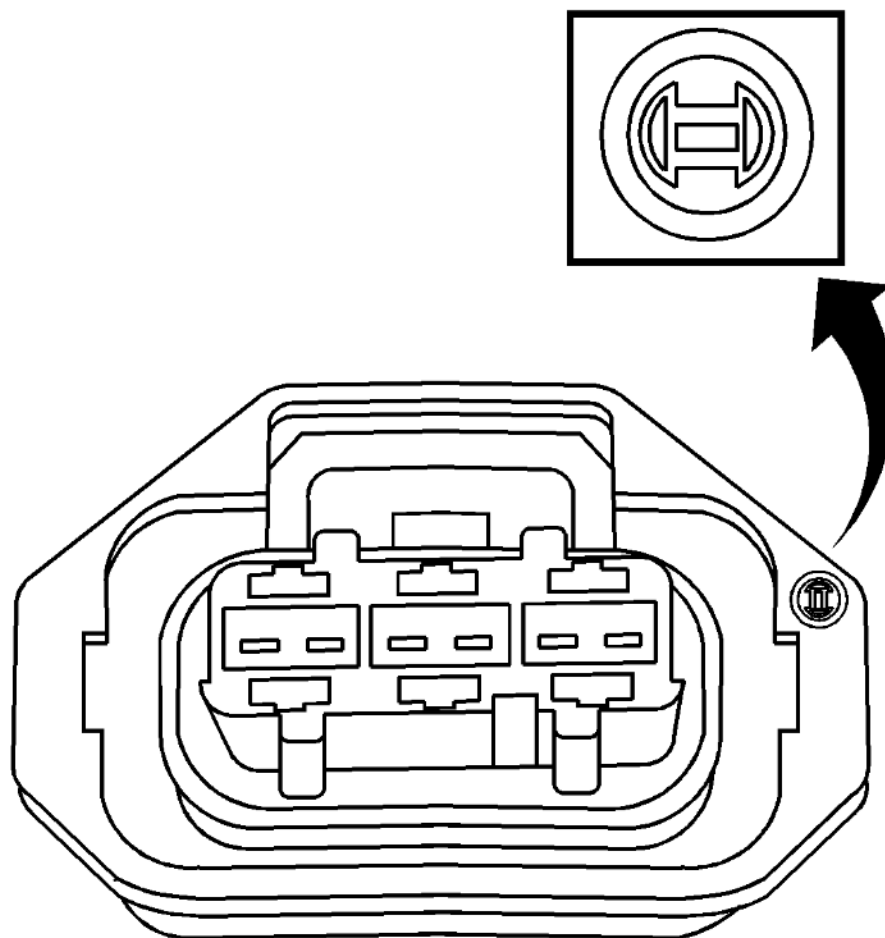


Fig. 25: View Of Bosch Identification On Connector Body
Courtesy of GENERAL MOTORS COMPANY

- In some cases Delphi will actually be printed on the connector. If Delphi is not printed on the connector, look for PED. In both cases there is no specific orientation for Delphi or PED and they can appear anywhere on the connector.

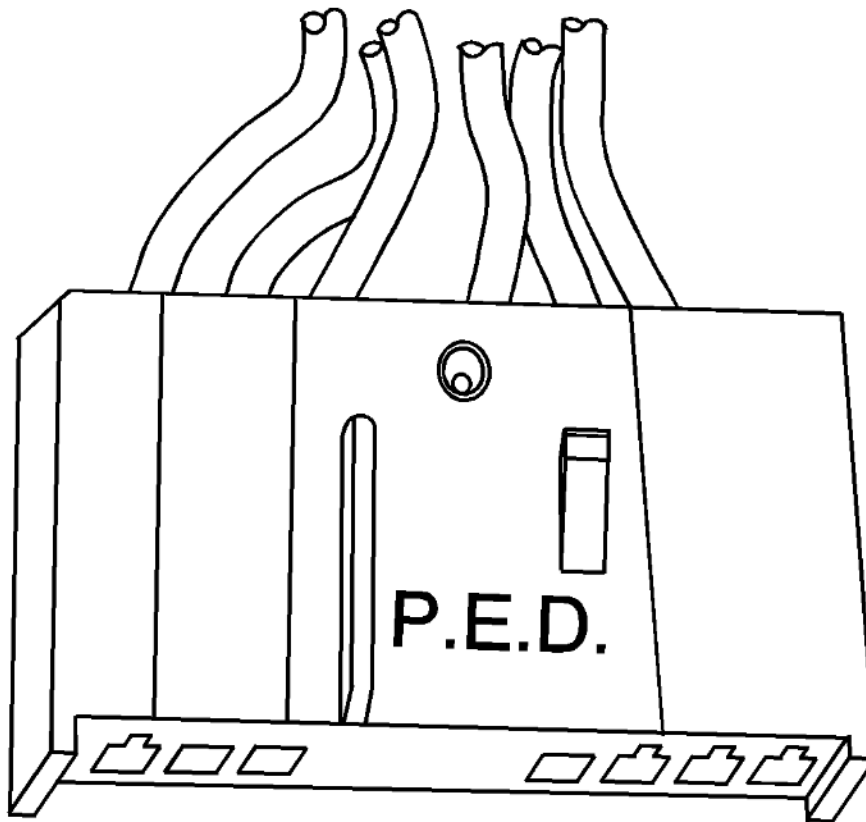


Fig. 26: View Of PED Identification On Connector Body
Courtesy of GENERAL MOTORS COMPANY

- FCI connectors may have the FCI logo on their connectors. The logo is the letters FCI with an "A" above it.

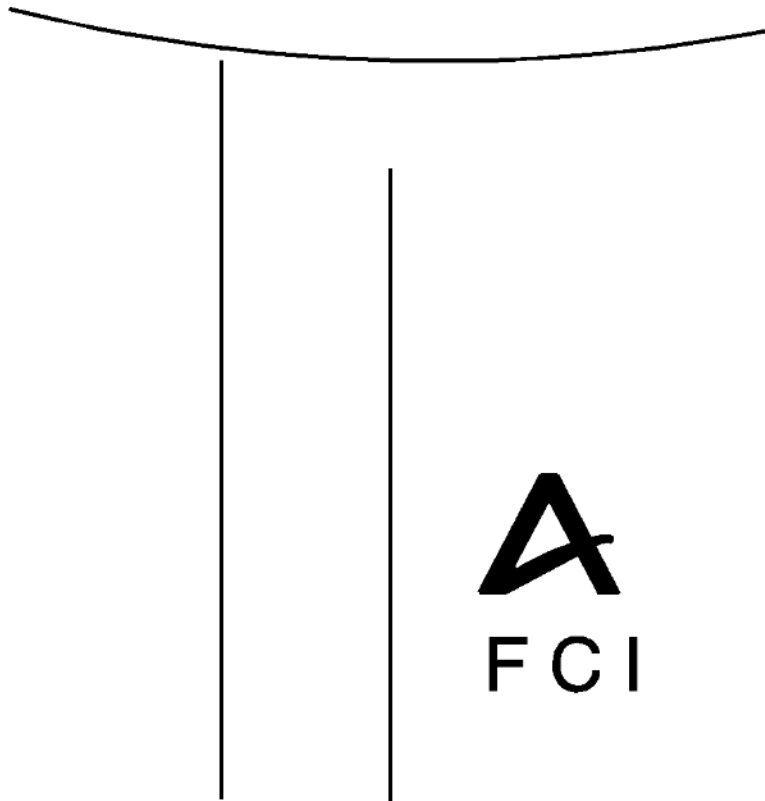


Fig. 27: View Of FCI Identification On Connector Body
Courtesy of GENERAL MOTORS COMPANY

- JAE connector have JAE in small letters on their connectors.

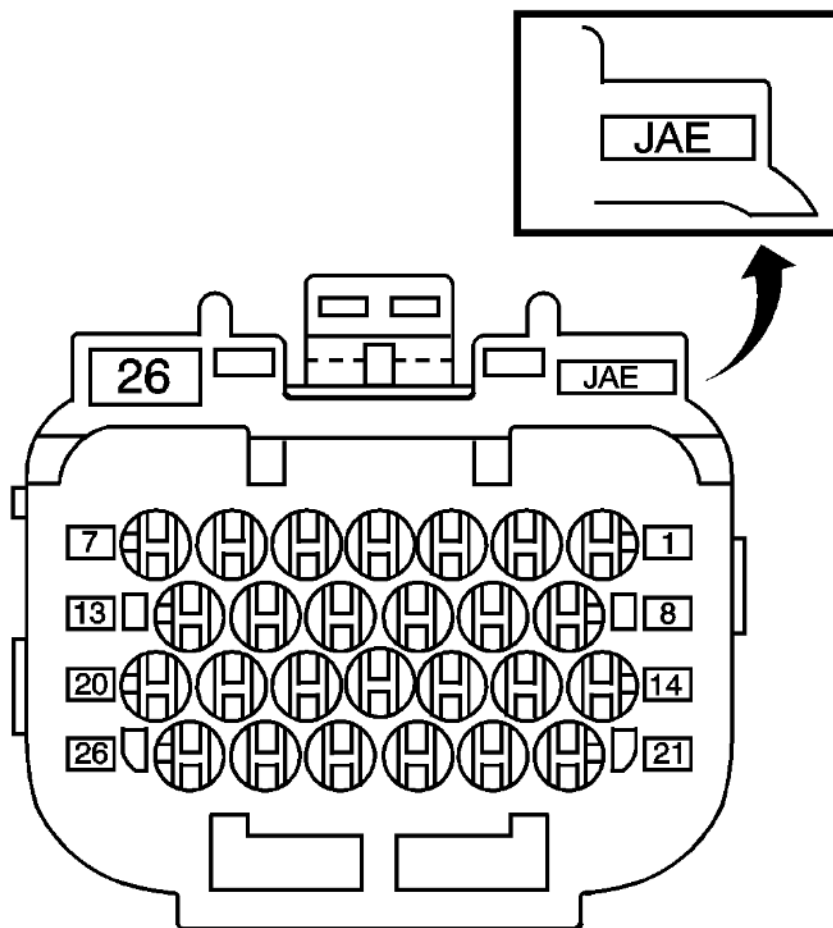


Fig. 28: View Of JAF Identification On Connector Body
 Courtesy of GENERAL MOTORS COMPANY

- JST connectors have JST in small letters on their connectors, similar to that above. The location of the logo will vary with the connector size and style.

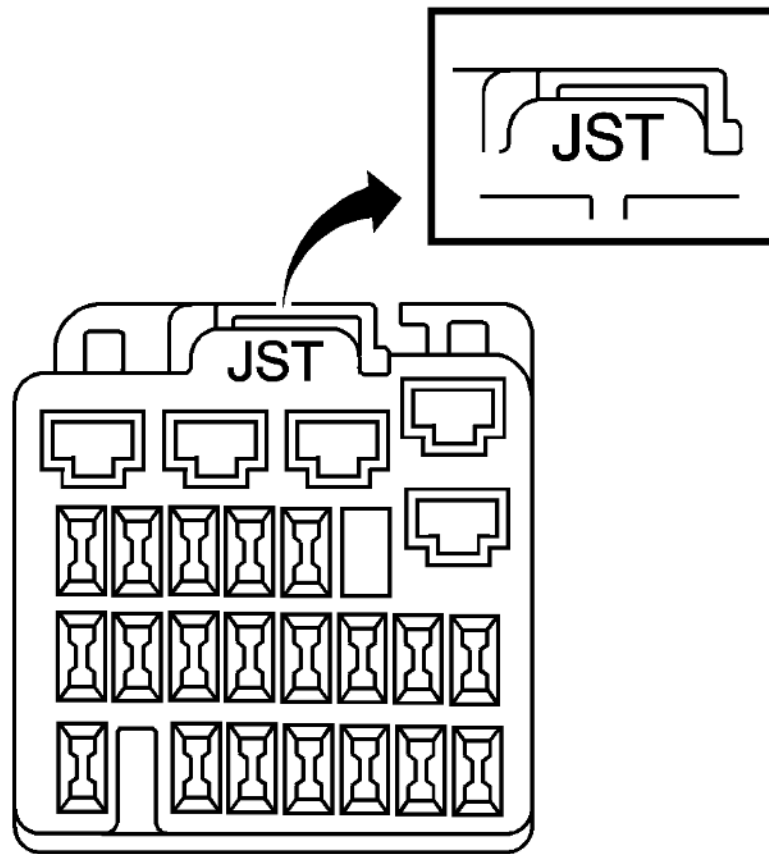


Fig. 29: View Of JST Identification On Connector Body
 Courtesy of GENERAL MOTORS COMPANY

- Kostel has an "LK" with a circle around it. These connector are usually used as a transmissions connection.

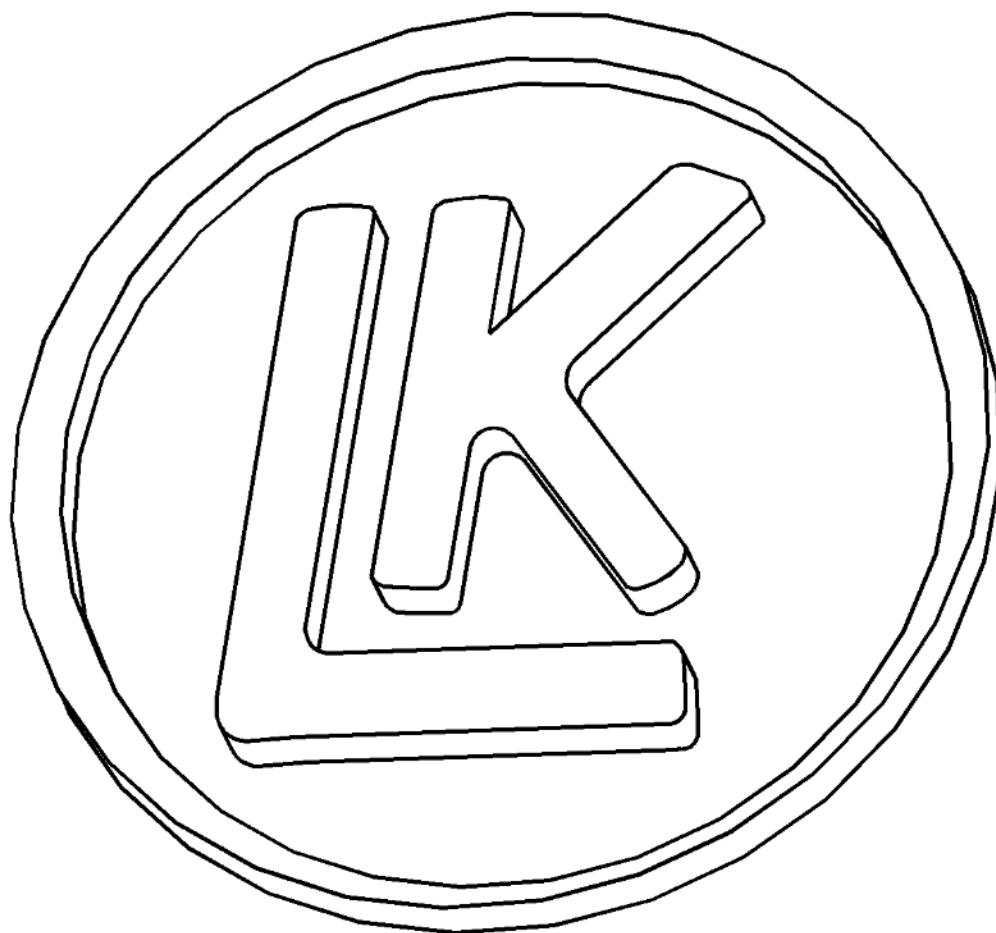


Fig. 30: View Of Kostel Connector Identifier
Courtesy of GENERAL MOTORS COMPANY

- Most Molex connectors will have the Molex logo on the dresscover of the connector. In some cases the connectors may have MX followed by another letter. The third letter indicates where the connector was made. A connector with MXD is a Molex connector made in Detroit.

cardiaqn.com

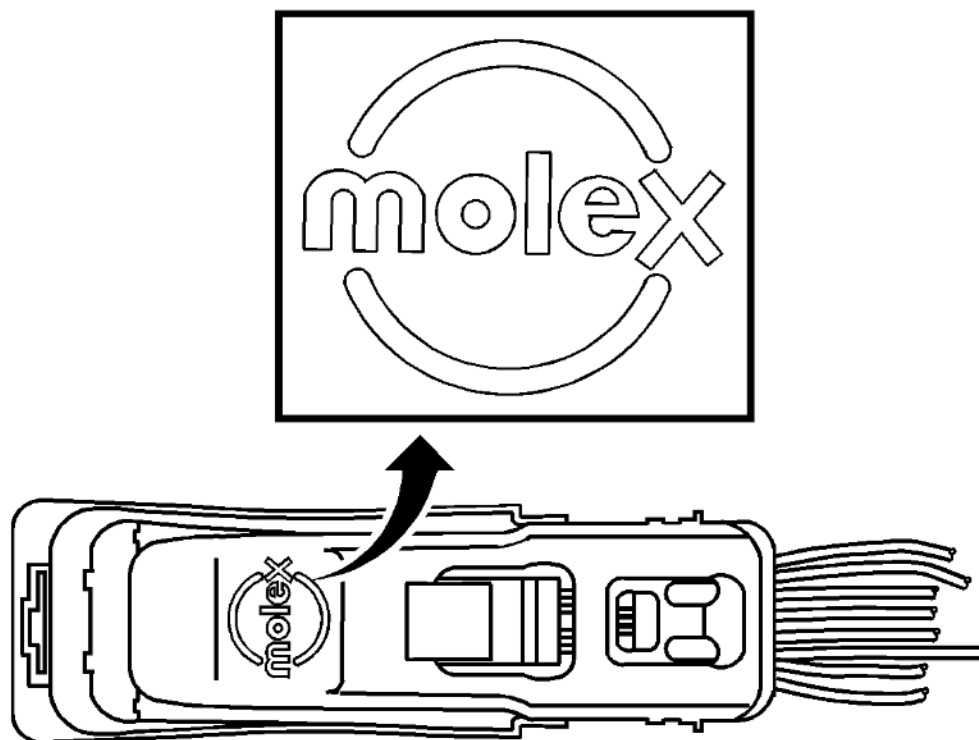


Fig. 31: View Of Molex Identification On Connector Body
Courtesy of GENERAL MOTORS COMPANY

cardiaqn.com

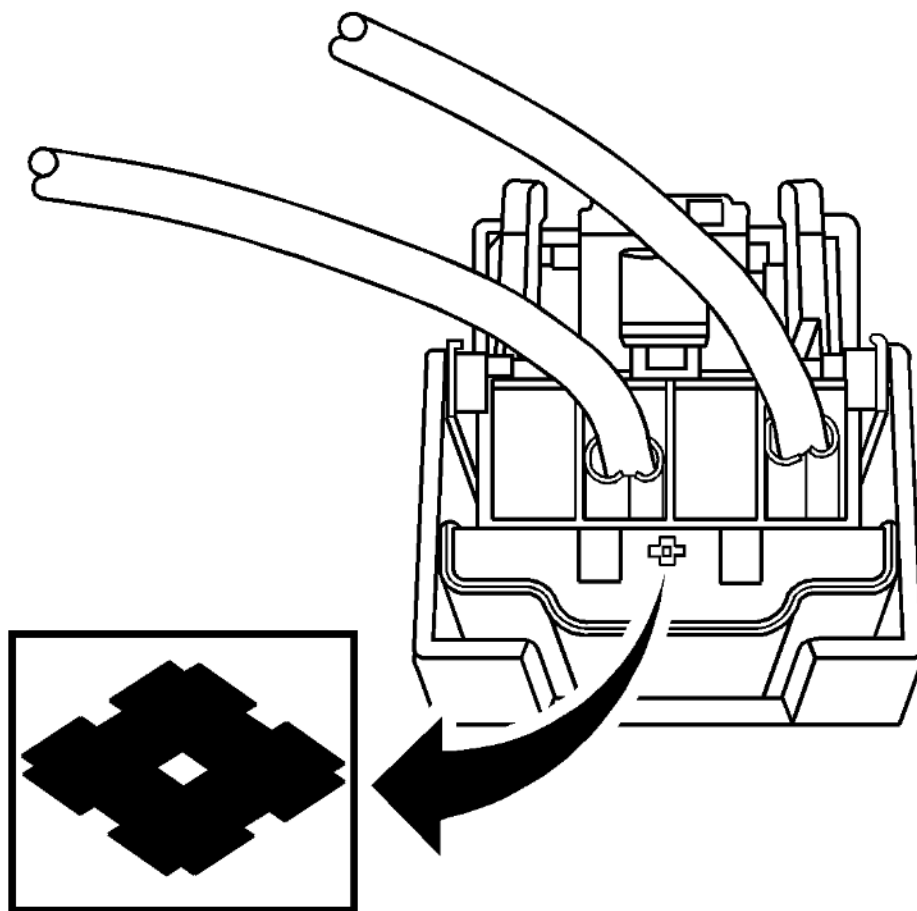


Fig. 32: View Of Sumitomo Identification On Connector Body
Courtesy of GENERAL MOTORS COMPANY

Sumitomo has a unique symbol on their connector and possibly a part number. The symbol is similar to that of a diamond lying on its side, similar to that shown. The logo could appear anywhere but the most common place is at the wire side of the housing.

- Tyco/AMP has many different and unique connector designs. Some may or may not have identifiable marks on them.
- Yazaki has a wedge or arrow shape, similar to that shown.

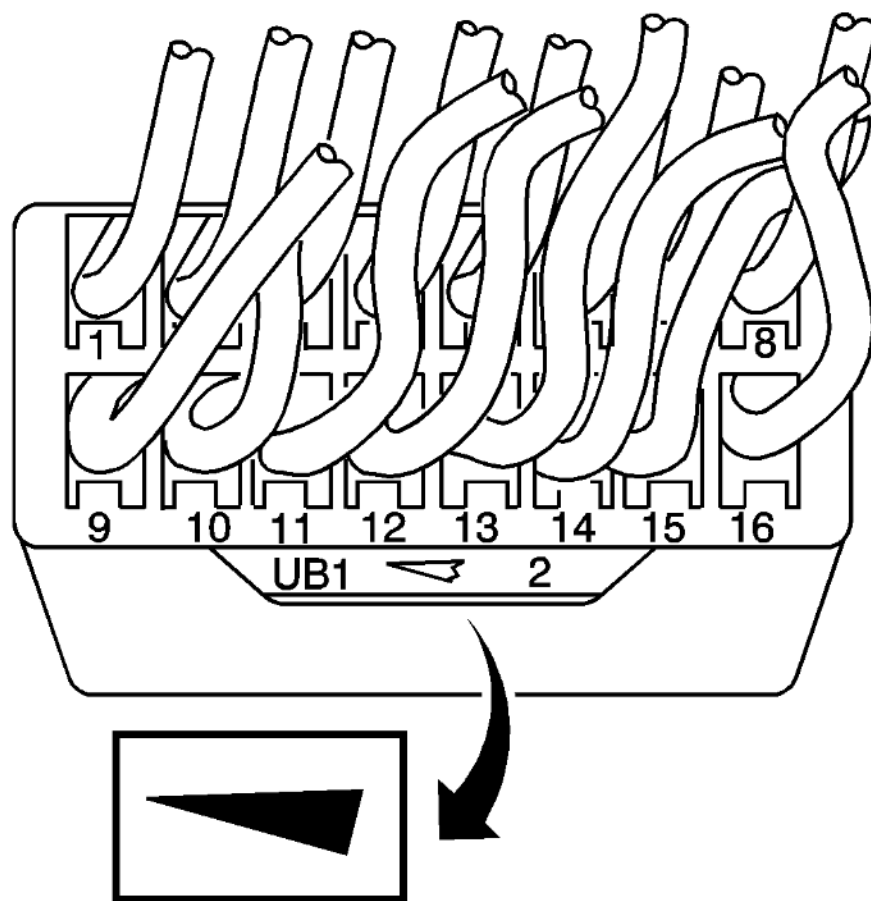


Fig. 33: View Of Yazaki Identification On Connector Body
 Courtesy of GENERAL MOTORS COMPANY

CONNECTOR POSITION ASSURANCE LOCKS

The connector position assurance (CPA) is a small plastic insert that fits through the locking tabs of the connector. CPAs are used in various connectors throughout the vehicle. CPAs are also used in all SIR system electrical connectors. The CPA ensures that the connector halves cannot vibrate apart. You must have the CPA in place in order to ensure good contact between the mating terminals of the connector.

TERMINAL POSITION ASSURANCE LOCKS

The terminal position assurance (TPA) insert resembles the plastic combs used in the control module connectors. The TPA keeps the terminal securely seated in the connector body. Do not remove the TPA from the connector body unless you remove a terminal for replacement. If the TPA is removed, be sure to reinstall it before reconnecting the connector.

AFL/EPC CONNECTORS

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-12A** Terminal Release Tool
- **J-38125-216** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

Follow the steps below in order to remove terminals from the connector.

1. For connectors with a bolt in the dress cover, turn the bolt counterclockwise to remove the connector from the component.

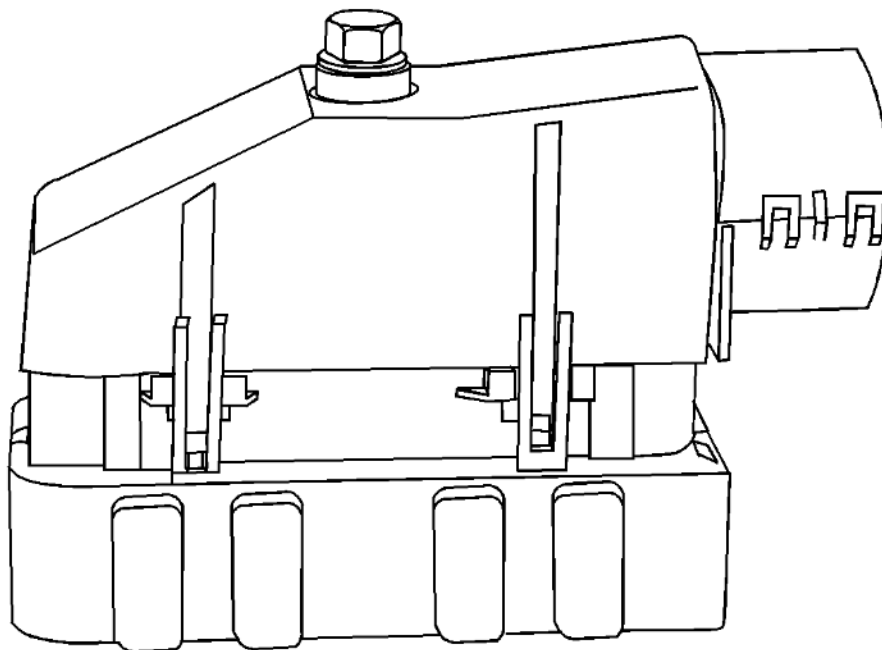


Fig. 34: View Of Bolt On Connector Cover
Courtesy of GENERAL MOTORS COMPANY

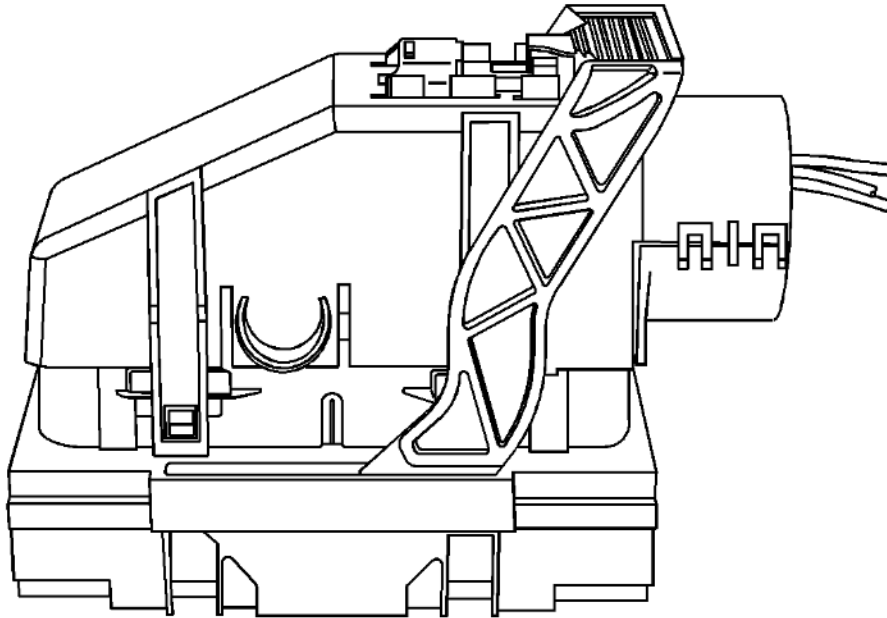


Fig. 35: Identifying Connector Position Assurance (CPA)
Courtesy of GENERAL MOTORS COMPANY

2. Locate the connector position assurance (CPA) on the top of the wire dress cover. Slide the CPA forward.

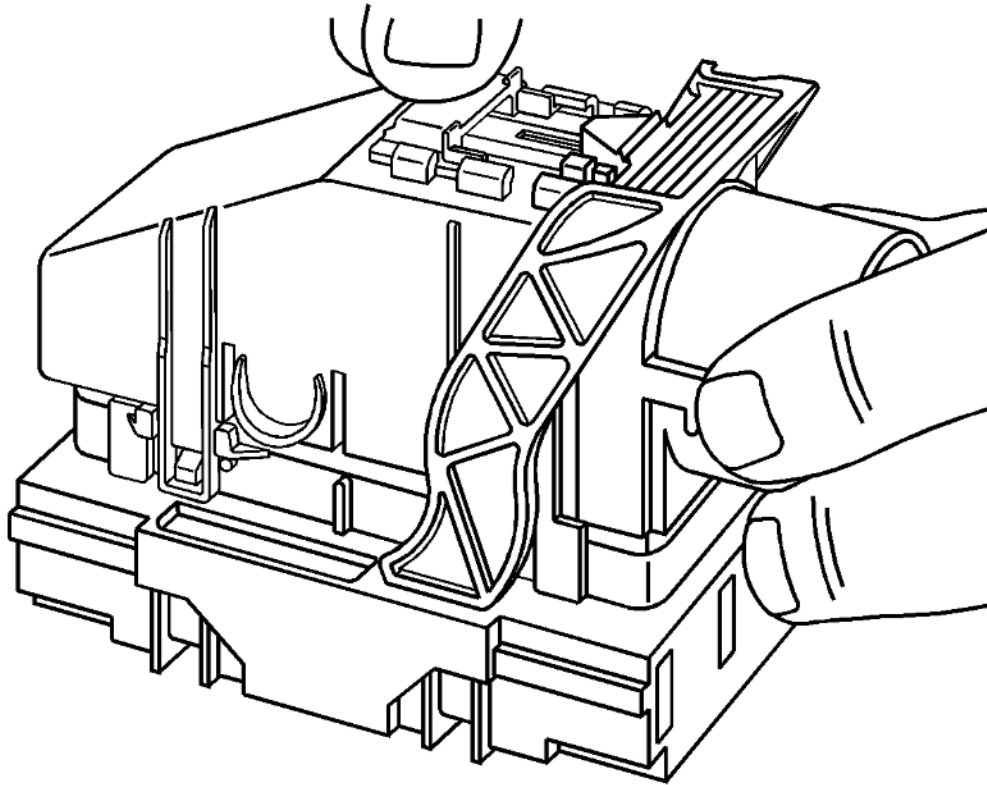


Fig. 36: Identifying Lever Lock & Lever Lock Release Tab
Courtesy of GENERAL MOTORS COMPANY

3. Slide the lever lock forward while pressing down on the lever lock release tab.

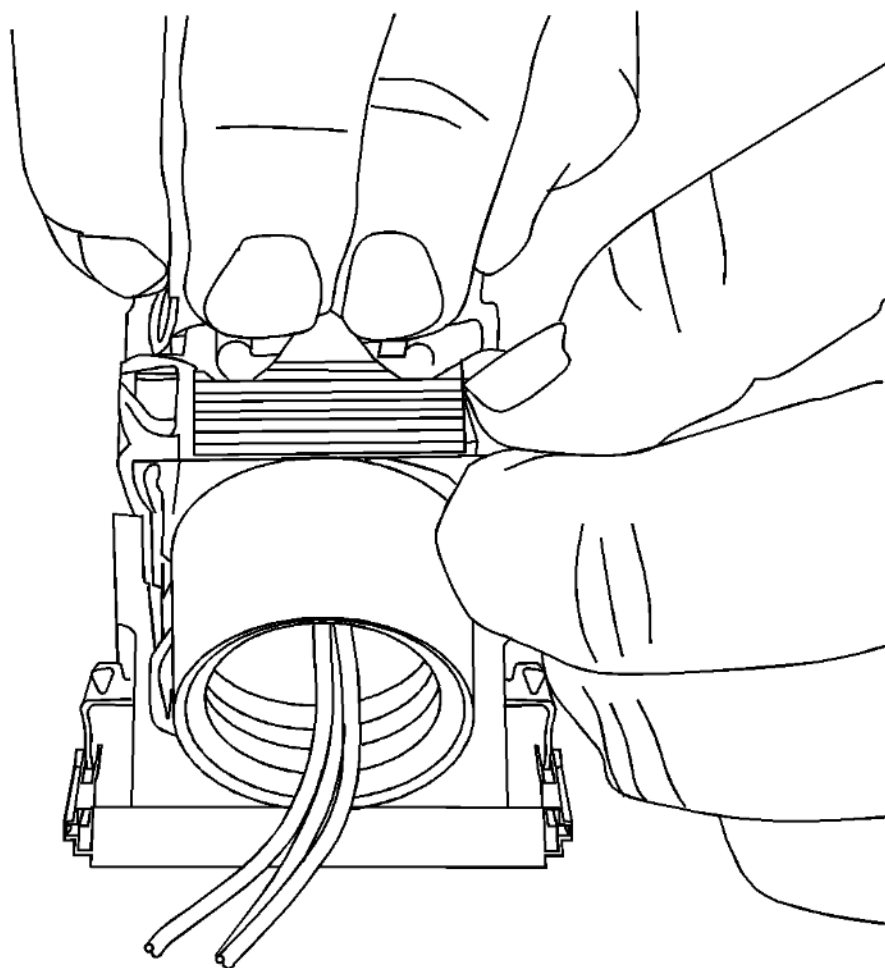


Fig. 37: View Showing Depressing Lever Lock Release Tab
Courtesy of GENERAL MOTORS COMPANY

4. View showing depressing of the lever lock release tab.

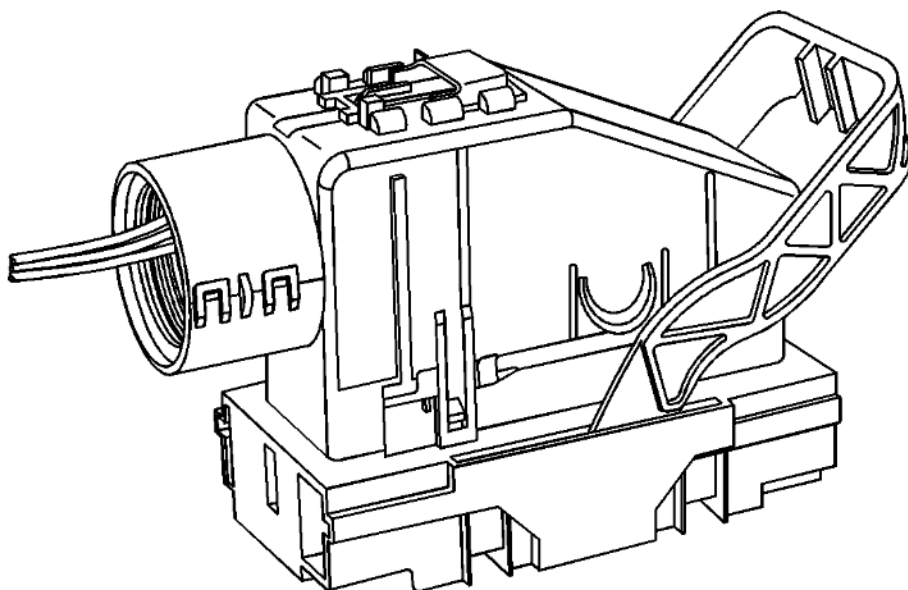


Fig. 38: View Of Connector In Released Position
Courtesy of GENERAL MOTORS COMPANY

5. View of connector in released position.
6. Disconnect the connector from the component.
7. Locate the dress cover locking tabs at the corners of the dress cover. Use a small flat-blade tool to release the locking tabs and remove the dress cover.
8. Release the rear lower half of the wiredress cover.

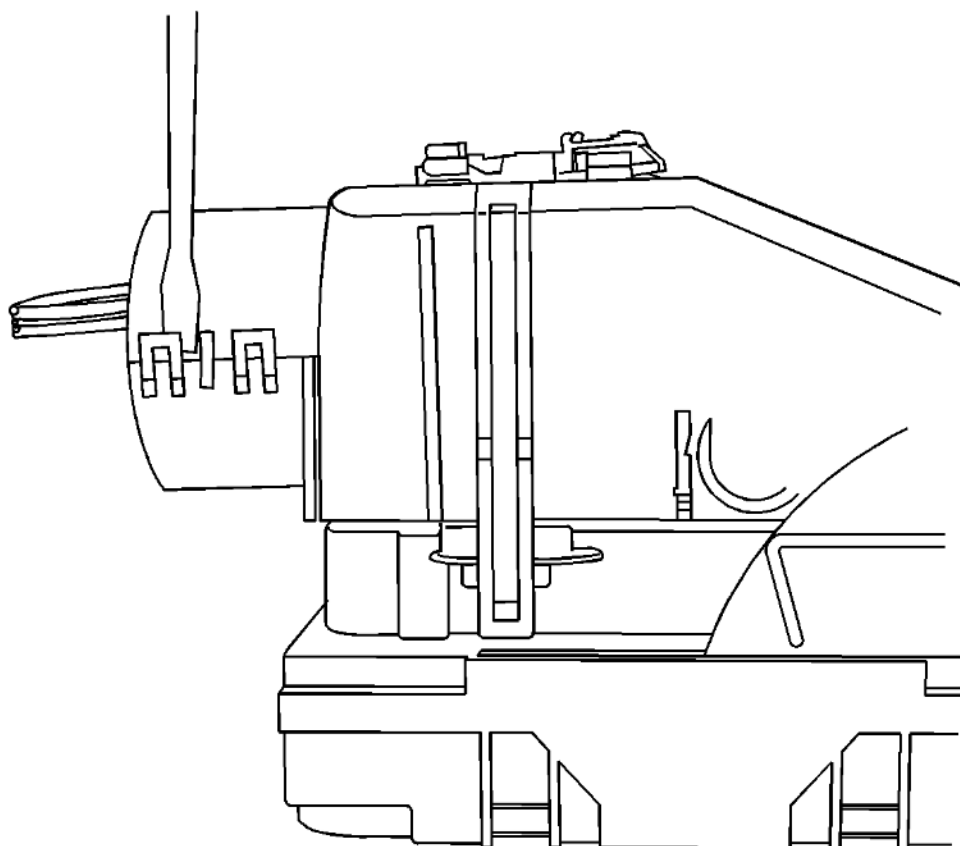


Fig. 39: View Of Connector In Released Position
Courtesy of GENERAL MOTORS COMPANY

9. Release the tabs that are holding the wiredress cover to the connector body.

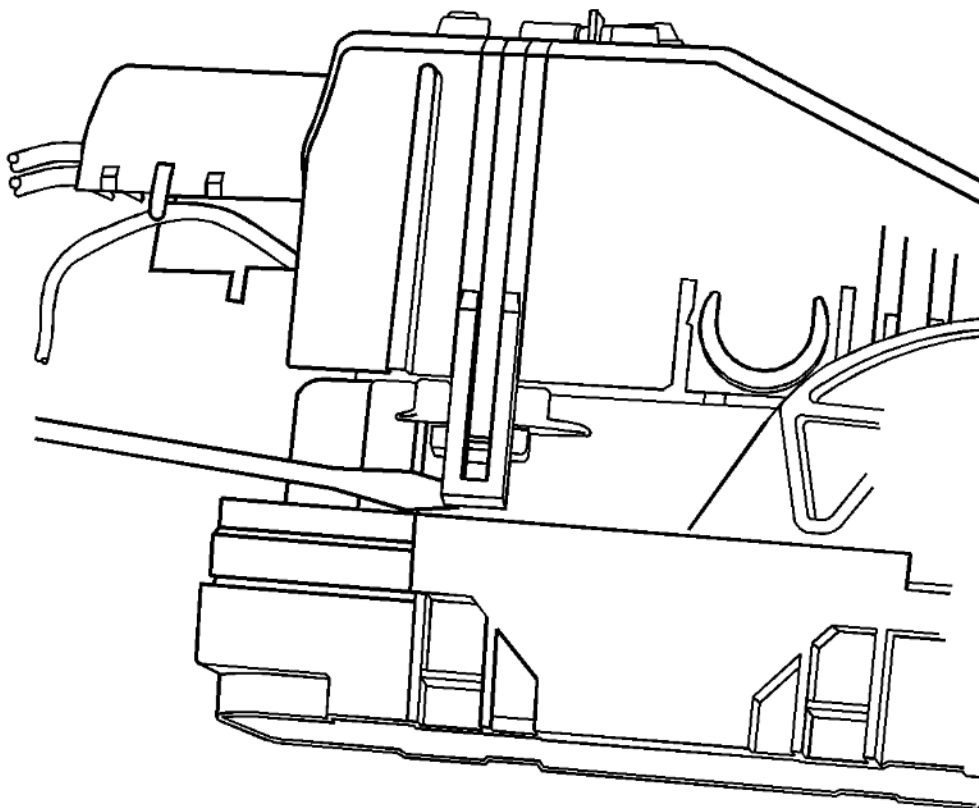


Fig. 40: Identifying Tabs Holding Wire Harness Cover
Courtesy of GENERAL MOTORS COMPANY

10. Remove the nose piece by inserting a small flat-blade tool into the slots on both ends of the connector body. Gently pry the nose piece out of the connector. J-38125-216 can also be used to remove the nose piece.

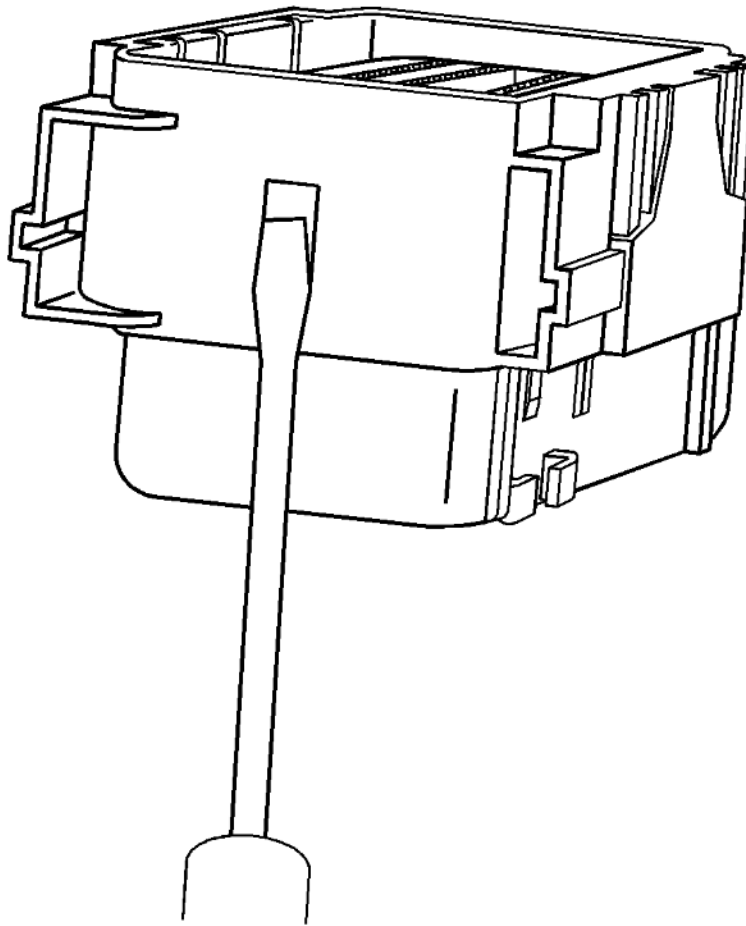


Fig. 41: Identifying Special Tool - J 38125-12A
Courtesy of GENERAL MOTORS COMPANY

11. Use the J-38125-12A tool to release the terminals by lifting the terminal retaining tabs on the inside of the connector.

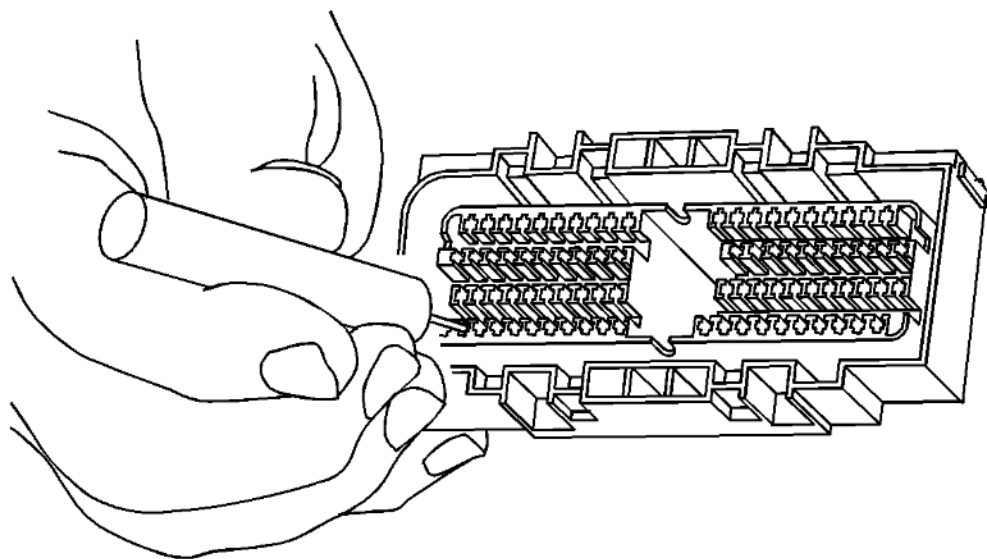


Fig. 42: Identifying J 38125-12A Removal Tool

Courtesy of GENERAL MOTORS COMPANY

12. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.
13. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
14. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

BOSCH CONNECTORS (BSK)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-561 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Disconnect the connector from the component.
2. Remove the wire dress cover, if necessary.
3. Push the wire side of the terminal that is being removed toward the connector and hold it in position.
4. Insert the J-38125-561 tool into the 2 cavities on each side of the terminal at the front of the connector and push until you feel the tool disengage the terminal retainers.

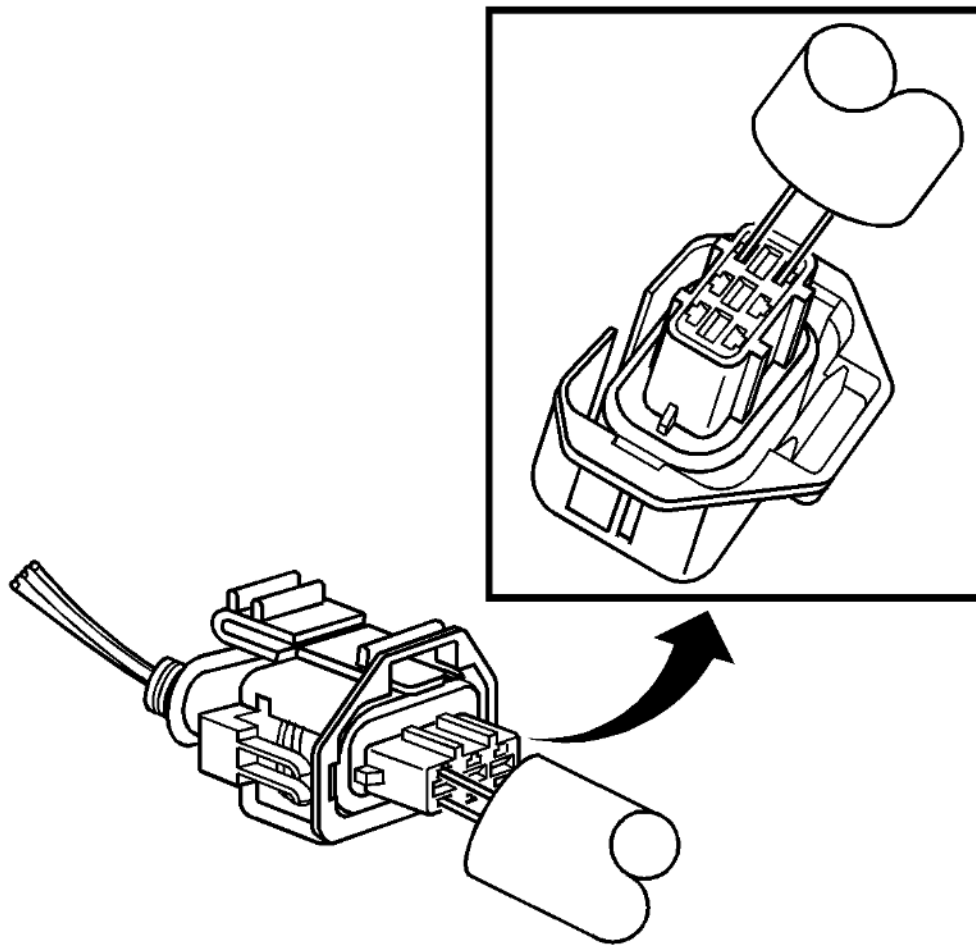


Fig. 43: View Of Bosch Connector Terminals (BSK)
Courtesy of GENERAL MOTORS COMPANY

5. Carefully pull the terminal out of the connector. Always remember never use force when pulling a terminal out of a connector. If the terminal is difficult to remove, repeat the entire procedure.
6. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.

7. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

BOSCH CONNECTORS (0.64)

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-560** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Locate the lever lock on the wire dress cover. While pressing the lock, pull the lever over and past the lock until the lever is at the end of its travel.
2. Disconnect the connector from the component.
3. Pull the rubber boot that covers the wires back to expose the end of the connector dress cover.
4. Place the connector locking lever in the center of the connector.
5. Locate the 2 dress cover locking tabs that are on the wire end of the connector. Insert a small flat-bladed tool between the cover and connector body and pry up.

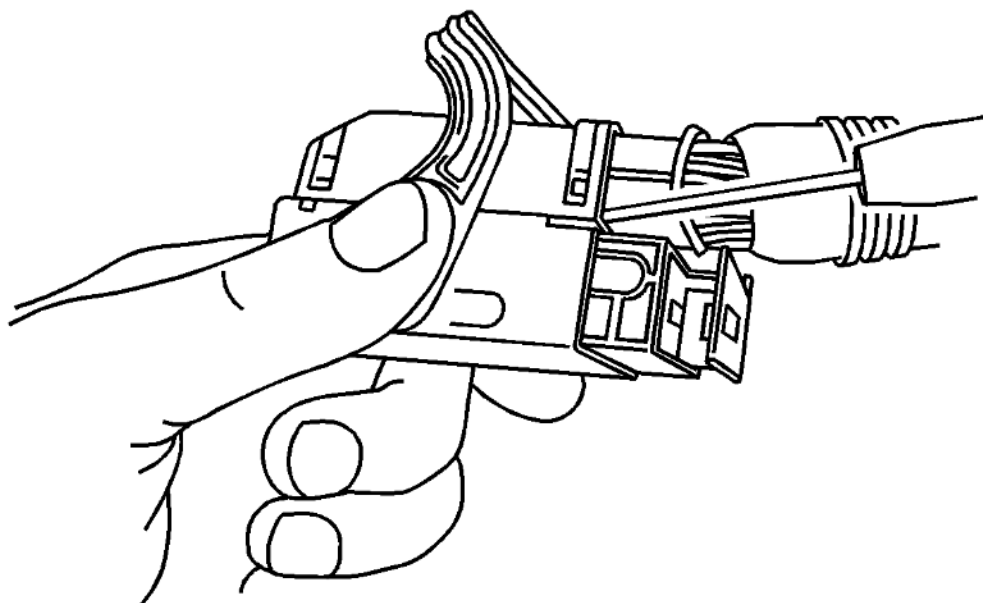


Fig. 44: View Of Flat-Bladed Tool Being Inserted Between Cover & Connector Body
Courtesy of GENERAL MOTORS COMPANY

6. Locate the 2 dress cover locking tabs located on the opposite side of the connector. Insert a small flat-bladed tool between the cover at the connector end and pry up.

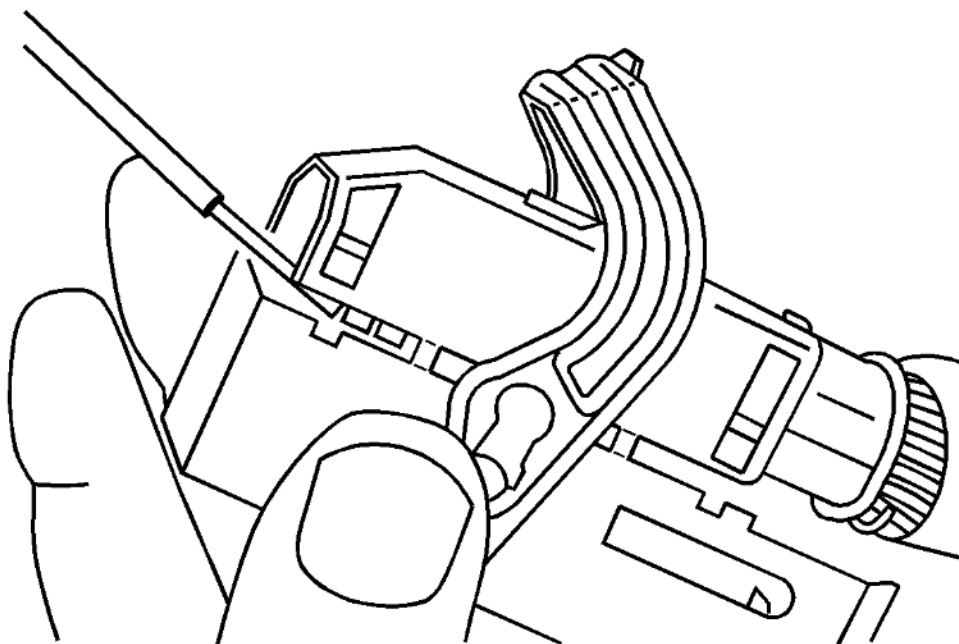


Fig. 45: View Of Flat-Bladed Tool Between Cover & Connector End
Courtesy of GENERAL MOTORS COMPANY

7. Remove the dress cover.
8. Cut the tie wrap on the wire bundle.
9. Remove the terminal position assurance (TPA) by inserting a small flat-bladed tool into the small slot in the end of the slider and pushing on the TPA until it comes out of the connector. When the TPA exits the opposite side of the connector, grasp the TPA and pull it completely out of the connector.

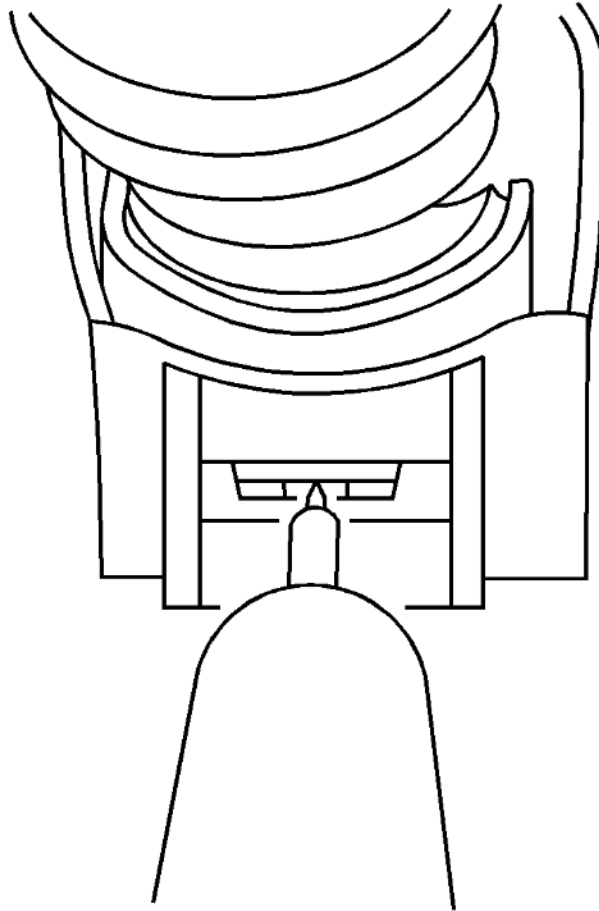


Fig. 46: View Of Terminal Position Assurance (TPA)
Courtesy of GENERAL MOTORS COMPANY

10. Push the wire side of the terminal that is being removed toward the connector and hold it in position.
11. Insert the J-38125-560 into the 2 triangular cavities on each side of the terminal at the front of the connector.

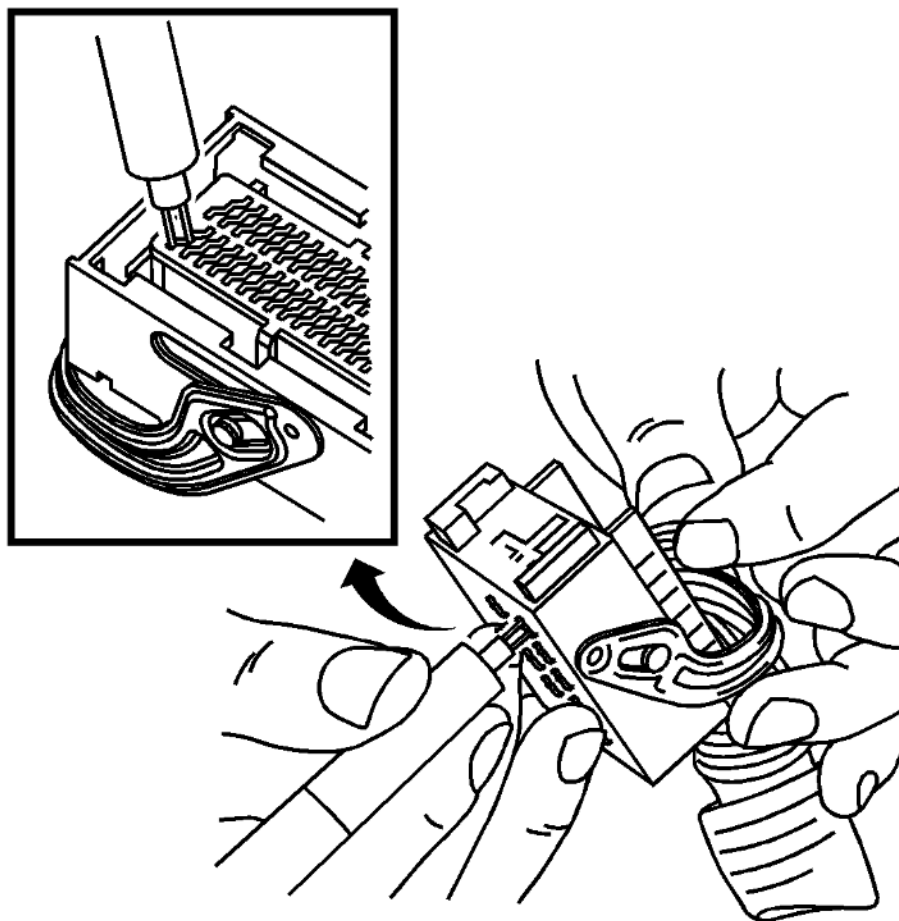


Fig. 47: View Of J 38125-560 Being Inserted Into Triangular Cavities
Courtesy of GENERAL MOTORS COMPANY

12. Carefully pull the terminal out of the connector. Always remember never use force when pulling a terminal out of a connector. If the terminal is difficult to remove, repeat the entire procedure.
13. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
14. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

Terminal Insertion Procedure

1. Prior to installation the terminal must be aligned so the (1) coding lugs align with the (2) coding grooves on the connector.

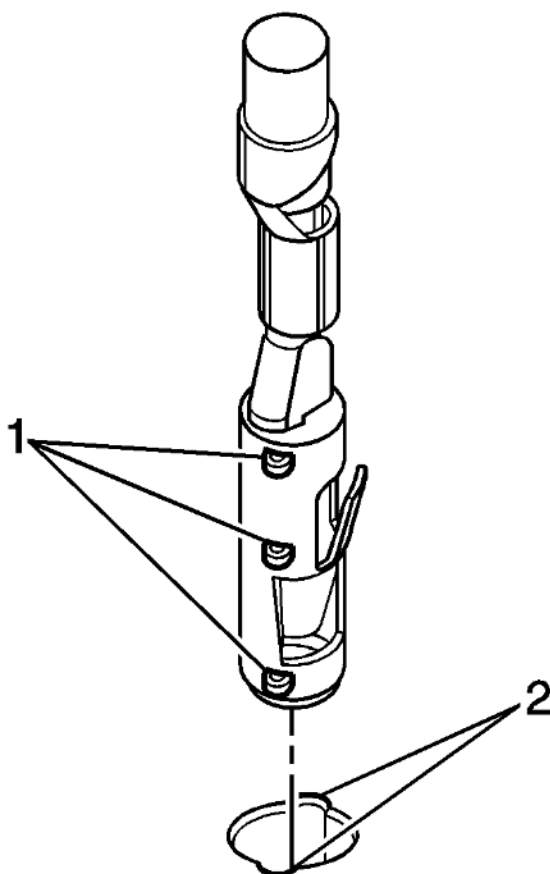


Fig. 48: Aligning Coding Lugs With Connector Coding Grooves
Courtesy of GENERAL MOTORS COMPANY

2. Once the terminal is aligned, slide the terminal into the cavity until the retainer has engaged in the cavity of the connector.
3. Slide the TPA in the connector body and seat it using a small flat bladed tool. The TPA is seated when it is flush with the contact housing.
4. Secure the wires to the connector body using a tie wrap and replace the dress cover and grommet.

BOSCH CONNECTORS (2.8 JPT)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-557 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Pull out the slider on the connector position assurance (CPA) until it is at the end of its travel.
2. Disconnect the connector from the component.
3. Remove the wire dress cover, if necessary.
4. Push the wire side of the terminal that is being removed toward the connector and hold it in position.
5. Insert the J-38125-557 into the 2 cavities on each side of the terminal at the front of the connector and push until you feel the tool disengage the terminal retainers.

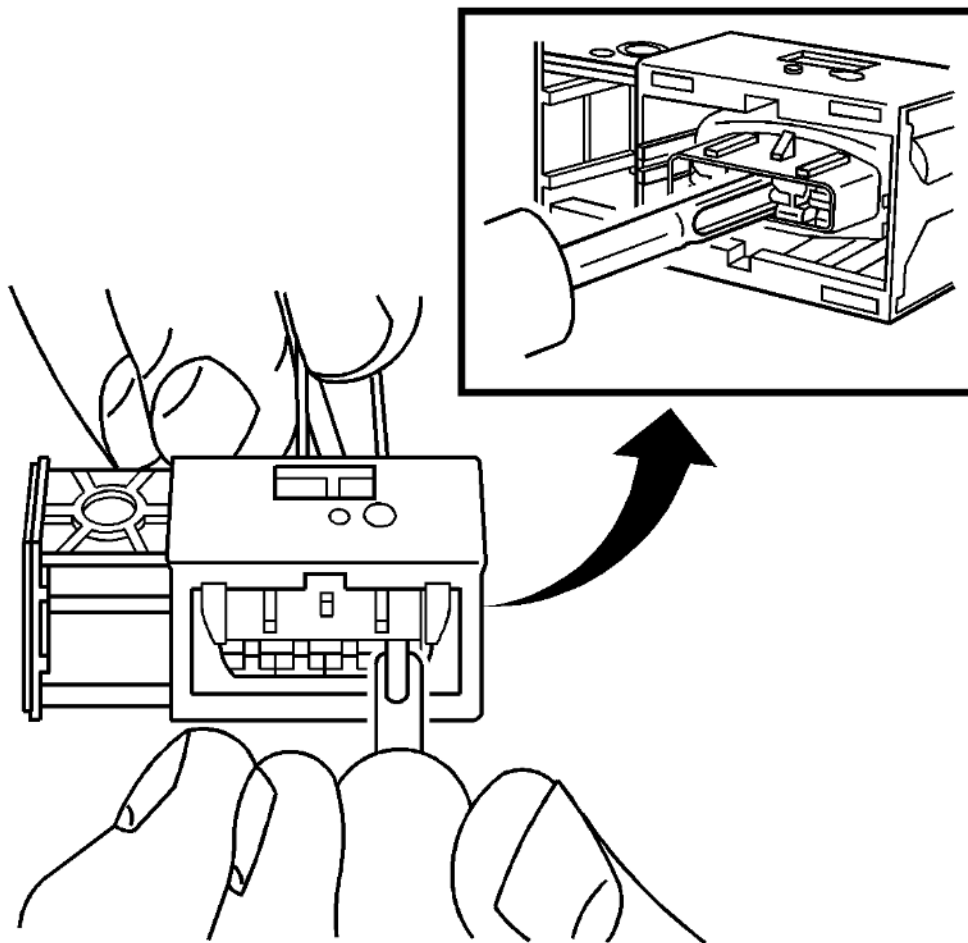


Fig. 49: View Of Bosch Connector Terminals (2.8 JPT)
 Courtesy of GENERAL MOTORS COMPANY

6. Carefully pull the terminal out of the connector. Always remember never use force when pulling a terminal out of a connector. If the terminal is difficult to remove, repeat the entire procedure.
7. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**.

Repairing Connector Terminals (Terminal Repair) procedure.

8. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

BOSCH CONNECTORS (ECM)

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-213** Terminal Release Tool
- **J-38125-556** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

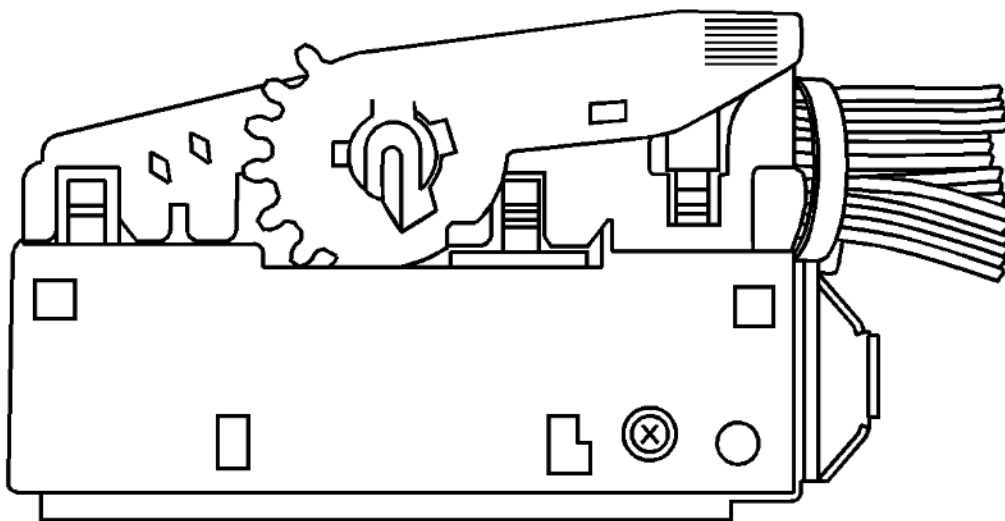
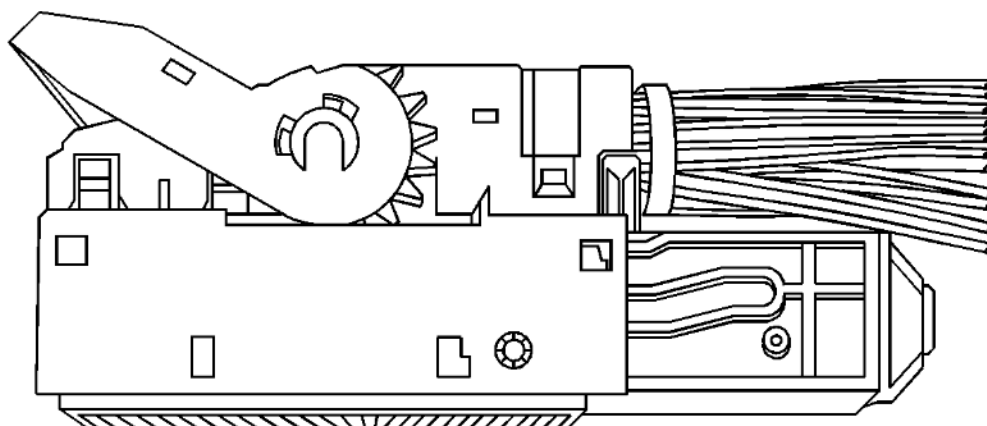


Fig. 50: View Of Bosch Connectors**Courtesy of GENERAL MOTORS COMPANY**

1. Locate the assist lever on the top of the connector. Move the assist lever to the forward position.

**Fig. 51: Identifying Assist Lever In Forward Position****Courtesy of GENERAL MOTORS COMPANY**

2. Disconnect the connector from the component.
3. Locate the dress cover locking tabs at the corners of the connector. Use a small flat-blade tool to release the locking tabs and remove the dress cover.

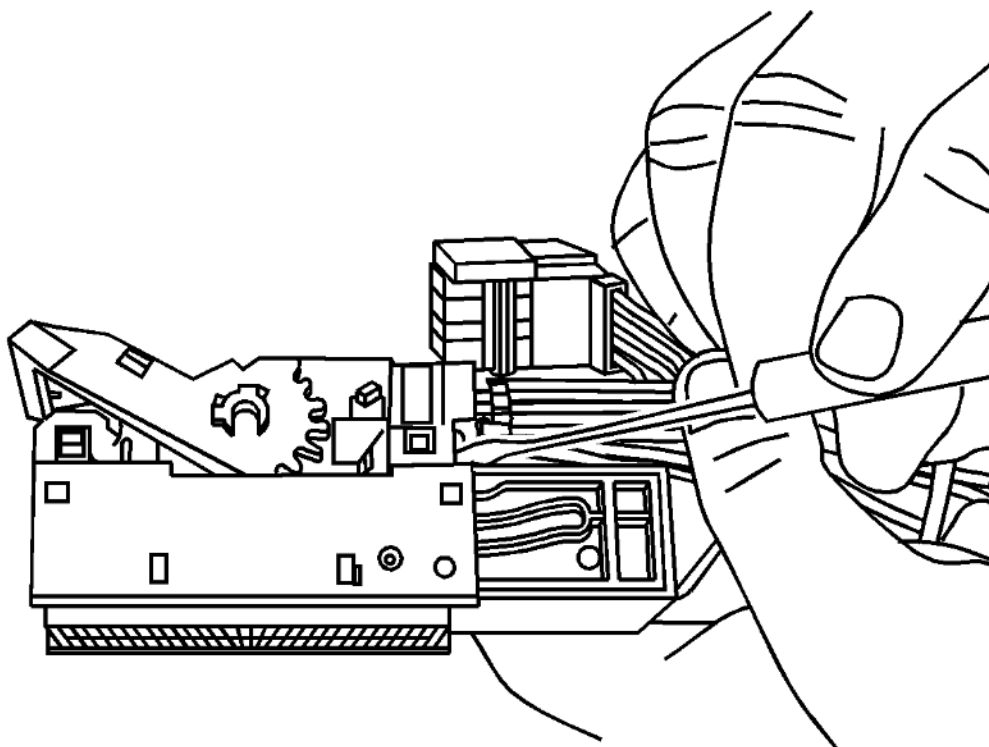


Fig. 52: View Of Releasing Locking Tabs
Courtesy of GENERAL MOTORS COMPANY

4. The terminal positive assurance (TPA) is located in the front of the connector.

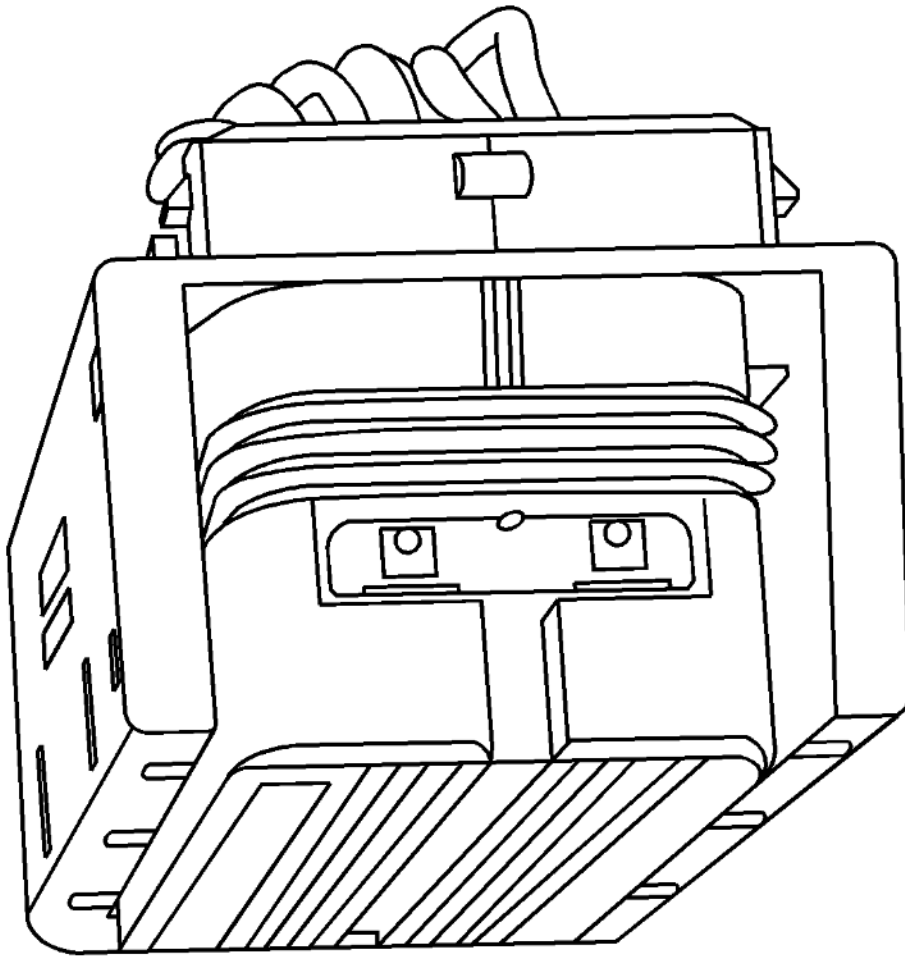


Fig. 53: View Of Terminal Positive Assurance (TPA) Connector
Courtesy of GENERAL MOTORS COMPANY

5. Use a small flat-blade tool to remove TPA from the connector.

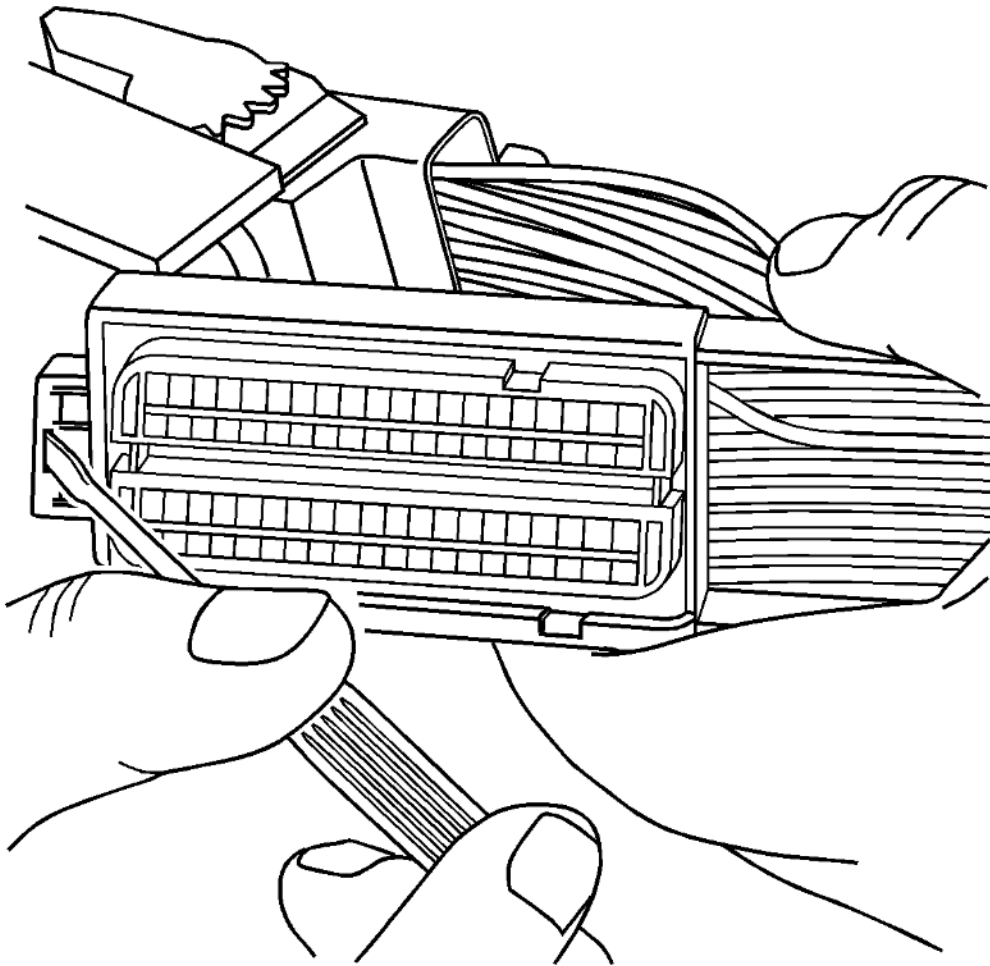


Fig. 54: View Of Removing TPA From Connector
Courtesy of GENERAL MOTORS COMPANY

6. Use the J-38125-213 or the J-38125-556 tool to release the terminals by inserting the tool into the terminal release cavity.

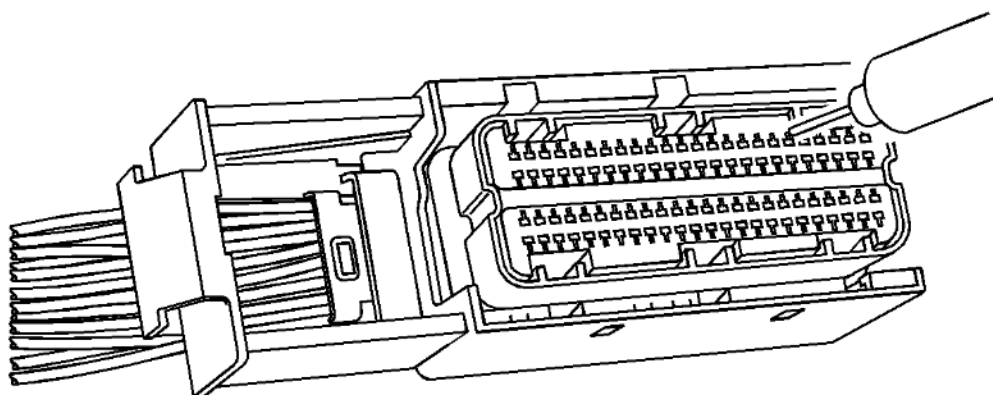


Fig. 55: View Of Special Tools And Terminals
Courtesy of GENERAL MOTORS COMPANY

7. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.
8. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
9. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.
10. Reconnect the connector bodies.

NOTE: Ensure that the dress cover and connector body are both in the released position before reassembling. Failure to do so may cause damage to the connector and component.

DELPHI CONNECTORS (WEATHER PACK)

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-10A** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

The following is the proper procedure for the repair of Weather Pack® Connectors.

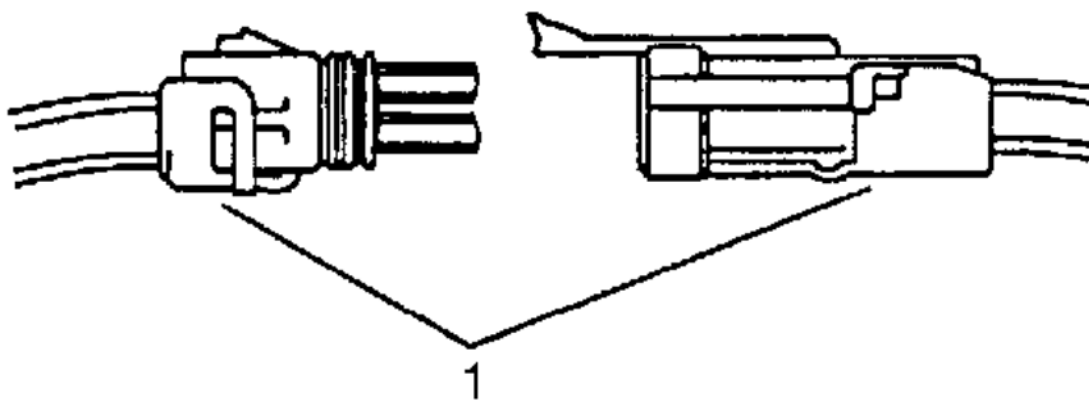


Fig. 56: View Of Connector Halves
Courtesy of GENERAL MOTORS COMPANY

1. Separate the connector halves (1).
2. Open the secondary lock. A secondary lock aids in terminal retention and is usually molded to the connector (1).
3. Grasp the wire and push the terminal to the forward most position. Hold the wire in this position.
4. Insert the Weather Pack® terminal removal tool J-38125-10A into the front (mating end) of the connector cavity until it rests on the cavity shoulder (1).

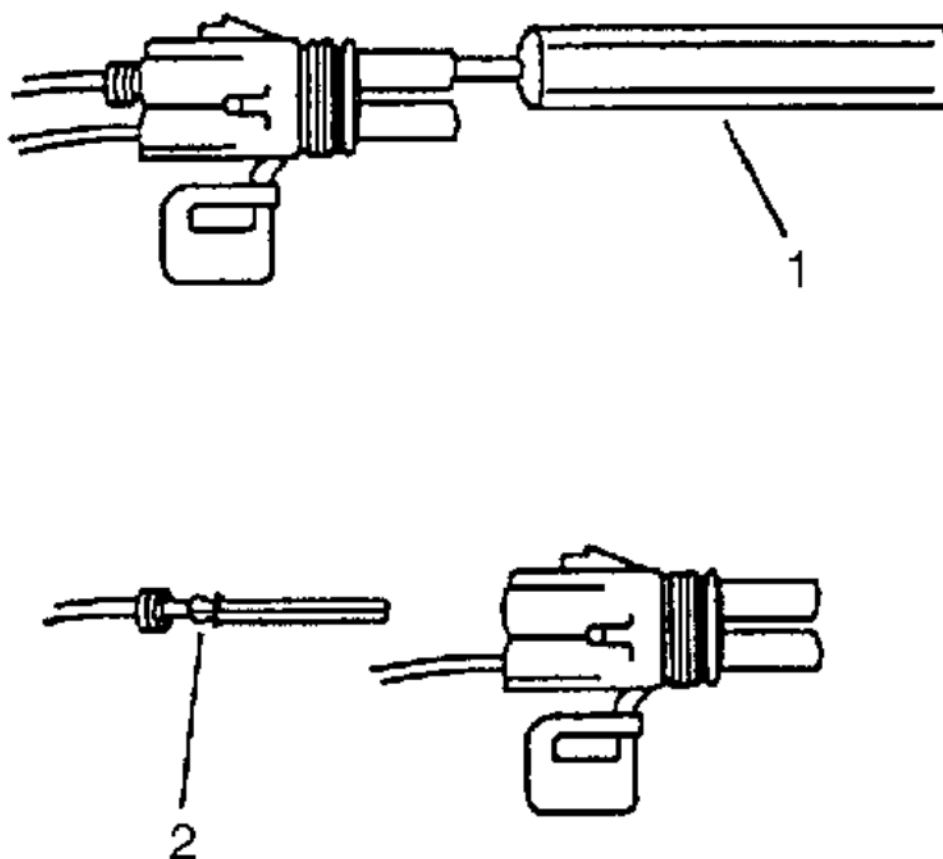


Fig. 57: Identifying Removal Tool & Terminal
Courtesy of GENERAL MOTORS COMPANY

5. Gently pull on the wire to remove the terminal through the back of the connector (2).

NOTE: **Never use force to remove a terminal from a connector.**

6. Inspect the terminal and connector for damage. Repair as necessary. Refer to **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)**.
7. Reform the lock tang (2) and reset terminal in connector body.
8. Close secondary locks and join connector halves.
9. Verify that circuit is complete and working satisfactorily.
10. Perform system check.
11. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
12. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

DELPHI CONNECTORS (PUSH TO SEAT)

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

Follow the steps below in order to repair push to seat connectors.

1. Remove the terminal position assurance (TPA) device, the connector position assurance (CPA) device, and/or the secondary lock.
2. Separate the connector halves (1).

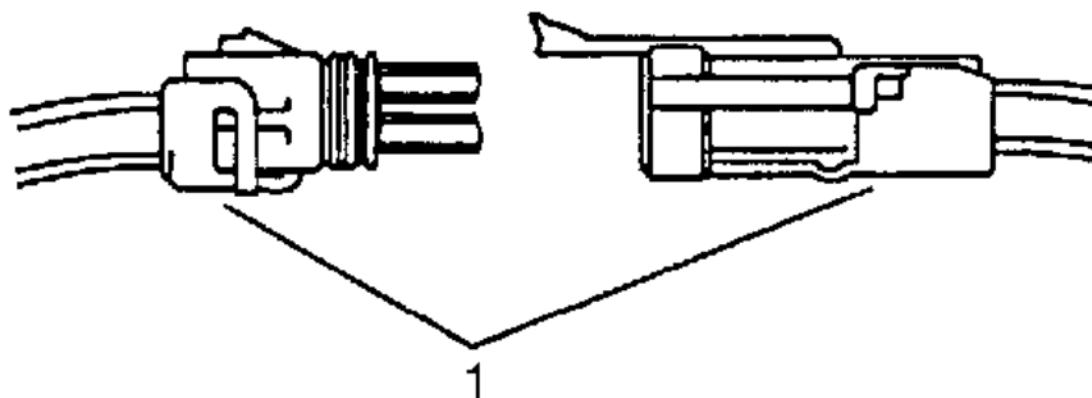


Fig. 58: View Of Connector Halves

Courtesy of GENERAL MOTORS COMPANY

3. Use the proper pick or removal tool (1) in order to release the terminal.

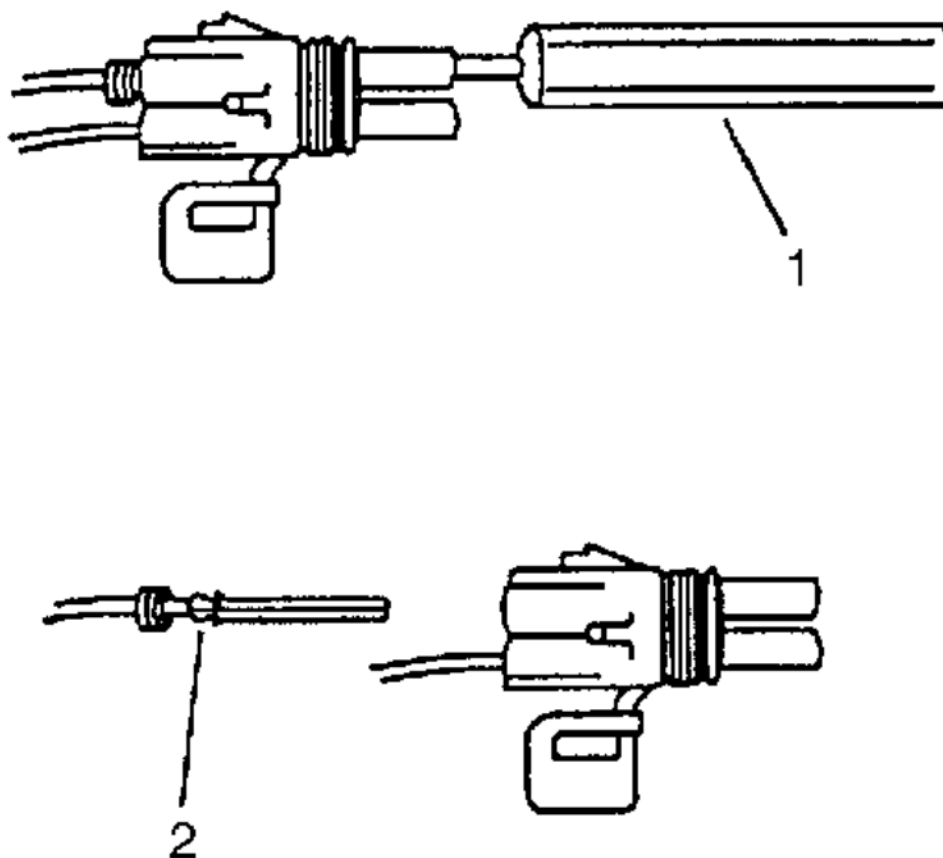


Fig. 59: Identifying Removal Tool & Terminal

Courtesy of GENERAL MOTORS COMPANY

4. Gently pull the cable and the terminal (2) out of the back of the connector.
5. Re-form the locking device if you are going to reuse the terminal (1).

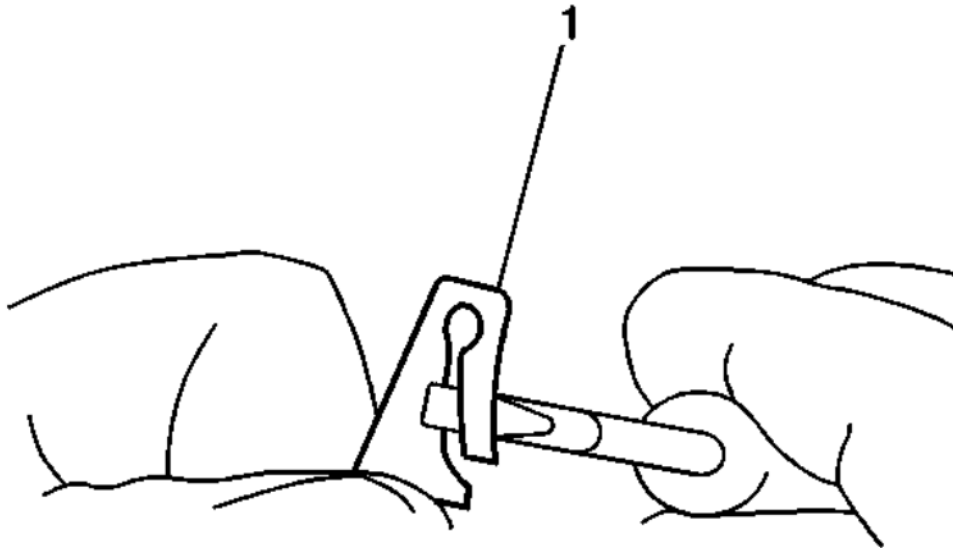


Fig. 60: Identifying Locking Device

Courtesy of GENERAL MOTORS COMPANY

6. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
7. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

Terminal Insertion Procedure

1. In order to reuse a terminal or lead assembly, refer to **Wiring Repairs**.
2. Ensure that the cable seal is kept on the terminal side of the splice.
3. Insert the lead from the back until it catches.
4. Install the TPA, CPA and/or the secondary locks.

DELPHI CONNECTORS (PULL TO SEAT)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

If the terminal is visibly damaged or is suspected of having a faulty connection, the terminal should be replaced.

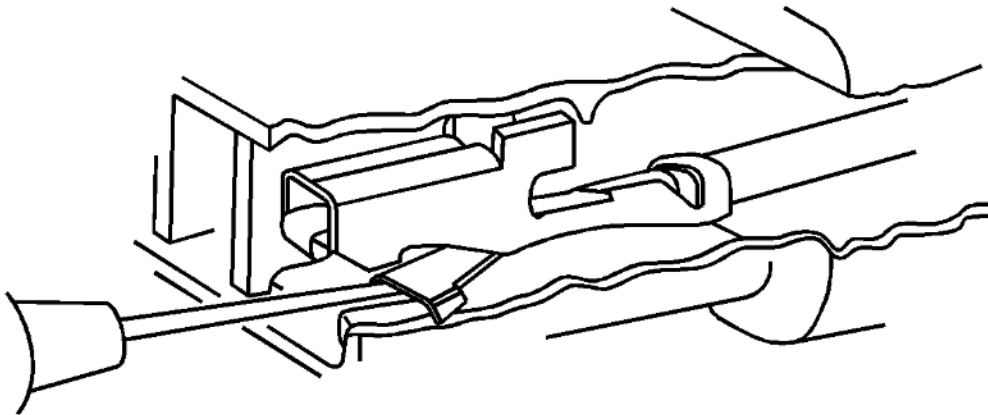


Fig. 61: Aligning Removal Tool - Delphi (Pull To Seat)
Courtesy of GENERAL MOTORS COMPANY

Follow the steps below in order to repair pull-to-seat connectors:

1. Remove the connector position assurance (CPA) device and/or the secondary lock.
2. Disconnect the connector from the component or separate the connectors for in-line connectors.

3. Remove the terminal position assurance (TPA) device.
4. Review the connector end view to determine the proper test probe and release tool.
5. Insert the release tool into the front of the connector body.
6. Grasp the wire at the back of the connector body and gently push the terminal out the front of the connector body.
7. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
8. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

Terminal Insertion Procedure

1. Align the terminal and pull the wire from the back of the connector in order to seat the terminal.
2. If the connector is outside of the passenger compartment, apply dielectric grease to the connector.
3. Install the TPA, CPA, and/or the secondary locks.

DELPHI CONNECTORS (MICRO-PACK 100W)**Special Tools**

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-12A** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

There are 2 styles of Micro-Pack 100W connectors. These connectors are very similar but use different terminals and have some minor physical differences also.

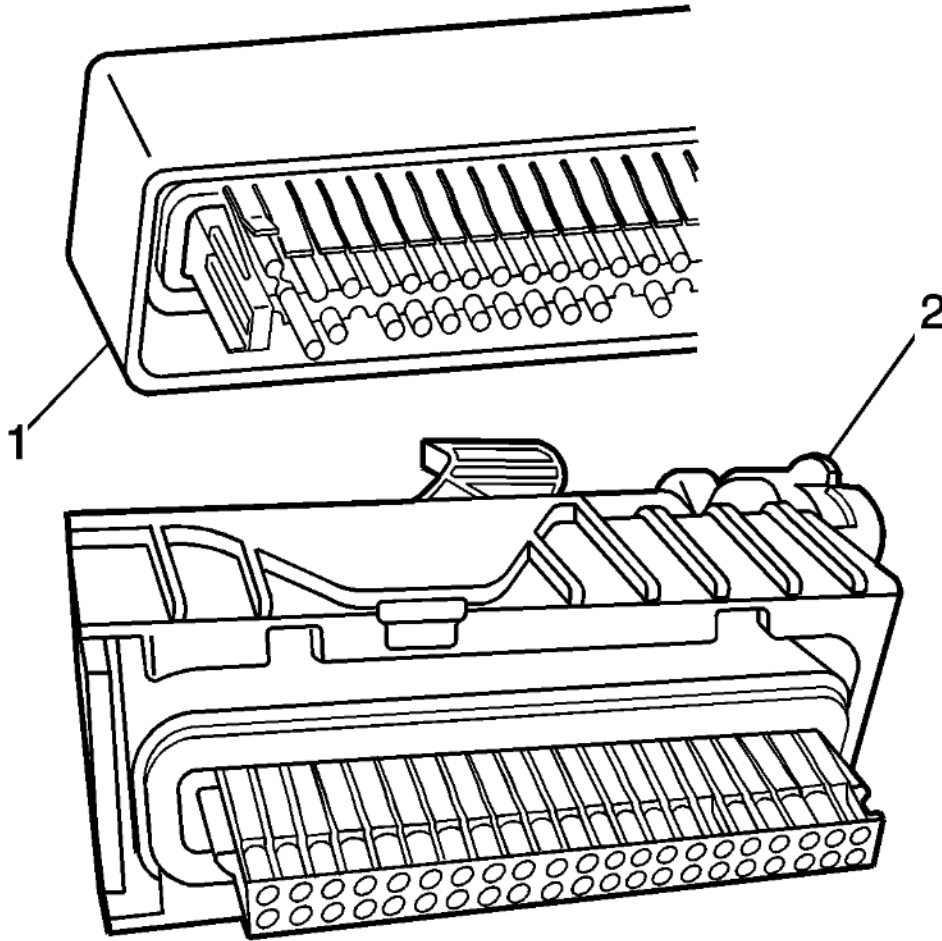


Fig. 62: Identifying Micro-Pack 100W First & Second Connector Designs
Courtesy of GENERAL MOTORS COMPANY

The first connector design of the Micro-Pack 100W (1) has a white connector interface that holds the terminals. The second design of the Micro-Pack 100W (2) has a gray interface to hold the terminals. Also, the first design has terminal cavities that are further apart (3 mm centerline) and offset from the other row of terminal cavities in the connector. The second design has terminals cavities that are closer together (2.54 mm centerline) and aligned vertically. One other way to identify the second design is the thin strip of material that runs along the outside of the cavities.

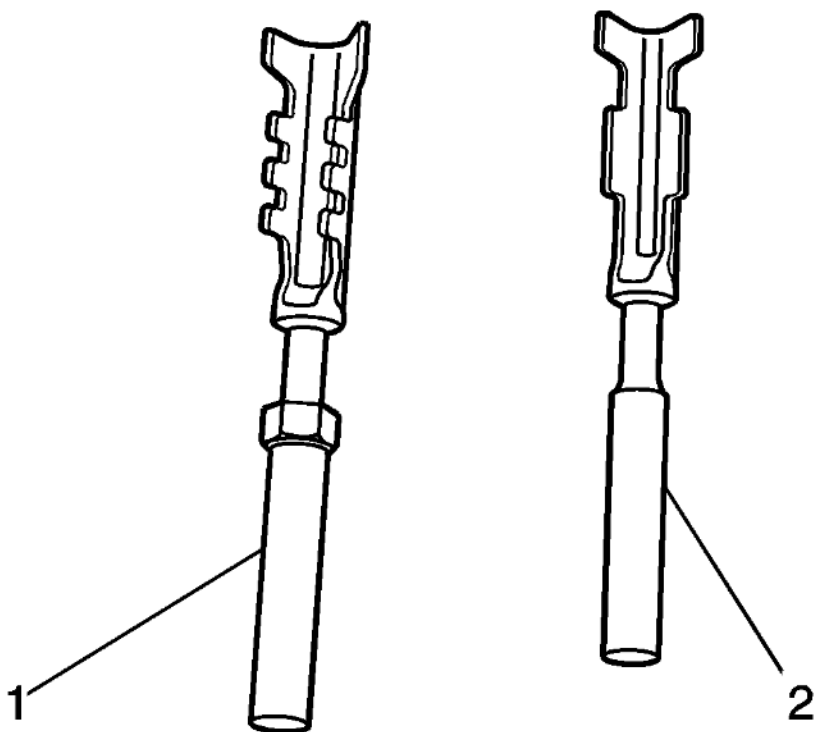


Fig. 63: Identifying Micro-Pack 100W Short & Long Terminals

Courtesy of GENERAL MOTORS COMPANY

NOTE: There are 2 styles of Micro-Pack 100W terminals which are very similar. Ensure that you have the correct terminal before crimping the new terminal to the wire. The first design connector uses the longer terminal (1) that has a raised area in front of the recess in the terminal. The second design connector uses the shorter terminal without the raised area.

Follow the steps below in order to remove terminals from Micro-Pack 100W connectors. Some Micro-Pack 100W connector disassembly procedures will vary. Use this procedure as a guide.

1. Disconnect the connector from the component.
2. Locate the nose piece locking tabs that are positioned on the side of the connector nose piece. The connector nose piece acts as a terminal positive assurance (TPA) and may be referred to as such.

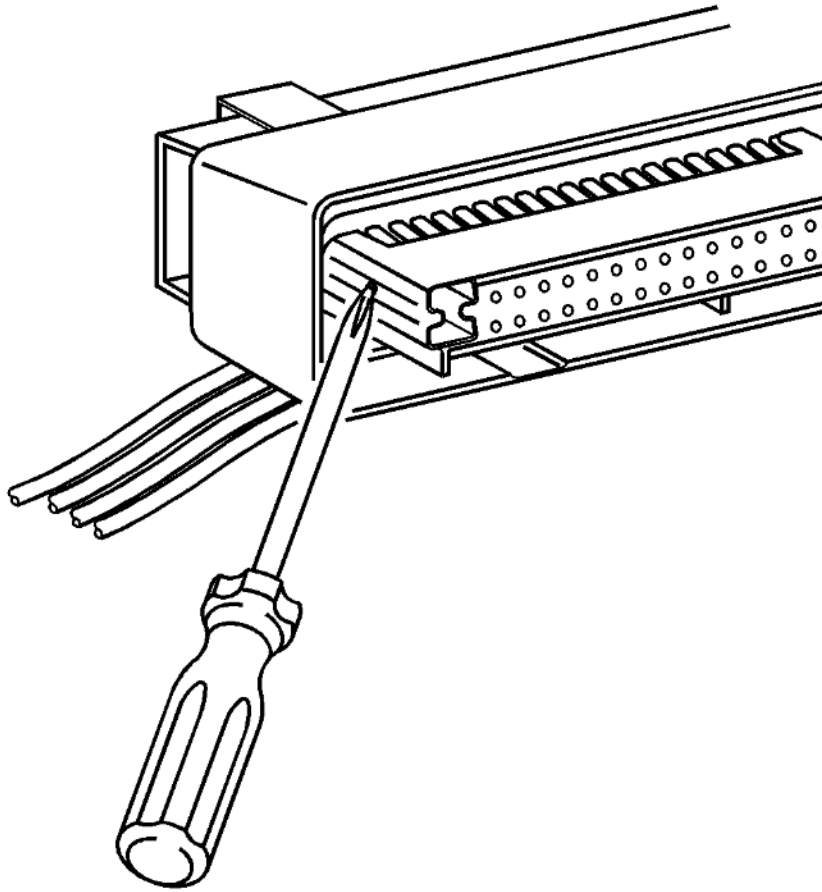


Fig. 64: Locating Nose Piece Locking Tabs
Courtesy of GENERAL MOTORS COMPANY

3. Use a small flat-blade tool to push in one of the locking tabs while gently pulling on the same side of the nose piece.

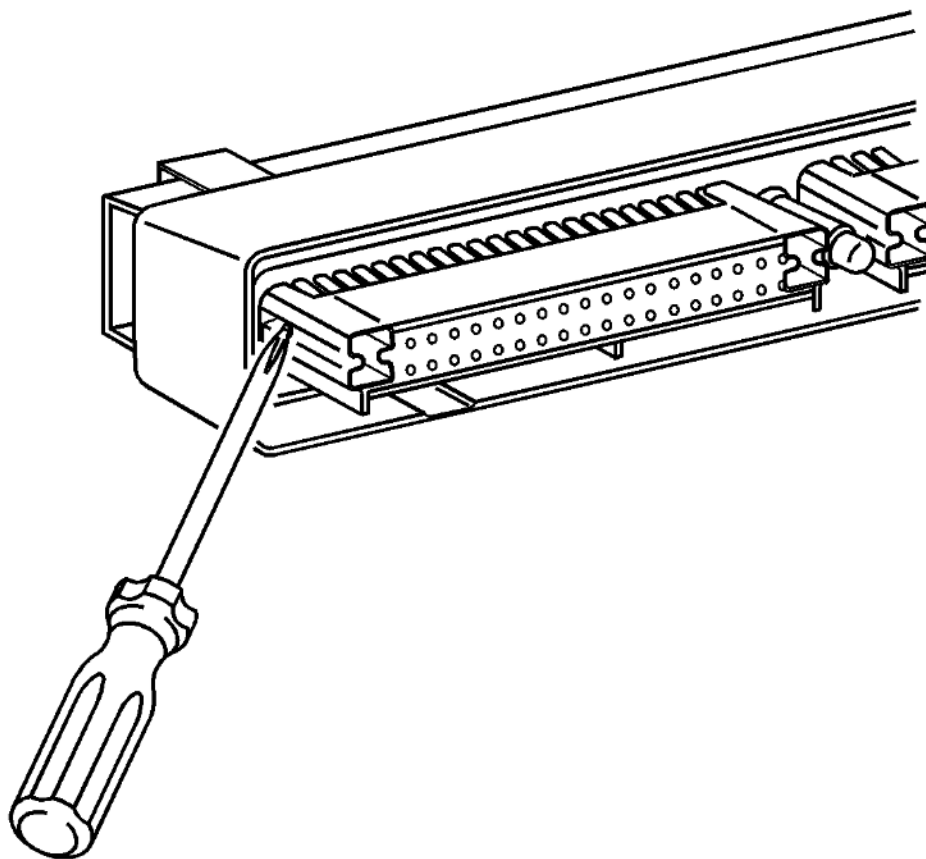


Fig. 65: Loosening Nose Piece Locking Tabs
Courtesy of GENERAL MOTORS COMPANY

4. Repeat the procedure for the other locking tab and remove the nose piece.
5. Remove the wire dress cover. The following is a general procedure for wire dress cover removal. Use this procedure as a guide, some dress cover removal procedures may vary.
6. Use fingers to squeeze the 2 locking legs of the cover.

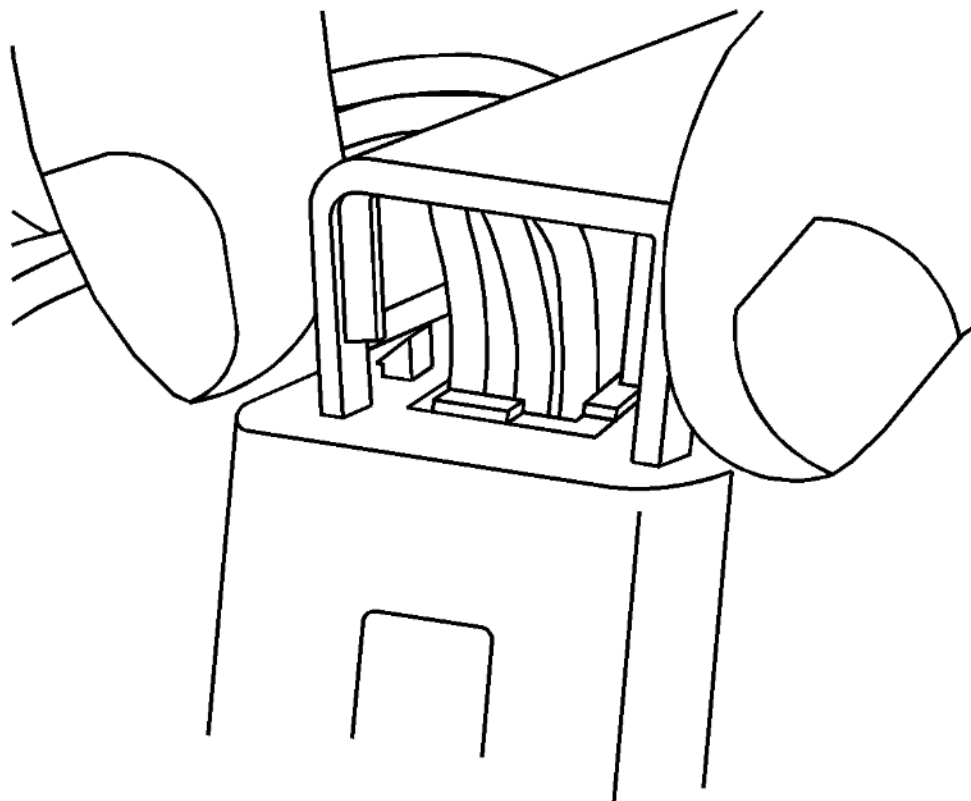


Fig. 66: Squeezing Cover Locking Legs
Courtesy of GENERAL MOTORS COMPANY

7. Apply pressure and gently rock the cover until one locking leg is unseated.

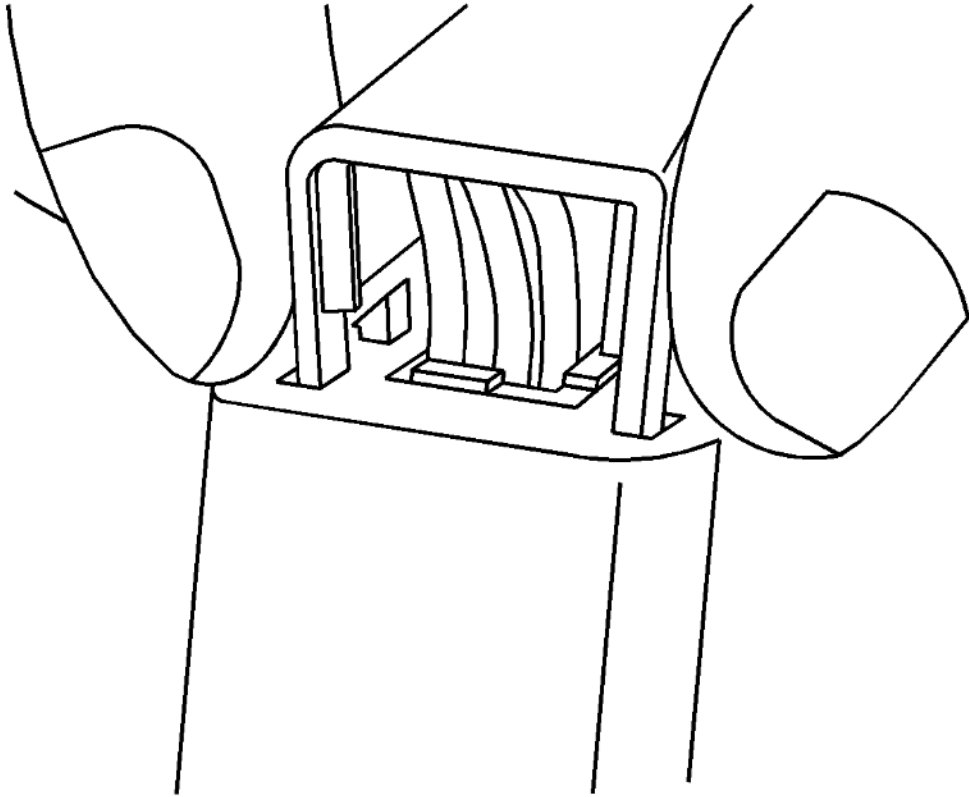


Fig. 67: Unseating Locking Leg

Courtesy of GENERAL MOTORS COMPANY

8. Continue to apply pressure and rock the cover until the second locking leg is unseated. Repeat procedure for the other side of the dress cover and remove the cover.

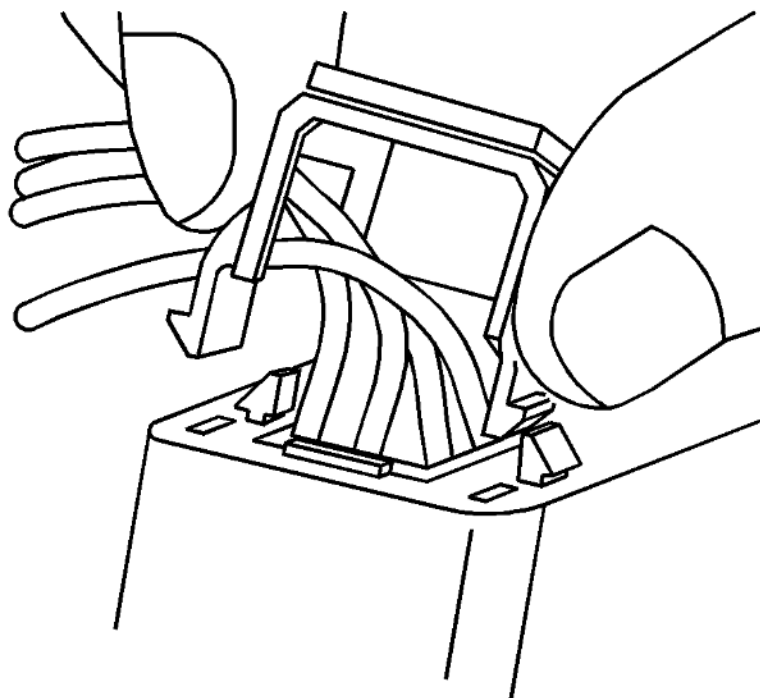


Fig. 68: Removing Cover

Courtesy of GENERAL MOTORS COMPANY

9. Use J-38125-12A to gently lift the terminal retaining tab while gently pulling the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.

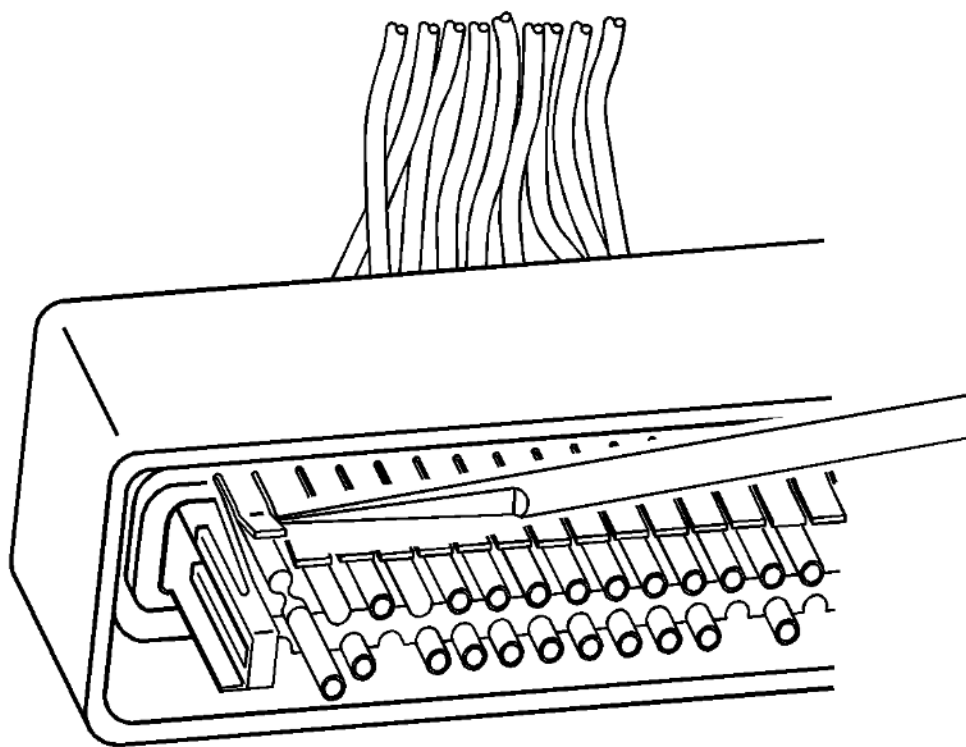


Fig. 69: Identifying Terminal Retaining Tab
Courtesy of GENERAL MOTORS COMPANY

10. If the terminal is severely bent or damaged, it may be possible on some connectors to push the wire out of the front of the connector instead of pulling it through. This will prevent damage to the internal seals of the connector. Once the terminal is pushed out of the connector, cut the wire as close to the terminal as possible and pull the wire through the connector.
11. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
12. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

Terminal Insertion Procedure

After the terminal is crimped to the wire perform the following procedure in order to replace Micro-Pack 100 terminals.

1. Slide the new terminal into the correct cavity at the back of the connector.

2. Push the terminal into the connector until it locks into place. The new terminal should be even with the other terminals. Ensure that the terminal is locked in place by gently pulling on the wire.
3. To assemble the connector, reverse **Terminal Removal Procedure**.

DELPHI CONNECTORS (MICRO.64)**Special Tools**

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-21** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

Follow the steps below in order to remove terminals from Micro.64 connectors.

1. Locate the lever lock on the wire dress cover. While depressing the lock, pull the lever over and past the lock. The lever lock may be located on the top or sides of the wire dress cover.

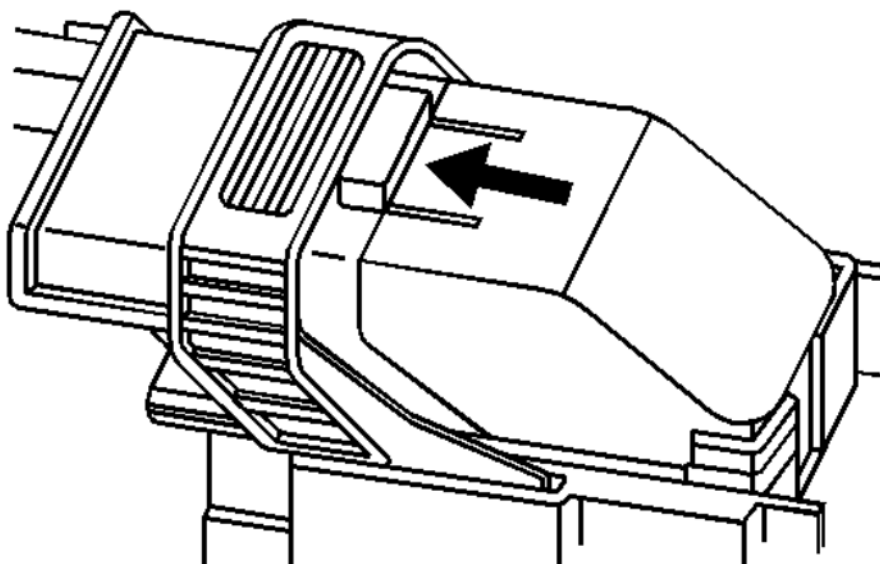


Fig. 70: Identifying Wire Dress Cover Lever Lock
Courtesy of GENERAL MOTORS COMPANY

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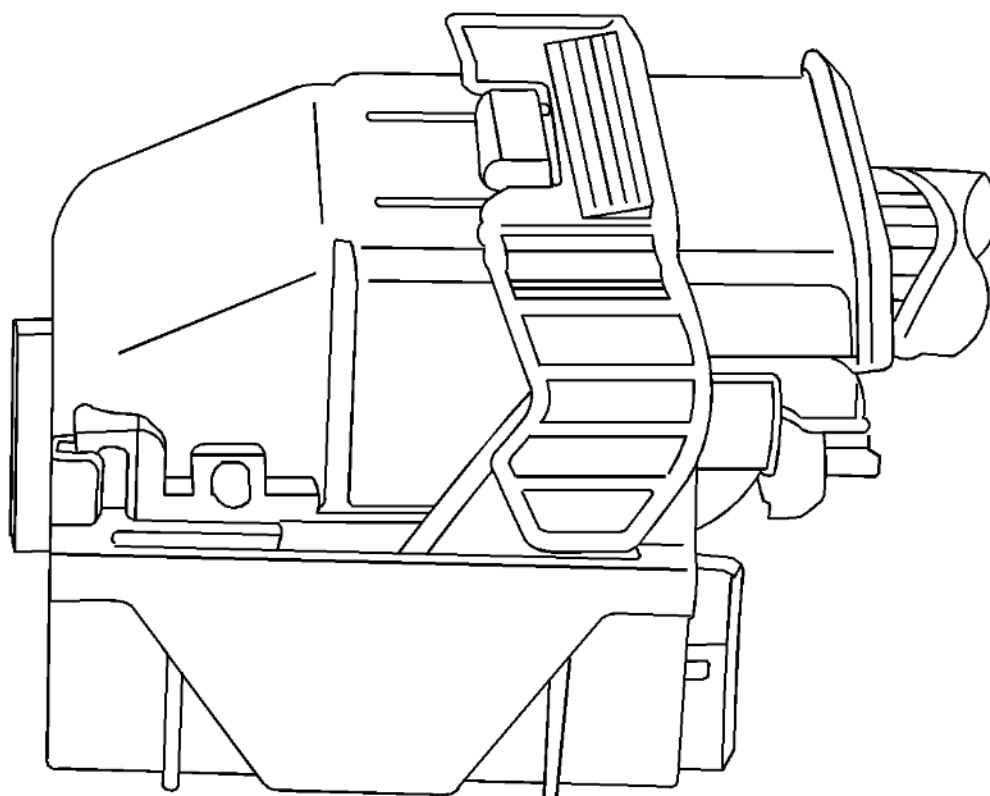


Fig. 71: View Of Typical Micro 64 Connector
Courtesy of GENERAL MOTORS COMPANY

View of a typical Micro 64 connector.

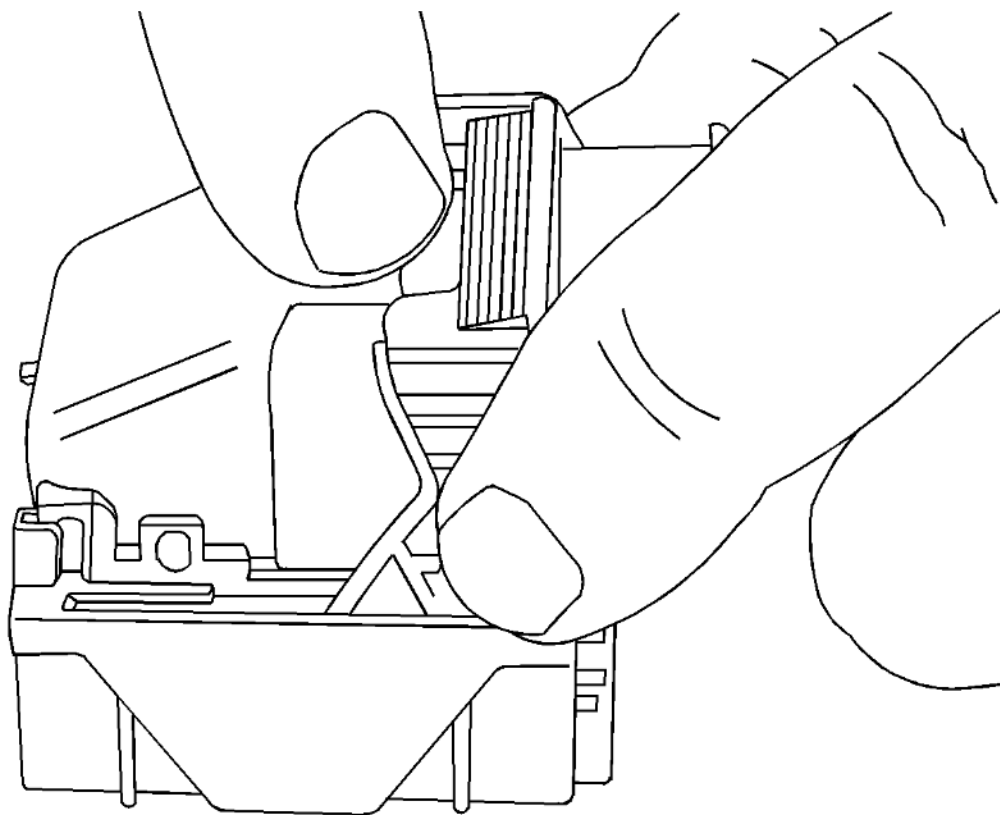


Fig. 72: Depressing Lock And Pulling Lever
Courtesy of GENERAL MOTORS COMPANY

Depress the lock and pull the lever over and past the lock.

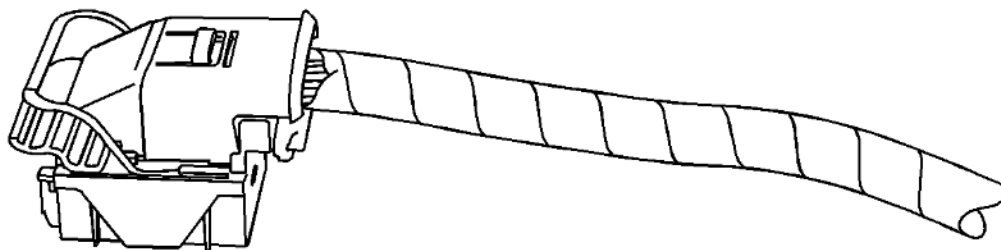


Fig. 73: View Of Connector When Released From Component
Courtesy of GENERAL MOTORS COMPANY

View of the connector when released from the component.

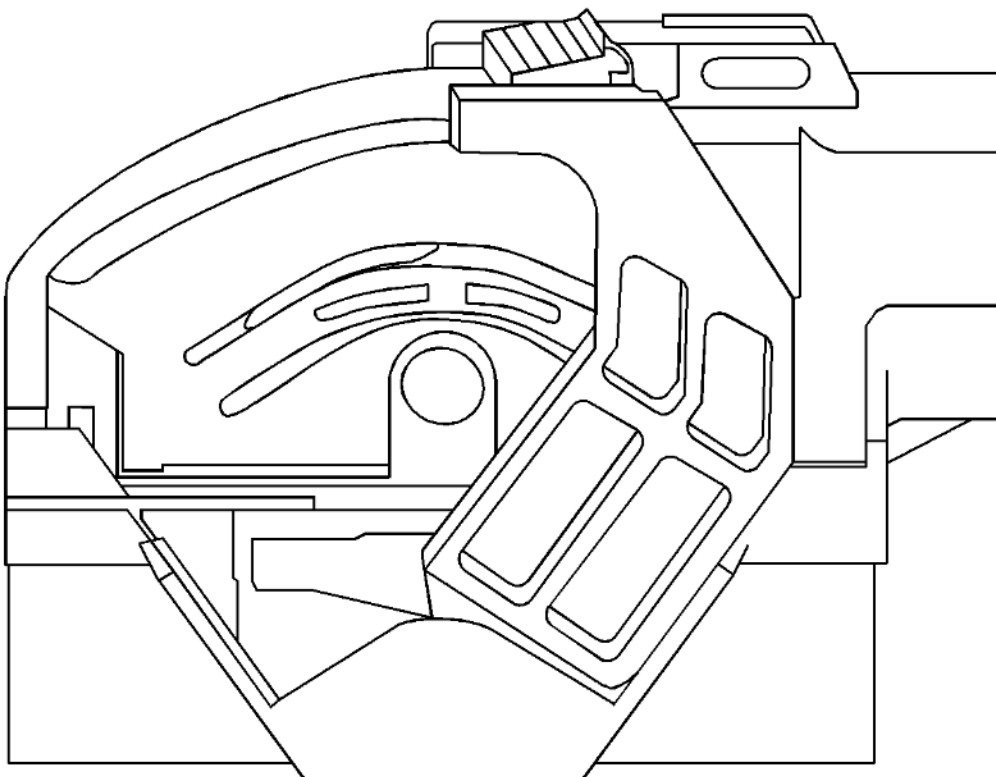


Fig. 74: View Of Another Type Of Micro 64 Connector
Courtesy of GENERAL MOTORS COMPANY

View of another type of Micro 64 connector.

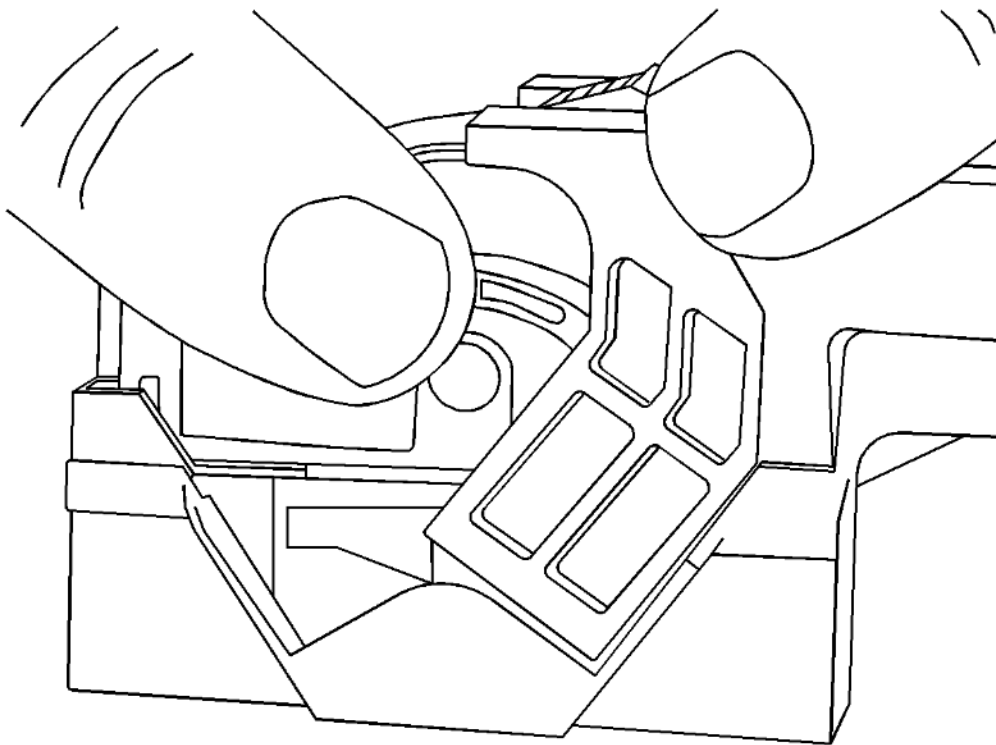


Fig. 75: Locating Locks On Both Sides Of Wire Dress Cover
Courtesy of GENERAL MOTORS COMPANY

Depress the locks that are located on both sides of the wire dress cover and pull the lever over and past the locks.

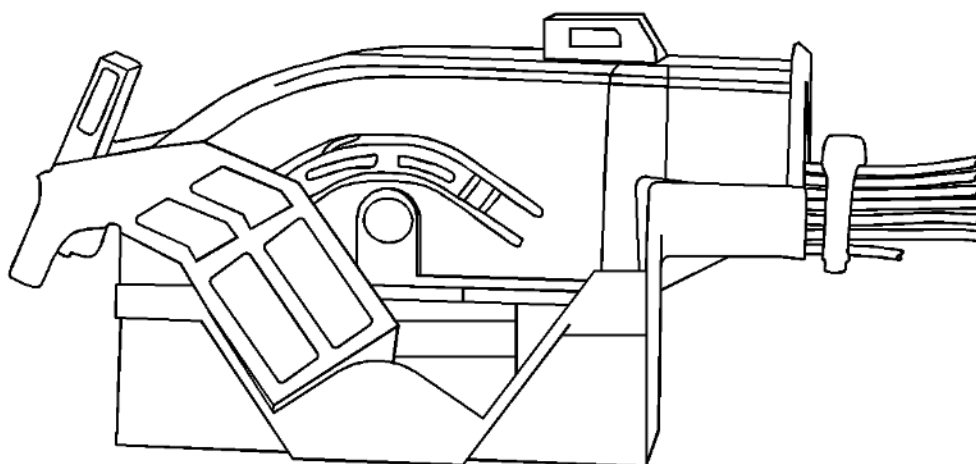


Fig. 76: View Of Connector When Released From Component
Courtesy of GENERAL MOTORS COMPANY

View of the connector when released from the component.

2. Disconnect the connector from the component.
3. Locate the dress cover locking tabs at the front of the connector. Using a small flat-blade tool push down on one of the locking tabs and pull the cover up until the dress cover releases. Repeat this procedure for the other locking tab.

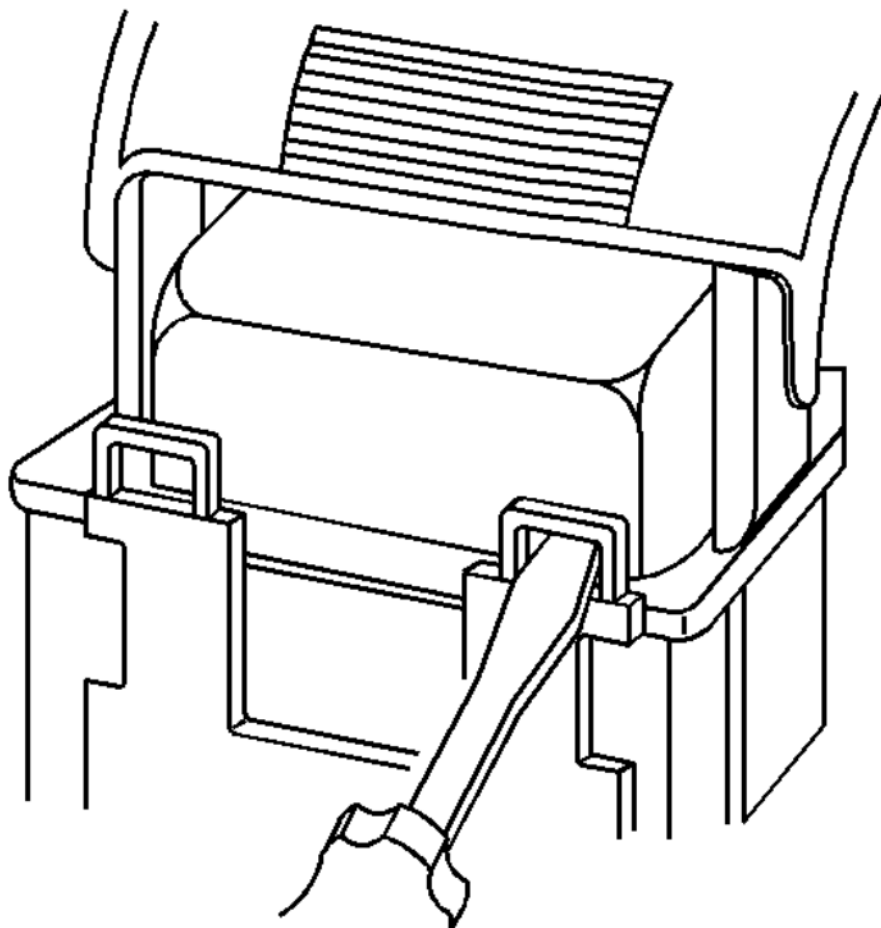


Fig. 77: View Of Releasing Locking Tabs
Courtesy of GENERAL MOTORS COMPANY

4. Once the front 2 locks are unlocked, lift the front of the dress cover and pull it forward.
5. Remove the TPA by inserting a small flat-blade tool into the small slot on the TPA and pushing down until the TPA releases. Gently pry the TPA out of the connector.

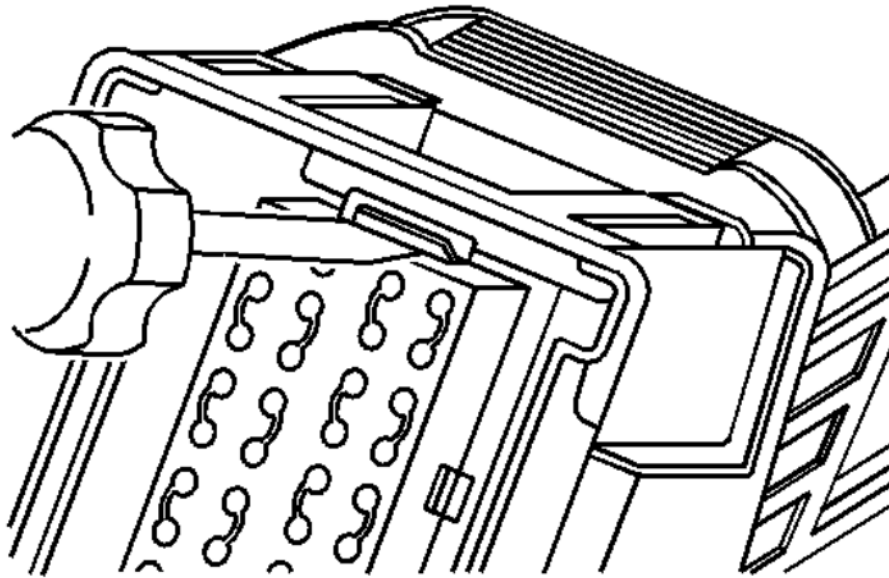


Fig. 78: View Of Removing Terminal Position Assurance
Courtesy of GENERAL MOTORS COMPANY

NOTE: Always use care when removing a terminal position assurance (TPA) in order to avoid damaging it.

6. Insert the J-38125-21 tool into the round canal between the terminals cavities at the front of the connector.

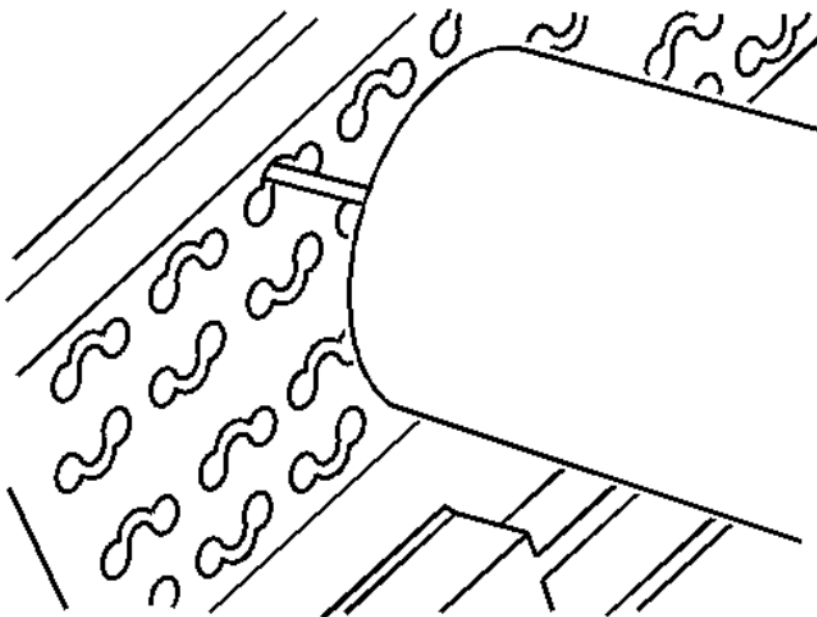


Fig. 79: Identifying Terminal Release Tool

Courtesy of GENERAL MOTORS COMPANY

NOTE: Be careful not to angle or rock the J-38125-21 tool when inserting it into the connector or the tool may break.

7. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.

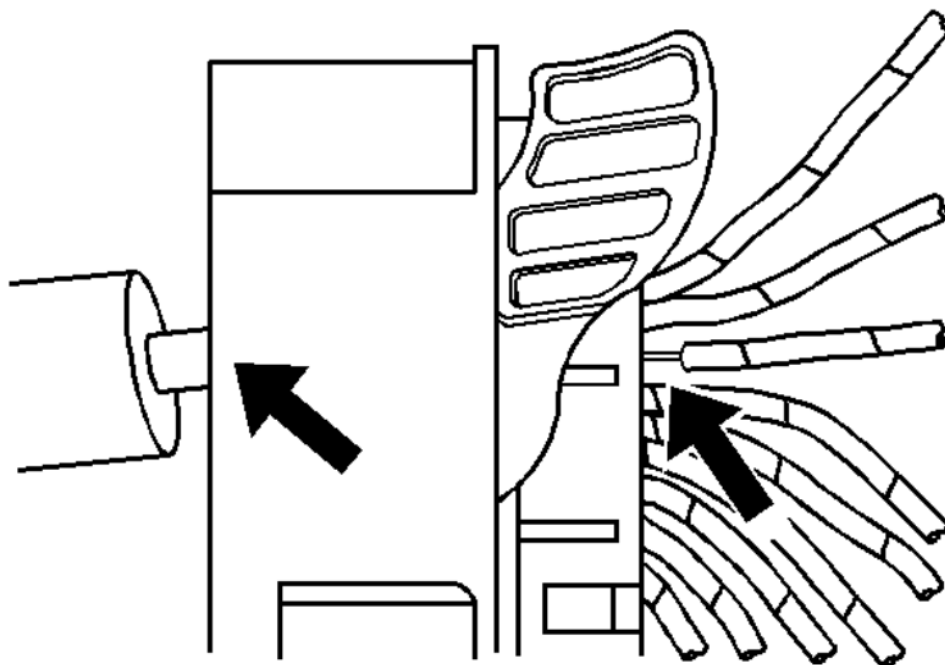


Fig. 80: View Of Removing Wire From Back Of Connector
Courtesy of GENERAL MOTORS COMPANY

8. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
9. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

DELPHI CONNECTORS (12-WAY)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-12A Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

Follow the steps below in order to remove terminals from the connector.

1. Locate the lever lock on the wire dress cover. Remove the connector position assurance (CPA) and slide the lever lock away from the connector body.

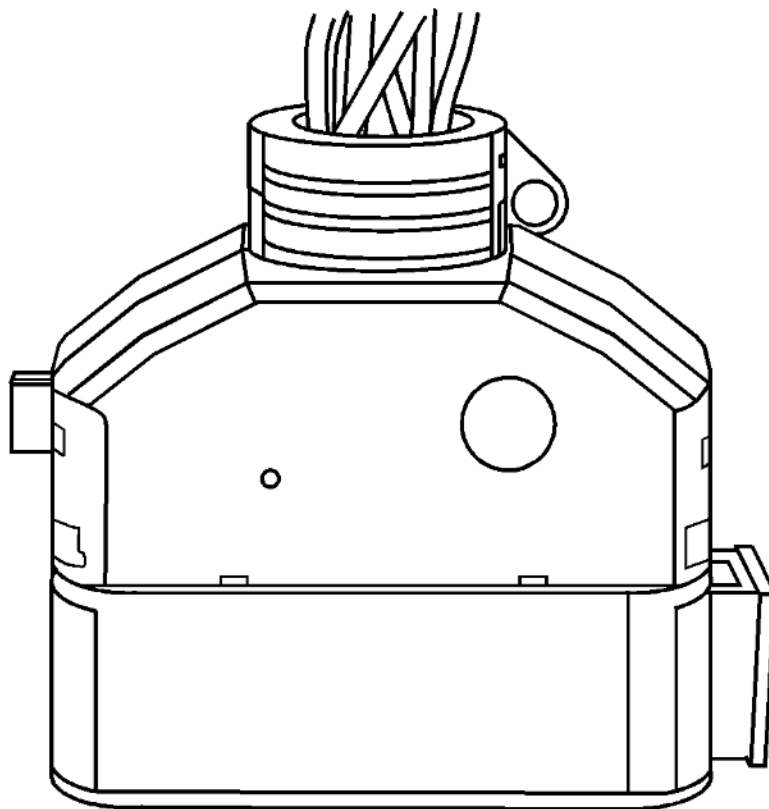


Fig. 81: Identifying Lever Lock

Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the connector from the component.
3. Locate the dress cover locking tabs on the dress cover of the connector. Using a small flat-blade tool release all of the locking tabs.

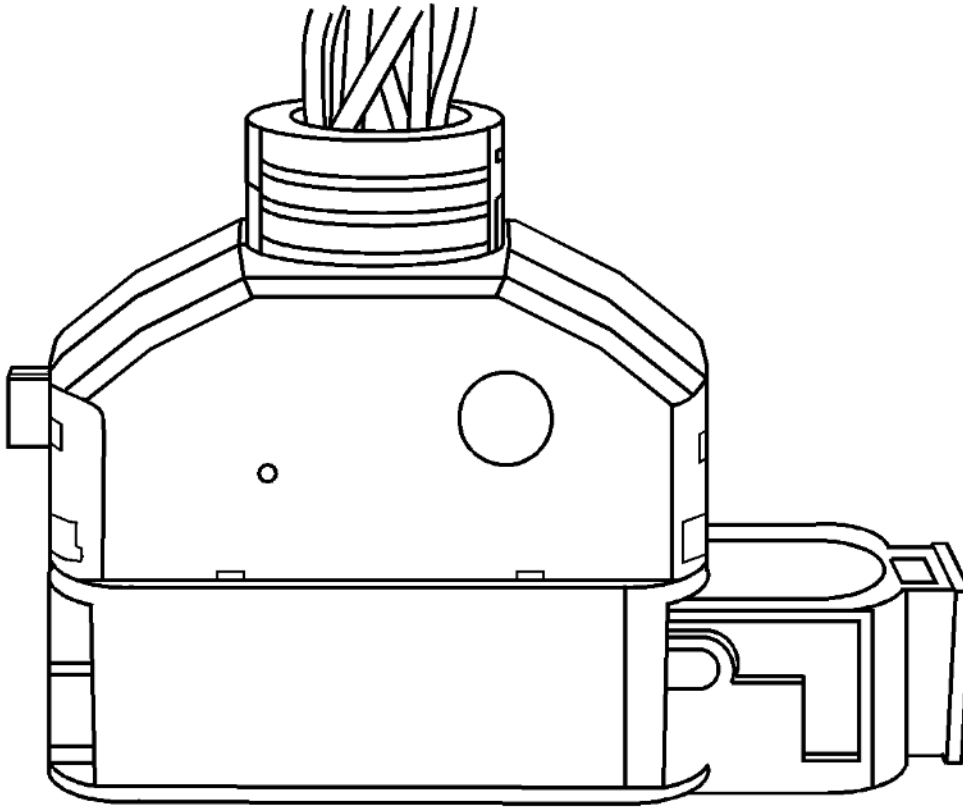


Fig. 82: Identifying Dress Cover Locking Tabs
Courtesy of GENERAL MOTORS COMPANY

4. Release the lower wire dress cover locking tab.

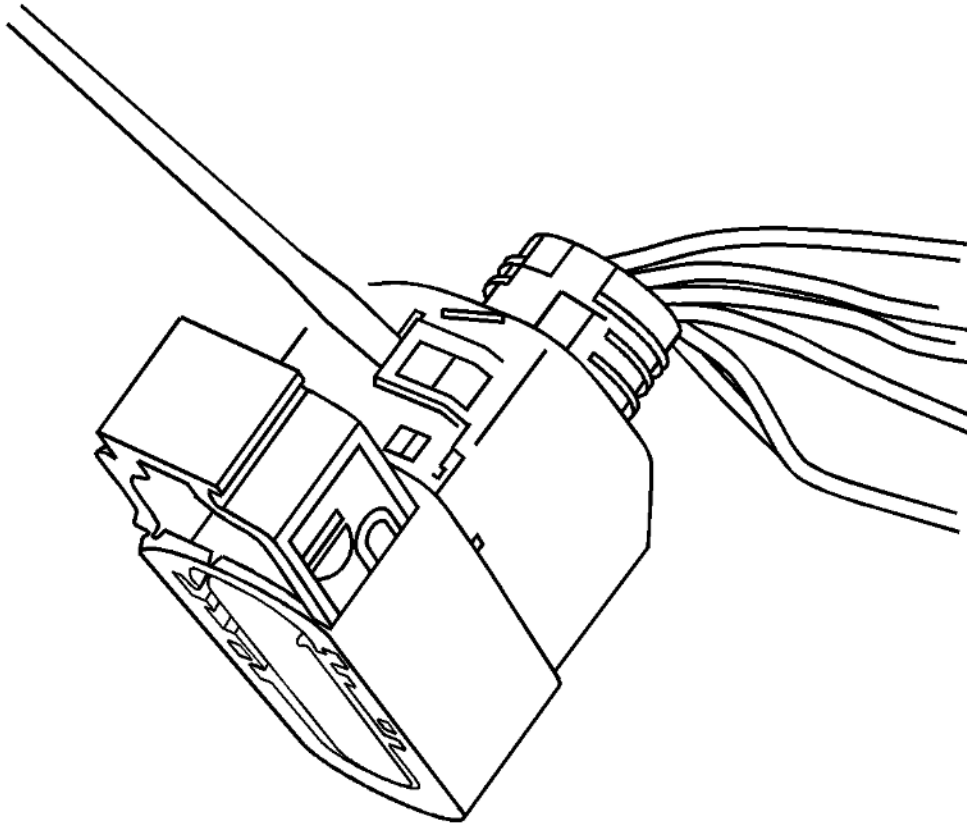


Fig. 83: Identifying Lower Wire Dress Cover Locking Tab
Courtesy of GENERAL MOTORS COMPANY

5. Release the upper wire dress cover locking tab.

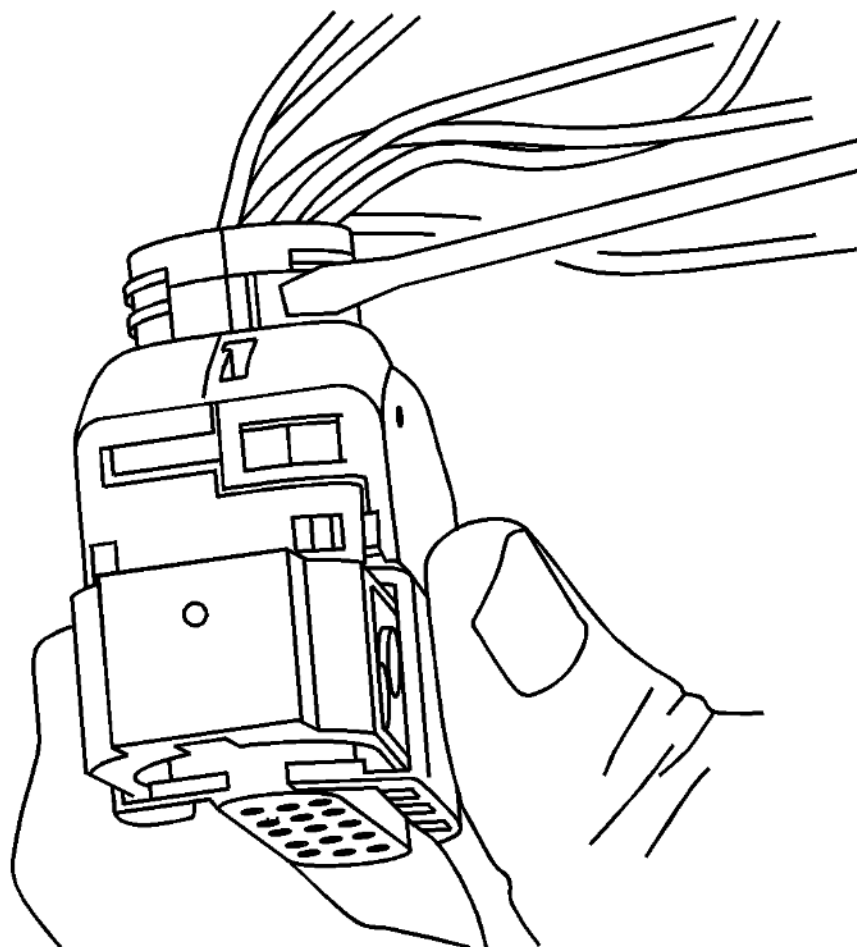


Fig. 84: Identifying Upper Wire Dress Cover Locking Tab
Courtesy of GENERAL MOTORS COMPANY

6. Once the locks are unlocked, lift the dress cover off.
7. Remove the TPA by inserting a small flat-blade tool into the locking tabs on both sides of the TPA. Gently pry the TPA out of the connector.

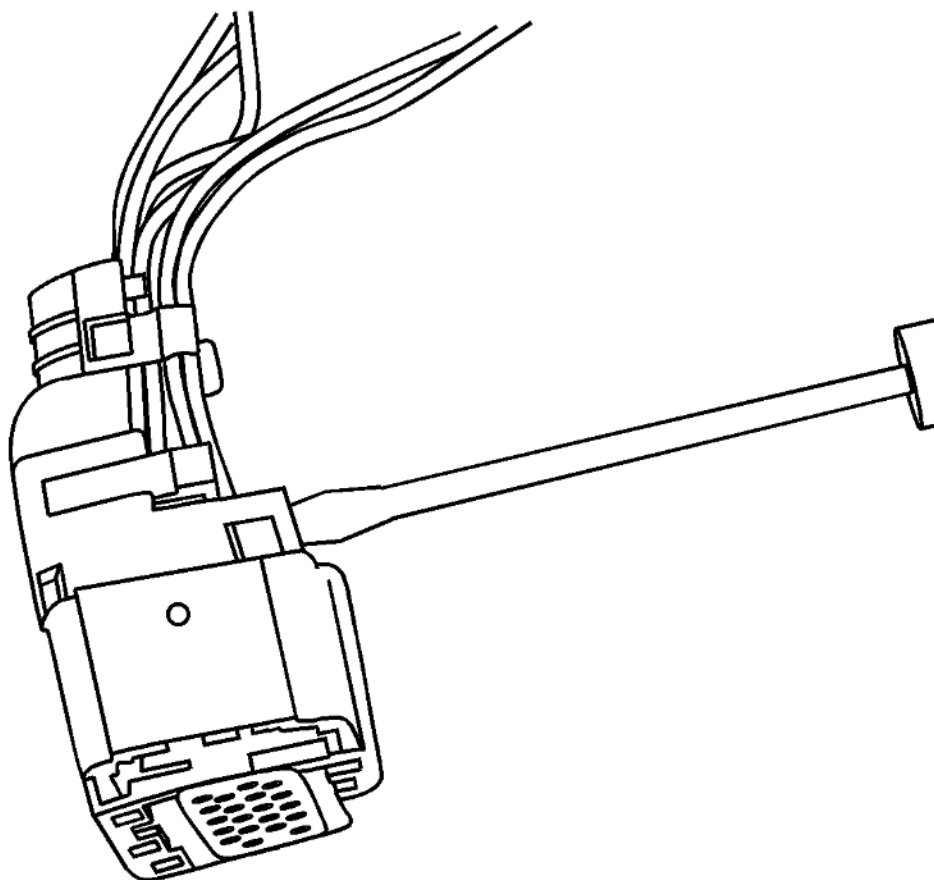


Fig. 85: View Of TPA Being Pried Out Of Connector
Courtesy of GENERAL MOTORS COMPANY

NOTE: Always use care when removing a terminal position assurance (TPA) in order to avoid damaging it.

8. Remove the nose piece by inserting a small flat-blade tool into the locking tabs on both sides of the nose piece. Gently pry the nose piece out of the connector.

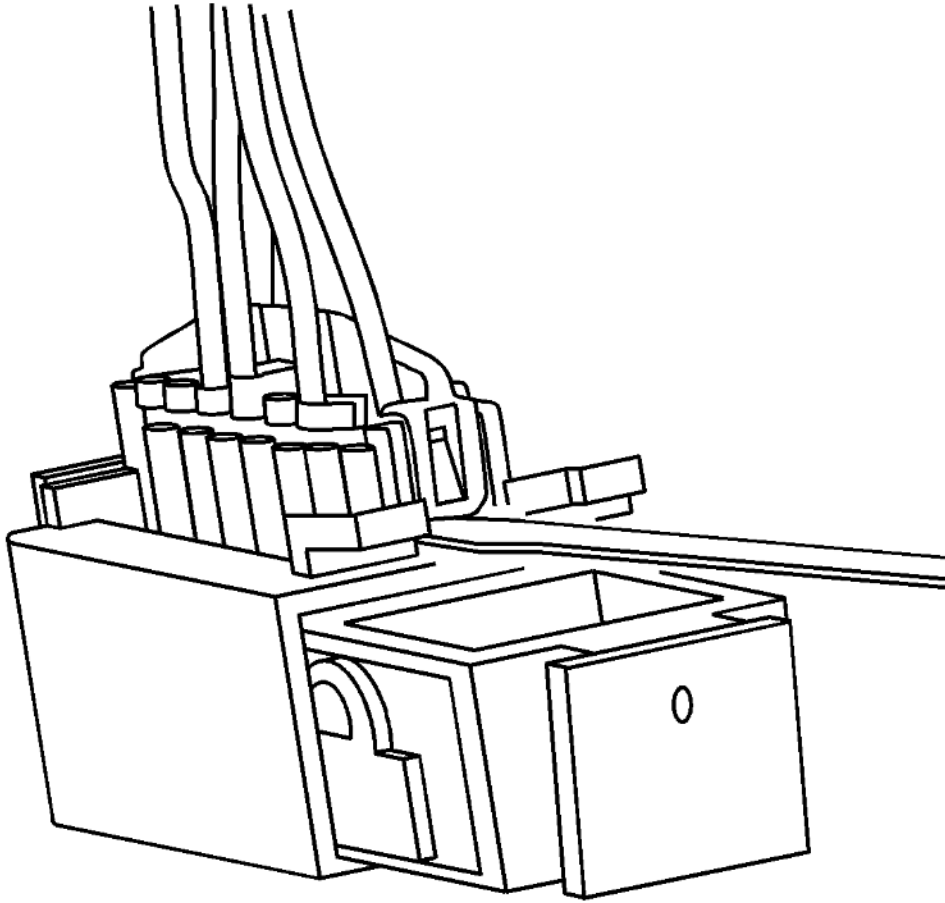


Fig. 86: Removing Nose Piece

Courtesy of GENERAL MOTORS COMPANY

9. Insert the J-38125-12A tool to release the terminals by inserting the tool into the terminal release cavity.

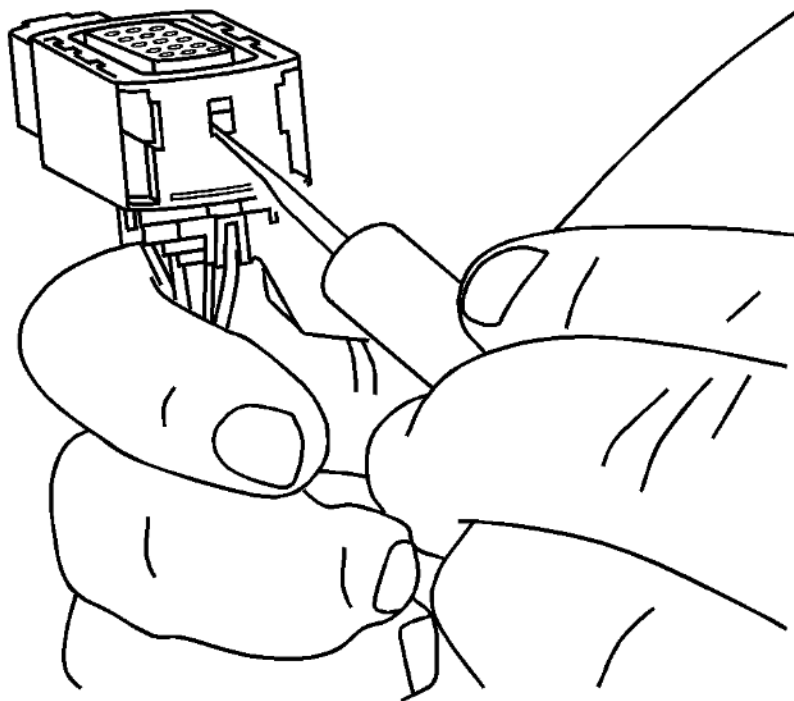


Fig. 87: View Of Installing J 38125-12A Into Terminal Release Cavity
Courtesy of GENERAL MOTORS COMPANY

10. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.

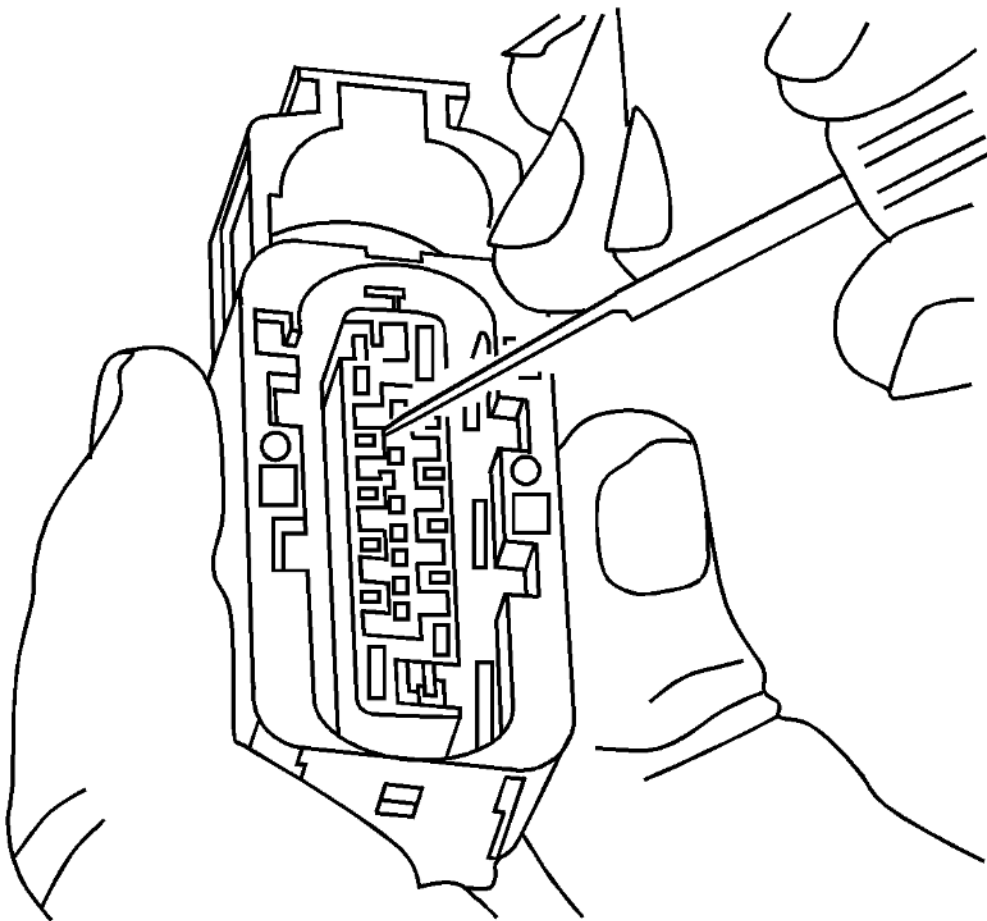


Fig. 88: Pulling Wire Out Of Back Of Connector
Courtesy of GENERAL MOTORS COMPANY

11. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
12. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

DELPHI CONNECTORS (STEERING GEAR)

Removal Procedure

1. Use a small flat-bladed tool to release the locking tab on the connector.

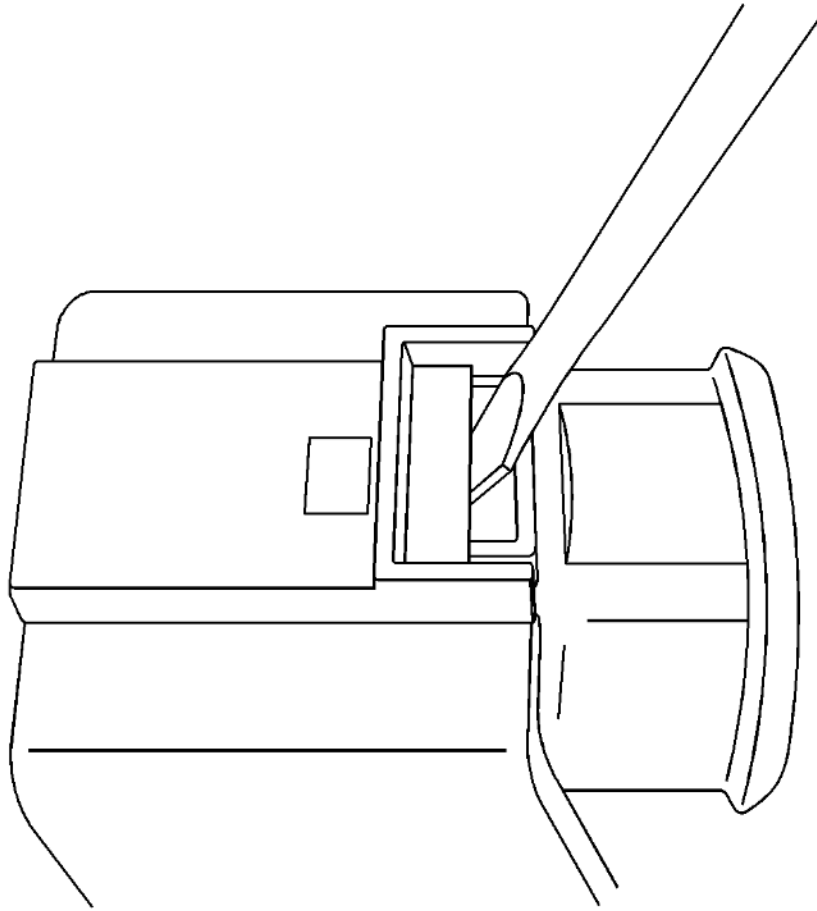


Fig. 89: Releasing Locking Tab On Connector
Courtesy of GENERAL MOTORS COMPANY

2. Push down the locking tab to release the connector. The small flat-bladed tool may need to be pushed down and angled back slightly to depress the locking tab. Pull on the connector body while releasing the locking tab to disconnect the connector.

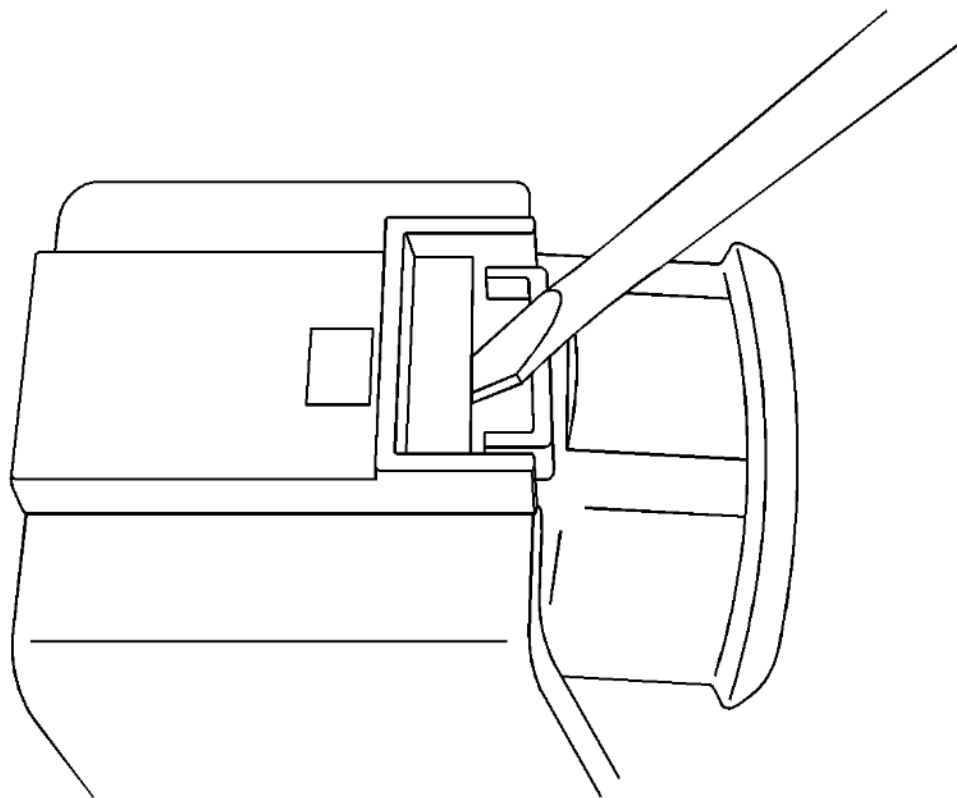


Fig. 90: Releasing Connector

Courtesy of GENERAL MOTORS COMPANY

FCI CONNECTORS (LEVER LOCK)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-556 Terminal Release Tool
- J-38125-560 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

Follow the steps below in order to remove terminals from the connector.

1. Slide the lever lock forward while pressing down on the lever lock release tab.

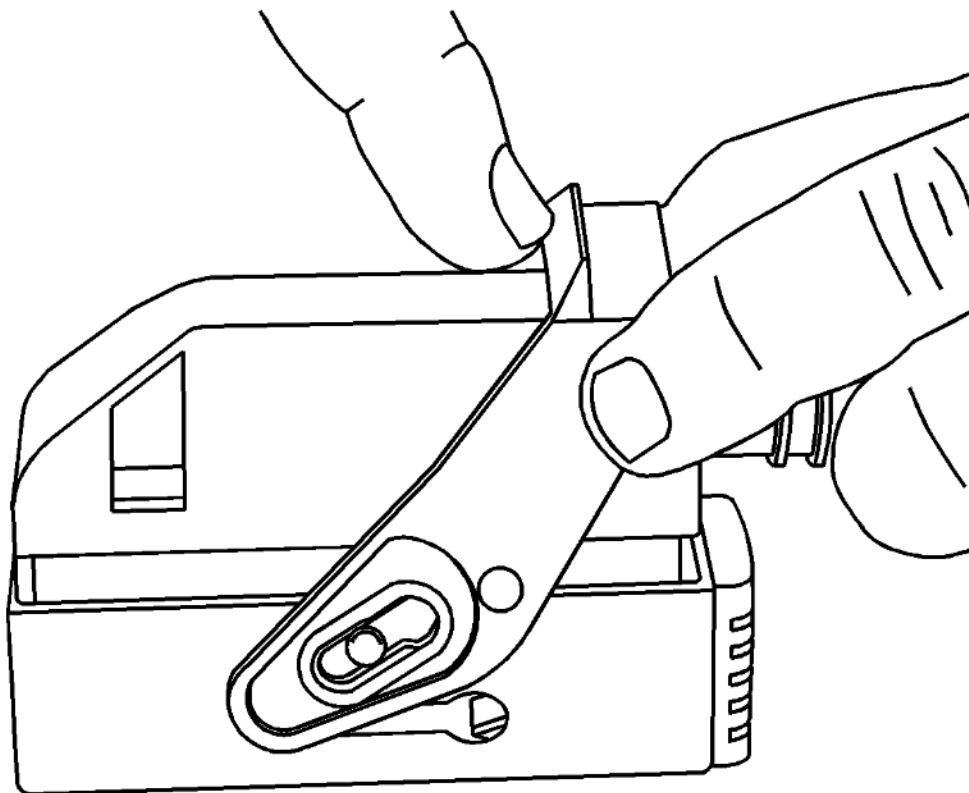


Fig. 91: Identifying Release Tab

Courtesy of GENERAL MOTORS COMPANY

2. The release tab is located on the top of the wiredress cover.
3. View of connector in released position.

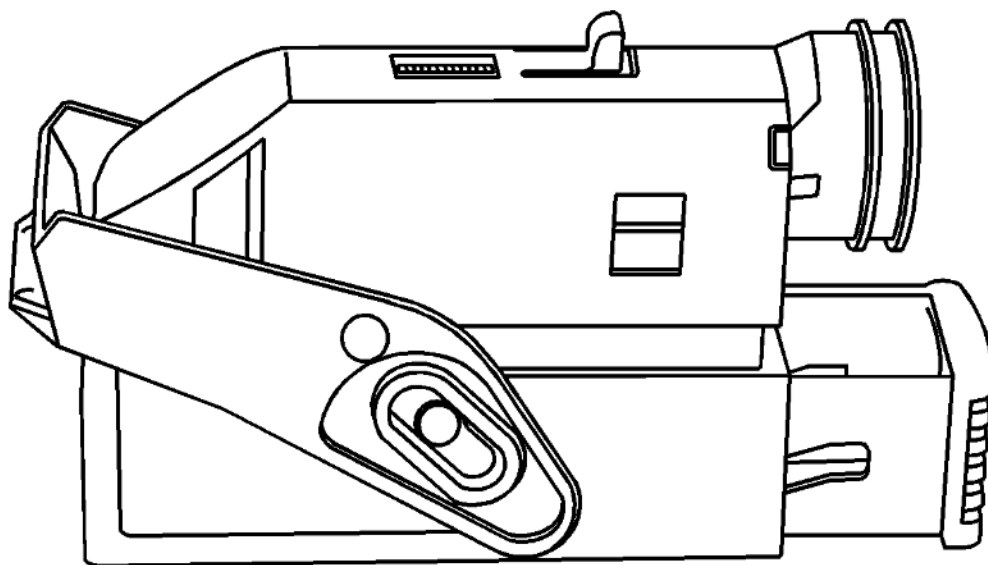


Fig. 92: View Of Connector In Released Position
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the connector from the component.
5. Locate the dress cover locking tabs at the corners of the dress cover. Use a small flat-blade tool to release the locking tabs and remove the dress cover.

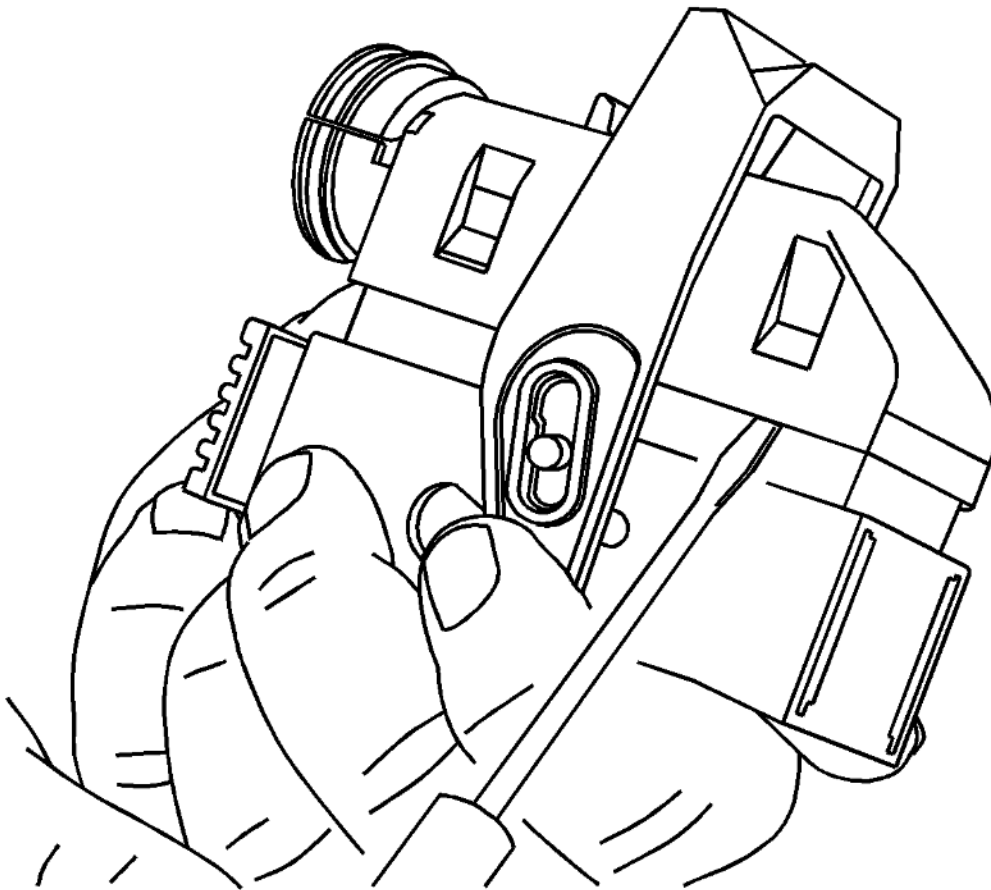


Fig. 93: View Of Sliding Terminal Position Assurance (TPA) Up One Notch
Courtesy of GENERAL MOTORS COMPANY

6. Use a small flat-blade tool to slide the terminal position assurance (TPA) up one notch on both ends of the connector. The TPA is located underneath the wire dress cover.
7. For the larger terminals insert the J-38125-556 tool to release the terminals by inserting the tool into the terminal release cavity. For the smaller terminals insert the J-38125-560 tool to release the terminals by inserting the tool into the terminal release cavity.

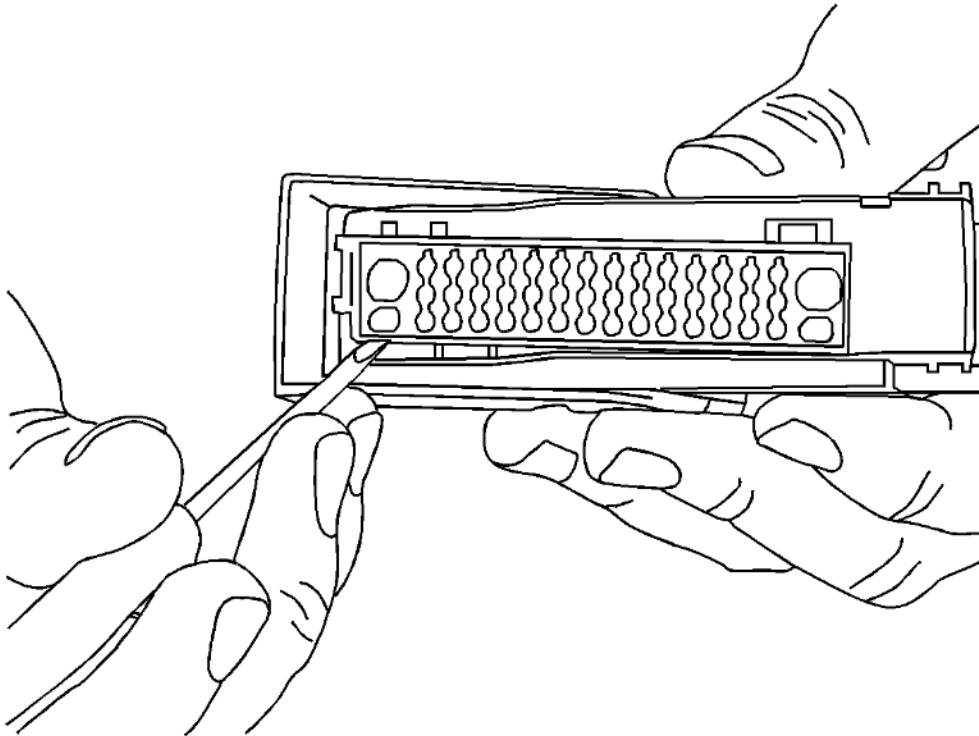


Fig. 94: View Of Releasing Terminals
Courtesy of GENERAL MOTORS COMPANY

8. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.

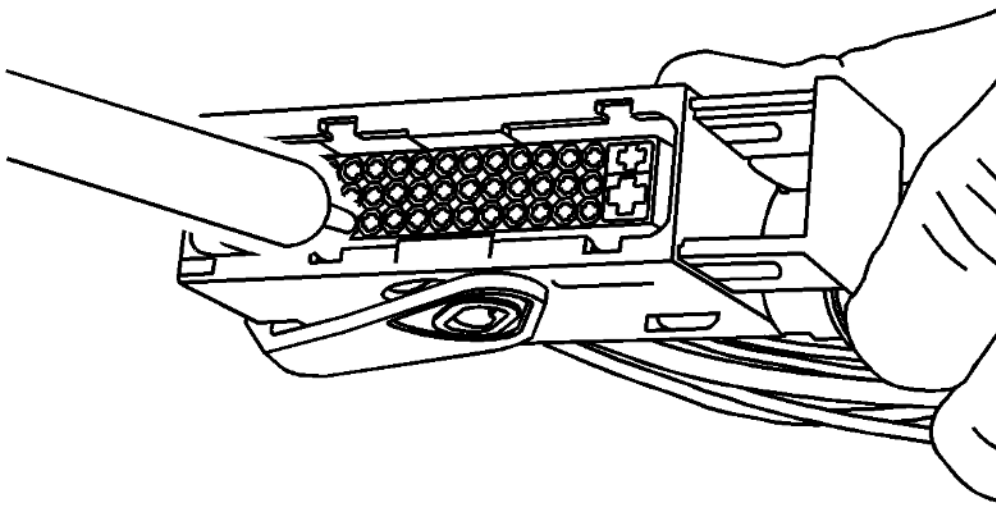


Fig. 95: View Of Wire Being Pulled Out Of Back Of Connector While Holding Removal Tool In Place

Courtesy of GENERAL MOTORS COMPANY

9. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
10. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

FCI CONNECTORS (SIR)

Removal Procedure

NOTE: The orange or yellow connector position assurance (CPA) must be released first to disconnect or to connect the connector.

1. Lift the orange or yellow CPA vertically (avoid lifting on an angle to the connector) approximately 4 mm to release the connector. Use a small flat-bladed tool to help release the CPA. The CPA may also be

released manually without any tools.

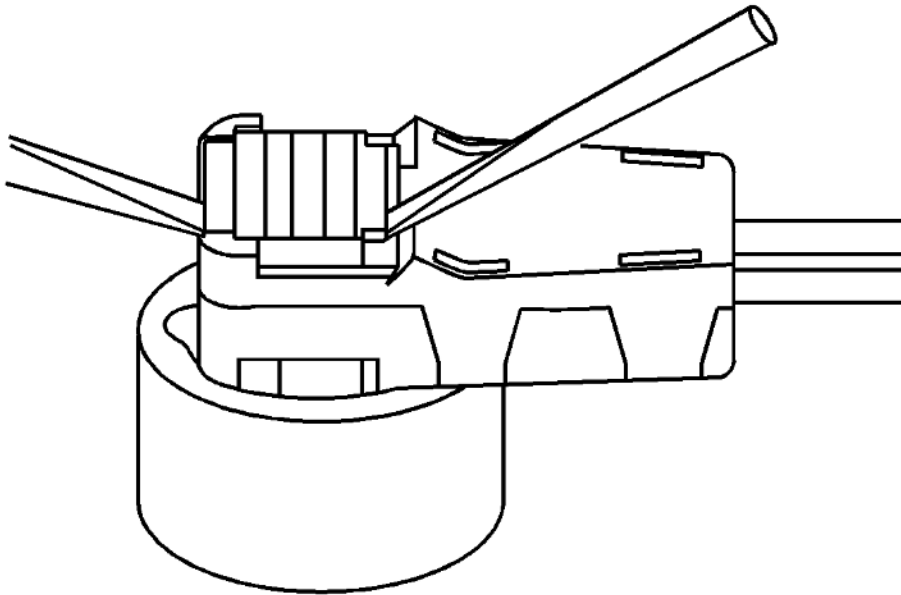


Fig. 96: View Of Lifting Orange CPA
Courtesy of GENERAL MOTORS COMPANY

2. Grab the connector on both sides and lift vertically to disconnect the connector.

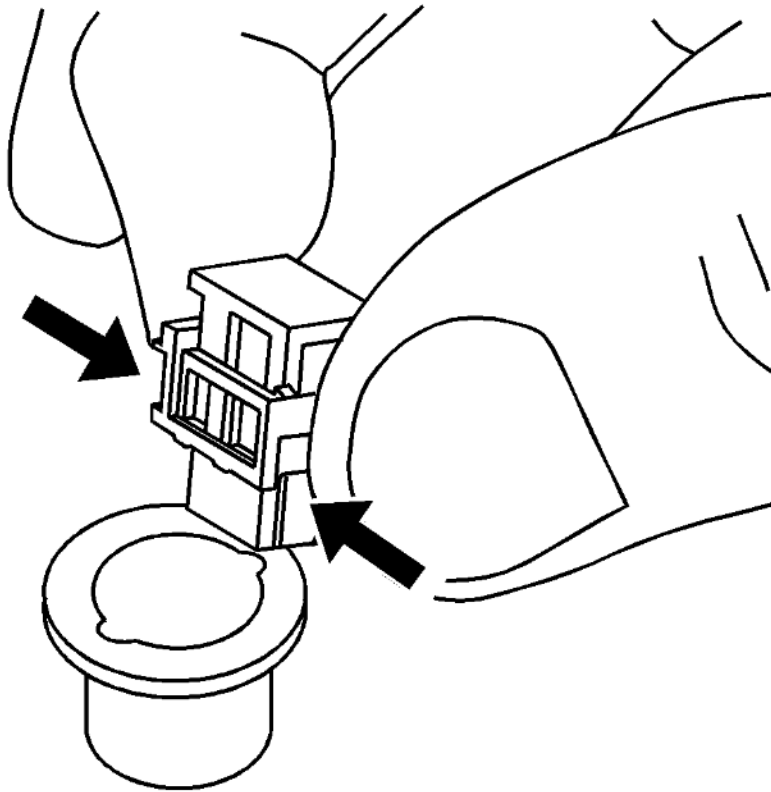


Fig. 97: Grabbing Connector On Both Sides
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. The CPA should be approximately 4 mm above the yellow cover before installing the connector. If not, use a small flat-bladed tool to help release the CPA. The CPA may also be released manually without any tools.

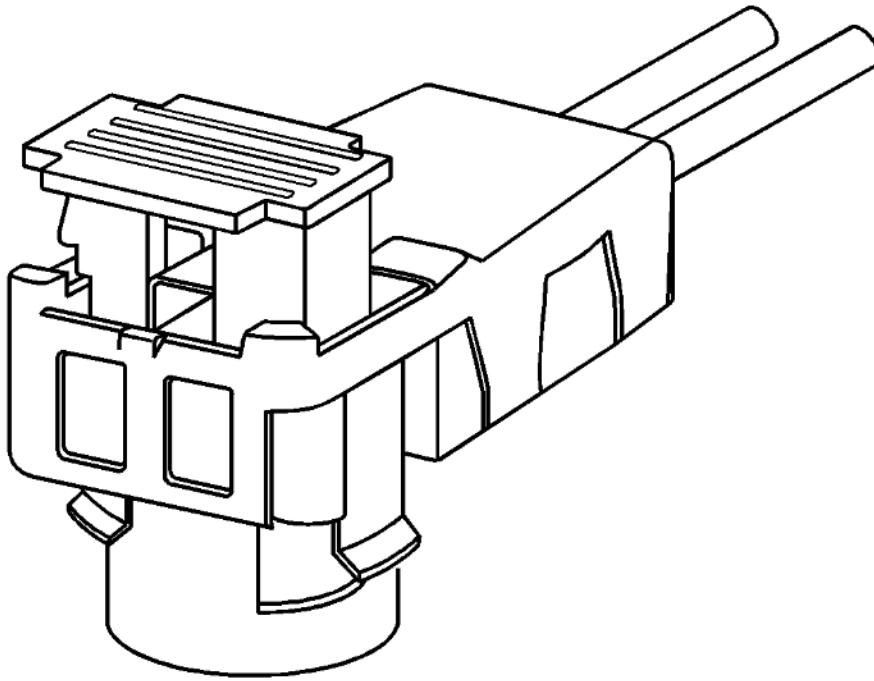


Fig. 98: Orange CPA

Courtesy of GENERAL MOTORS COMPANY

2. Line up the connector key tabs with the initiator key slots. Grab the connector on both sides and push down into the initiator connector sub assembly until fully seated.

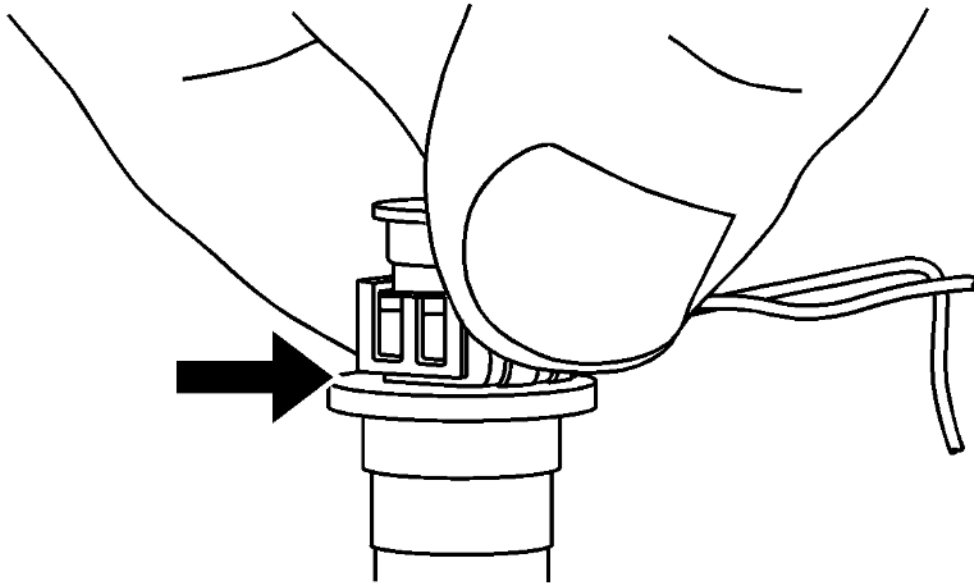


Fig. 99: Seating Connector Sub-Assembly
Courtesy of GENERAL MOTORS COMPANY

3. After the connector is fully seated, push the CPA down with your thumb until the CPA is touching the yellow cover on the connector.

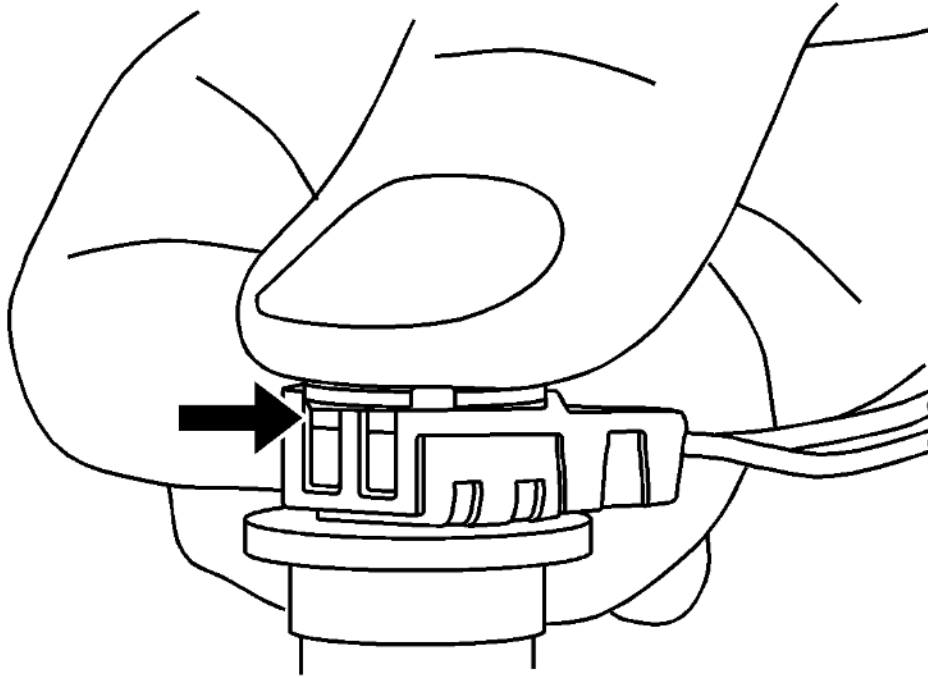


Fig. 100: Pushing CPA Down

Courtesy of GENERAL MOTORS COMPANY

FEP CONNECTORS (STEERING GEAR)

Removal Procedure

1. Use a flat-bladed tool to release the locking tab on the connector.

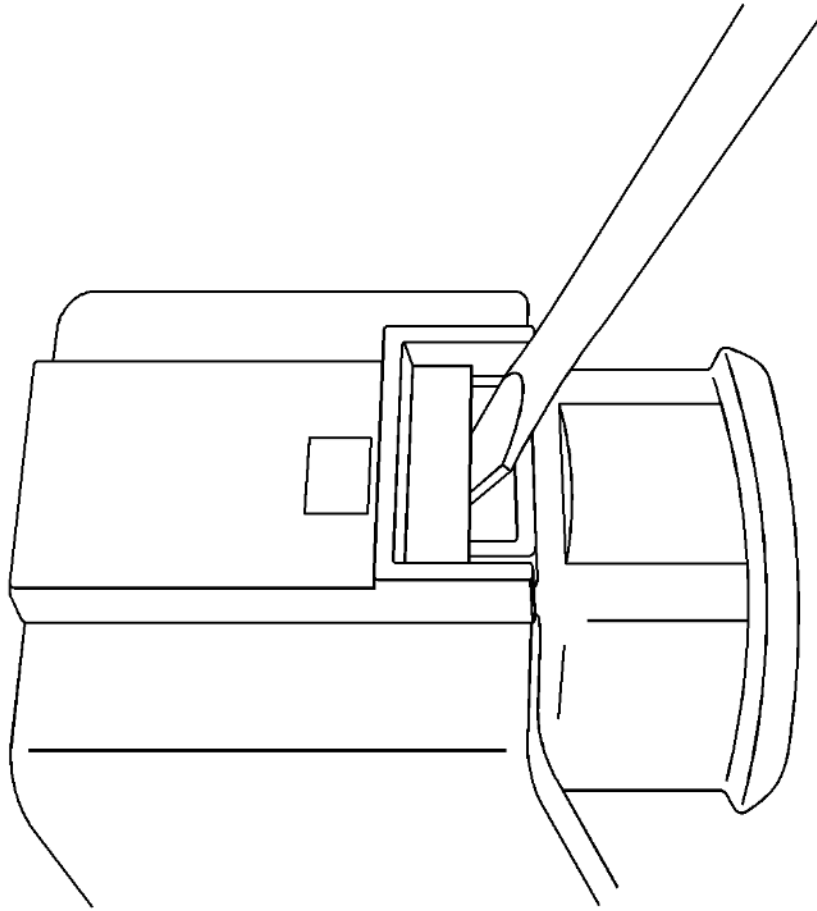


Fig. 101: Releasing Locking Tab On Connector
Courtesy of GENERAL MOTORS COMPANY

2. Option 1: Twist the flat-bladed tool to push the top of the locking tab inward while pulling the connector body out.

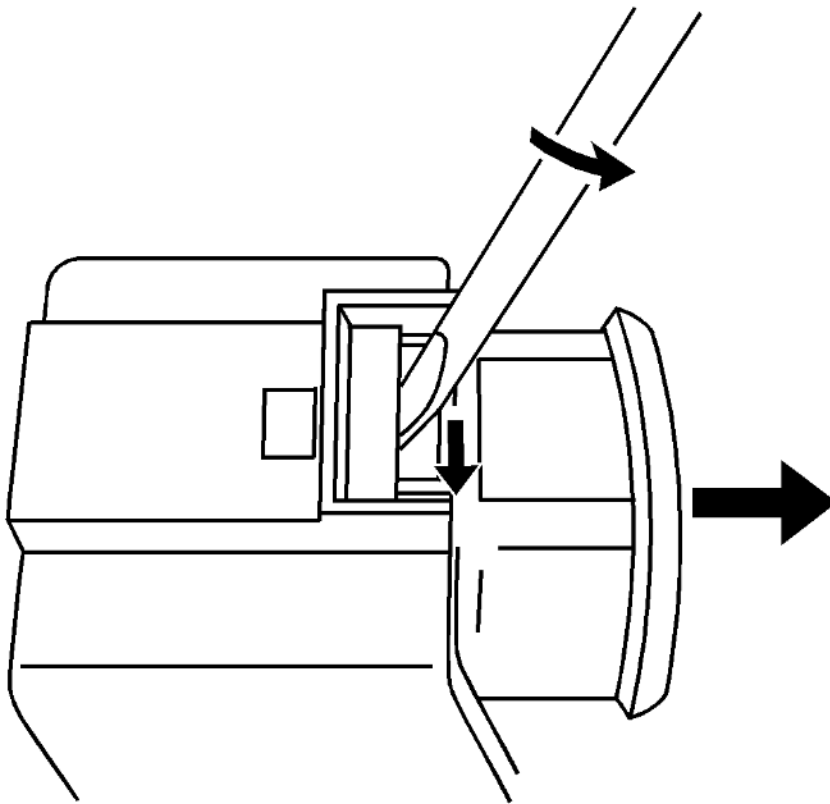


Fig. 102: Twisting Flat-Bladed Tool To Push Top Of Locking Tab Inward
Courtesy of GENERAL MOTORS COMPANY

3. Option 2: Pry using the flat-bladed tool to depress the locking tab while pulling the connector body out.

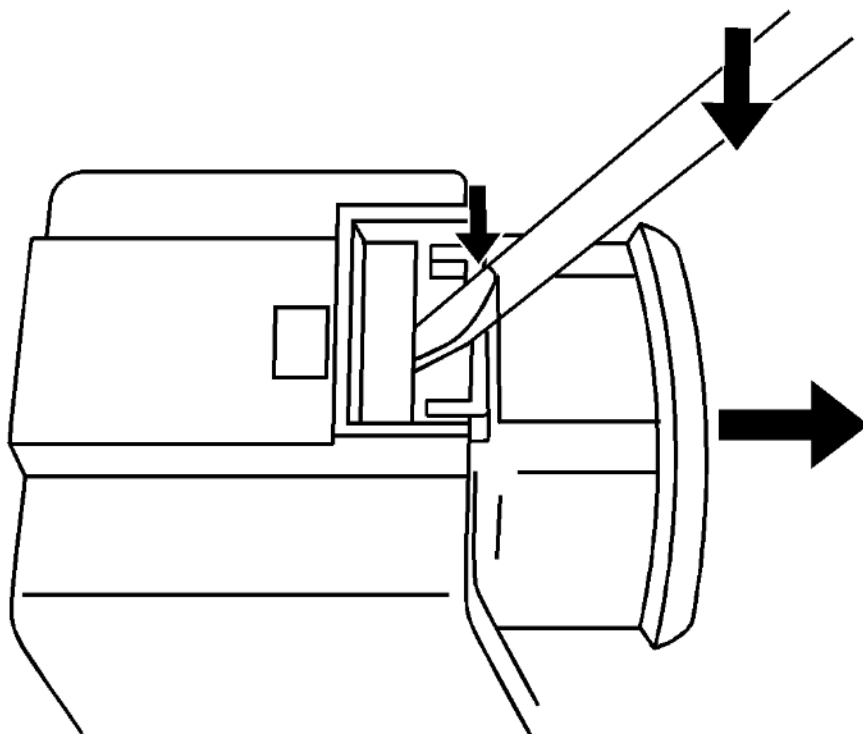


Fig. 103: Using Flat-Bladed Tool To Depress Locking Tab
Courtesy of GENERAL MOTORS COMPANY

JST CONNECTORS

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-553 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

The JST connector family consists of seven unique connector housings differentiated by color and keying. This connector family is designed to use both 0.64 and 2.8 sized terminals.

JST BCM Connector

GM Service Part #	Color
88988806	Gray
88988837	Brown
88988838	Lt Green
88988839	Natural
88988840	Lt Blue
88988841	Black
88988842	Pink

1. While depressing the lock, remove the connector from the component.

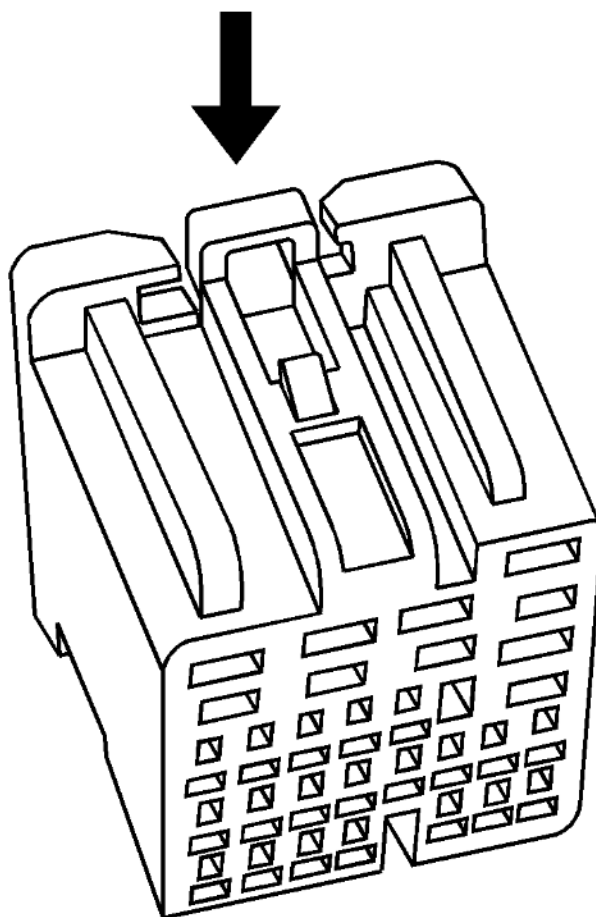


Fig. 104: Identifying Terminal Position Assurance (TPA)
Courtesy of GENERAL MOTORS COMPANY

2. Unlock the terminal position assurance (TPA):

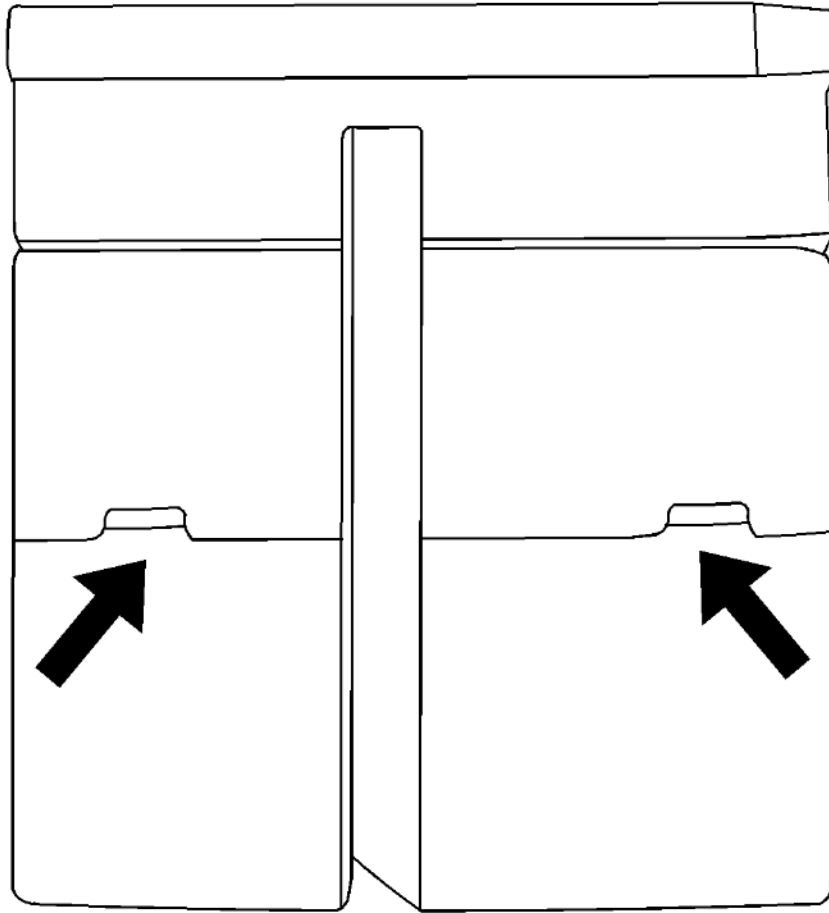


Fig. 105: Identifying TPA On Both Sides Of Connector
Courtesy of GENERAL MOTORS COMPANY

- Position connector as shown (above) and locate TPA staging cavities.

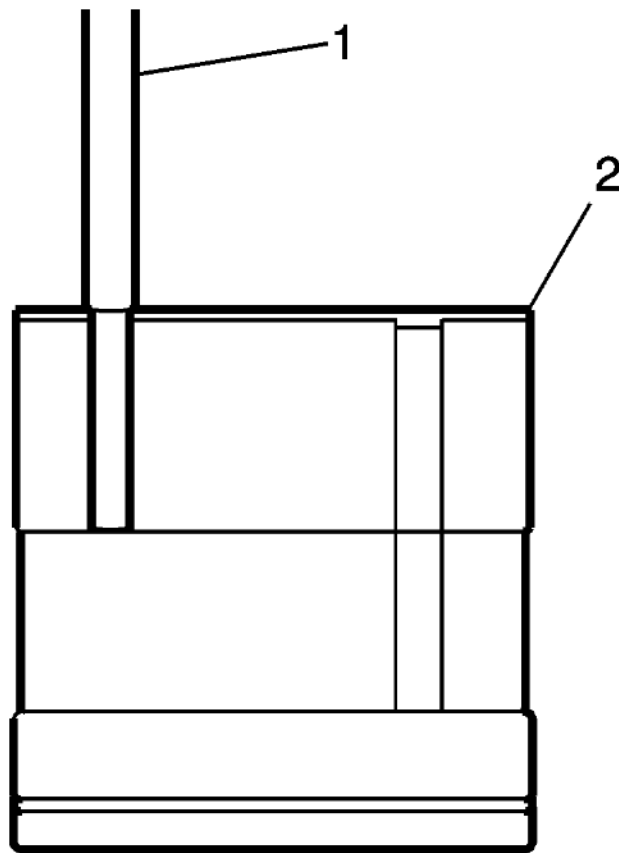
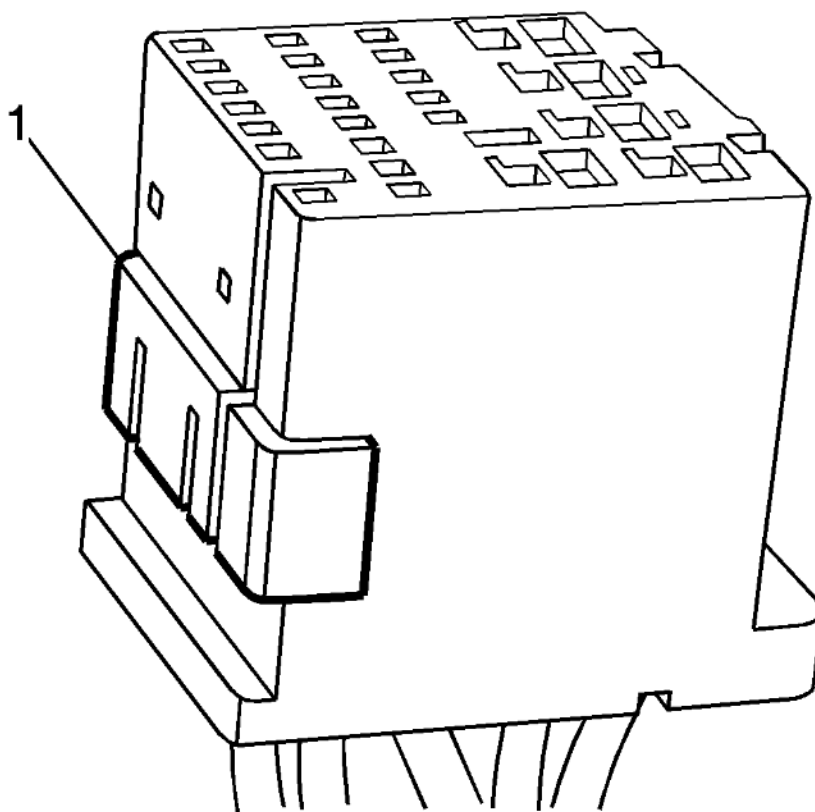


Fig. 106: Terminal Release Tool J-38125-553

Courtesy of GENERAL MOTORS COMPANY

- Using connector terminal release tool J-38125-553 (1) lift the TPA into the staged position. Perform this step on both sides of the TPA.

**Fig. 107: TPA In Staged Position****Courtesy of GENERAL MOTORS COMPANY**

- You will feel the TPA click into place when fully extended into the staged position. The figure above shows the TPA (1) in the staged position.
3. Release the terminal from the connector:

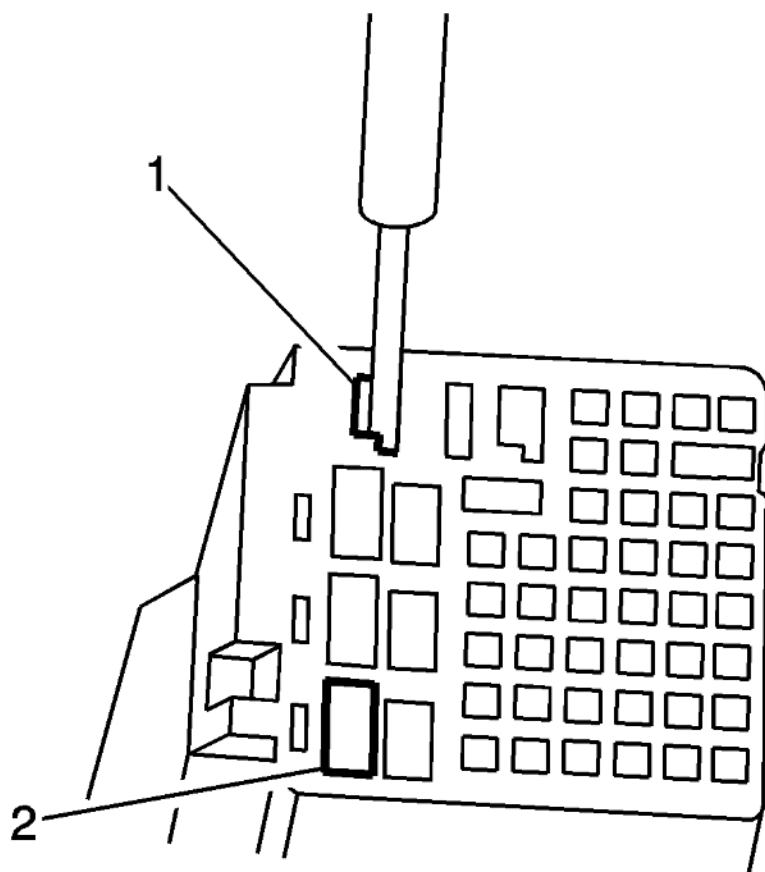


Fig. 108: Connector Terminal Release Tool J-38125-553

Courtesy of GENERAL MOTORS COMPANY

- Position the connector as shown (above) and locate the terminal release entry canal (1) of the suspect terminal.
- Insert the connector terminal release tool J-38125-553 into the entry canal with the angled side of the tool facing the connector wall containing cavity 4 (2).

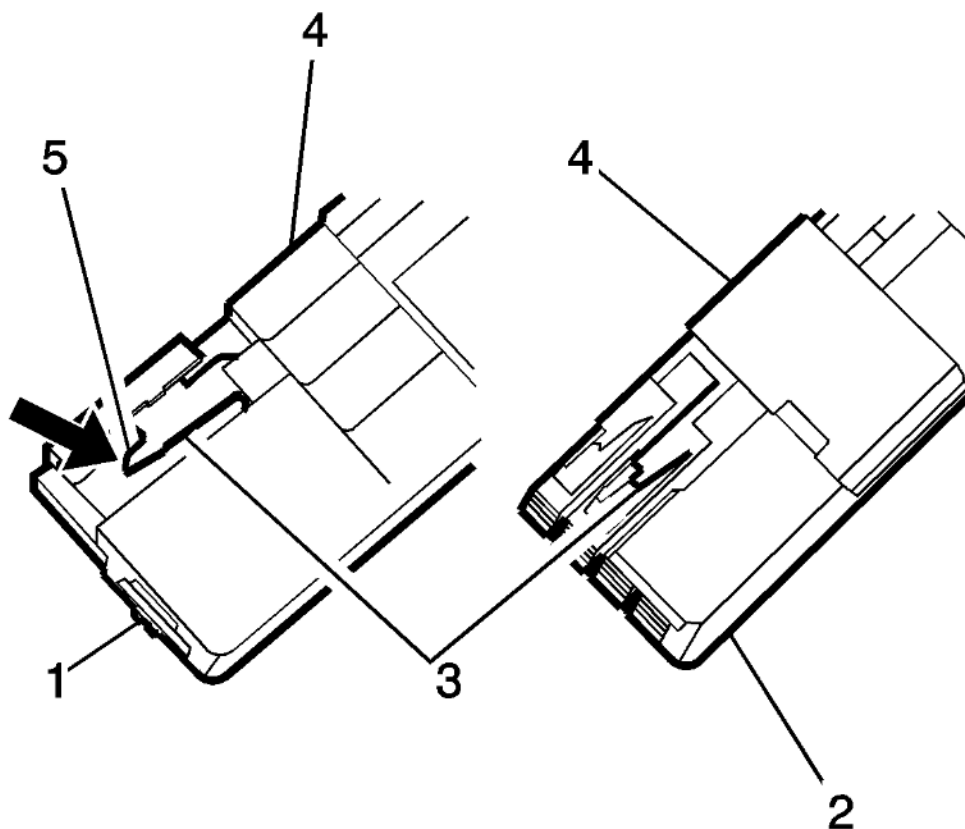


Fig. 109: Identifying Connector Lance And TPA
Courtesy of GENERAL MOTORS COMPANY

- The cavity on the left (1) is a 2.8 mm² cavity and the cavity on the right (2) is a 0.64 mm² cavity.
 - Place the tip of the connector terminal release tool onto the connector lance (3) and deflect the lance to the right (5) to release the lock. Hold this released position.
 - Holding the lance in the released position, slightly pull on the suspect terminal to remove it from the connector housing. The side TPA (4) is a secondary lock.
4. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
 5. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

KOSTAL CONNECTORS (GLOW PLUG CONTROL MODULE)

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-24** Terminal Release Tool
- **J-38125-560** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

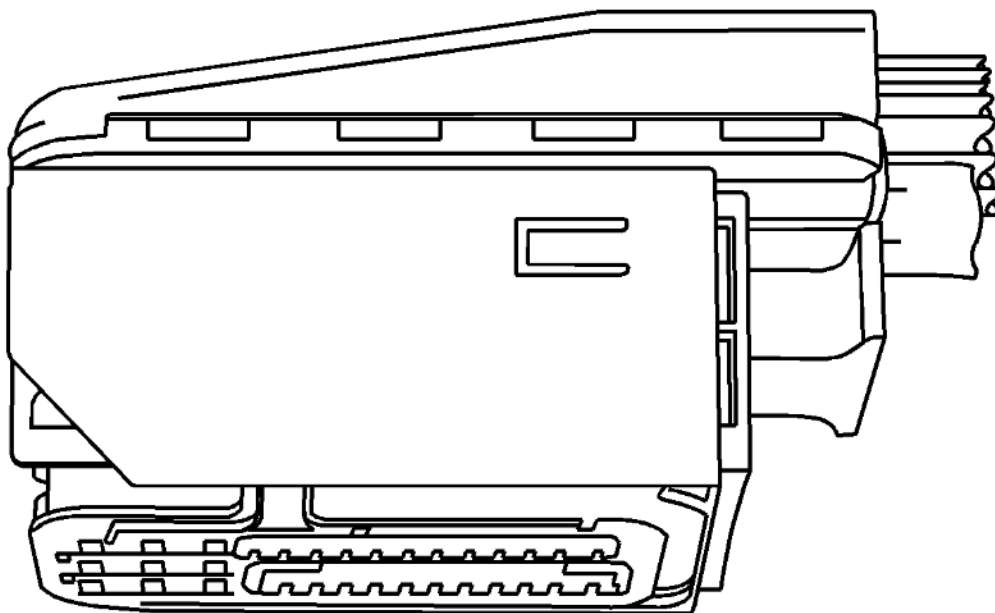


Fig. 110: View Of Typical Kostal Connector
Courtesy of GENERAL MOTORS COMPANY

View of typical connector.

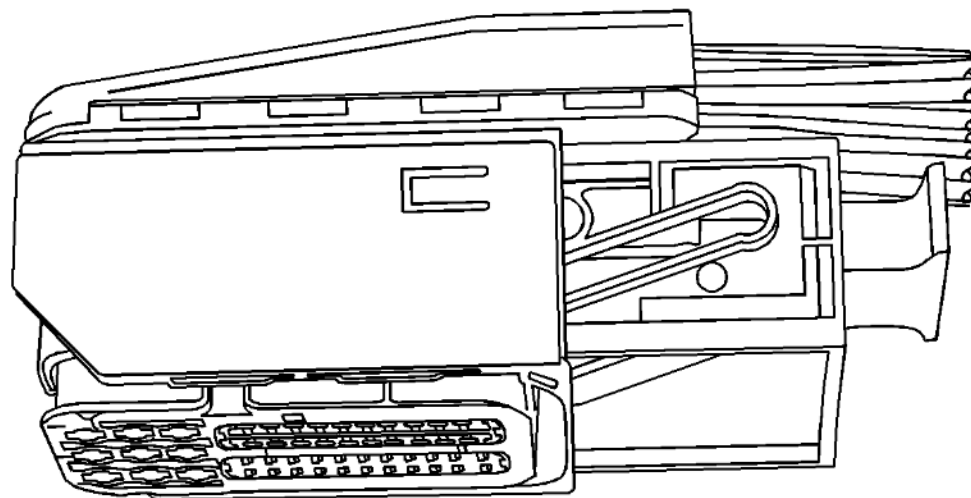


Fig. 111: View Of Connector In Released Position
Courtesy of GENERAL MOTORS COMPANY

View of connector in released position.

1. Locate the assist lever at the back of the connector. Move the assist lever to the rear position.
2. Disconnect the connector from the component.
3. Use a small flat-blade tool to remove the dress cover.

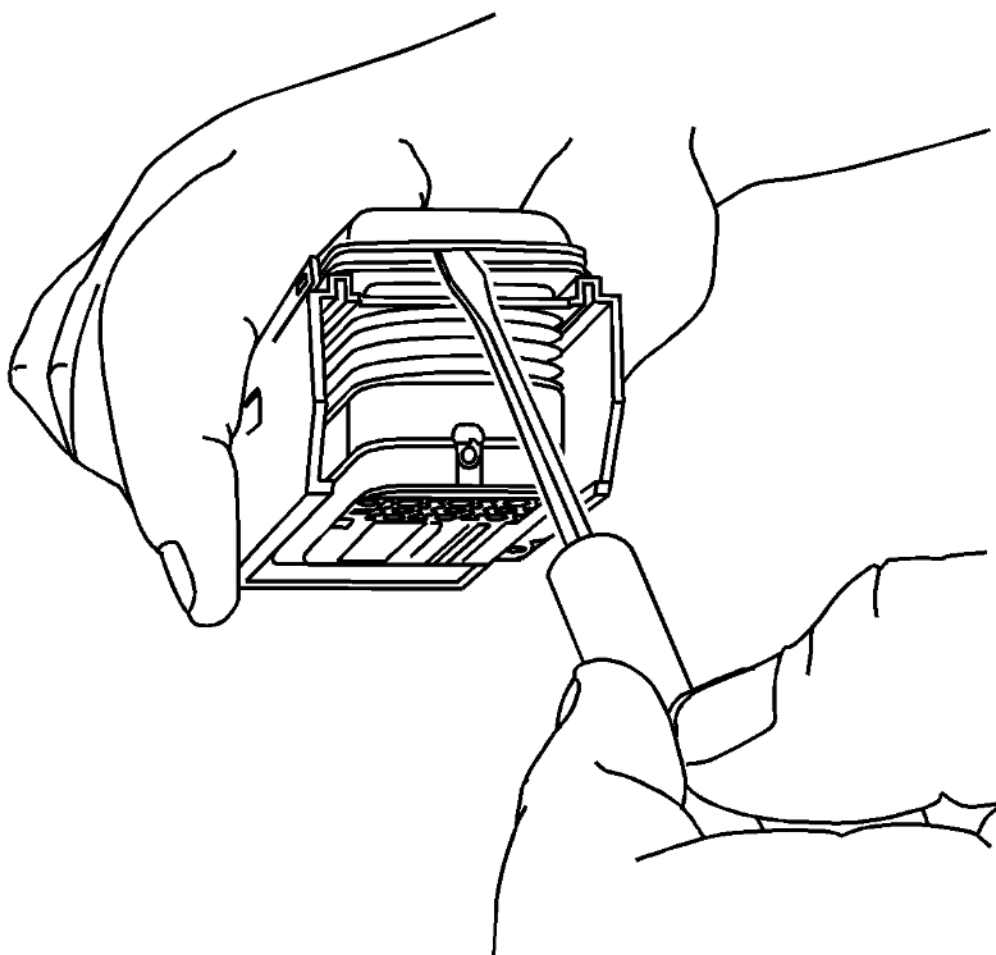


Fig. 112: Using Small Flat-Blade Tool To Remove Dress Cover
Courtesy of GENERAL MOTORS COMPANY

4. Slide the dress cover forward and off of the connector.

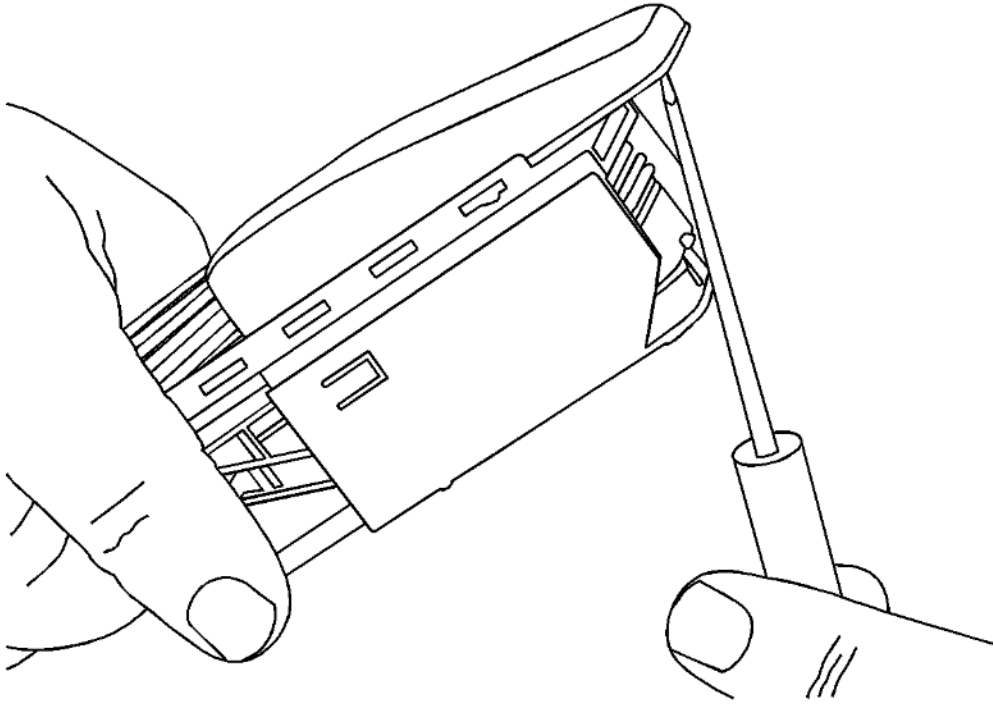


Fig. 113: Sliding Dress Cover Forward & Off Of Kostal Connector (Glow Plug Control Module)
Courtesy of GENERAL MOTORS COMPANY

5. The terminal positive assurance (TPA) is located in the front and rear of the connector.

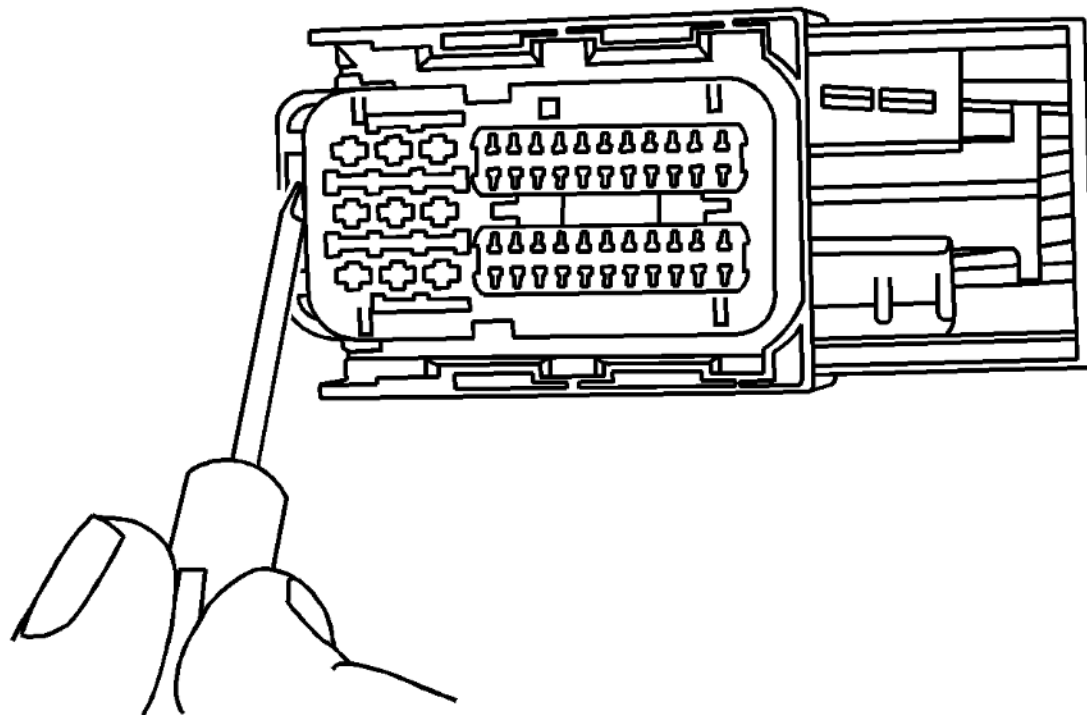


Fig. 114: Locating TPA In Front & Rear Of Connector
Courtesy of GENERAL MOTORS COMPANY

6. Use a small flat-blade tool to move the front TPA to the preset position, outboard approximately 0.125 in. (3 mm).

NOTE: The front TPA cannot be removed from the connector. Only move it to the preset position.

7. Use a small flat-blade tool to completely remove the rear TPA from the connector.

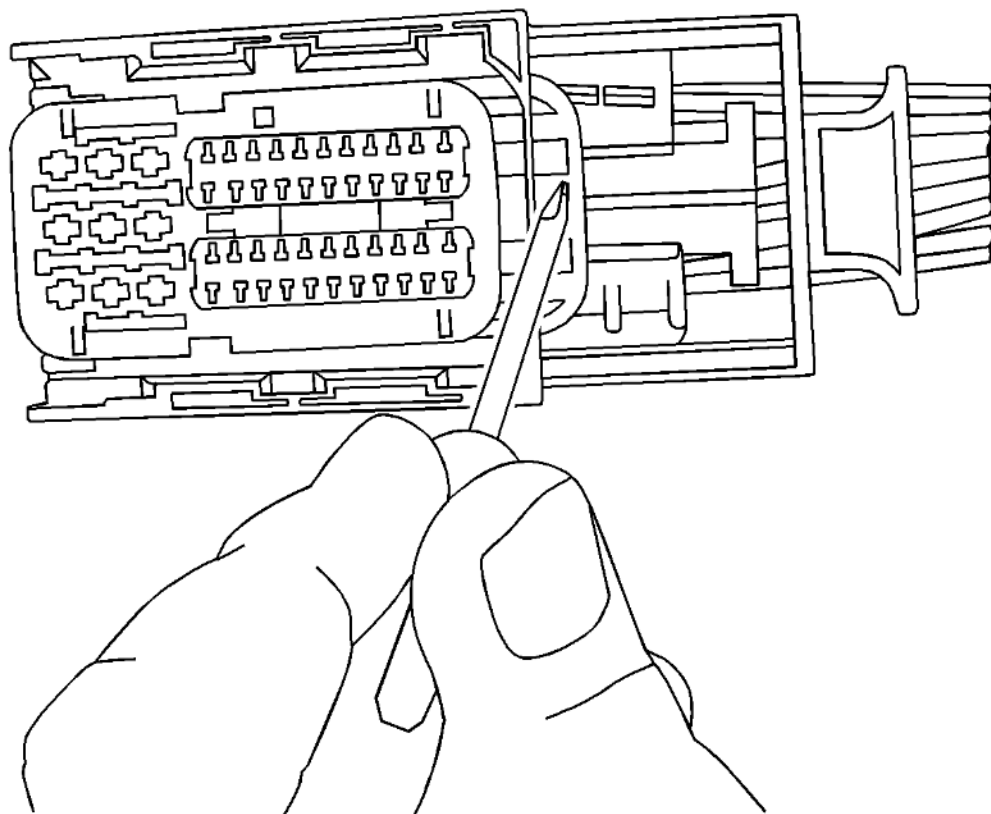


Fig. 115: Using Small Flat-Blade Tool To Remove Rear TPA
Courtesy of GENERAL MOTORS COMPANY

8. Use the J-38125-24 or the J-38125-560 tool to release the terminals by inserting the tool into the terminal release cavity.

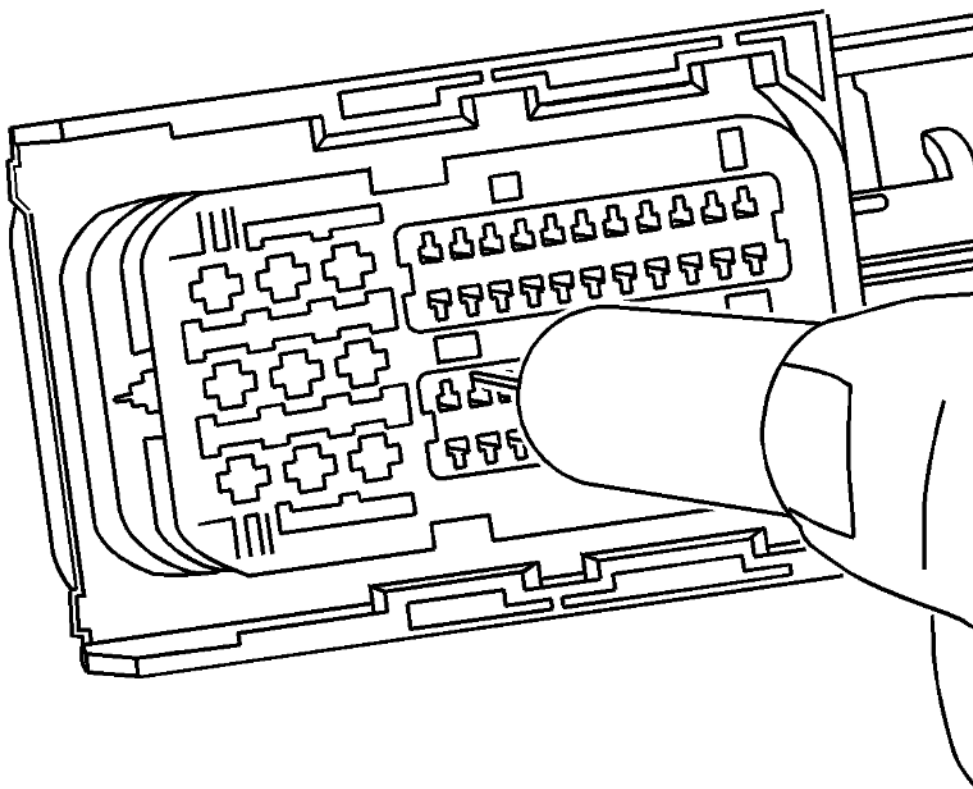


Fig. 116: Releasing Terminals

Courtesy of GENERAL MOTORS COMPANY

9. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.
10. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.

KOSTAL CONNECTORS (TRANSMISSION)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-28 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. While depressing the lock, twist and remove the connector from the component.

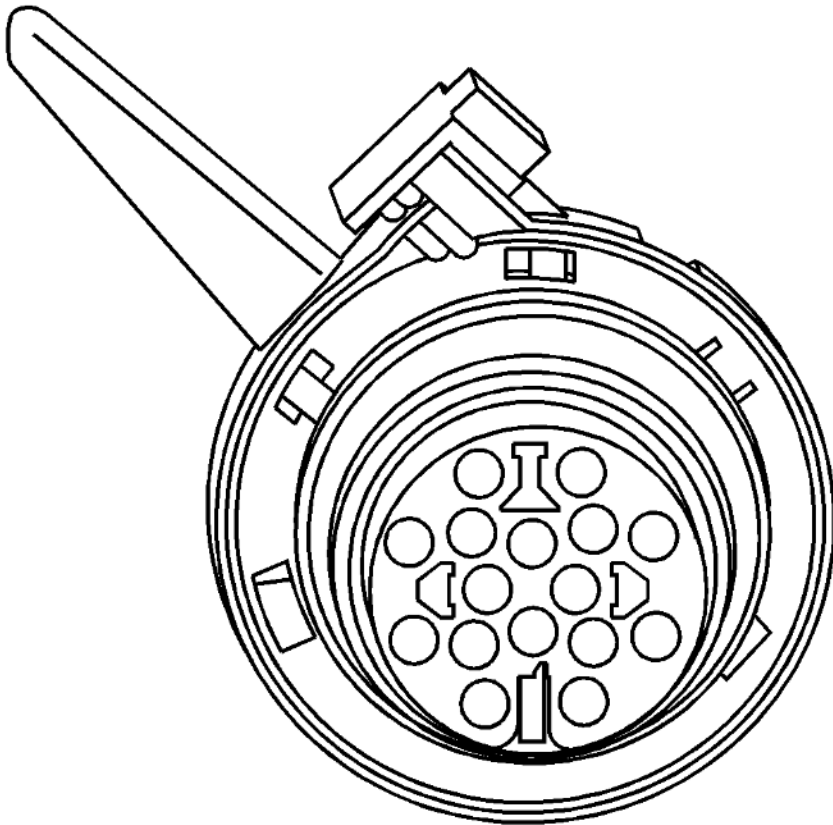


Fig. 117: View Of Connector & Lock
Courtesy of GENERAL MOTORS COMPANY

2. Locate the terminal position assurance (TPA).

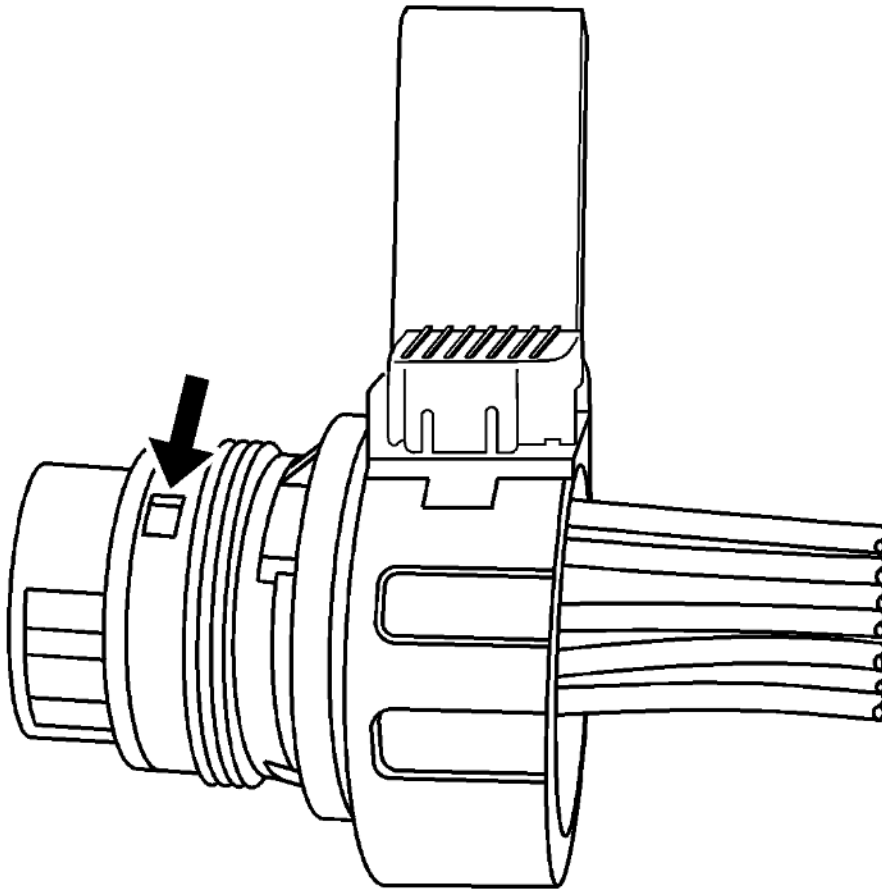


Fig. 118: View Of Terminal Position Assurance (TPA)
Courtesy of GENERAL MOTORS COMPANY

3. Use a small flat-blade tool to push the TPA until it bottoms out.

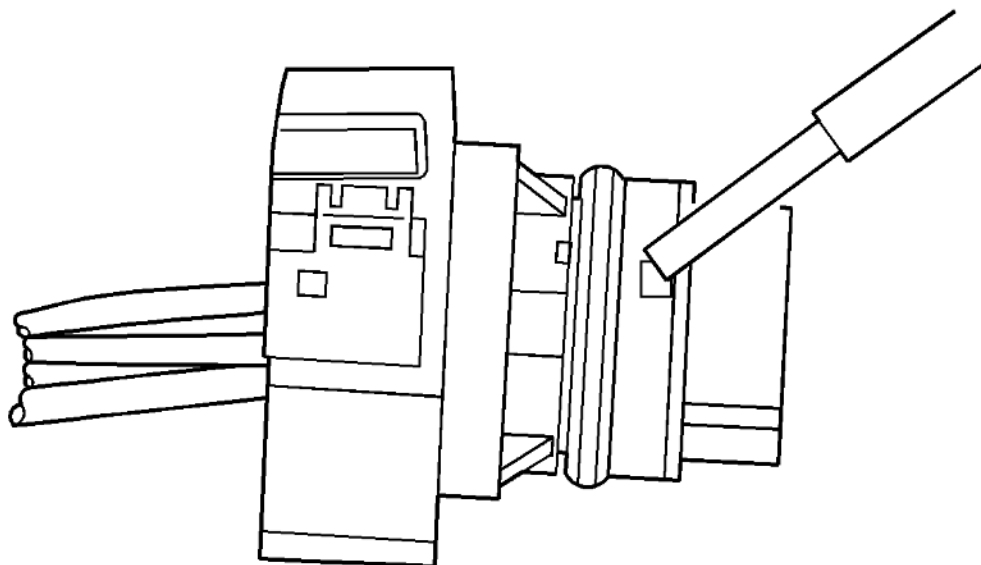


Fig. 119: View Of TPA & Flat-Bladed Tool
Courtesy of GENERAL MOTORS COMPANY

NOTE: The TPA cannot be removed from the connector while there are terminals present in the connector body.

4. Use the J-38125-28 tool to release the terminals by inserting the tool into the terminal cavity as shown in the graphic.

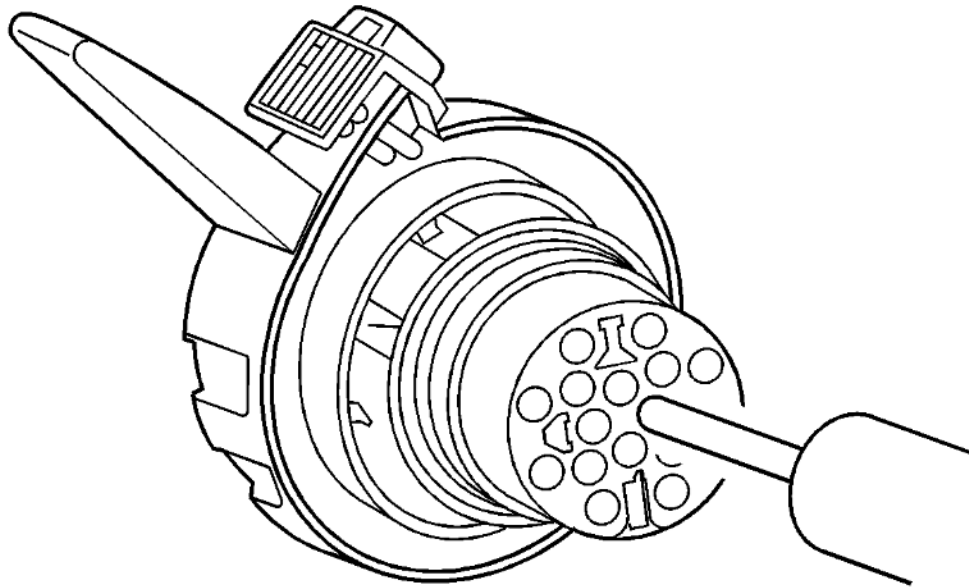


Fig. 120: Releasing Terminals

Courtesy of GENERAL MOTORS COMPANY

5. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.
6. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.

Terminal Insertion Procedure

After the terminal is replaced, perform the following procedure in order to insert the terminal.

1. Slide the new terminal into the correct cavity at the back of the connector.
2. Push the terminal into the connector until it locks into place. The new terminal should be even with the other terminals. Ensure that the terminal is locked in place by gently pulling on the wire.
3. Locate the TPA.

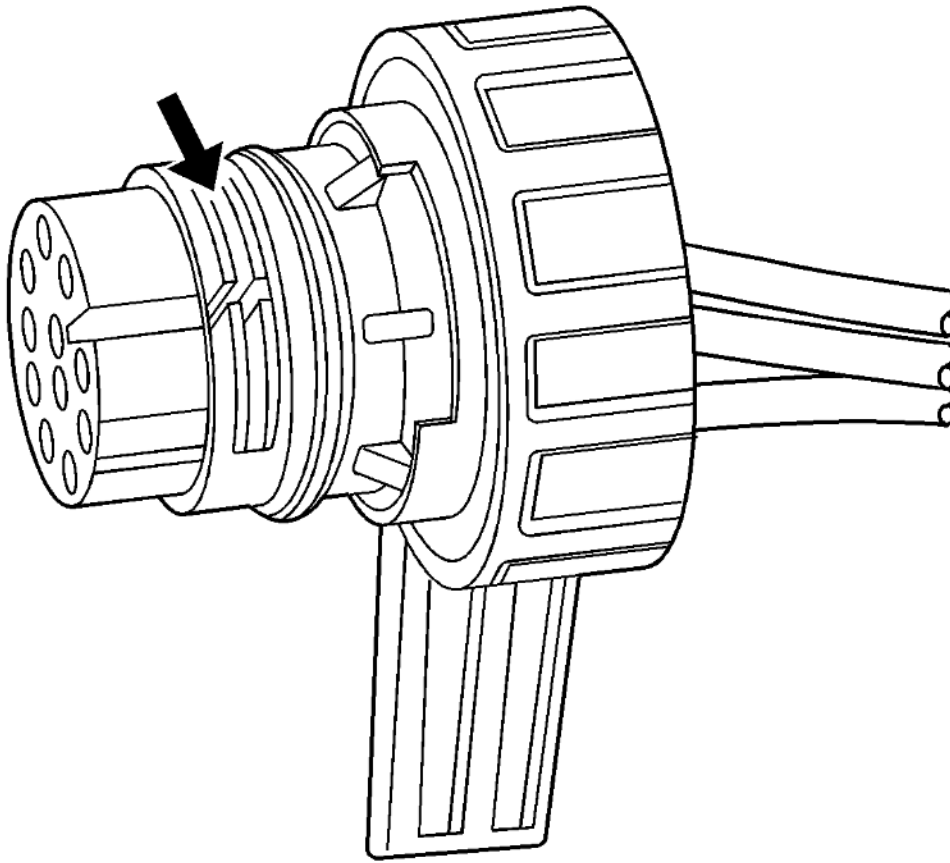


Fig. 121: Locating Terminal Position Assurance (TPA)
Courtesy of GENERAL MOTORS COMPANY

4. Use a small flat-blade tool to push the TPA until it bottoms out.

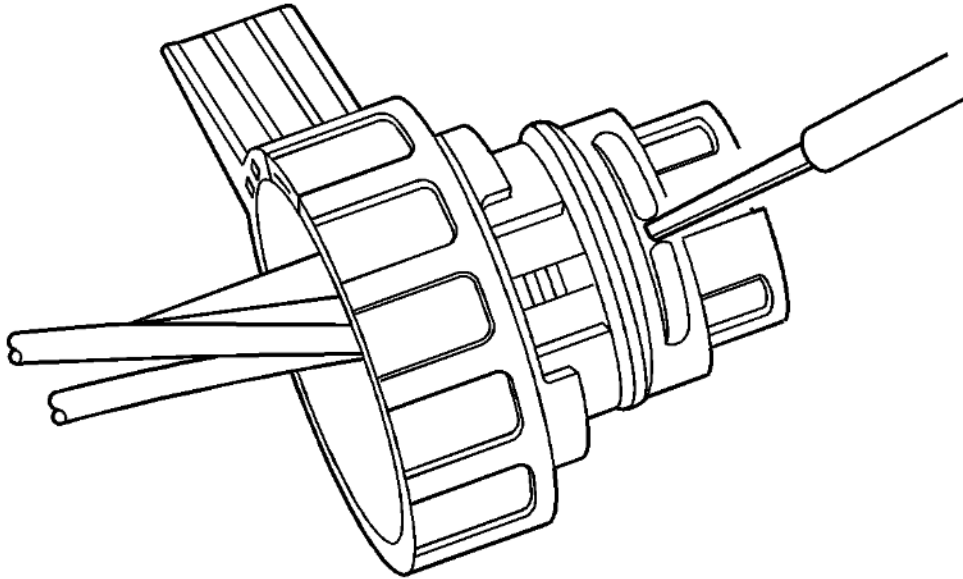


Fig. 122: View Of TPA & Flat-Bladed Tool
Courtesy of GENERAL MOTORS COMPANY

5. Ensure the TPA is fully seated. The TPA should be centered and flush with the connector body when viewed.

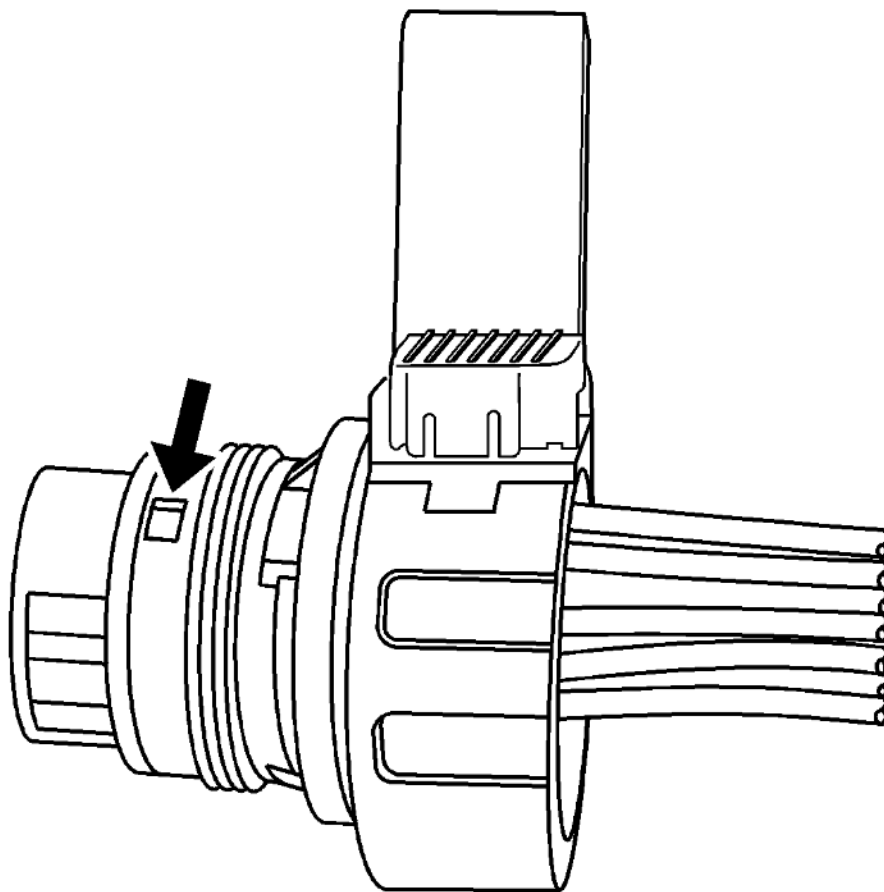


Fig. 123: View Of Terminal Position Assurance (TPA)
Courtesy of GENERAL MOTORS COMPANY

MOLEX CONNECTORS

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-213 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Locate the connector position assurance (CPA) on the top of the wire dress cover. Slide the CPA forward.

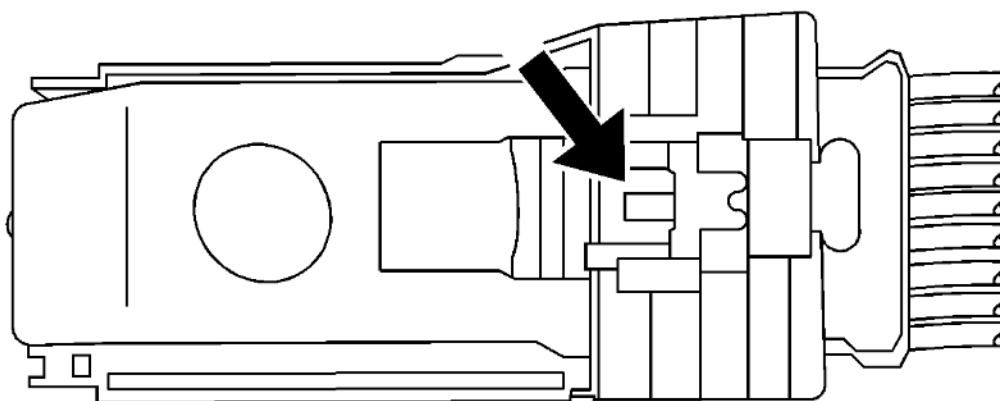


Fig. 124: Identifying Lever Lock Release Tab
Courtesy of GENERAL MOTORS COMPANY

2. Slide the lever lock forward while pressing down on the lever lock release tab.

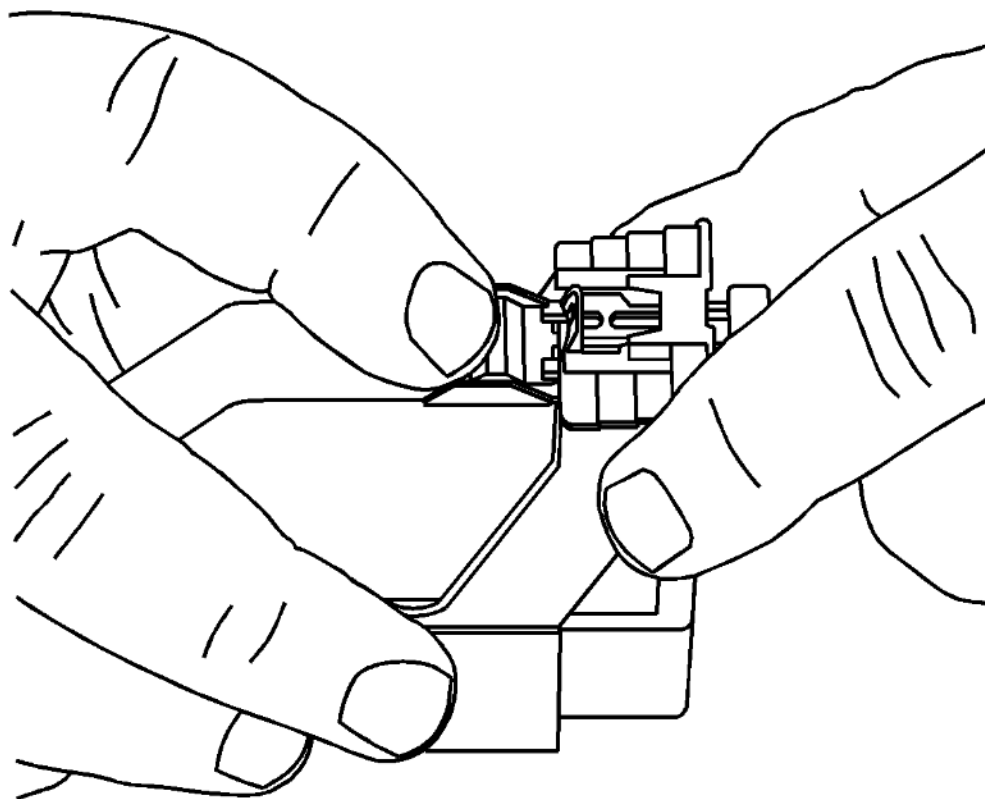


Fig. 125: View Of Lever In Full Forward Position
Courtesy of GENERAL MOTORS COMPANY

3. The lever should be in the full forward position.

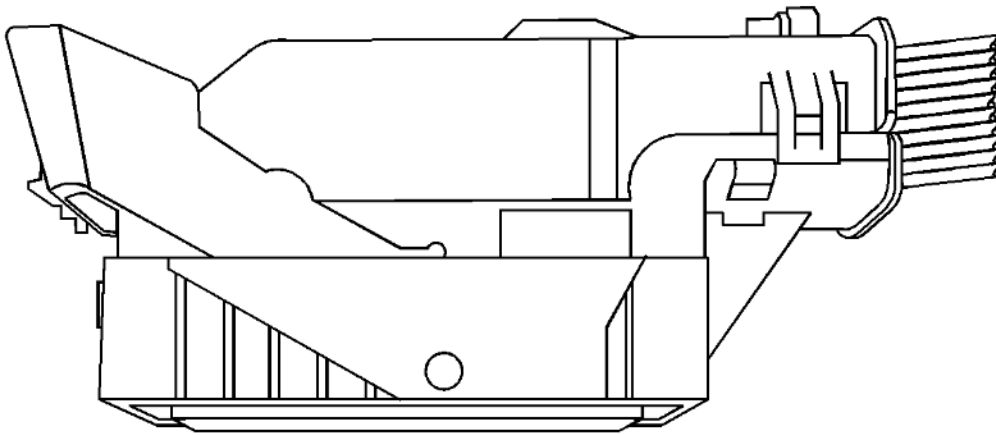


Fig. 126: View Of CPA Connector
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect the connector from the component.
5. Remove the dress cover by using a flat bladed tool to release the dress cover locking tabs and lift up on the dress cover.

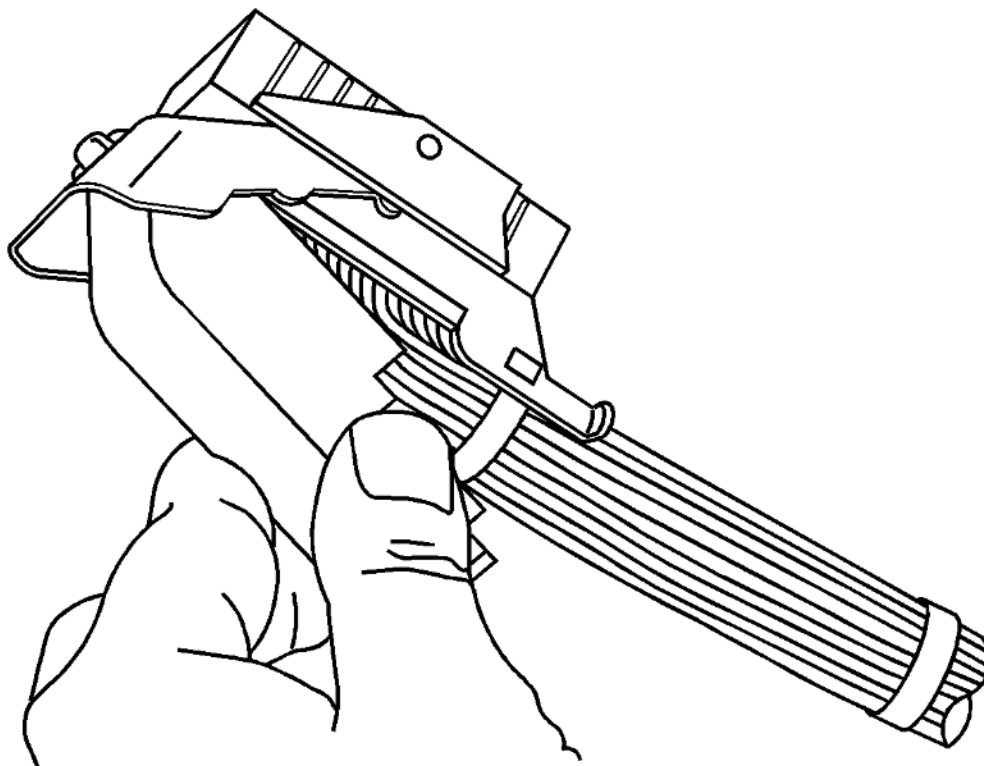
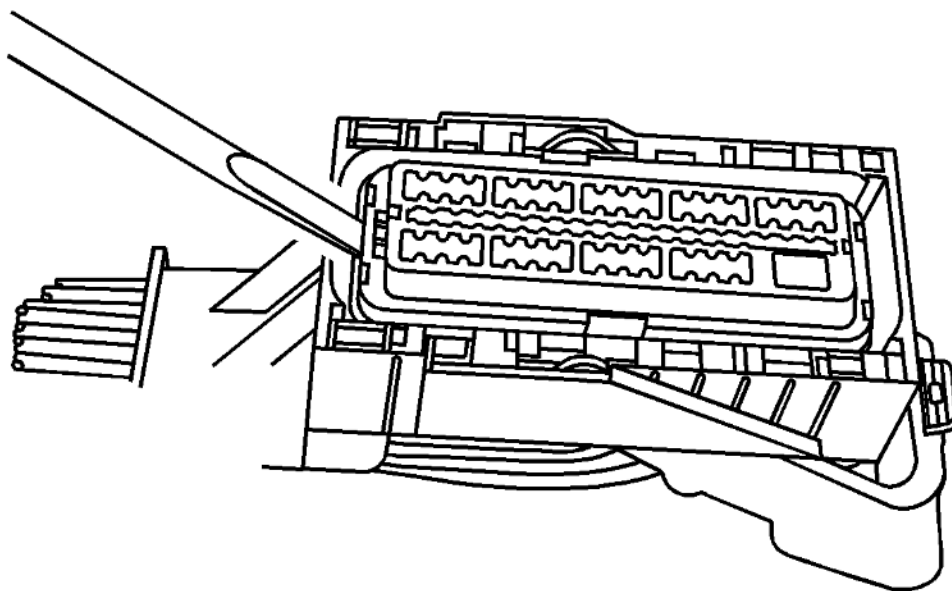


Fig. 127: View Of Dress Cover

Courtesy of GENERAL MOTORS COMPANY

6. Cut the tie wrap that holds the wires to the connector body.
7. Use a small flat-blade tool to pry one side of the nose piece up to the pre-stage position. When the nose piece is in the pre-staged position, the nose piece will be raised above the connector body the length of the step in the nose piece.

**Fig. 128: Prying One Side Of Nose Piece**

Courtesy of GENERAL MOTORS COMPANY

8. Use a small flat-blade tool to pry the other side of the piece to the pre-stage position. If the nose piece is higher than the first step in the nose piece, gently push down on the nose piece until it meets with resistance from the connector body, you should feel the nose piece click into position.

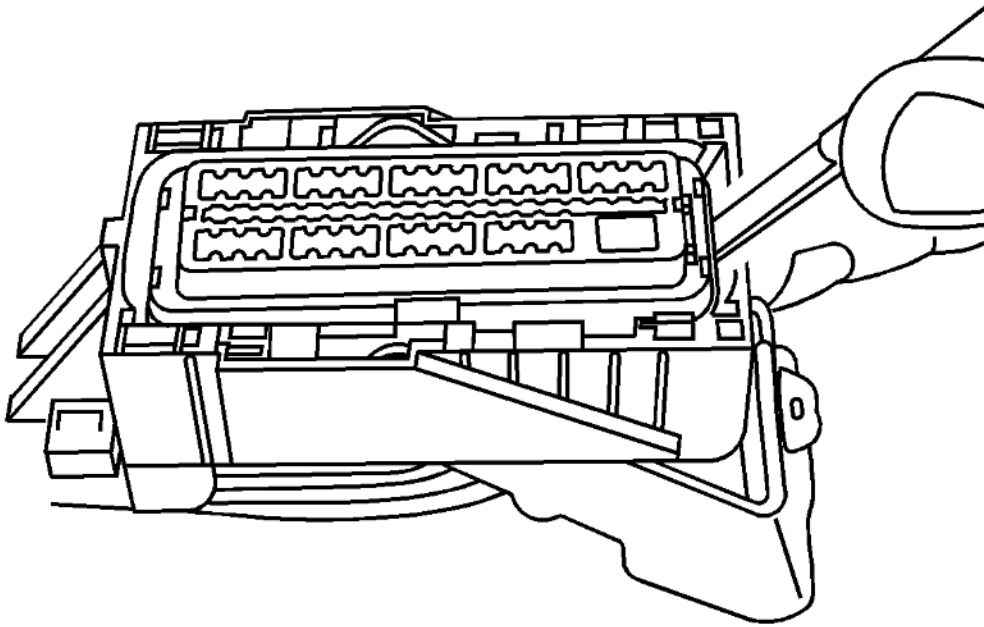


Fig. 129: Prying Side Of Nose Piece

Courtesy of GENERAL MOTORS COMPANY

9. Insert the J-38125-213 into the small terminal release hole on the nose piece and gently pull on the back of the wire.

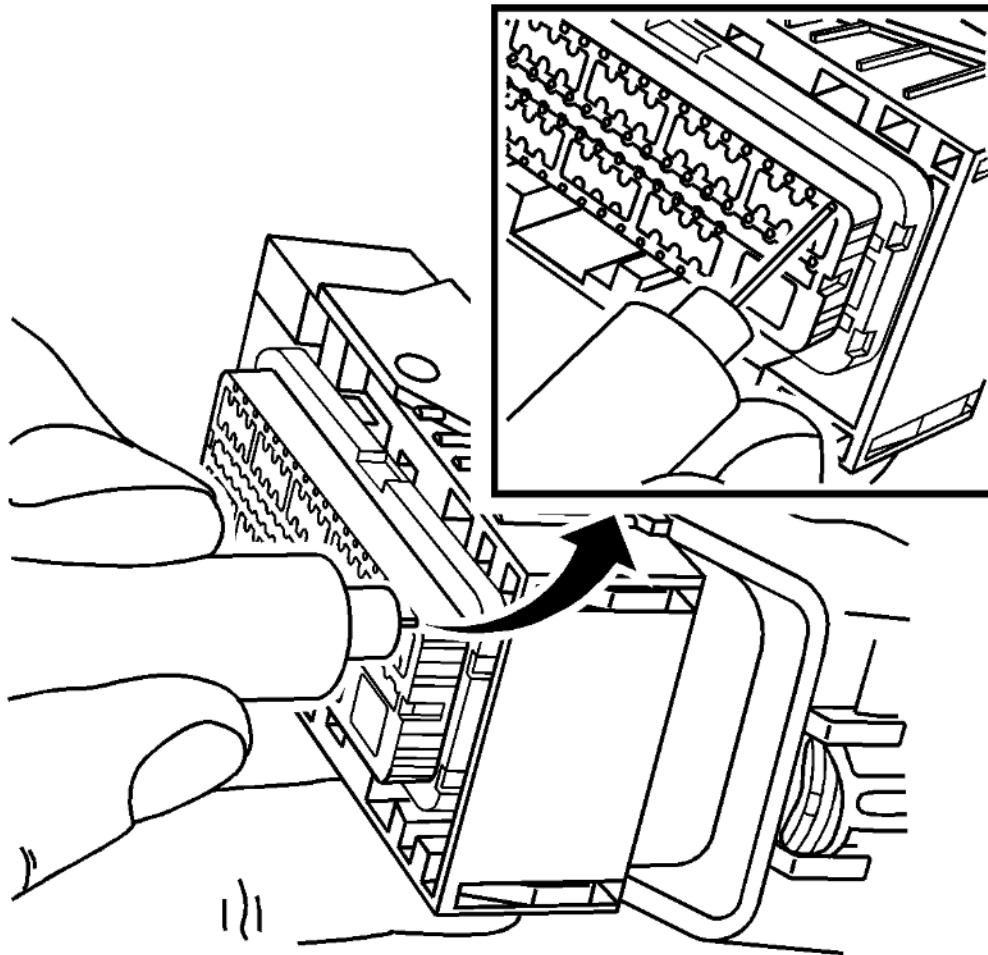


Fig. 130: View Of J38125-213 & Small Terminal Release Hole
 Courtesy of GENERAL MOTORS COMPANY

10. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
11. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

Terminated Lead Repair

1. Remove the terminal.
2. Find the appropriate terminated lead.
3. Use the appropriate splice sleeves depending on the gauge size.
4. Refer to **Splicing Copper Wire Using Splice Sleeves**.

Terminal Insertion Procedure

After the terminal is replaced, perform the following procedure in order to insert the terminal.

1. Slide the new terminal into the correct cavity at the back of the connector.
2. Push the terminal into the connector until it locks into place. The new terminal should be even with the other terminals. Insure that the terminal is locked in place by gently pulling on the wire.
3. To assemble the connector, reverse the connector disassembly procedure.

MOLEX CONNECTORS (SIR)

Removal Procedure

NOTE: The orange or yellow connector position assurance (CPA) must be released first to disconnect or to connect the connector.

1. Lift the orange or yellow CPA vertically (avoid lifting on an angle to the connector) approximately 4 mm to release the connector. Use a small flat-bladed tool to help release the CPA. The CPA may also be released manually without any tools.

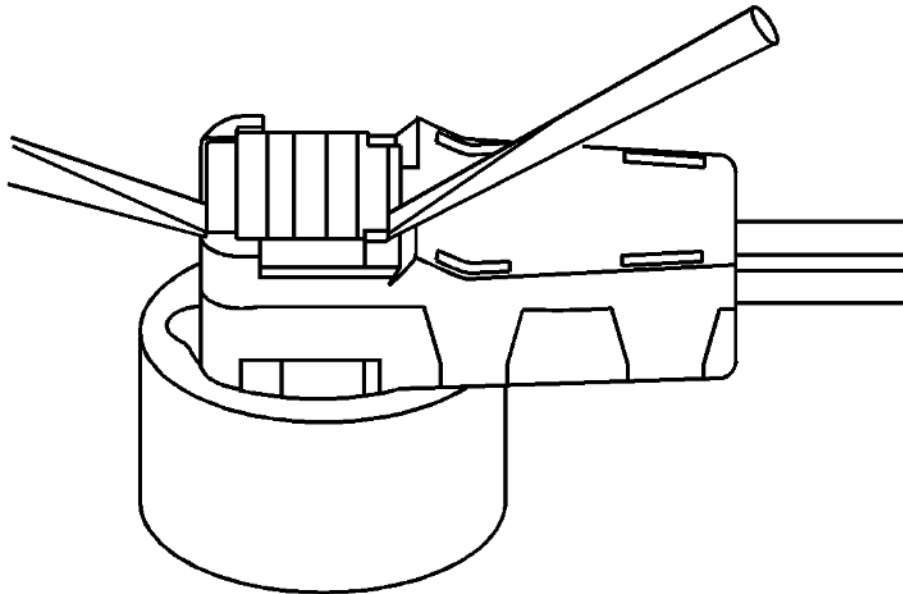


Fig. 131: View Of Lifting Orange CPA

Courtesy of GENERAL MOTORS COMPANY

2. Grab the connector on both sides and lift vertically to disconnect the connector.

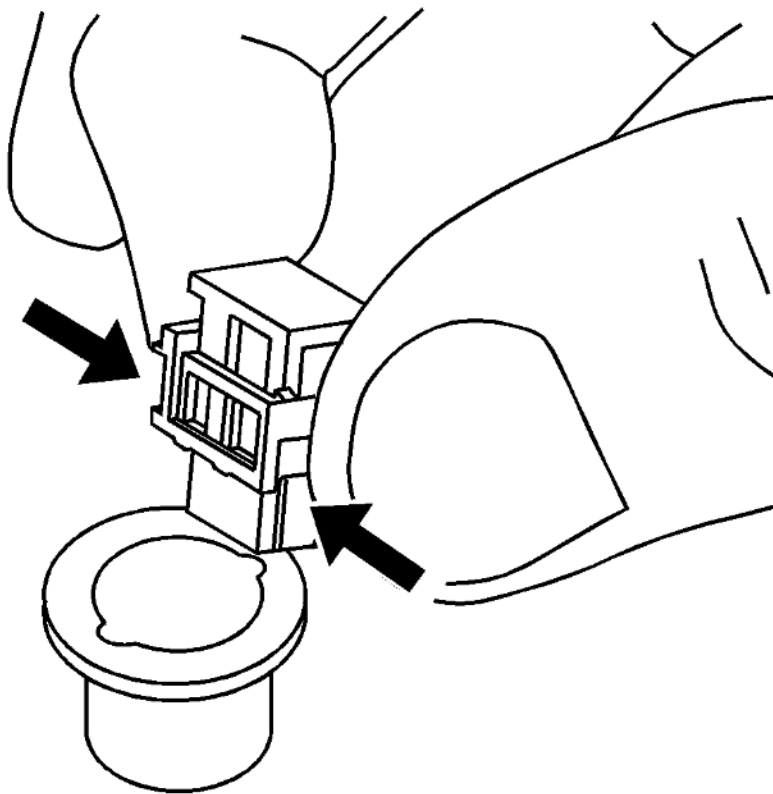


Fig. 132: Grabbing Connector On Both Sides
Courtesy of GENERAL MOTORS COMPANY

Installation Procedure

1. The CPA should be approximately 4 mm above the yellow cover before installing the connector. If not, use a small flat-bladed tool to help release the CPA. The CPA may also be released manually without any tools.

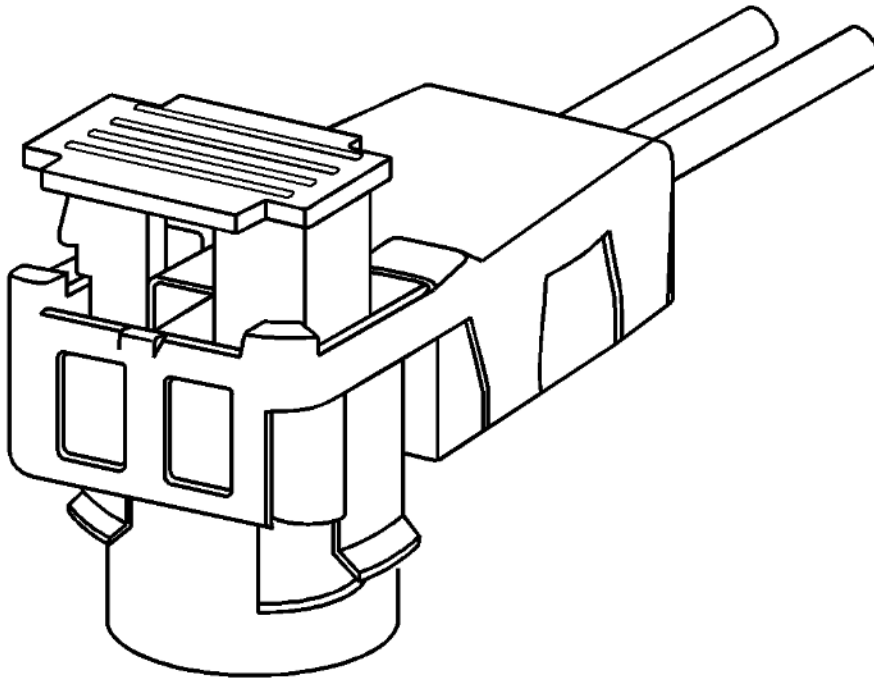


Fig. 133: Orange CPA

Courtesy of GENERAL MOTORS COMPANY

2. Line up the connector key tabs with the initiator key slots. Grab the connector on both sides and push down into the initiator connector sub assembly until fully seated.

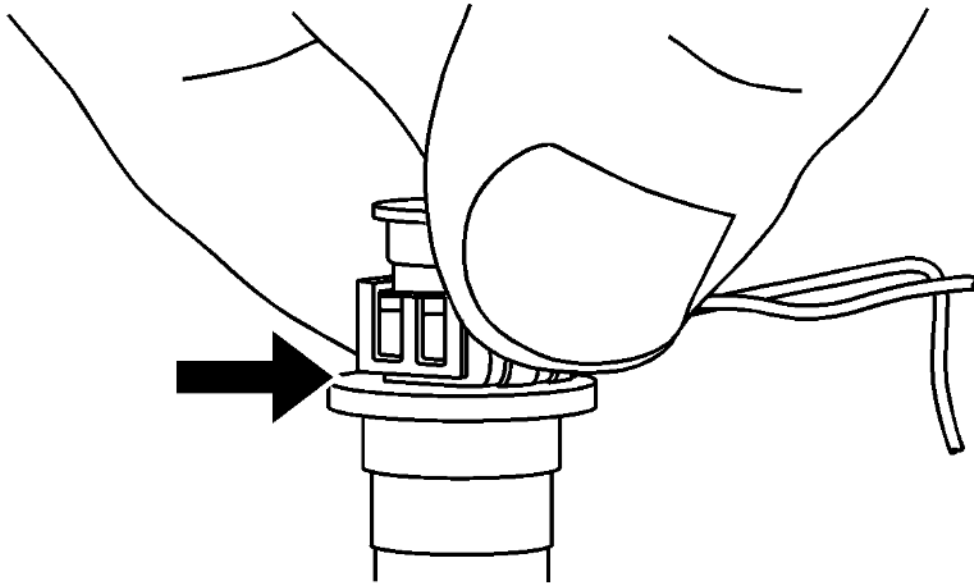


Fig. 134: Seating Connector Sub-Assembly
Courtesy of GENERAL MOTORS COMPANY

3. After the connector is fully seated, push the CPA down with your thumb until the CPA is touching the yellow cover on the connector.

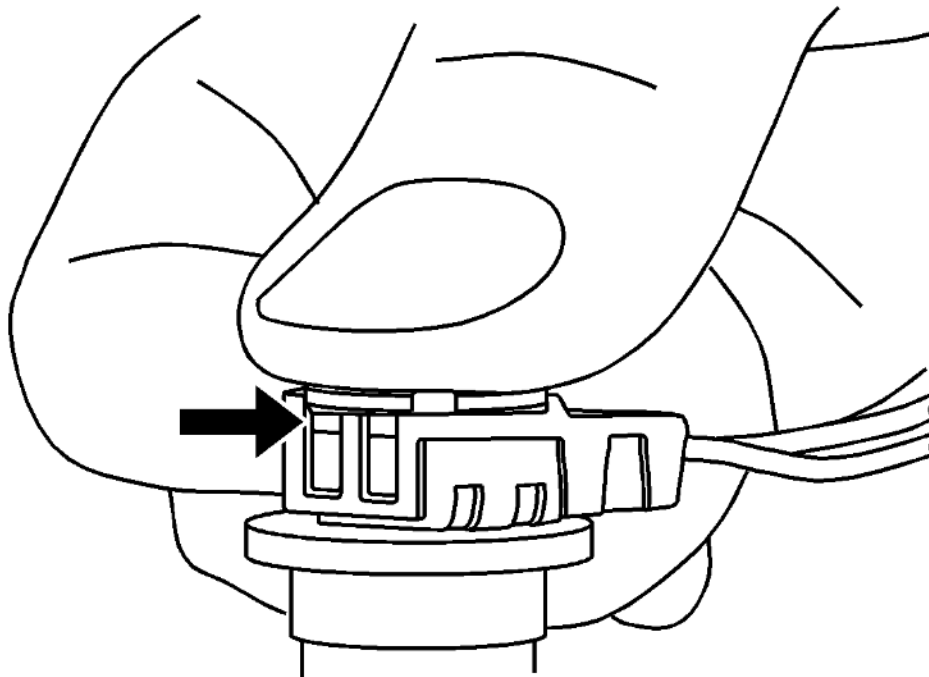


Fig. 135: Pushing CPA Down

Courtesy of GENERAL MOTORS COMPANY

SUMITOMO CONNECTORS

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-12A Terminal Release Tool
- J-38125-552 Terminal Release Tool
- J-38125-553 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Slide the lever lock forward while pressing down on the lever lock release tab.

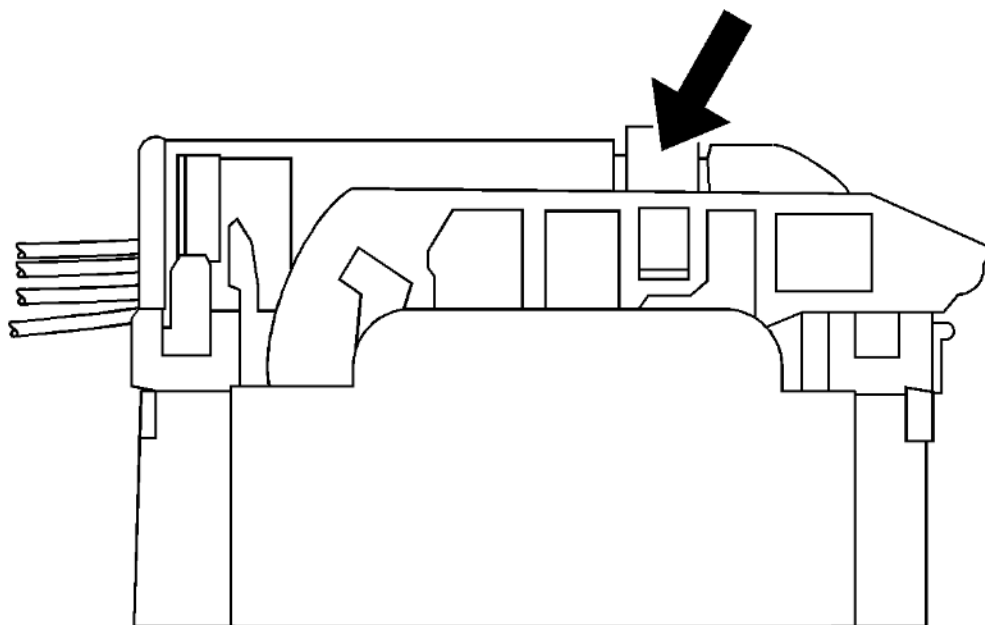


Fig. 136: Identifying Lever Lock

Courtesy of GENERAL MOTORS COMPANY

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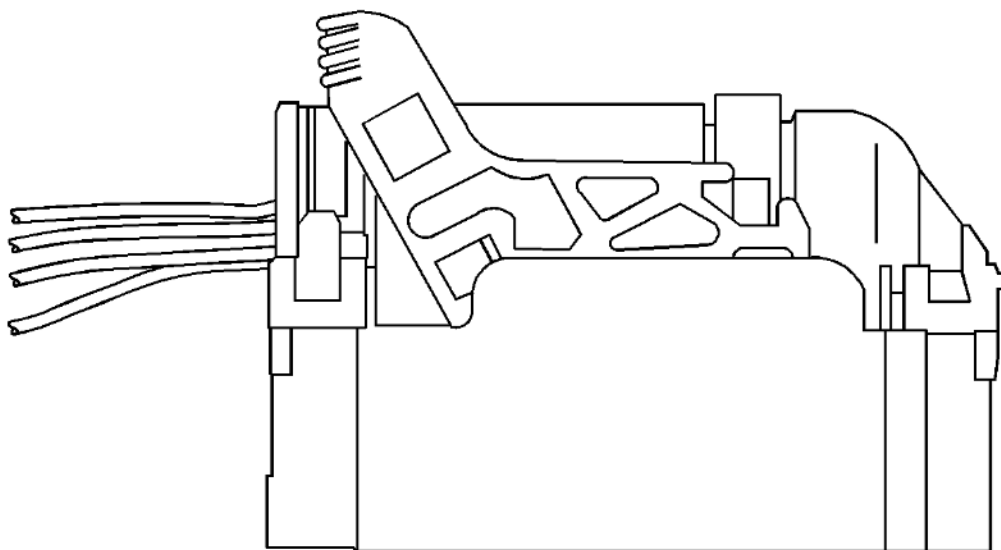


Fig. 137: View Of Lever Lock In Forward Position
Courtesy of GENERAL MOTORS COMPANY

2. Disconnect the connector from the component.
3. Remove the dress cover by using a flat-blade tool to release the connector locking tabs and pulling off the dress cover.

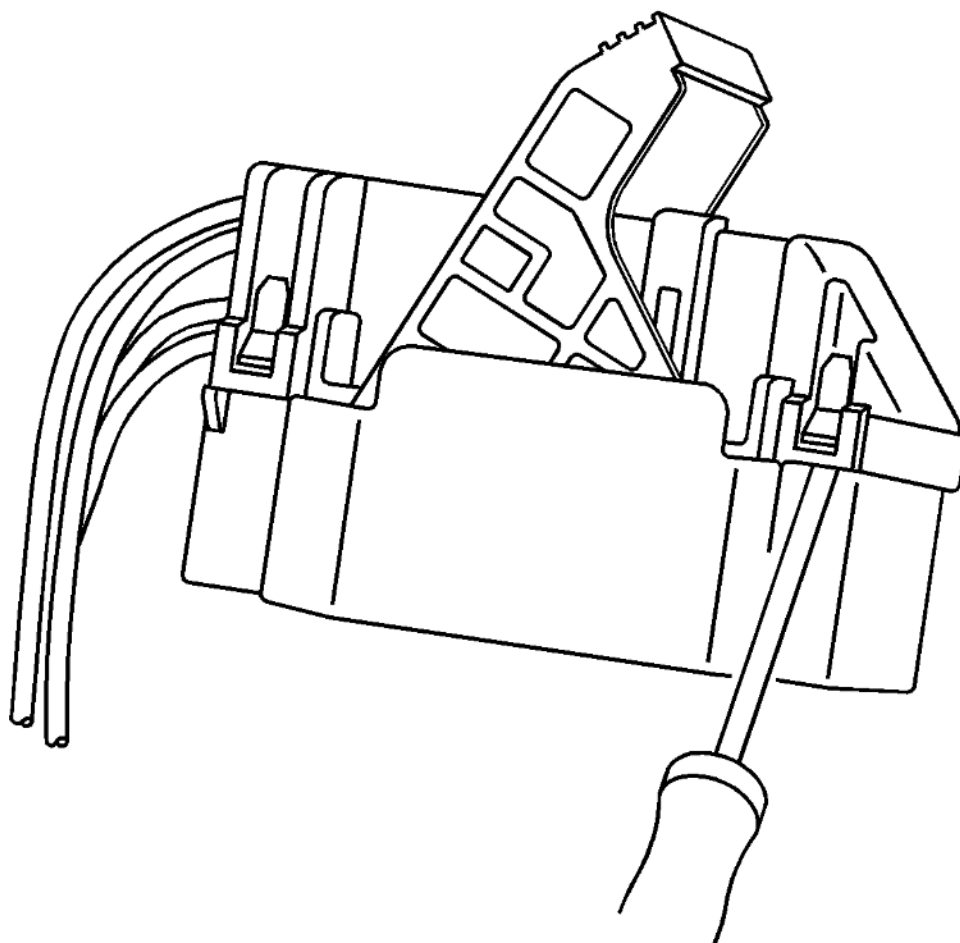


Fig. 138: View Of Connector Locking Tabs

Courtesy of GENERAL MOTORS COMPANY

4. Relieve the tension on the nose piece retainers by inserting J-38125-12A into the single retainer slot on the end of the nose piece and gently prying out the locking tab. Repeat the process for both of the nose piece locking tabs on the opposite side of the nose piece.

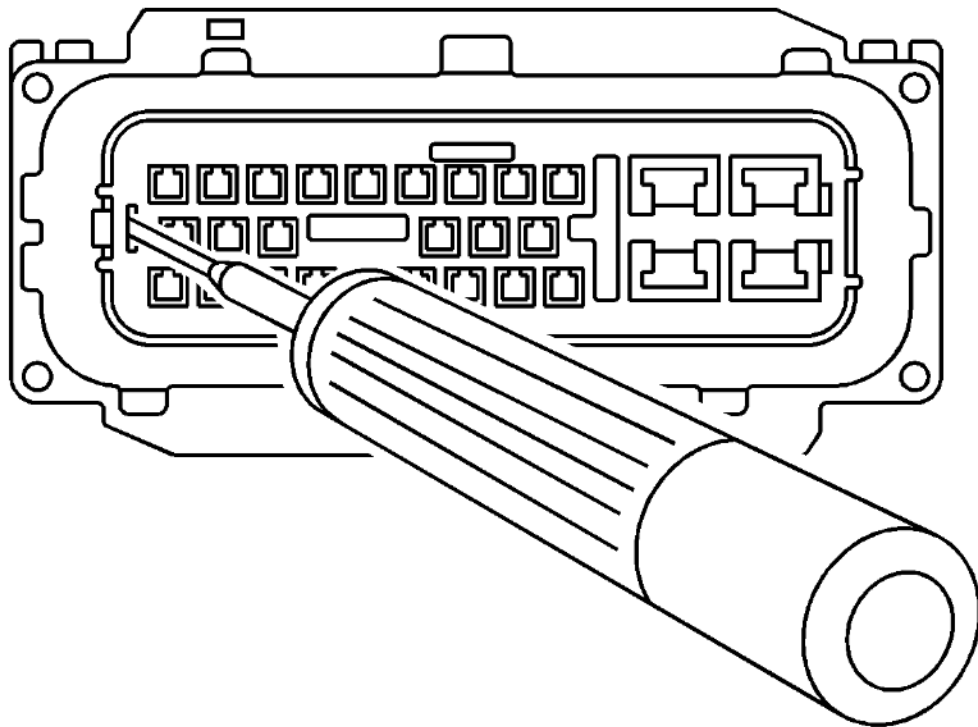
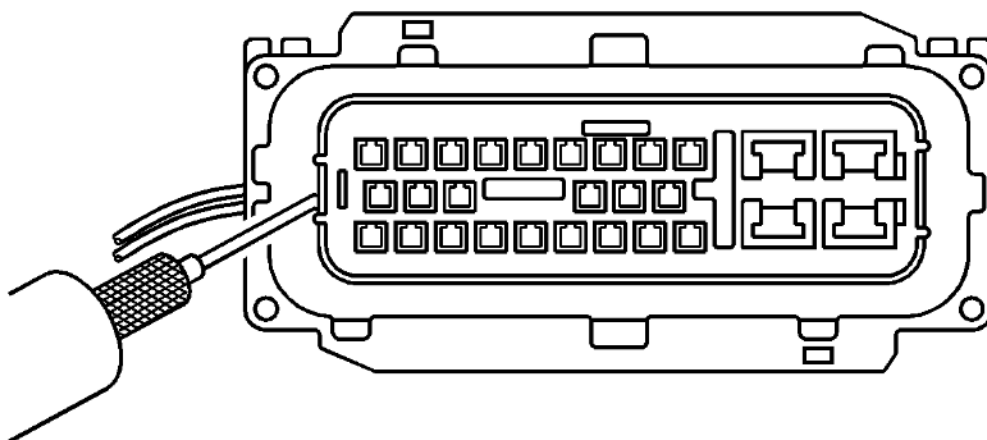


Fig. 139: Inserting J-38125-12A (12094429) Into Single Retainer Slot
Courtesy of GENERAL MOTORS COMPANY

5. Once the nose piece retainers are relaxed, use the J-38125-552 to pull up the nose piece by hooking the tool under the nose piece and pulling up. The nose piece should raise slightly.

**Fig. 140: Pulling Up Nose Piece**

Courtesy of GENERAL MOTORS COMPANY

6. On the opposite side of the nose piece, use the J-38125-552 pull up the nose piece by hooking the tool under the nose piece and pulling up. The nose piece should release completely. If the nose piece does not come off, repeat the procedure on the opposite side.

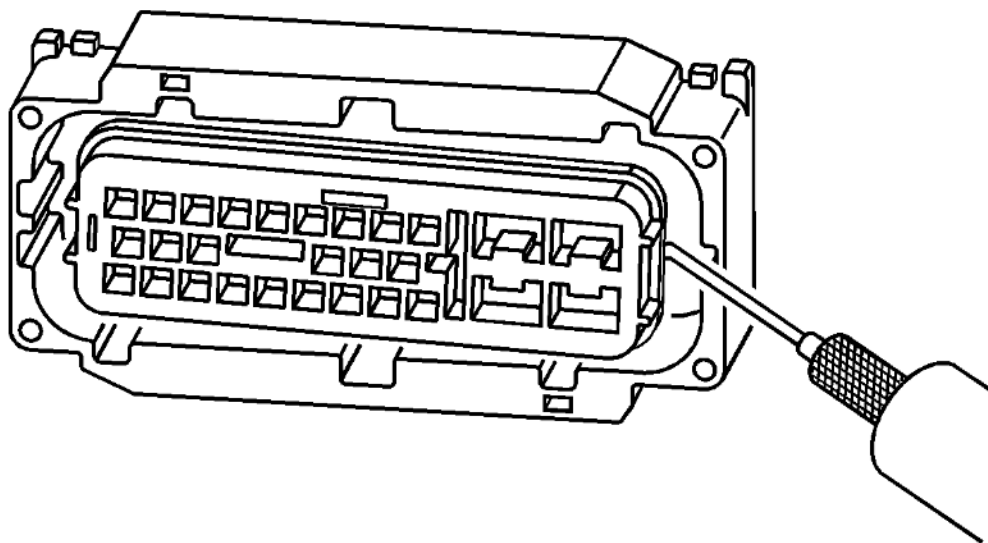


Fig. 141: Pulling Up Other End Of Nose Piece
Courtesy of GENERAL MOTORS COMPANY

7. The illustration below identifies the entry canal where the terminal release tool will be inserted and the terminal cavity.

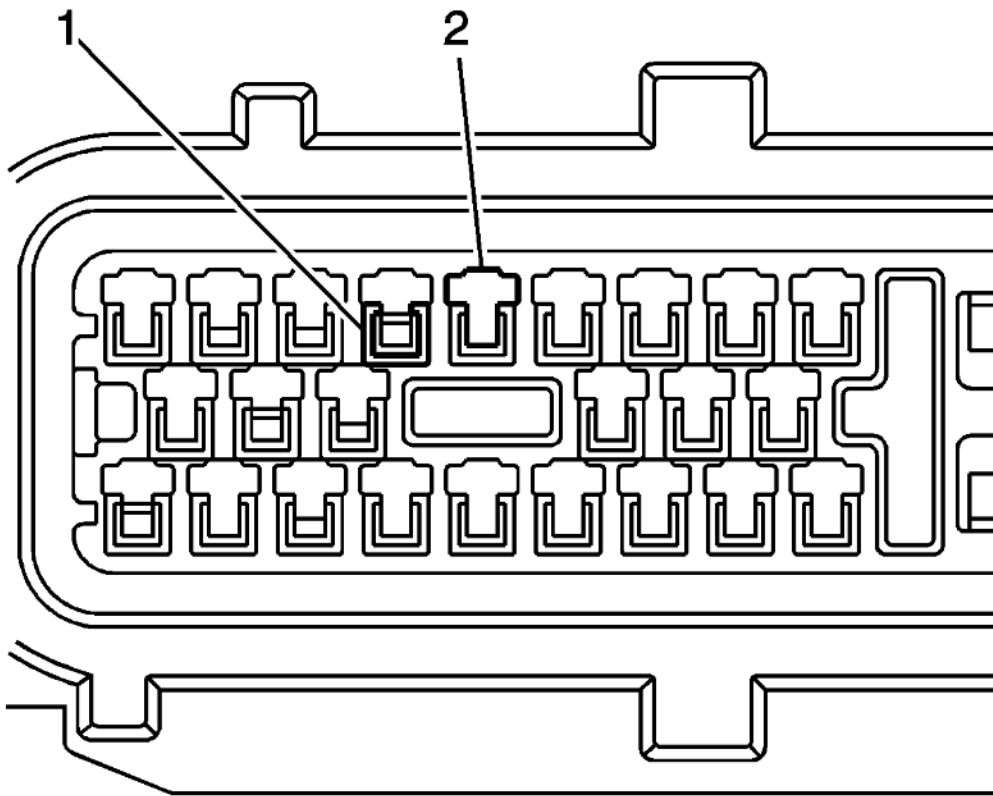


Fig. 142: View Of Terminal & Entry Canal

Courtesy of GENERAL MOTORS COMPANY

- Terminal (1)
 - Entry Canal (2)
8. Insert the J-38125-553 tool into the entry canal and pry up on the terminal retainer. The terminal retainer is a small plastic piece on the top of the terminal. The terminal retainer must be held up while the terminal is pulled out of the connector.

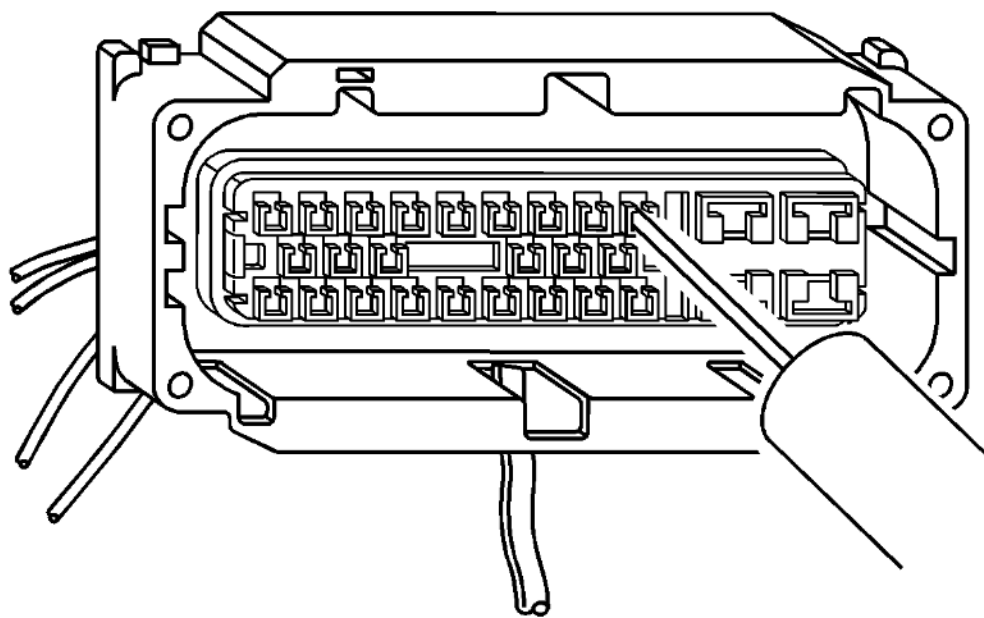


Fig. 143: Inserting J-38125-553 (15315247) Tool Into Entry Canal
Courtesy of GENERAL MOTORS COMPANY

9. This illustration shows a cutaway view of the connector to aid the technician in releasing the terminal retainer.

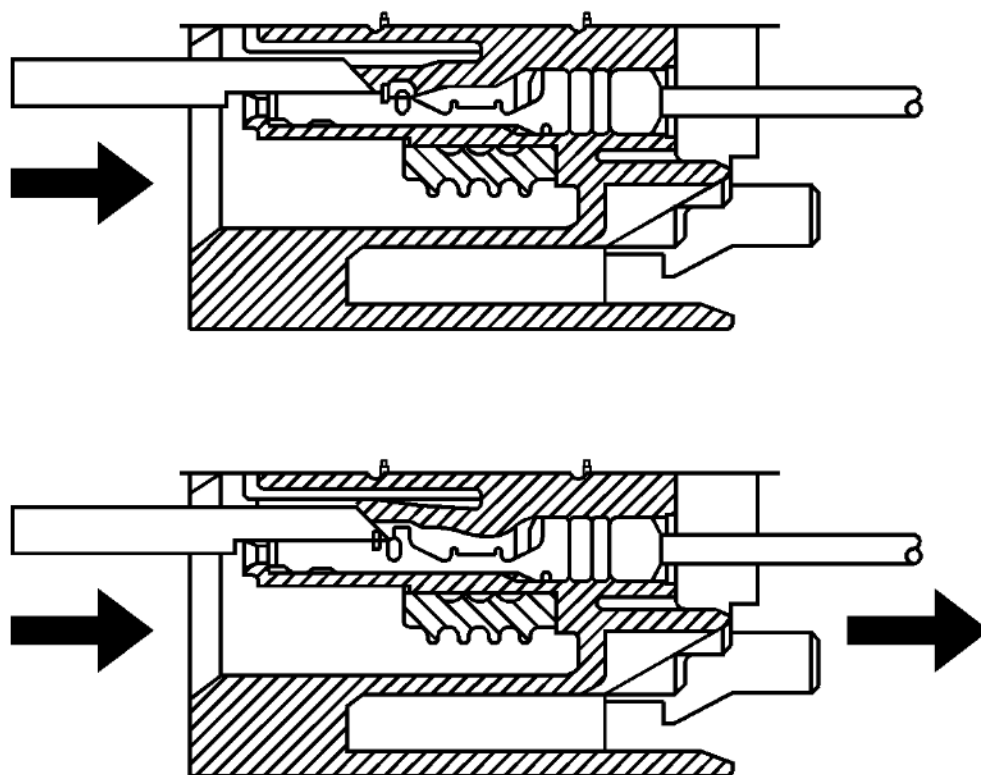


Fig. 144: Cutaway View Of Connector
Courtesy of GENERAL MOTORS COMPANY

10. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
11. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

Terminal Insertion Procedure

After the terminal is replaced, perform the following procedure in order to insert the terminal.

1. Slide the new terminal into the correct cavity at the back of the connector.
2. Push the terminal into the connector until it locks into place. The new terminal should be even with the other terminals. Ensure that the terminal is locked in place by gently pulling on the wire.
3. To assemble the connector, reverse the connector disassembly procedure.

TYCO/AMP CONNECTORS (CM 42-WAY)

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-12A** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Locate the connector position assurance (CPA) on the connector body and pull the CPA out. The CPA is on the wire harness side of connector.
2. Disconnect the connector from the component.
3. Use a small flat-bladed tool to gently pry off the dress cover by inserting the tool under the cover opposite the harness side and prying up.

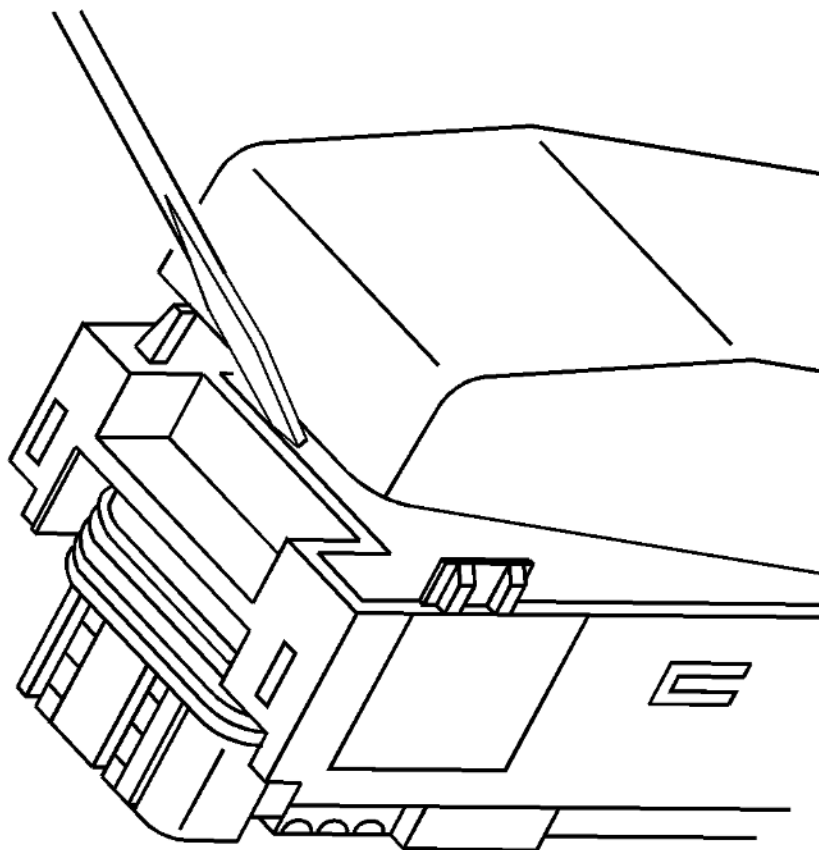
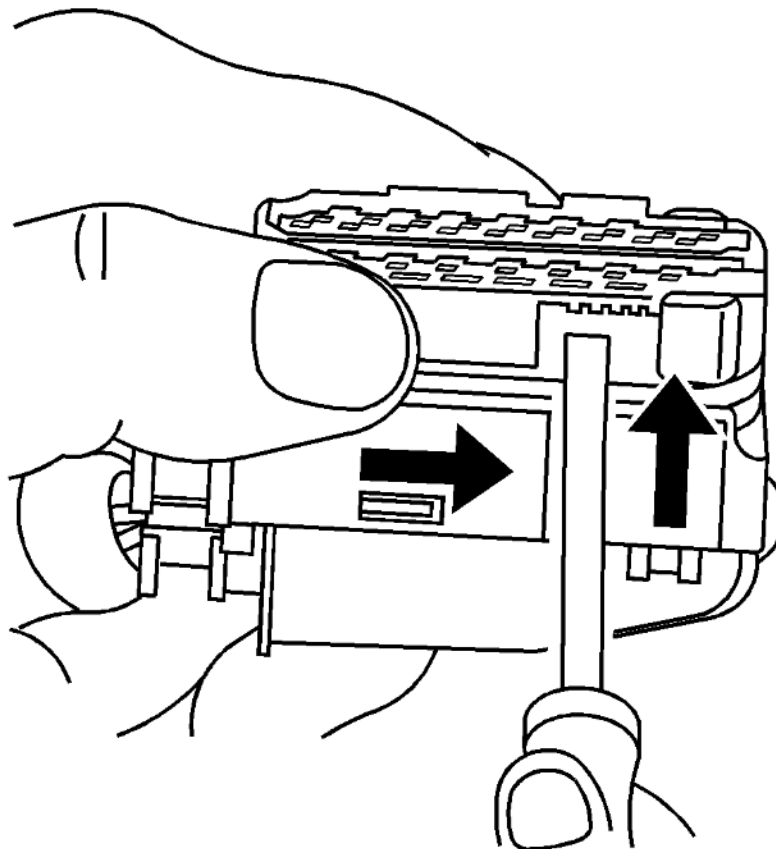


Fig. 145: View Of Dress Cover

Courtesy of GENERAL MOTORS COMPANY

4. Remove the cover.
5. Using a small flat-bladed tool, push on the side of the nose piece retainer while pushing the nose piece forward with your thumb. This will release the terminal position assurance (TPA).

**Fig. 146: View Of Terminal Position Assurance (TPA)****Courtesy of GENERAL MOTORS COMPANY**

6. Insert the **J-38125-12A** tool into the corresponding terminal release cavity. The release cavities are the 2 center rows of cavities on one half of the connector.

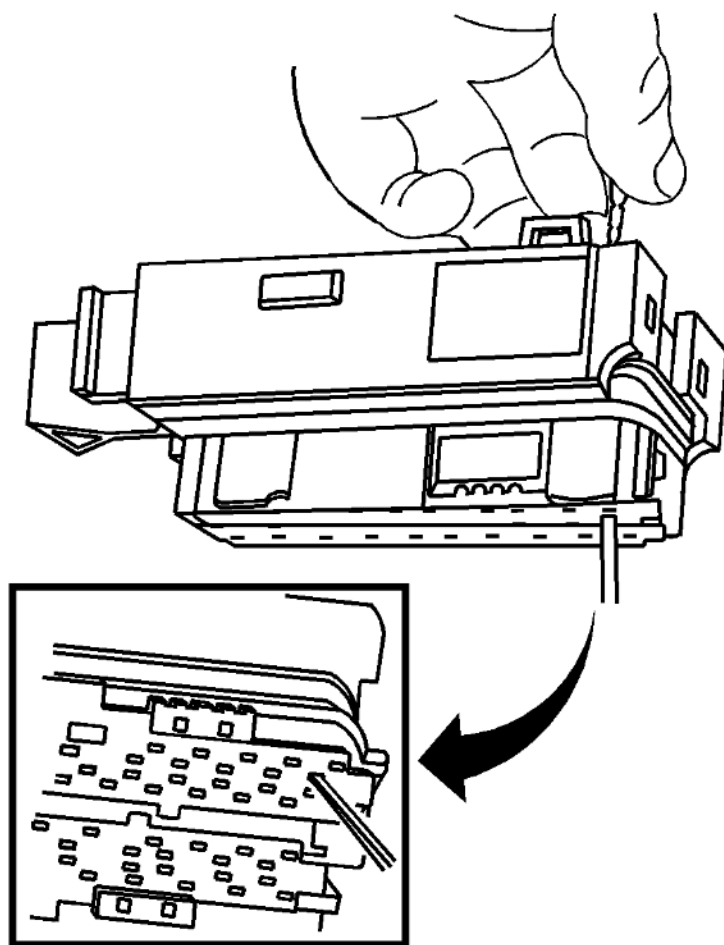


Fig. 147: View Of Inserting J 38125-12A Into Terminal Release Cavity
Courtesy of GENERAL MOTORS COMPANY

7. Pressing the **J-38125-12A** tool in the release cavity of the terminal you are removing, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.

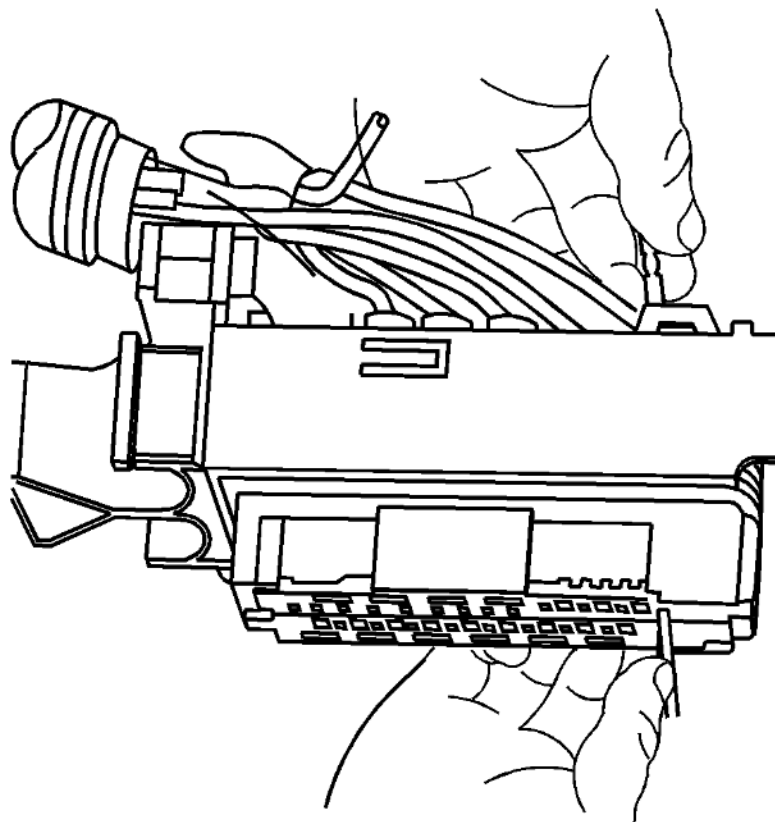


Fig. 148: Identifying Special Tool & Release Cavity
Courtesy of GENERAL MOTORS COMPANY

8. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
9. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

TYCO/AMP CONNECTORS (SENSOR)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-11A Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Disconnect the connector from the component.
2. Insert the J-38125-11A tool into the cavity on the lower right hand face of the connector until the terminal release tang access panel slides over.

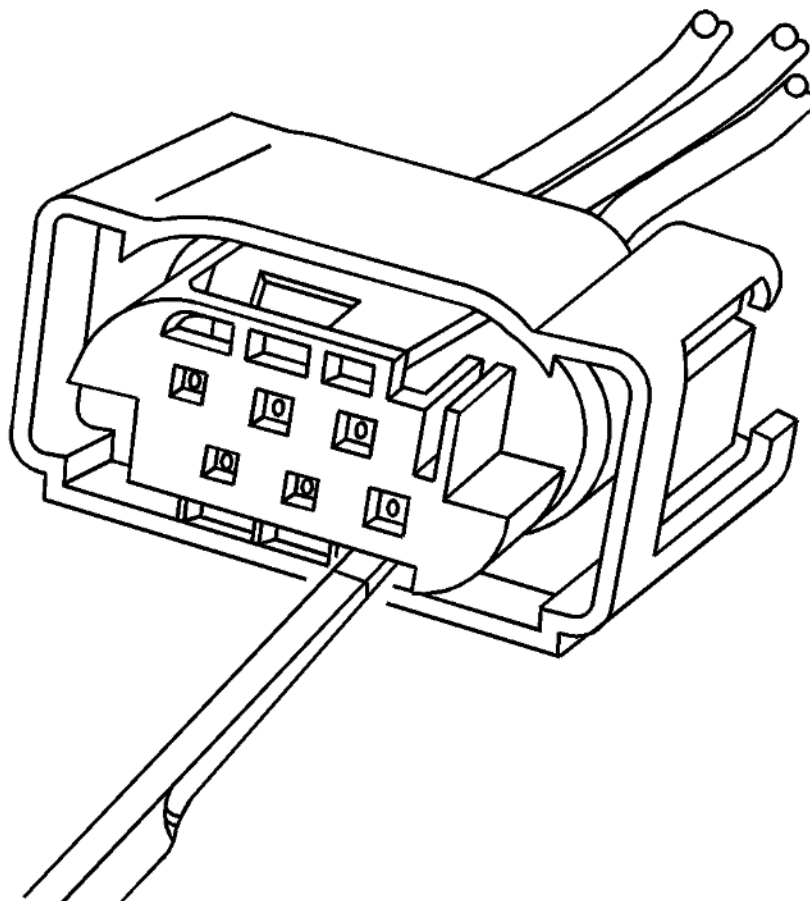


Fig. 149: View Of Inserting Special Tool Into Lower Right Face Cavity
Courtesy of GENERAL MOTORS COMPANY

3. Ensure that the terminal release tang access panel is in the correct location to access the terminals.

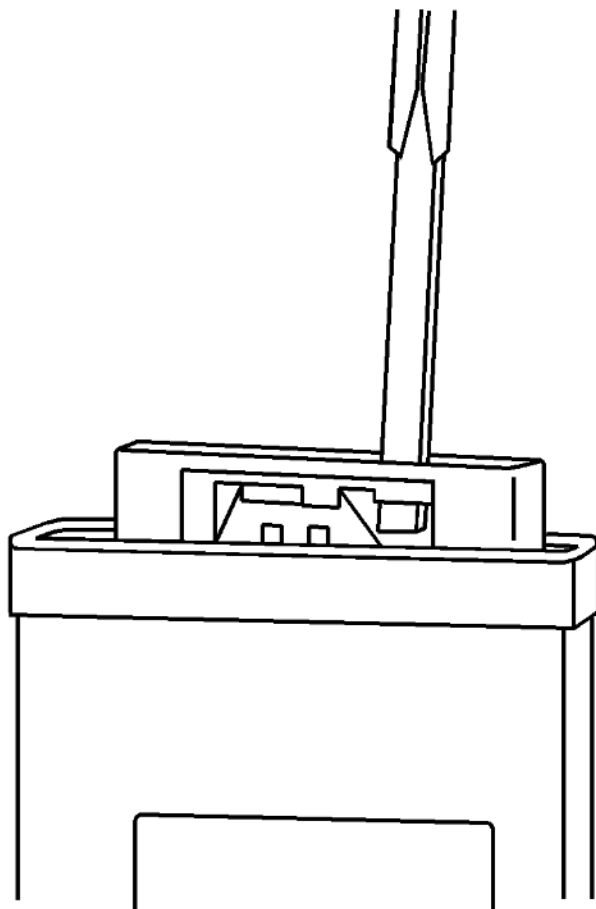


Fig. 150: Pushing Wire Side Of Terminal Toward Connector
Courtesy of GENERAL MOTORS COMPANY

4. Push the wire side of the terminal that is being removed toward the connector and hold it in position.
5. Insert the J-38125-11A into the terminal release tang access slot located behind the access panel of the connector and press down on the terminal while carefully pulling the terminal out of the connector. Always remember never use force when pulling a terminal out of a connector. If the terminal is difficult to remove, repeat the entire procedure.

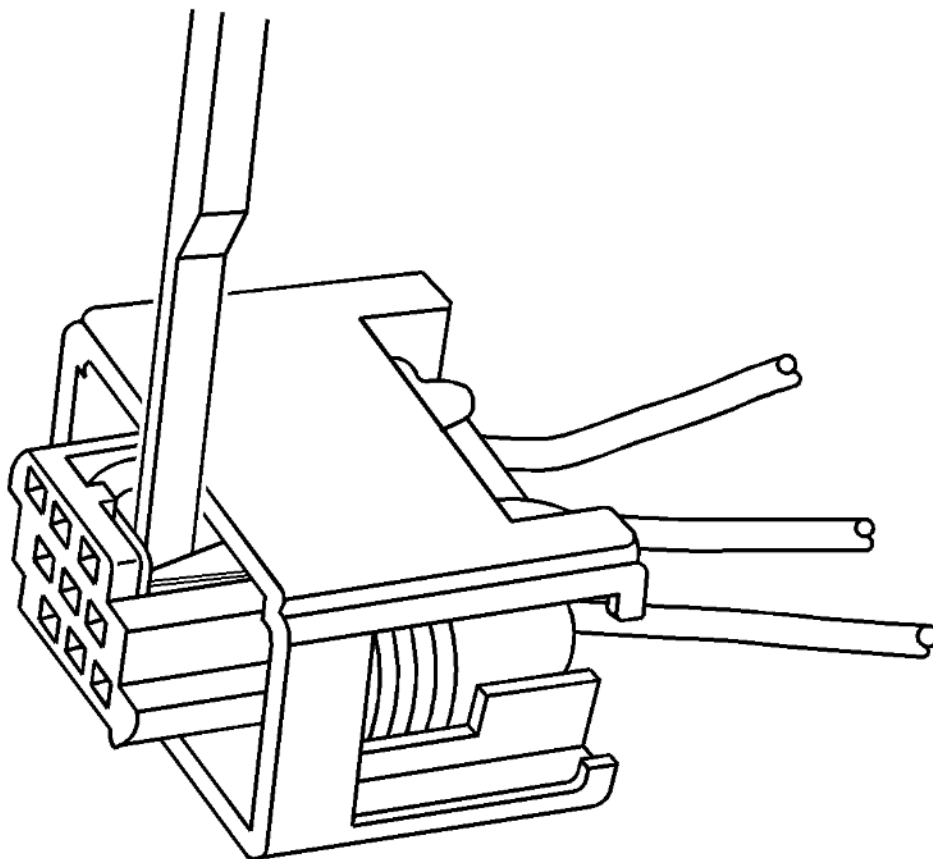


Fig. 151: View Of Inserting Tool Into Terminal Release Tang Access Slot (Sensor)
Courtesy of GENERAL MOTORS COMPANY

6. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
7. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

TYCO/AMP CONNECTORS (0.25 CAP)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-24 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Disconnect the connector from the component by pressing down on the connector position assurance (CPA).
2. Use a small flat-bladed tool to release the terminal position assurance (TPA) by inserting the tool in the small recess on the side of the connector and pushing up until the TPA releases from the connector body. The TPA should raise just slightly. Do not try to remove the TPA.

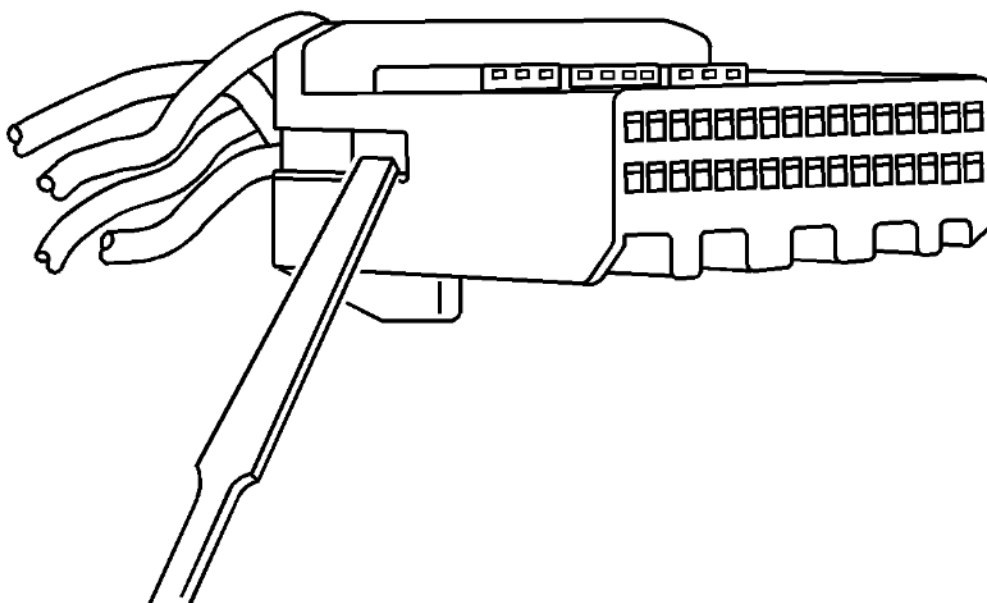


Fig. 152: Releasing TPA Using Small Flat-Bladed Tool
Courtesy of GENERAL MOTORS COMPANY

NOTE: The TPA on this connector cannot be removed unless the terminals are removed first. The TPA will come out of the connector body, but only slightly. When the TPA is slightly raised the terminals can be removed. Using excessive force to remove the TPA with the terminals still in the connector will damage the connector.

3. Repeat the process for the other side of the connector.

4. Ensure that the TPA is in the proper position to remove the terminals.

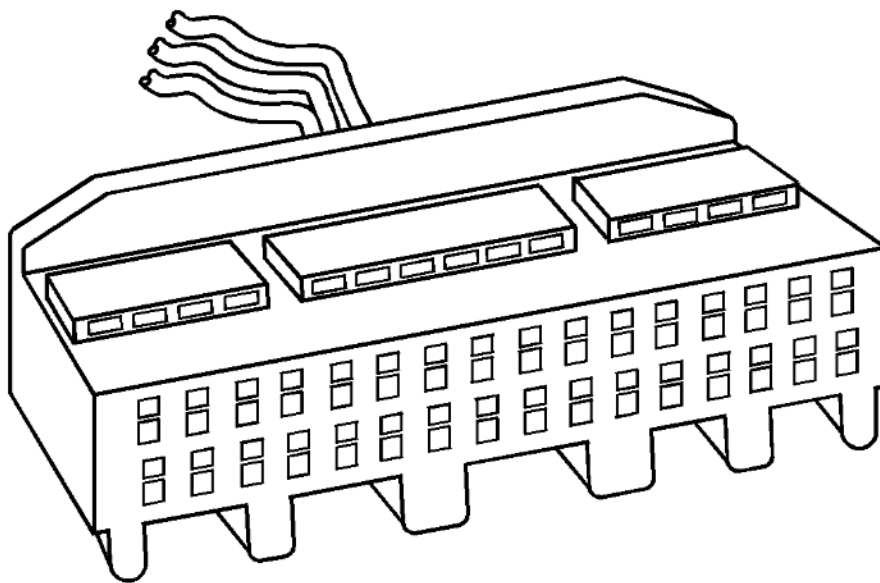


Fig. 153: View Of Terminal Position Assurance
Courtesy of GENERAL MOTORS COMPANY

5. While pushing the terminal forward, insert the J-38125-24 in the release cavity above the terminal you are removing, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.

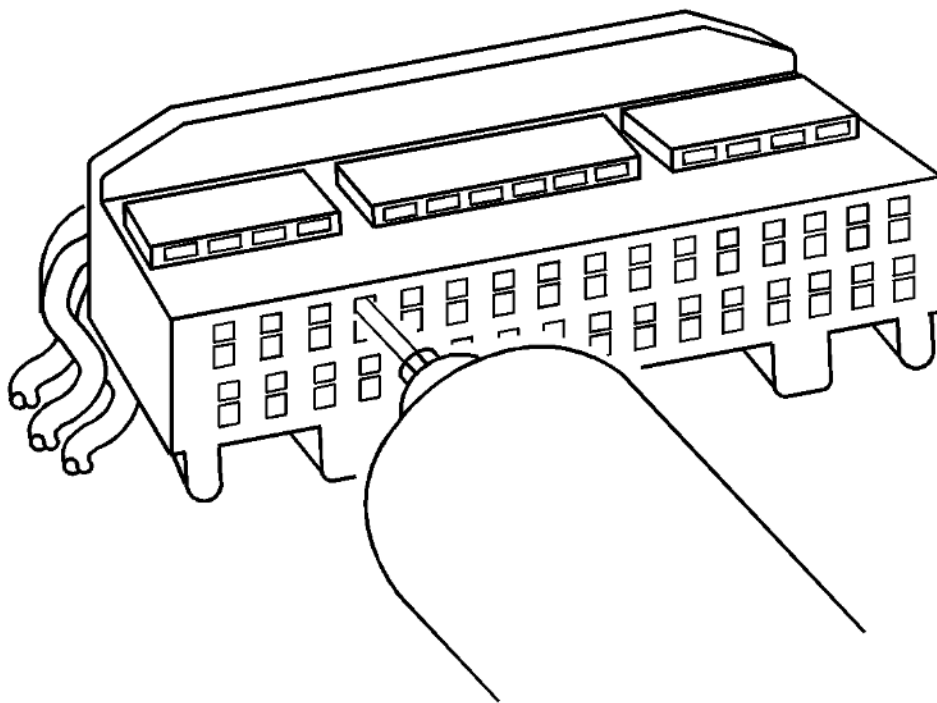


Fig. 154: Identifying Special Tool & Release Cavity
Courtesy of GENERAL MOTORS COMPANY

6. Repair the terminal by following **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
7. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

TYCO/AMP CONNECTORS (43-WAY)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-12A Terminal Release Tool
- J-38125-13A Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

Follow the steps below in order to remove terminals from the connector.

1. Locate the lever lock on the wire dress cover. Slide the lever lock away from the connector body.
2. Disconnect the connector from the component.
3. Locate the dress cover locking tabs on the dress cover of the connector. Using a small flat-bladed tool release all of the locking tabs.
4. Once the locks are unlocked, lift the dress cover off.
5. Release the TPA by inserting a small flat-bladed tool into the blue locking tabs on both ends of the connector. Gently slide the TPA up to the released position on both ends.

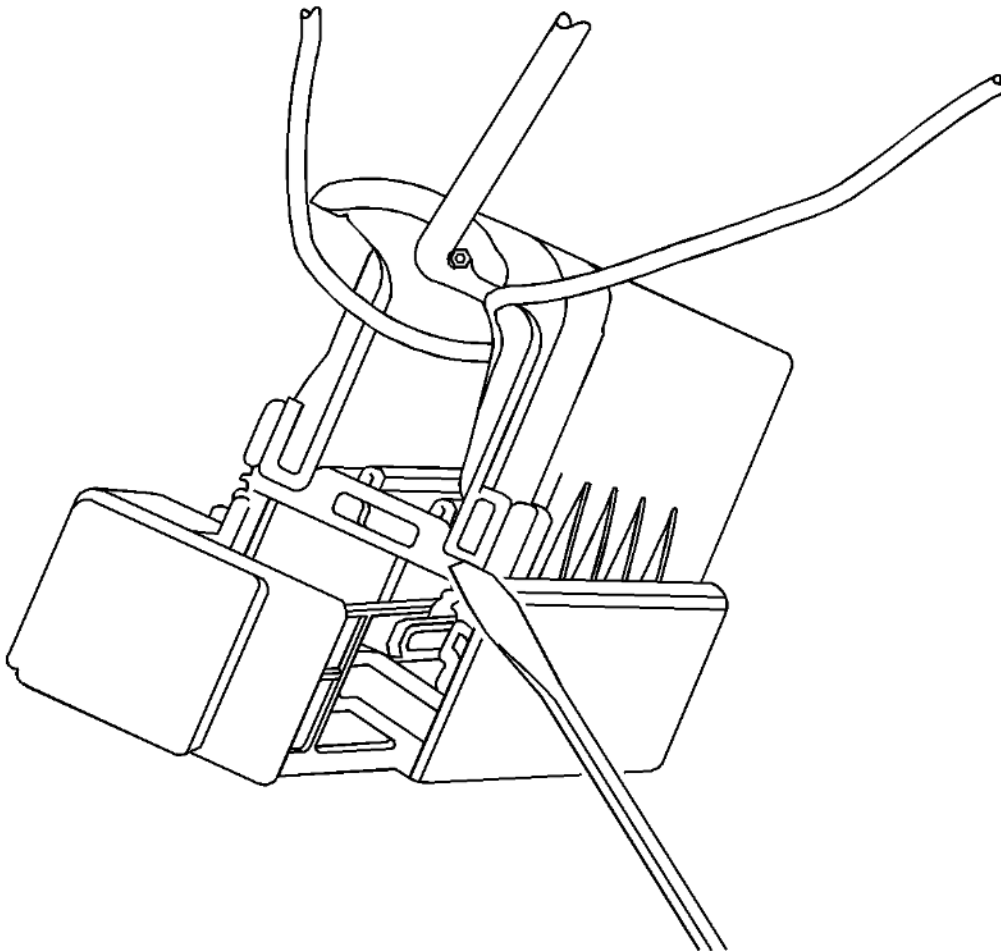


Fig. 155: Releasing TPA

Courtesy of GENERAL MOTORS COMPANY

NOTE: Always use care when removing a terminal position assurance (TPA) in order to avoid damaging it.

6. For the larger terminals insert the **J-38125-13A** tool to release the terminals by inserting the tool into the terminal release cavity. For the smaller terminals insert the **J-38125-12A** tool to release the terminals by inserting the tool into the terminal release cavity.

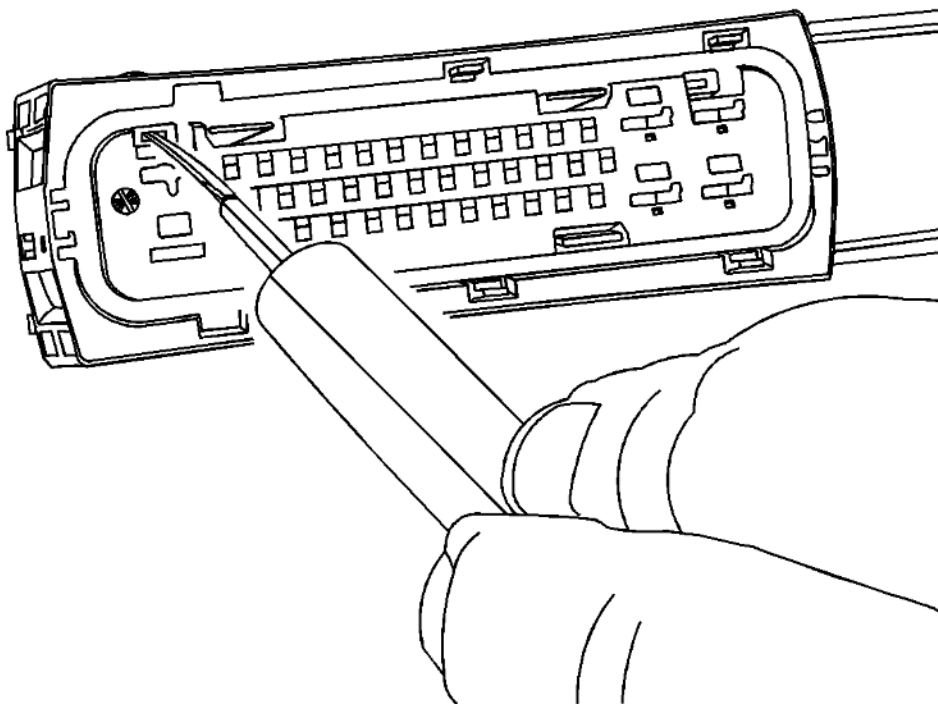


Fig. 156: View Of Inserting Tool Into Terminal Release Cavity
Courtesy of GENERAL MOTORS COMPANY

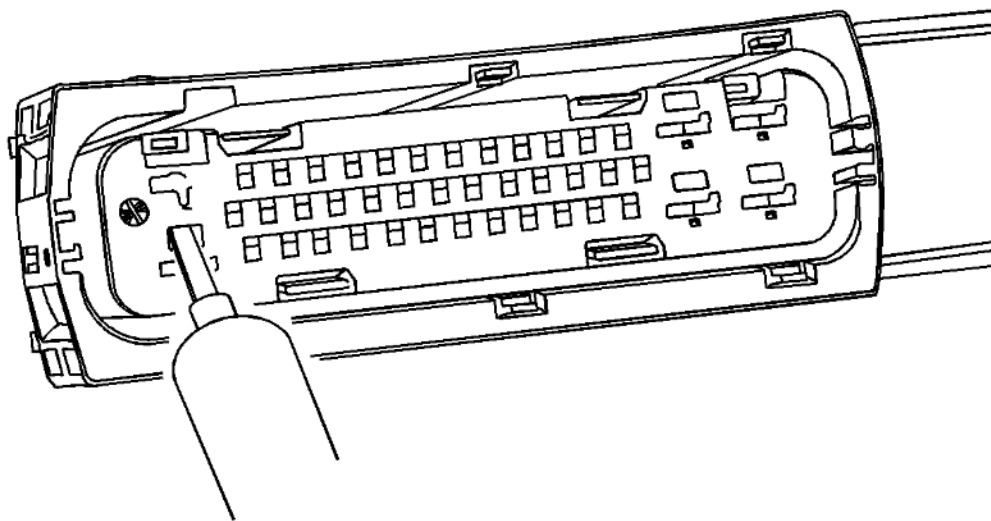


Fig. 157: View Of Release Tool Being Used For Larger Terminals
Courtesy of GENERAL MOTORS COMPANY

View of the release tool being used for the larger terminals.

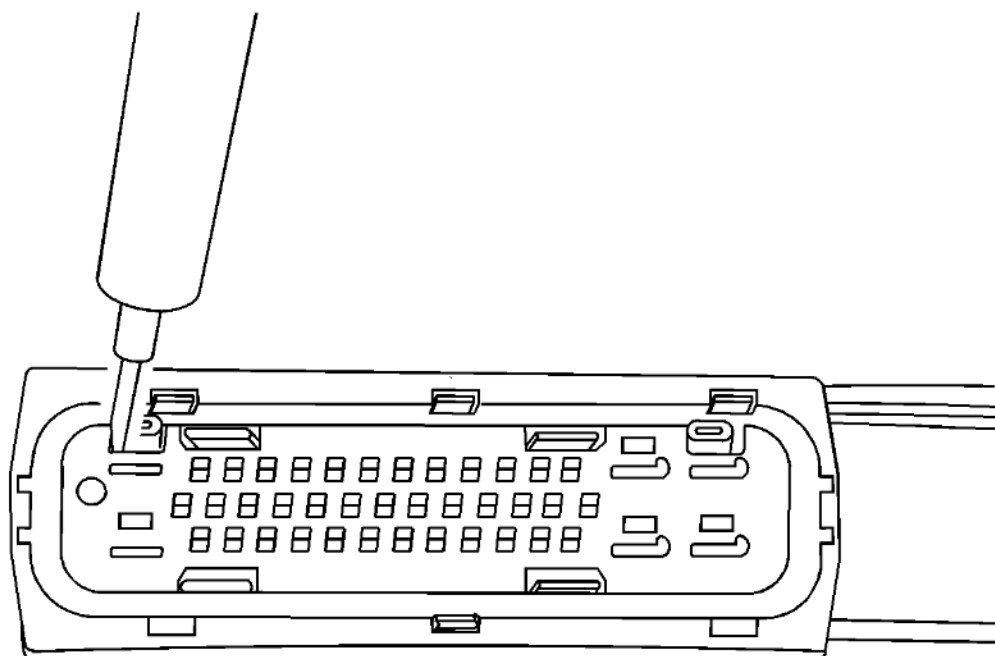


Fig. 158: View Of Release Tool Being Used For Larger Terminals
Courtesy of GENERAL MOTORS COMPANY

View of the release tool being used for the larger terminals.

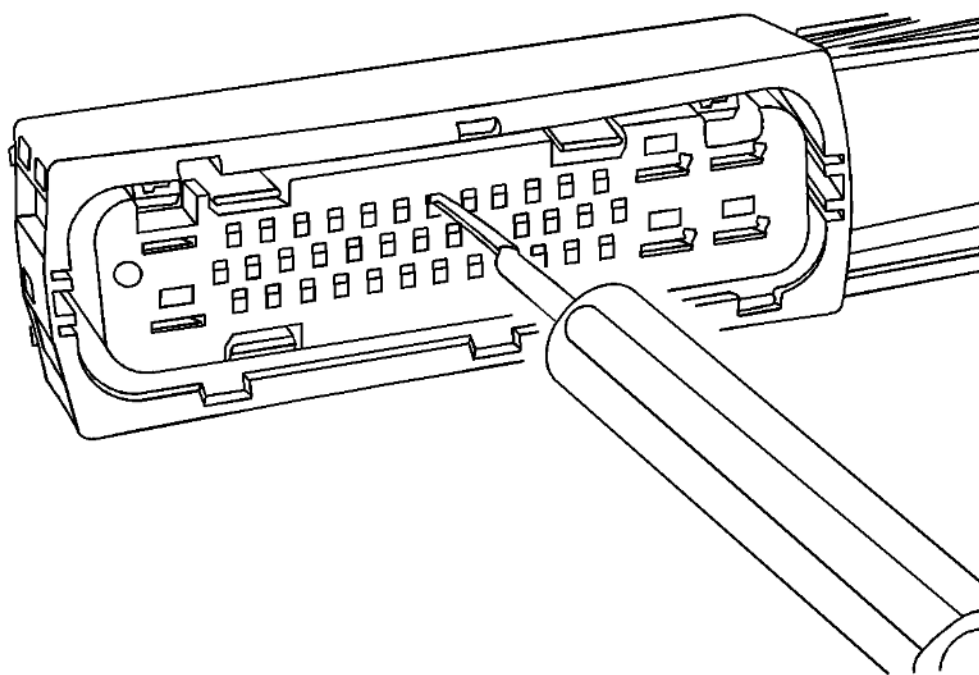


Fig. 159: View Of Release Tool Being Used For Smaller Terminals
Courtesy of GENERAL MOTORS COMPANY

View of the release tool being used for the smaller terminals.

7. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.
8. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
9. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

TYCO/AMP CONNECTORS (DOOR MODULE)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit

- **J-38125-12A** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

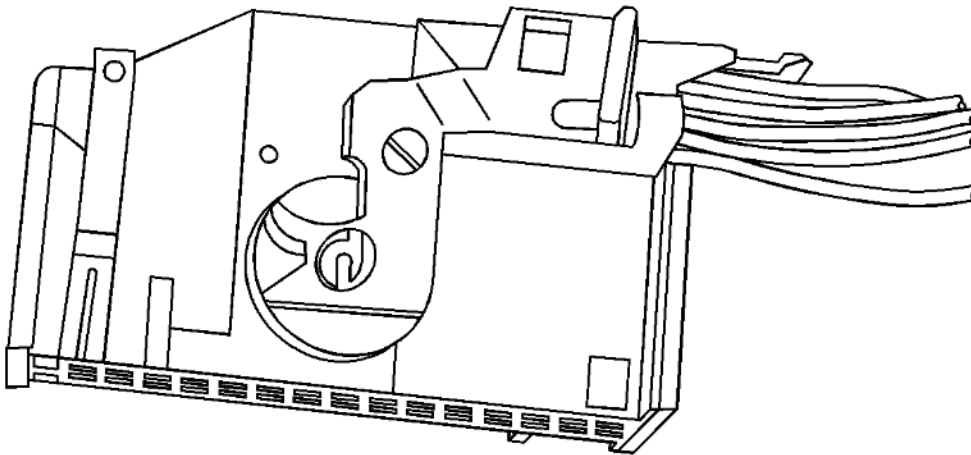


Fig. 160: Side View Of Tyco/AMP Connector
Courtesy of GENERAL MOTORS COMPANY

Side view of connector.

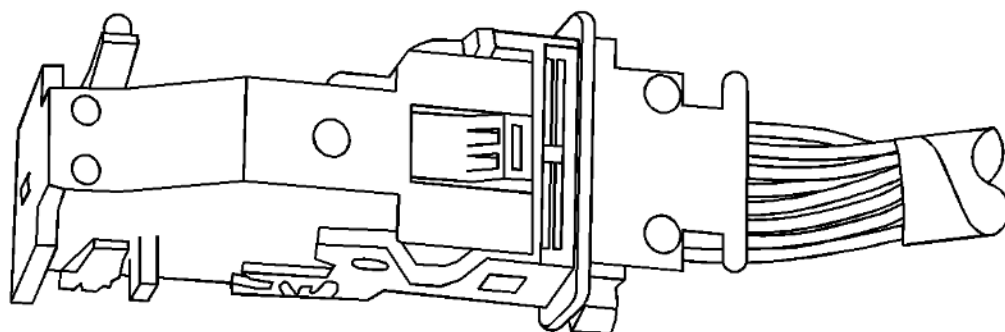


Fig. 161: Top View Of Tyco/AMP Connector
Courtesy of GENERAL MOTORS COMPANY

View of top of connector.

1. Locate the assist lever and lock on the top of the connector.
2. While depressing the lock, pull the lever over and past the lock.

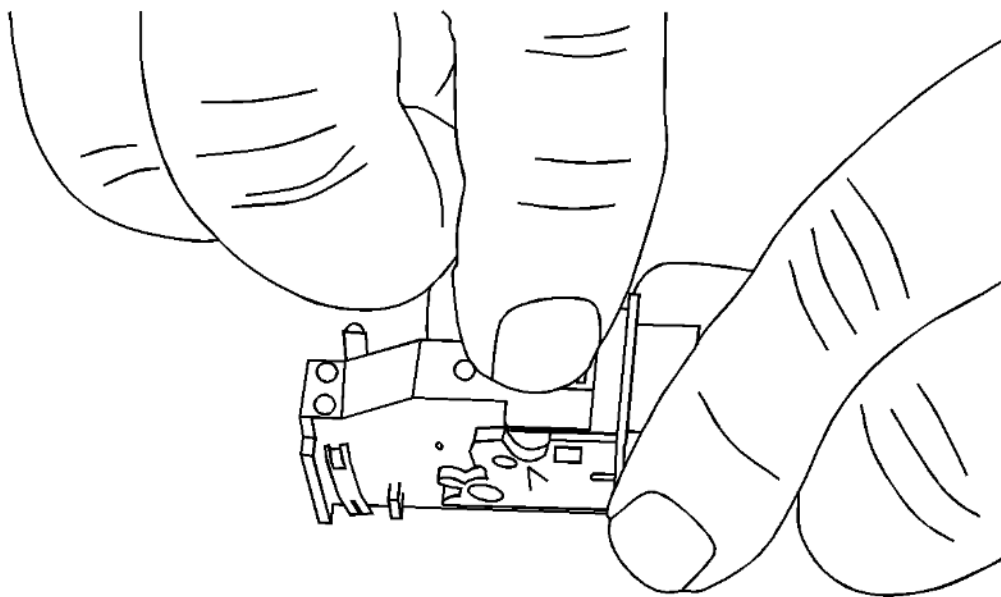


Fig. 162: View Of Depressing Lock & Pulling Assist Lever
Courtesy of GENERAL MOTORS COMPANY

3. Disconnect the connector from the component.

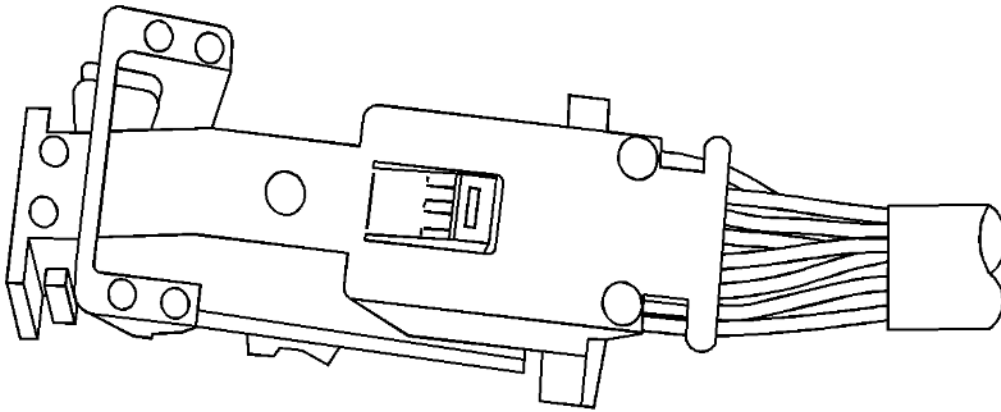


Fig. 163: View Of Component Connector
Courtesy of GENERAL MOTORS COMPANY

4. Locate the dress cover locking tabs at the rear of the connector. Use a small flat-blade tool to release the locking tabs. Repeat this procedure for the other locking tab.

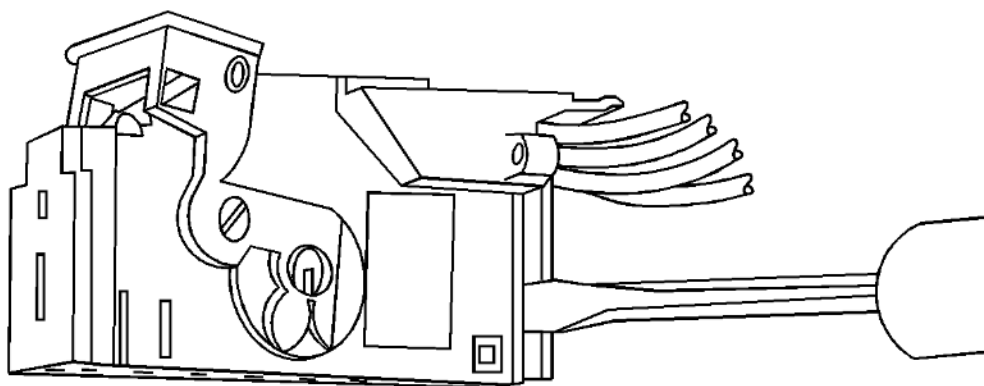


Fig. 164: Identifying Locking Tabs

Courtesy of GENERAL MOTORS COMPANY

5. Once the locking tabs are unlocked, slide the inner connector out of the rear of the connector housing.

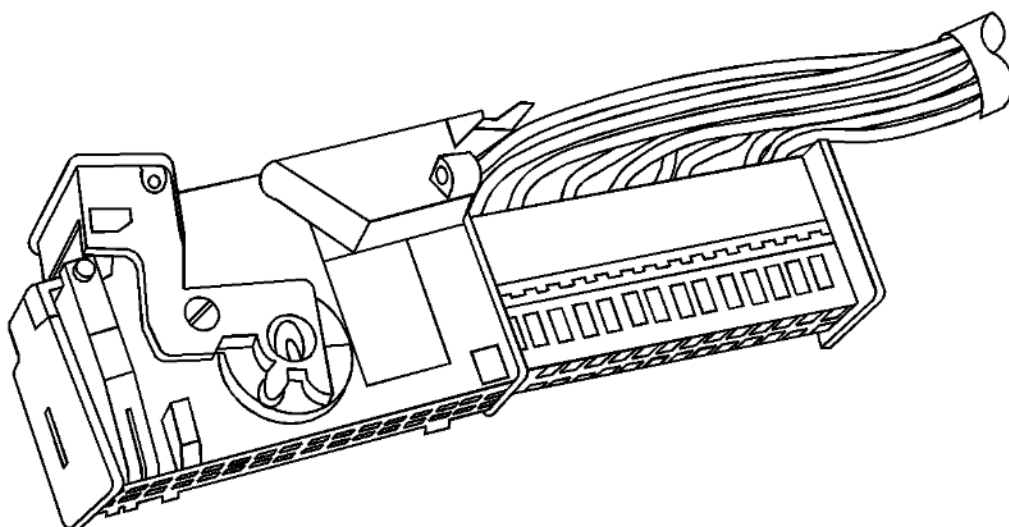


Fig. 165: Sliding Inner Connector Out Of Connector Housing
Courtesy of GENERAL MOTORS COMPANY

6. Use the J-38125-12A tool to release the terminals by pressing on the tang.

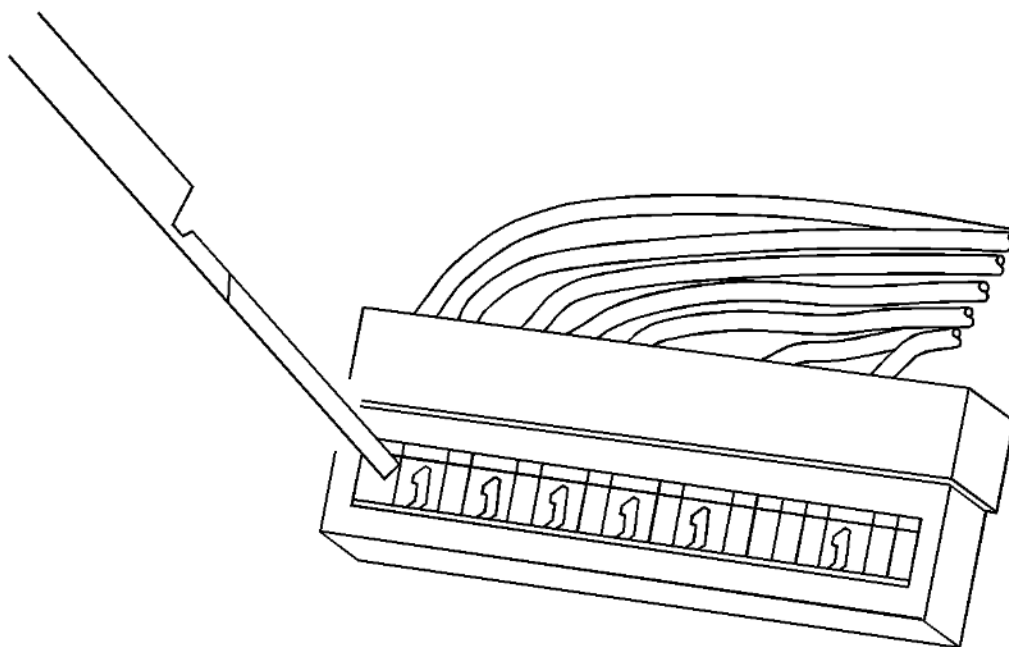


Fig. 166: Releasing Terminals

Courtesy of GENERAL MOTORS COMPANY

7. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.
8. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
9. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

TYCO/AMP CONNECTORS (102-WAY INLINE)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-11A Terminal Release Tool

- **J-38125-212** Terminal Release Tool
- **J-38125-216** Terminal Release Tool
- **J-38125-221** Terminal Release Tool
- **J-38125-560** Terminal Release Tool
- **J-38125-566** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

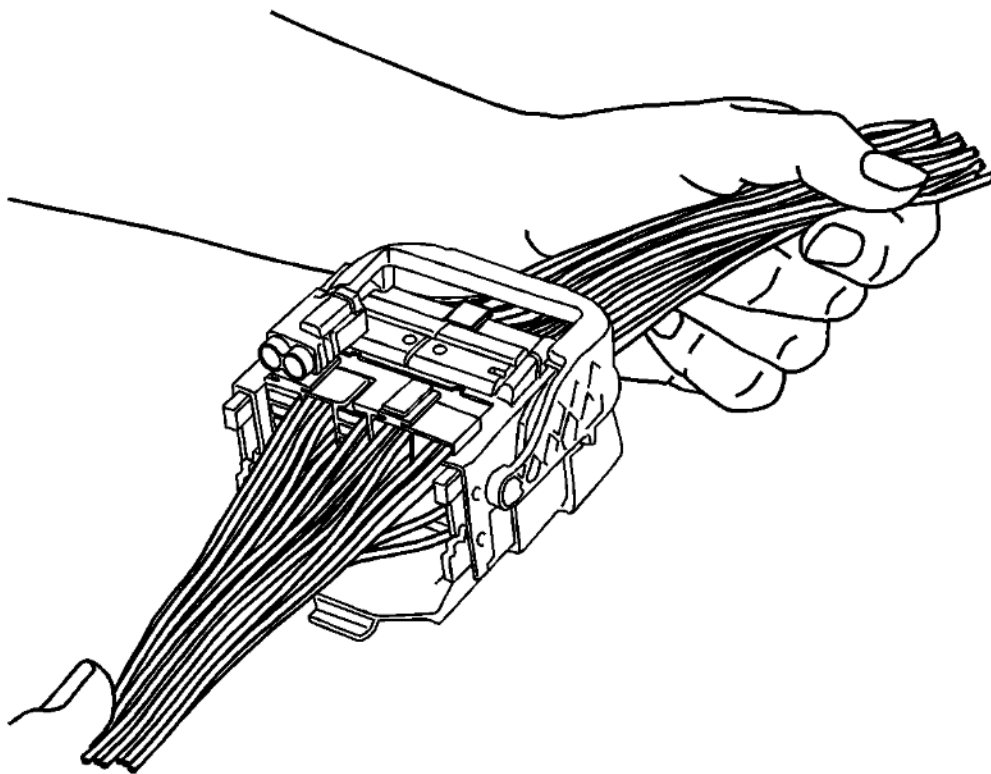


Fig. 167: View Of Typical Connector In Assembled Position
Courtesy of GENERAL MOTORS COMPANY

View of a typical connector in the assembled position.

1. Pull the locking lever to the 90° position from the connector body.

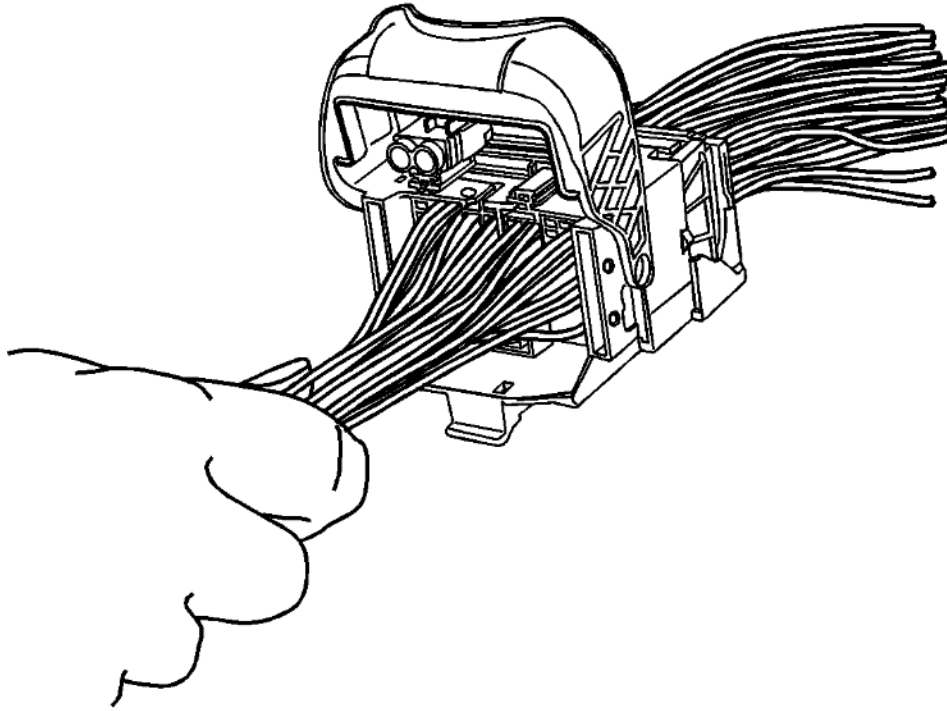


Fig. 168: View Of Locking Lever At 90 Degrees From Connector Body
Courtesy of GENERAL MOTORS COMPANY

2. With the locking lever in the 90° position and the male connector body separated, it can be slid outward for removal.

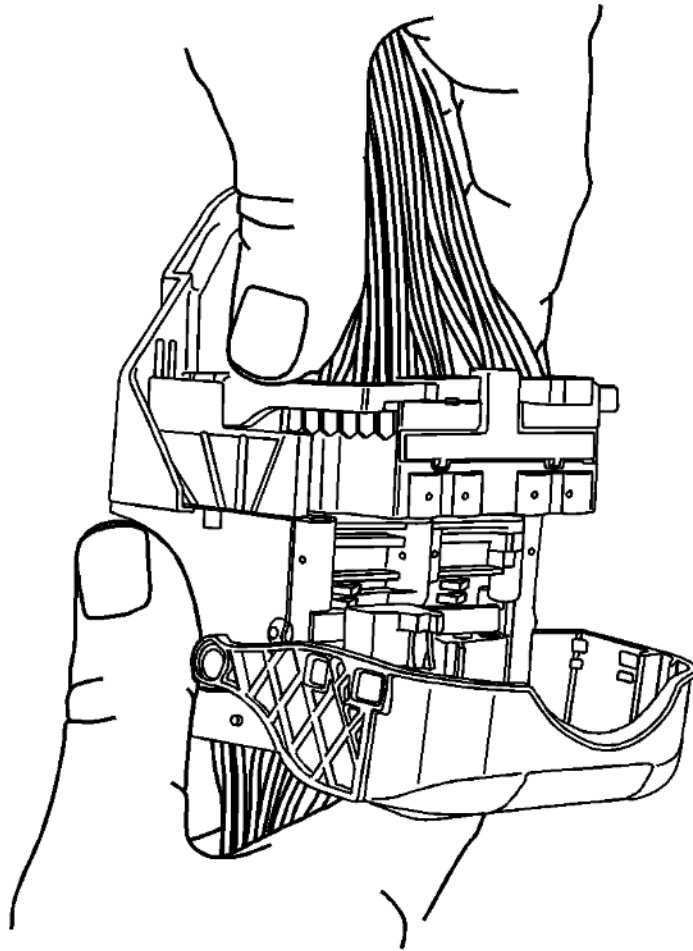


Fig. 169: Assembled View Of Connector - Tyco/AMP (102-Way Inline)
Courtesy of GENERAL MOTORS COMPANY

3. Slide the male connector body out away from the guide plates.

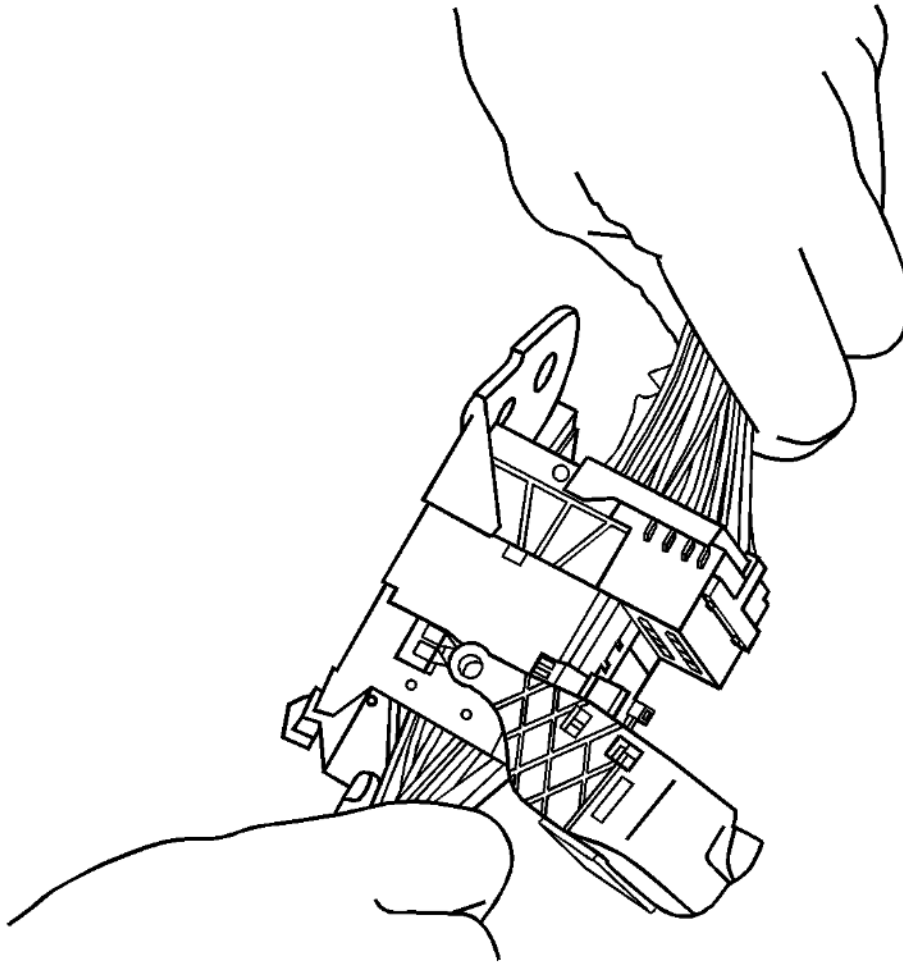


Fig. 170: Sliding Male Connector Body Away From Guide Plates
Courtesy of GENERAL MOTORS COMPANY

4. Using terminal release tool J-38125-11A or equivalent, remove the TPA from the connector body.

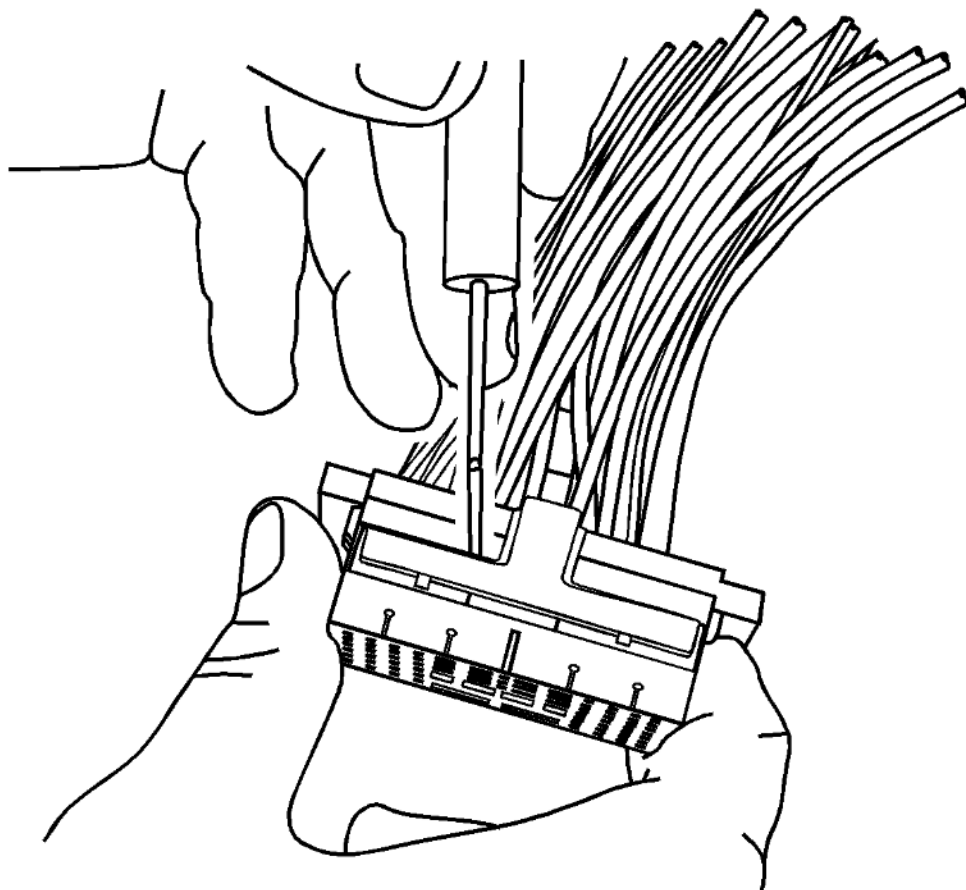


Fig. 171: View of Terminal Release Tool J-38125-566 And TPA
Courtesy of GENERAL MOTORS COMPANY

NOTE: During assembly the terminal position assurance (TPA) will not fully seat if any terminal is not fully seated.

5. Using terminal release tool J-38125-566, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

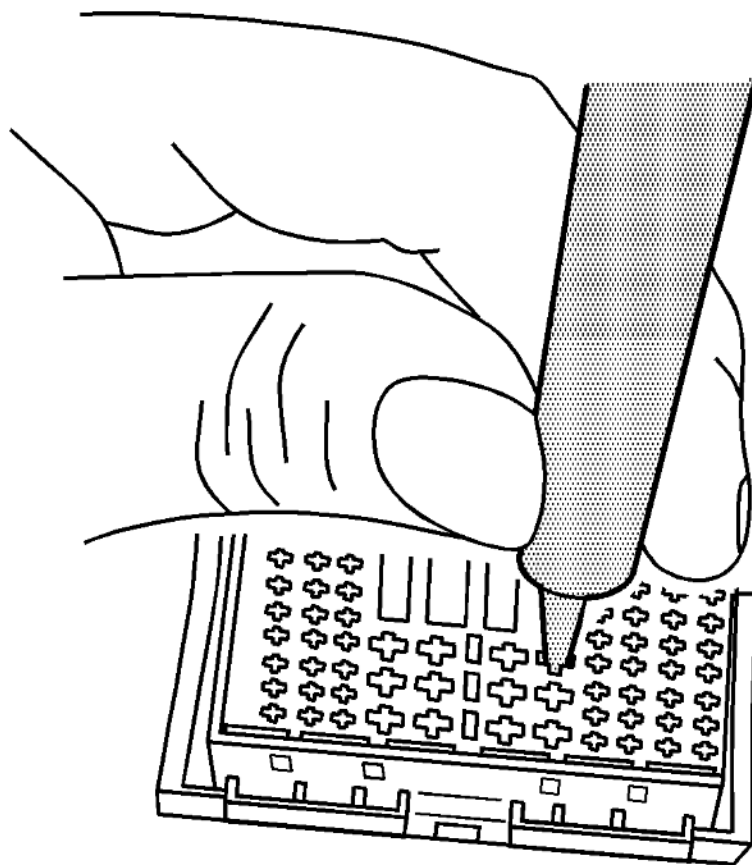


Fig. 172: Using Terminal Release Tool J 38125-566 to Release Lock Tabs
Courtesy of GENERAL MOTORS COMPANY

6. Using terminal release tool J-38125-560, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

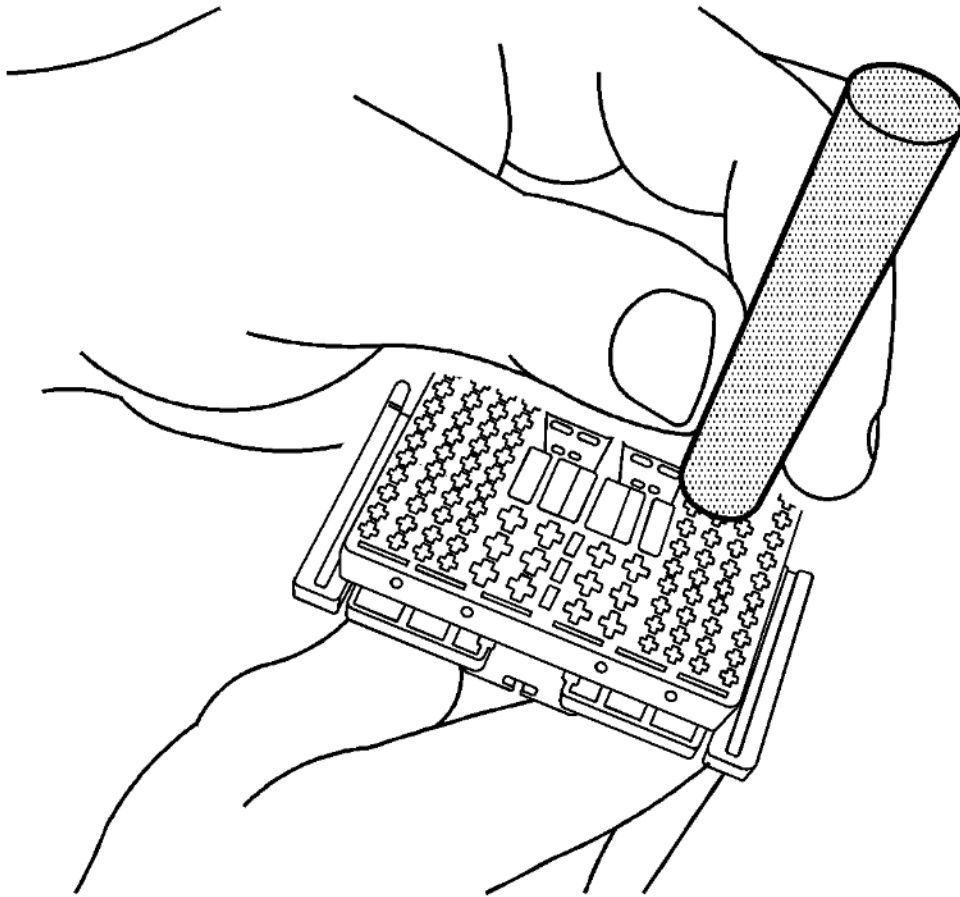


Fig. 173: Using Terminal Release Tool J-38125-221
Courtesy of GENERAL MOTORS COMPANY

7. Using terminal release tool J-38125-221, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

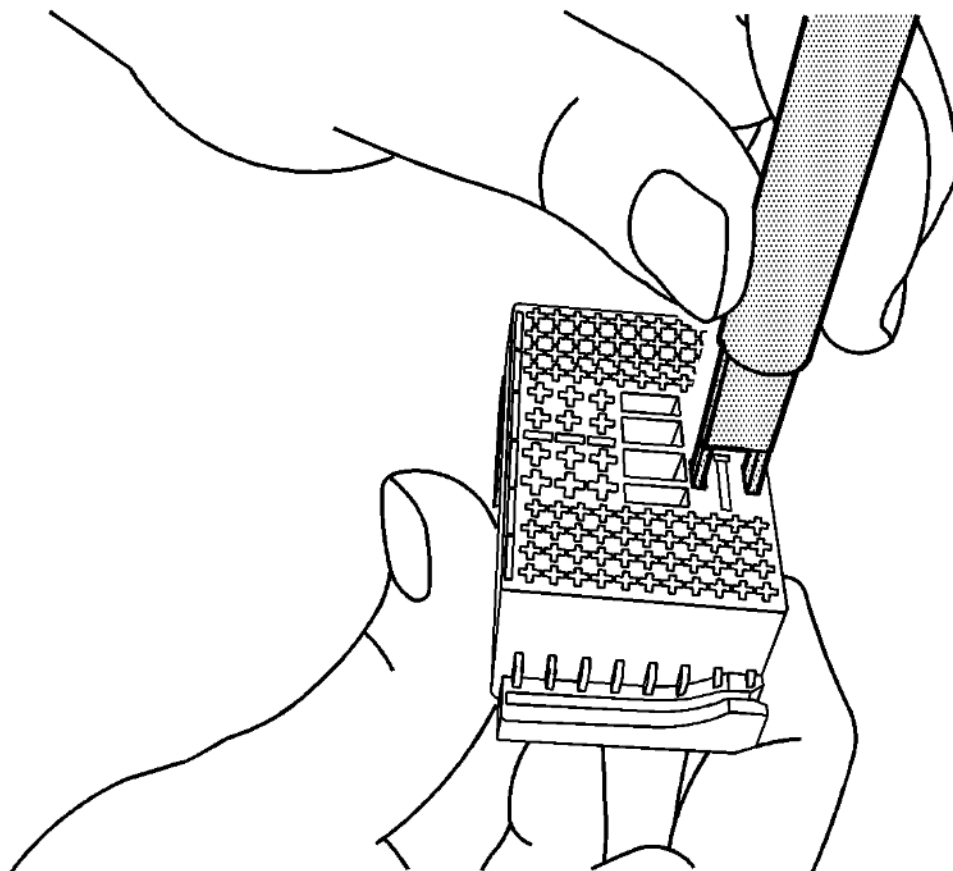


Fig. 174: Releasing Lock Tabs

Courtesy of GENERAL MOTORS COMPANY

8. The female connector body may have an additional connector hooked to the edge of the body. Use terminal release tool J-38125-11A or equivalent to release the locking tab and slide the connector off the female body.

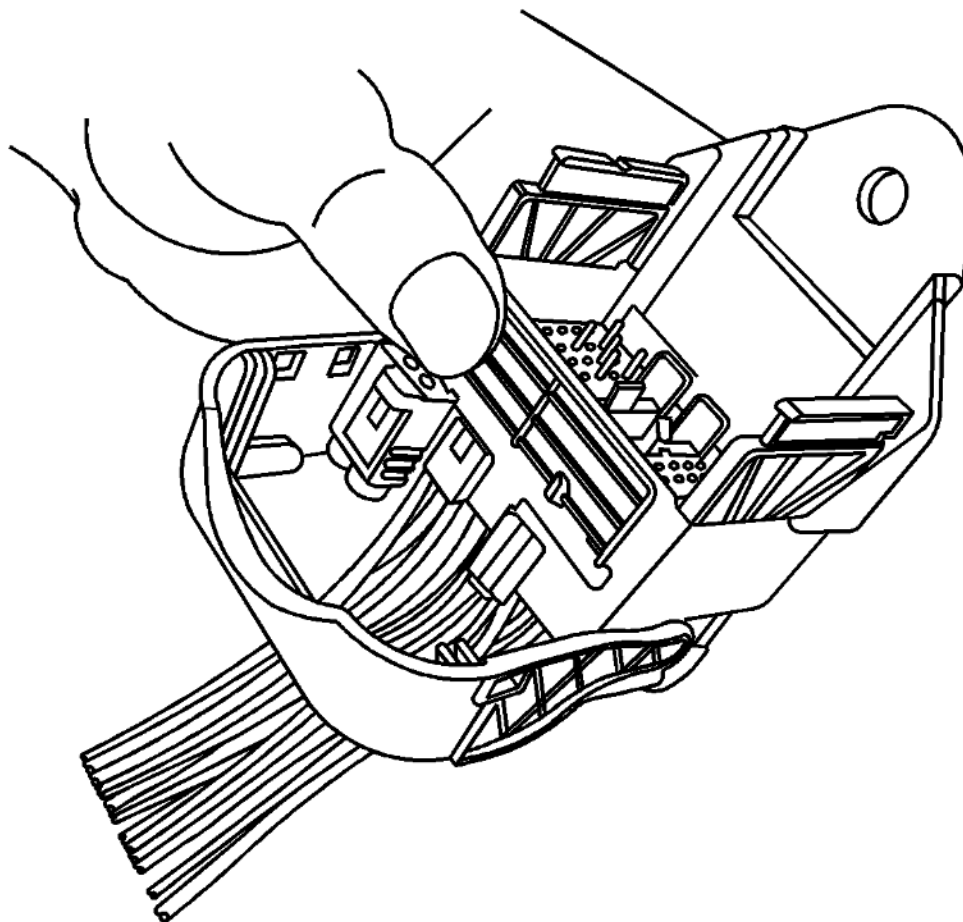


Fig. 175: View Of Female Connector Body - Tyco/AMP (102-Way Inline)
Courtesy of GENERAL MOTORS COMPANY

9. Move the locking lever 180° from the connected position.

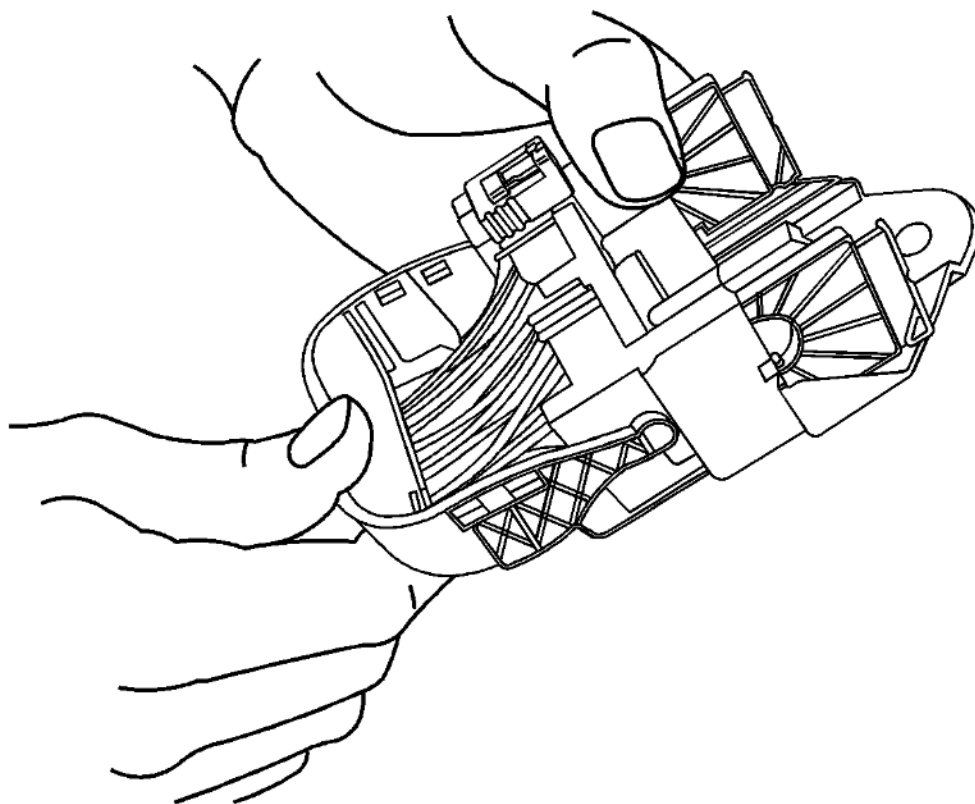


Fig. 176: Moving Locking Lever 180 Degrees From The Connected Position - Tyco/AMP (102-Way Inline)

Courtesy of GENERAL MOTORS COMPANY

10. With the locking lever in the 180° position the guide plates can be removed from the connector body.

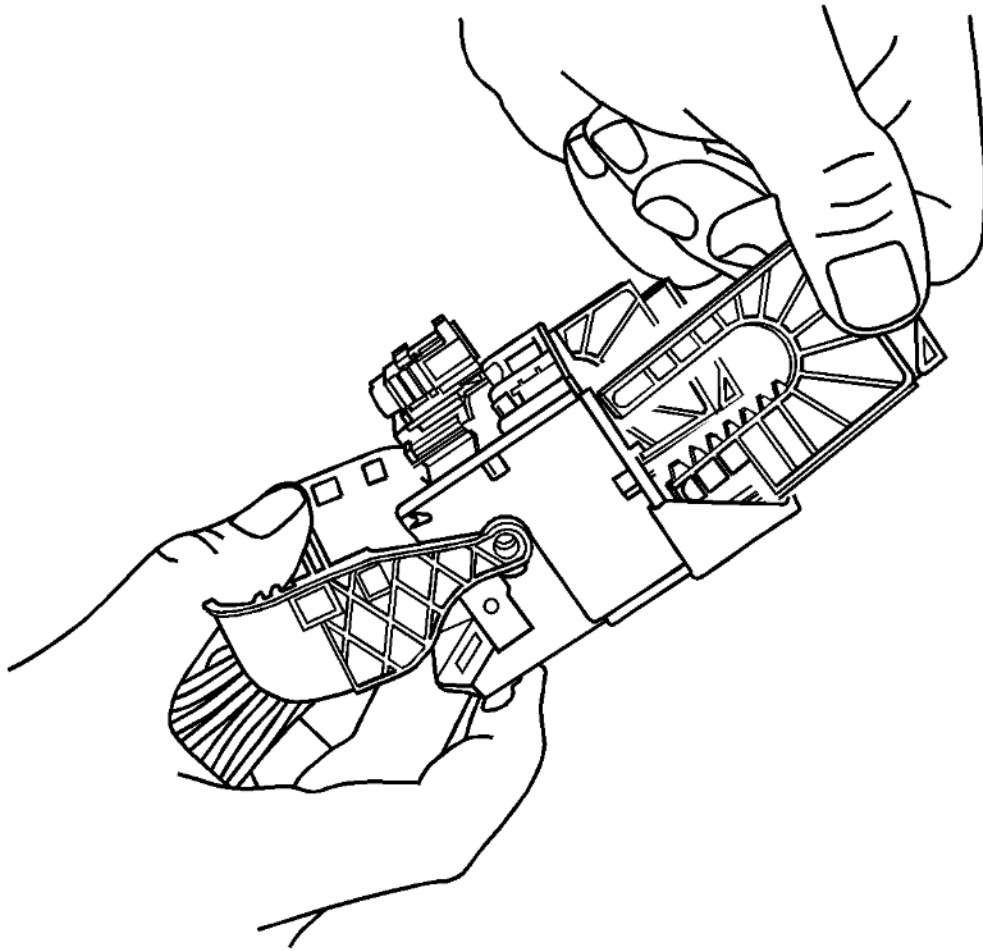


Fig. 177: Removing Guide Plates From Connector Body
Courtesy of GENERAL MOTORS COMPANY

11. Using terminal release tool J-38125-11A or equivalent, remove the TPA from the connector body.

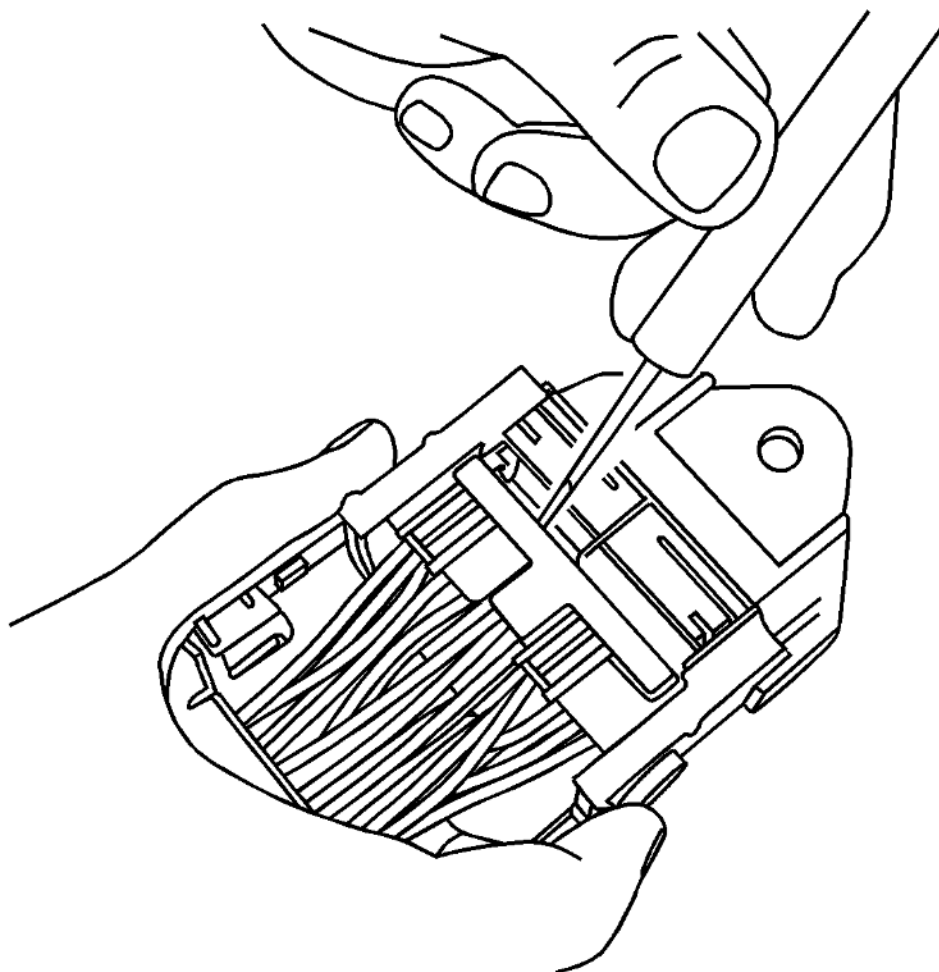


Fig. 178: Removing TPA

Courtesy of GENERAL MOTORS COMPANY

NOTE: During assembly the TPA will not fully seat if any terminal is not fully seated.

12. Using terminal release tool J-38125-216, lift the terminal plate past the terminals and out of the connector body cavity.

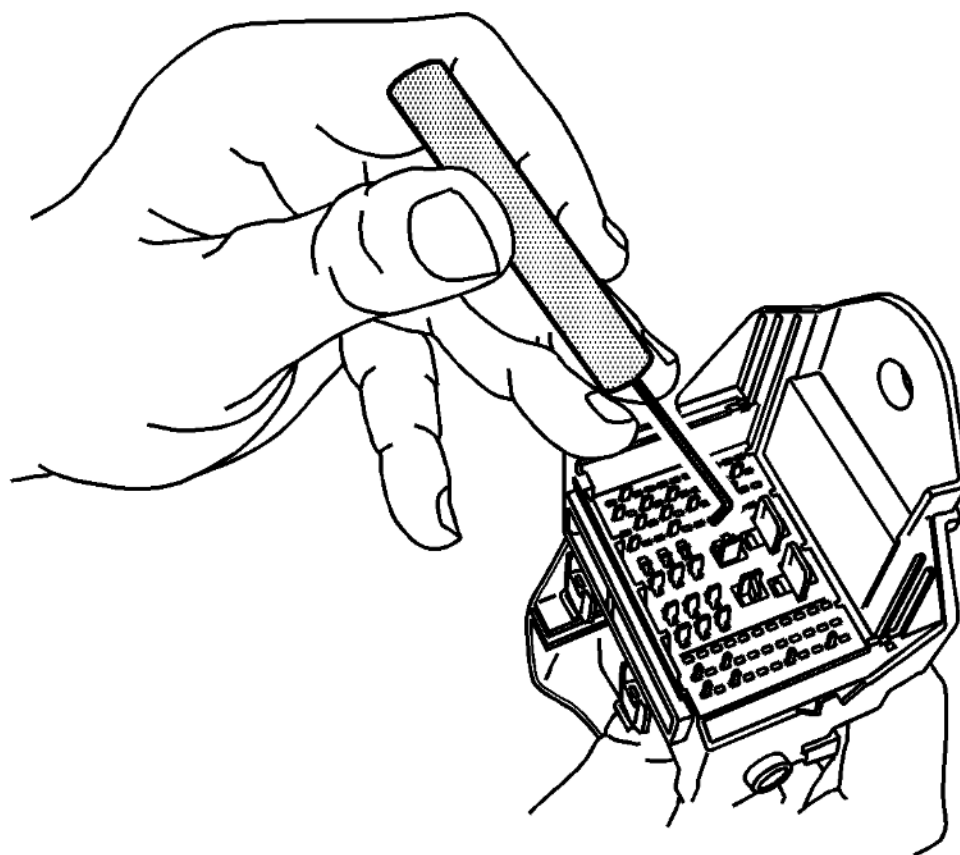


Fig. 179: Lifting Terminal Plate Past Terminals
Courtesy of GENERAL MOTORS COMPANY

13. Terminal plate will bind slightly on each corner.

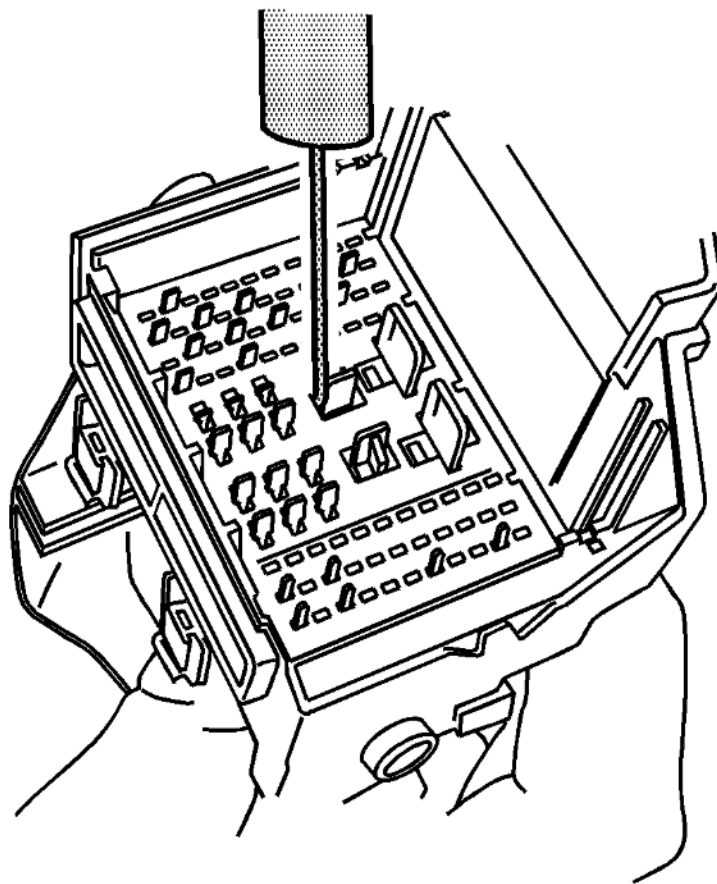


Fig. 180: View Of Terminal Plate

Courtesy of GENERAL MOTORS COMPANY

14. Using terminal release tool J-38125-221, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

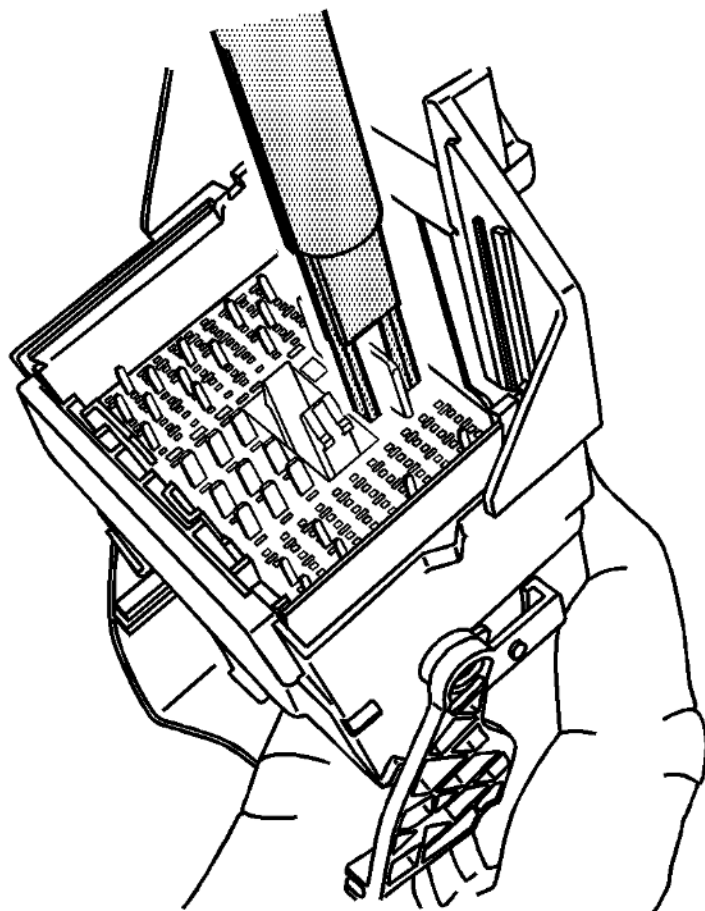


Fig. 181: View of Using Terminal Release Tool J 38125-221 to Release Lock Tabs
Courtesy of GENERAL MOTORS COMPANY

15. Using terminal release tool J-38125-212, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

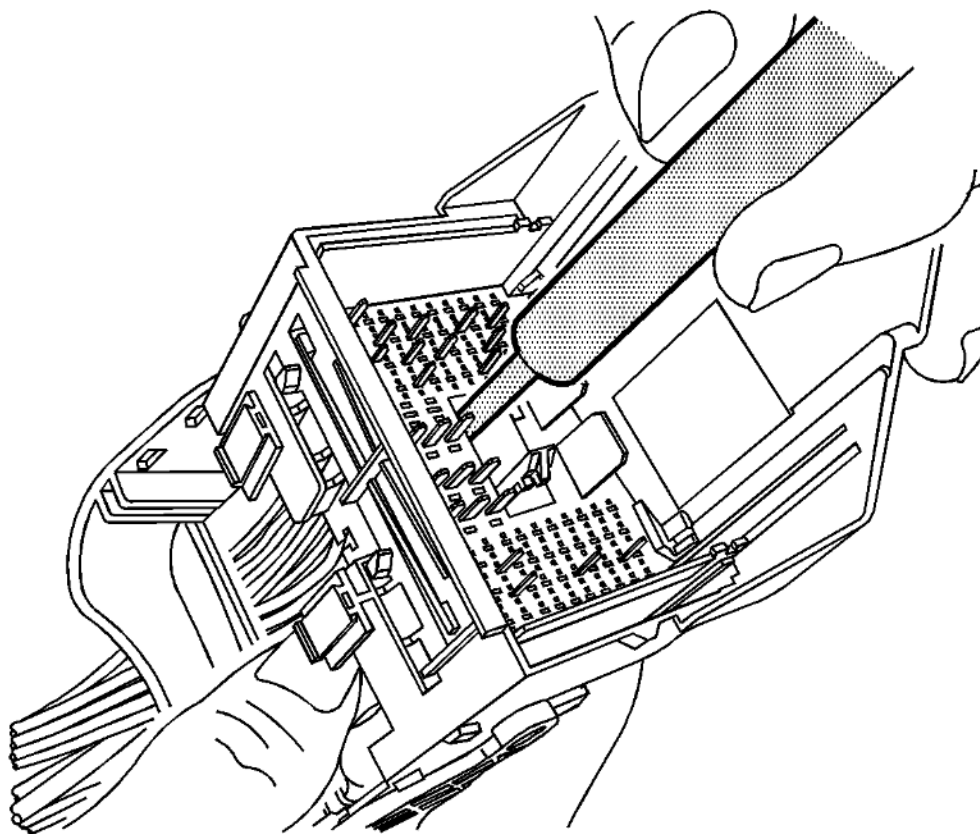


Fig. 182: View of Pressing Prongs On Each Side Of Terminal Using J 38125-212
Courtesy of GENERAL MOTORS COMPANY

16. Using terminal release tool J-38125-560, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

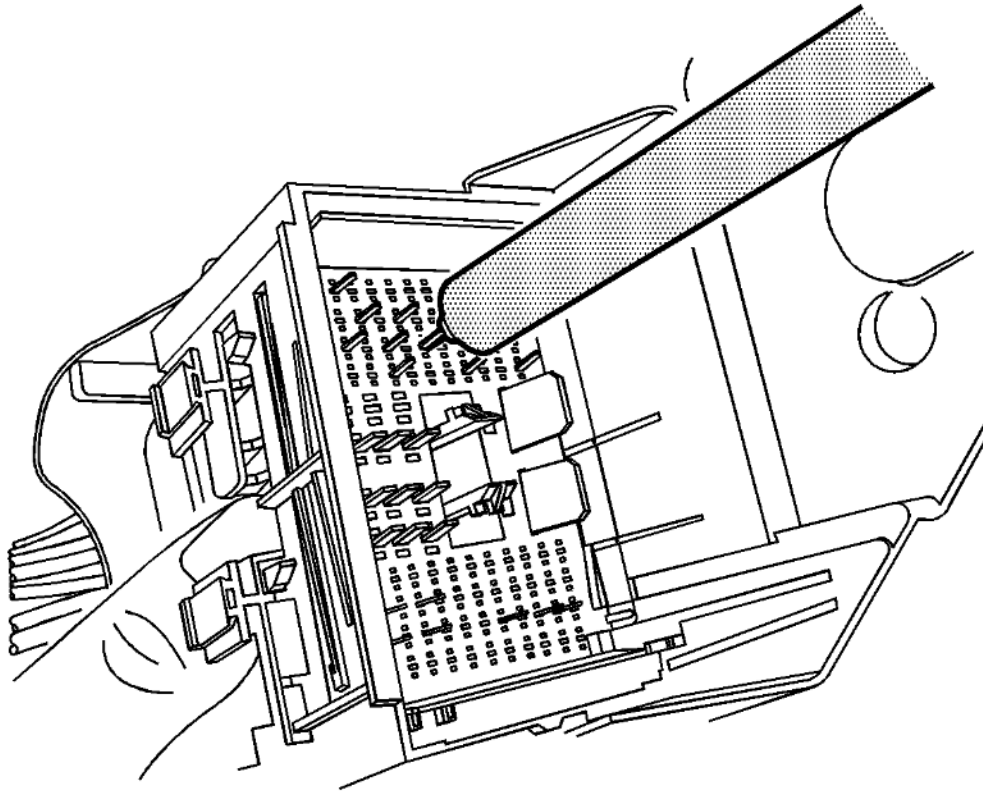


Fig. 183: Pressing Prongs On Each Side Of Terminal - Tyco/AMP (102-Way Inline)
Courtesy of GENERAL MOTORS COMPANY

17. Press the terminal plate back into the female connector to the preset position. The plate will bind slightly on each corner.

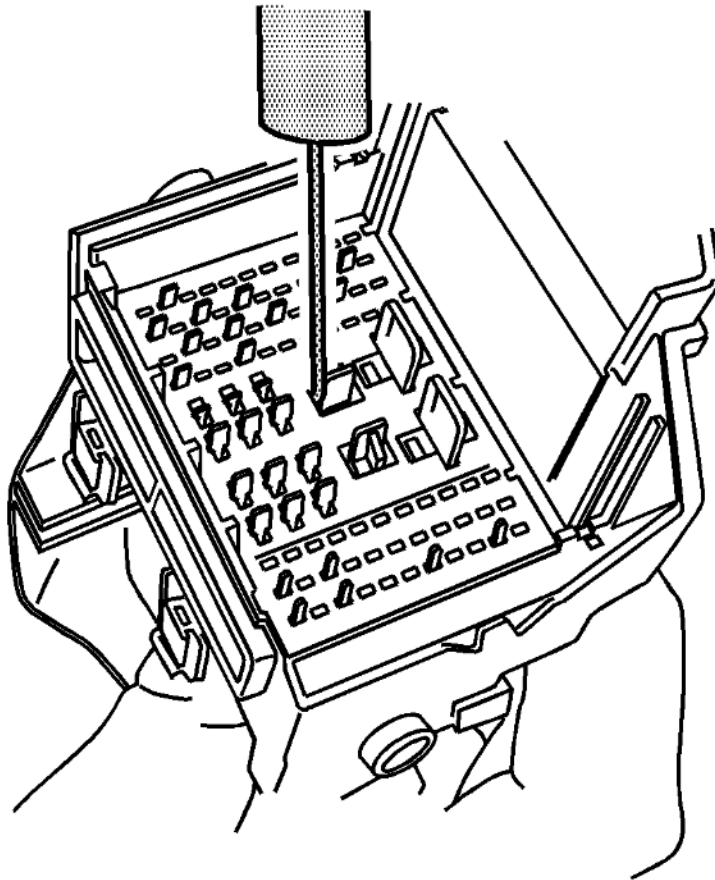


Fig. 184: View Of Terminal Plate

Courtesy of GENERAL MOTORS COMPANY

18. With the locking lever in the 180° position, align the guide plates to mesh with the gears on the locking lever.

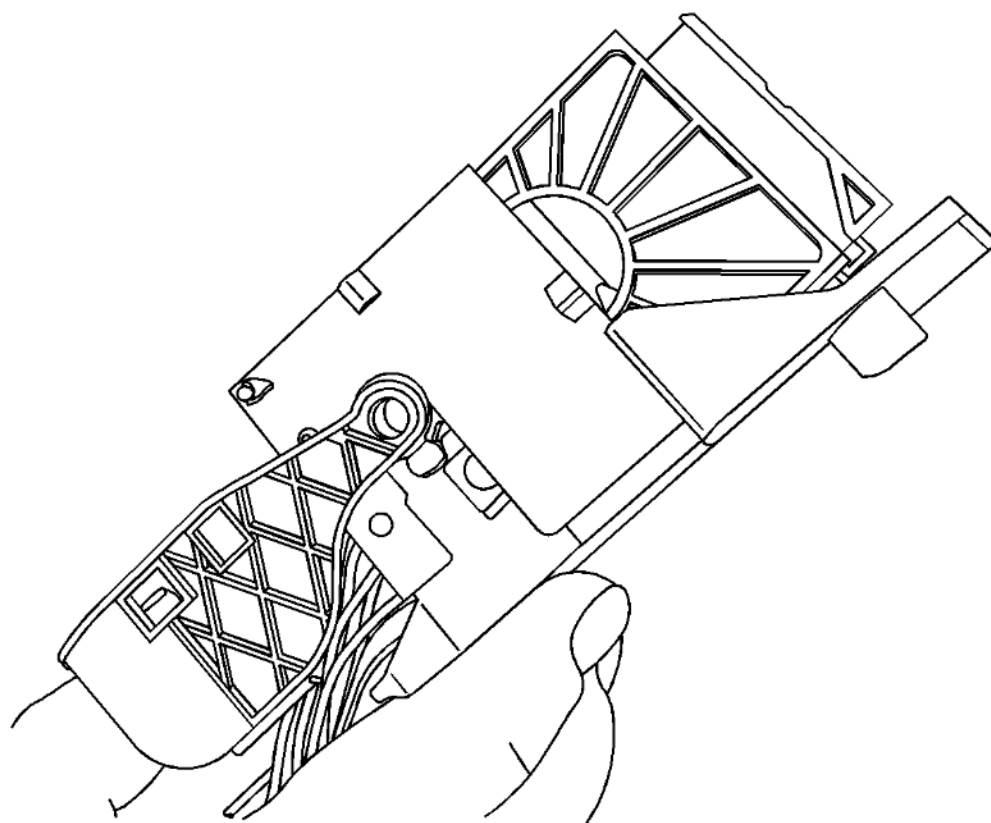


Fig. 185: Aligning Guide Plates To Mesh With Locking Lever Gears
Courtesy of GENERAL MOTORS COMPANY

19. Slide the male connector body back inward toward the guide plates.

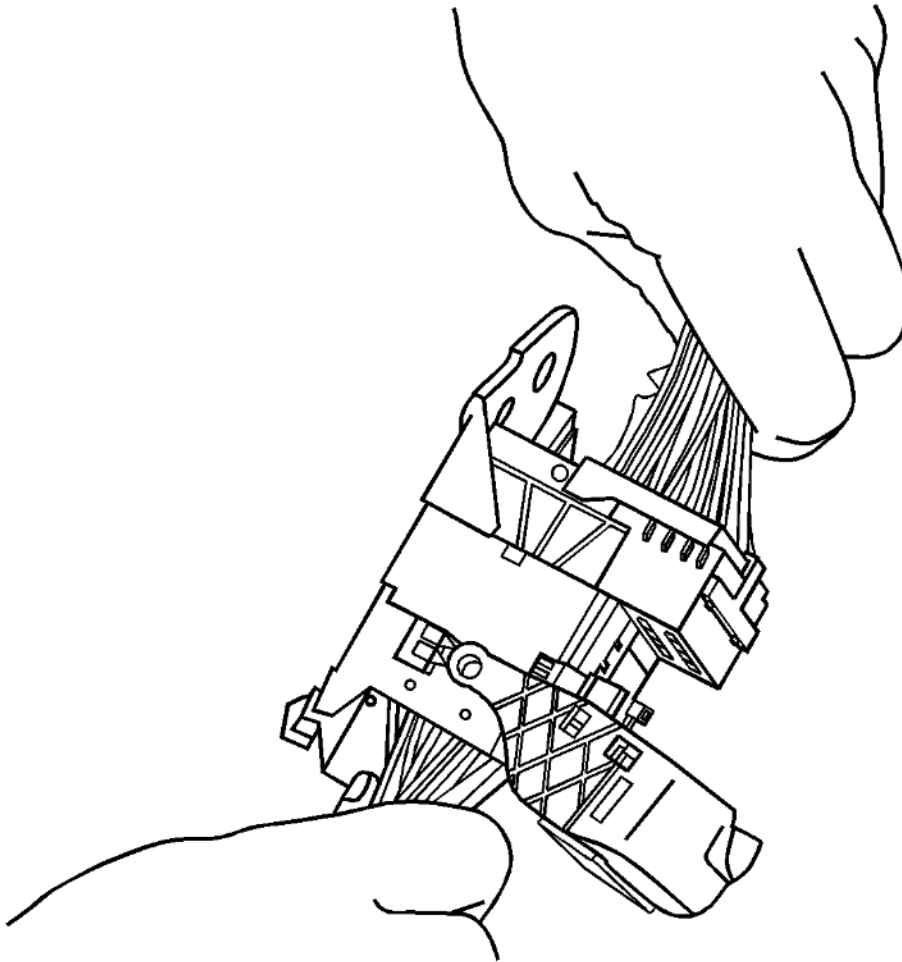


Fig. 186: Sliding Male Connector Body Away From Guide Plates
Courtesy of GENERAL MOTORS COMPANY

20. With the locking lever in the 90° position and the male connector body connected, it can be slid inward for assembly.

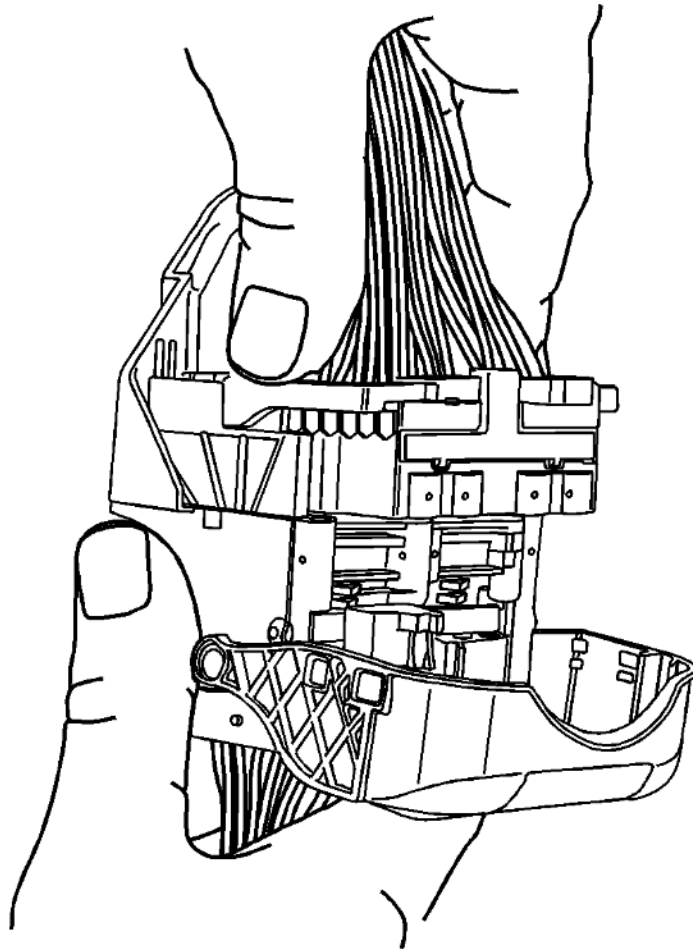


Fig. 187: Assembled View Of Connector - Tyco/AMP (102-Way Inline)
Courtesy of GENERAL MOTORS COMPANY

21. Move the lever into the locked position or in the assembled position. This will pull the male connector down into the female connector.

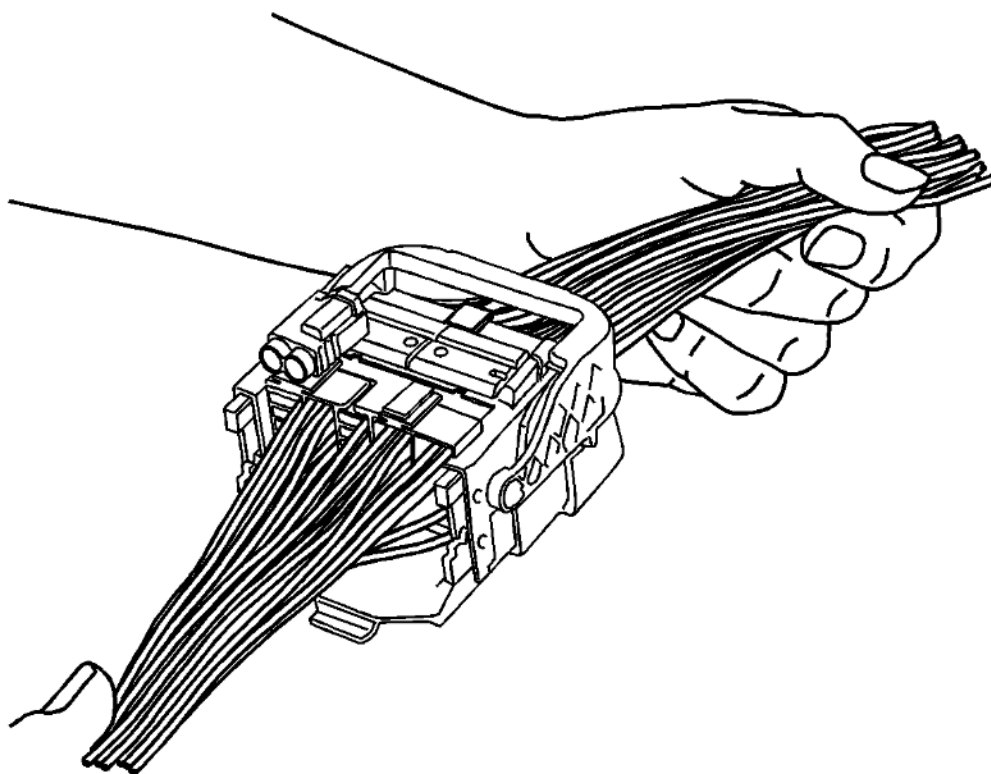


Fig. 188: View Of Typical Connector In Assembled Position
Courtesy of GENERAL MOTORS COMPANY

22. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
23. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

TYCO/AMP CONNECTORS (SEAT)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-11A Terminal Release Tool
- J-38125-212 Terminal Release Tool
- J-38125-556 Terminal Release Tool

- **J-38125-560** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Grasp the locking slide lever and pull outward from the end of the connector.

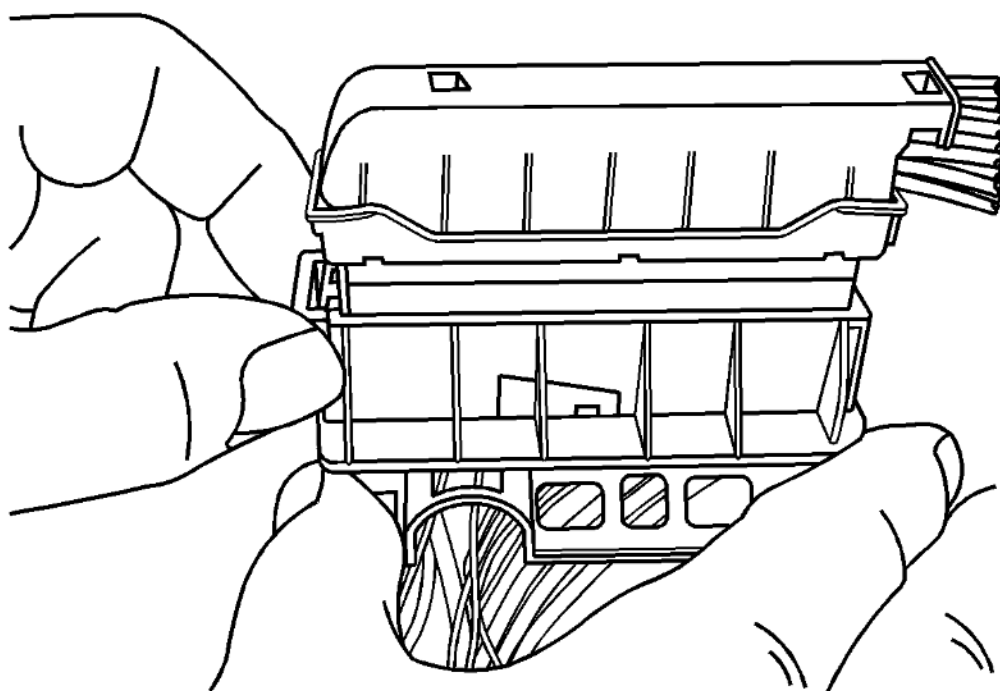


Fig. 189: Locating Locking Slide Lever
Courtesy of GENERAL MOTORS COMPANY

2. As the slide lever is pulled out the mating connector is lifted from the seated position.

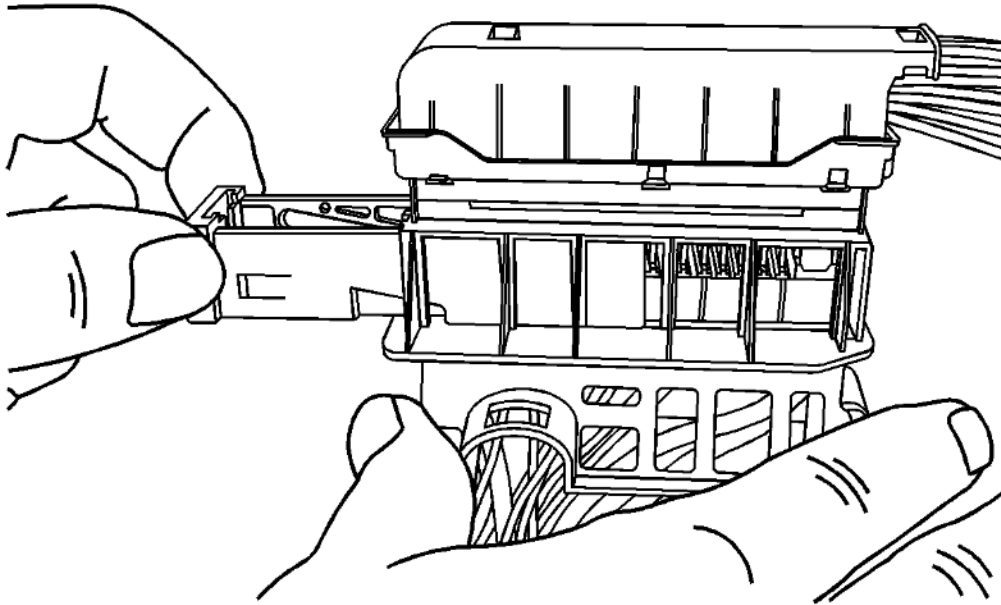


Fig. 190: Pulling Slide Lever Out Of Mating Connector
Courtesy of GENERAL MOTORS COMPANY

3. Using terminal release tool J-38125-11A or equivalent, push the TPA tabs into the connector body.

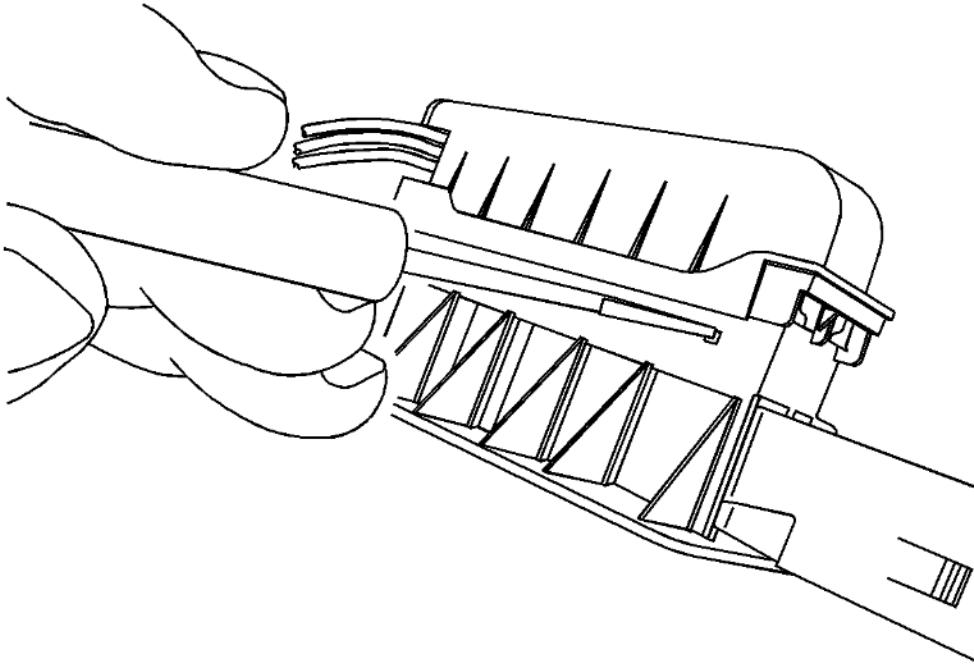


Fig. 191: Pushing TPA Tabs Into Connector Body
Courtesy of GENERAL MOTORS COMPANY

NOTE: Terminal position assurance (TPA) is keyed and can only be inserted in one direction.

4. Pull the TPA from the connector body.

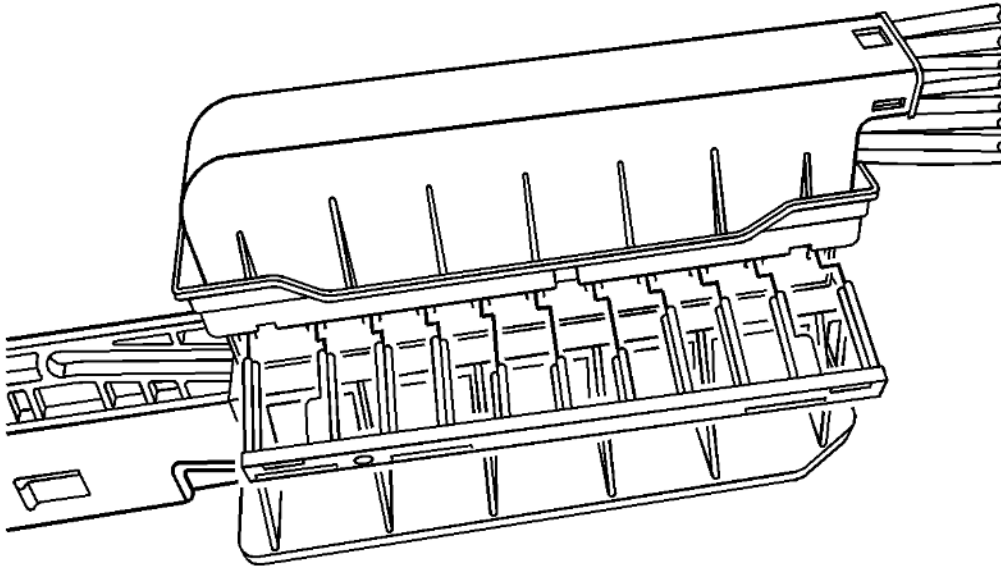


Fig. 192: Pulling TPA From Connector Body
Courtesy of GENERAL MOTORS COMPANY

5. Using terminal release tool J-38125-11A or equivalent, release the connector wire dress cover locking tab.

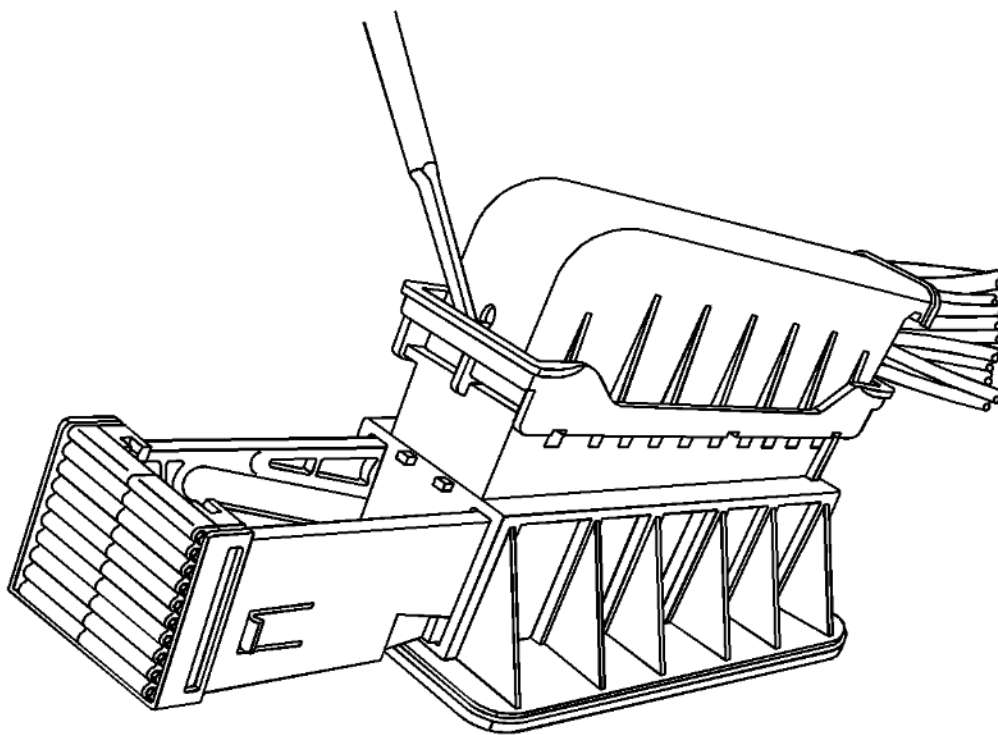


Fig. 193: Releasing Connector Wire Dress Cover Locking Tab
Courtesy of GENERAL MOTORS COMPANY

6. With the lock tab released, lift the connector wire dress cover from the connector body.

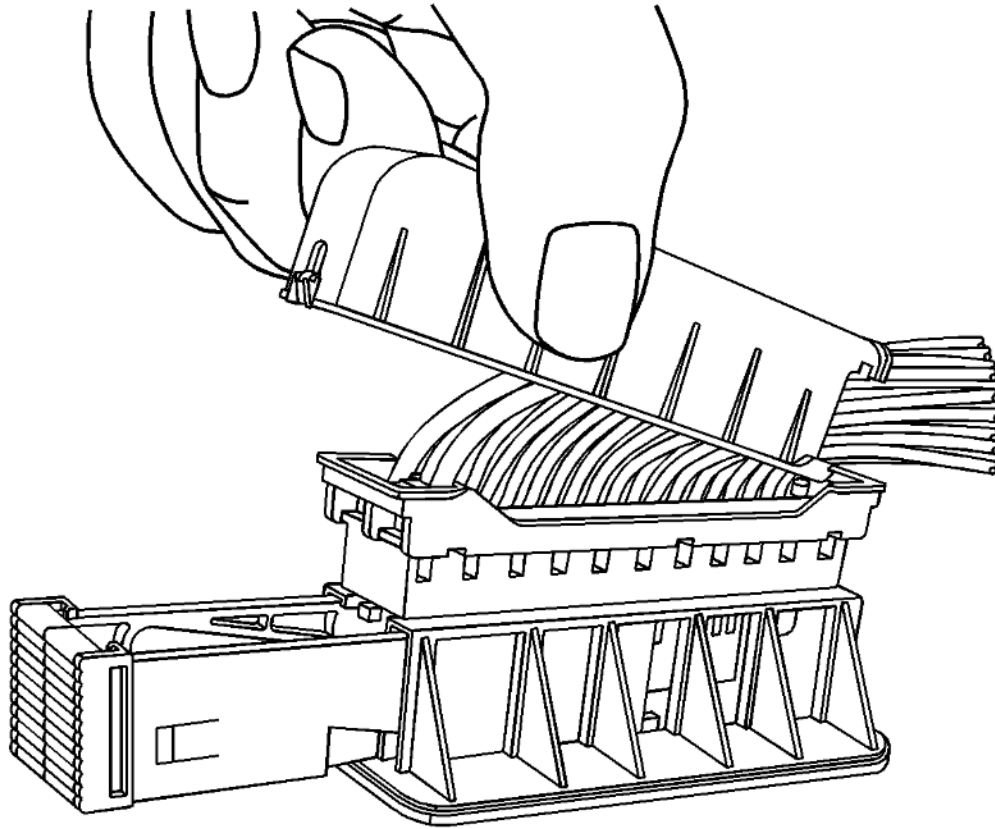


Fig. 194: Lifting Connector Wire Dress Cover From Connector Body
Courtesy of GENERAL MOTORS COMPANY

7. Using terminal release tool J-38125-212, press the prongs into the holes each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

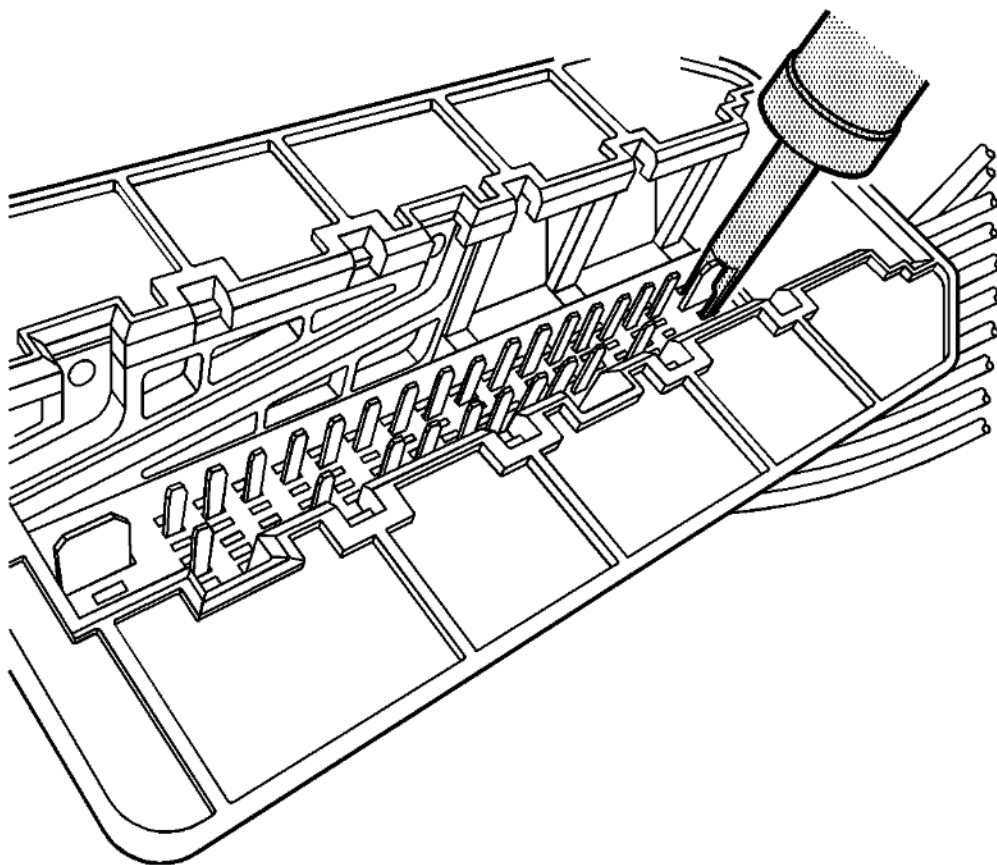


Fig. 195: Using Terminal Release Tool J-38125-212
Courtesy of GENERAL MOTORS COMPANY

8. Using terminal release tool J-38125-560, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

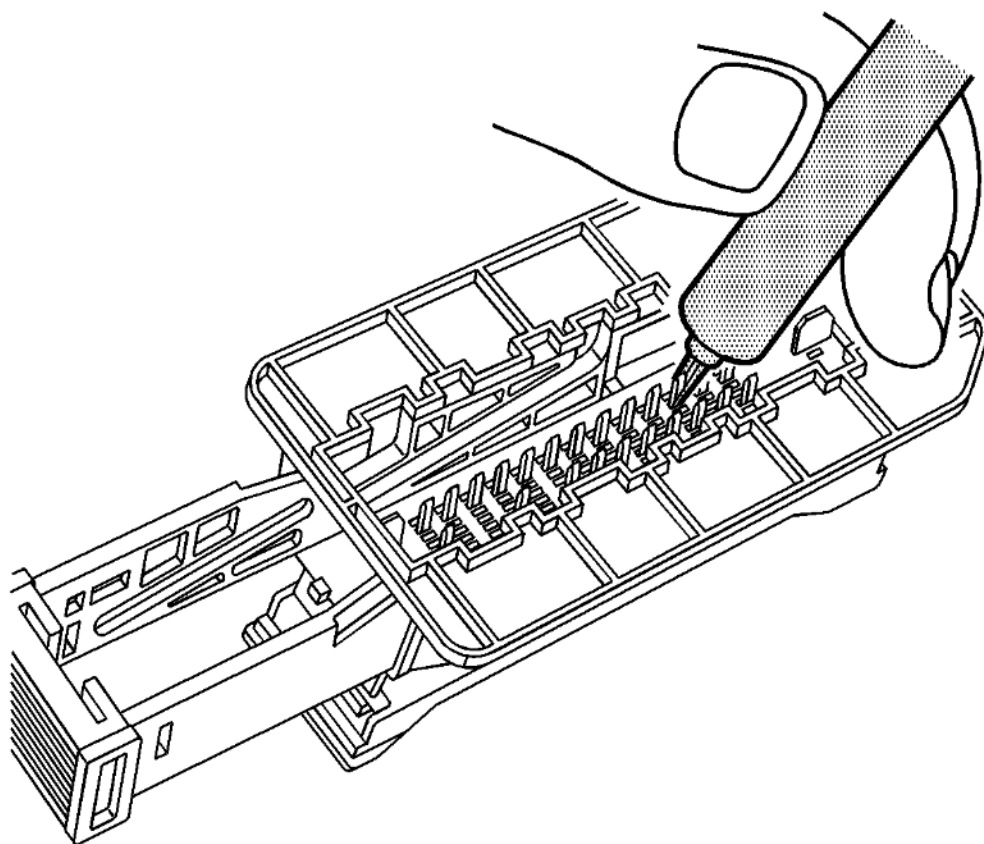


Fig. 196: Using Terminal Release Tool J-38125-560
Courtesy of GENERAL MOTORS COMPANY

9. Using terminal release tool J-38125-556, press the prongs into the holes on each side of the terminal to be removed to release the lock tabs and pull the terminal out of the connector body.

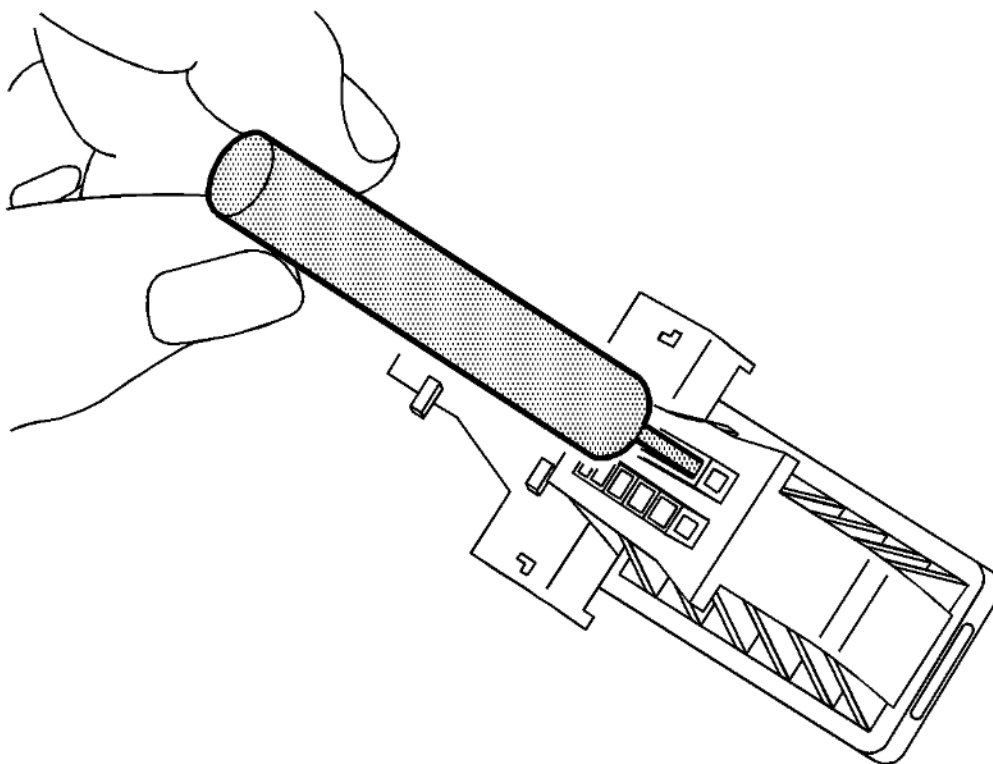


Fig. 197: Using Terminal Release Tool J-38125-556
Courtesy of GENERAL MOTORS COMPANY

10. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
11. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

TYCO/AMP CONNECTORS (SIR)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-11A Terminal Release Tool
- J-38125-215A Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Removal Procedure

1. Using your thumbs press down and slide the red CPA away from the connector lever.

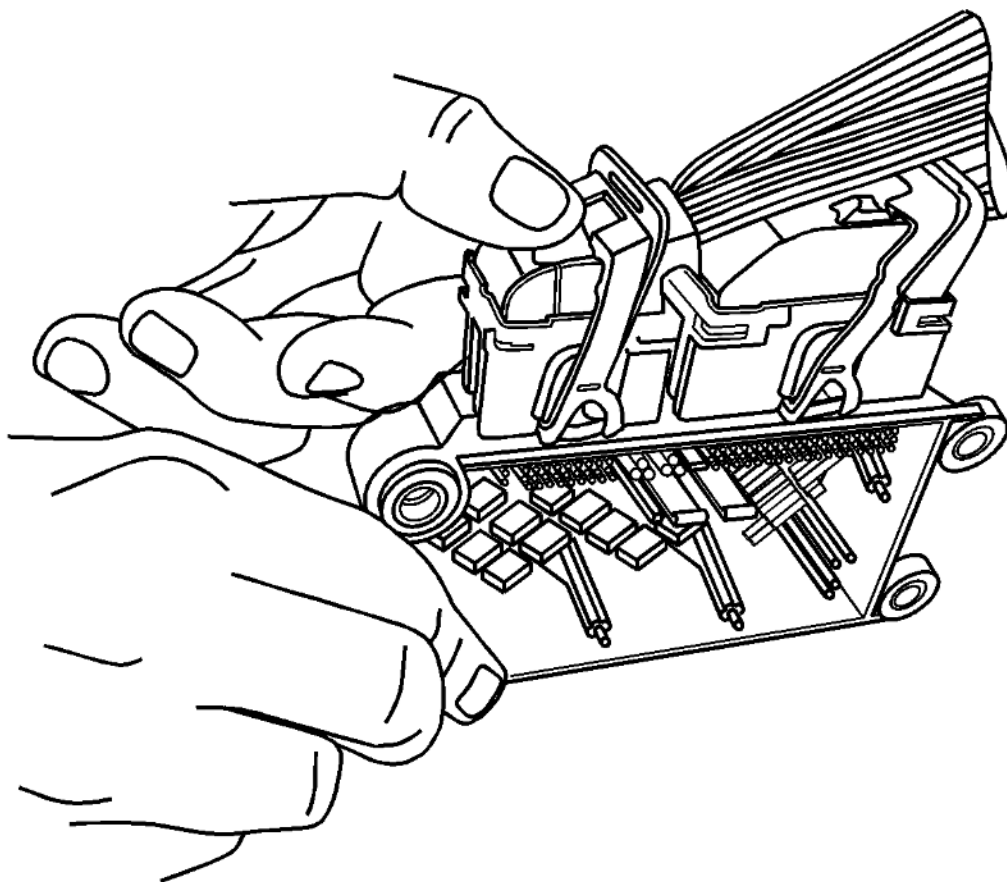


Fig. 198: Sliding Red CPA Away From Connector Lever
Courtesy of GENERAL MOTORS COMPANY

2. Using your thumb press down on the locking tab and move the lever to the released position.

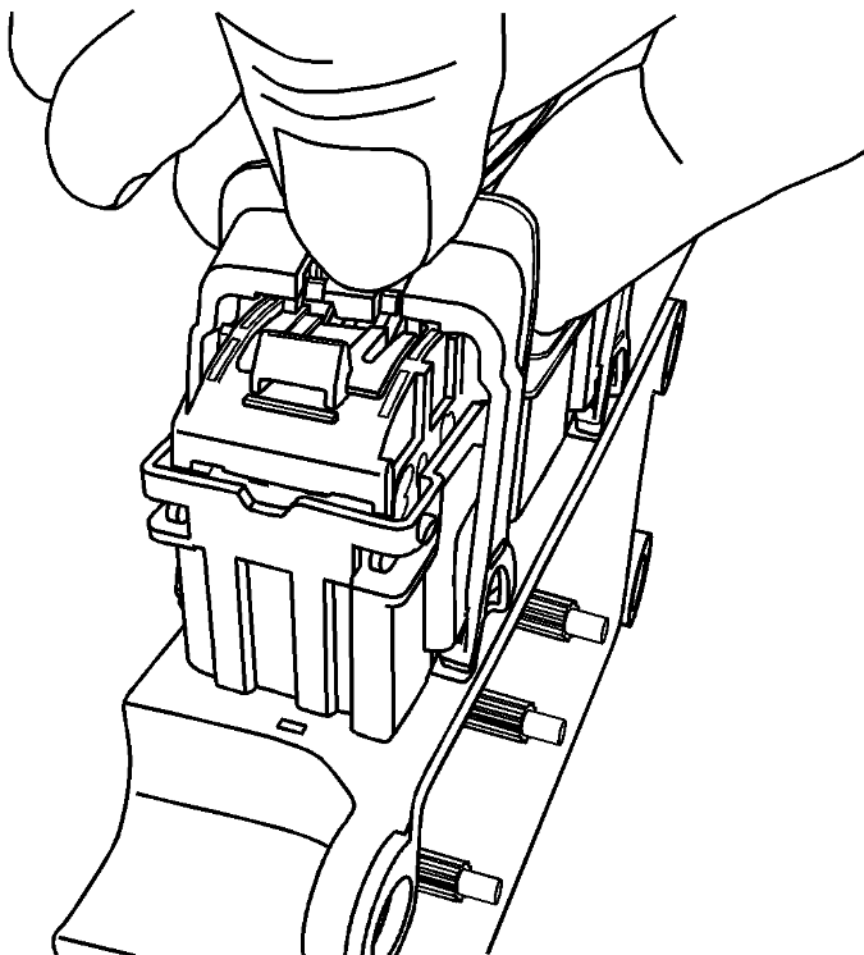


Fig. 199: Pressing Down On Locking Tab - Tyco/AMP Connectors (SIR)
Courtesy of GENERAL MOTORS COMPANY

3. Using terminal tool J-38125-11A or equivalent, release the wire dress cover locking tabs.

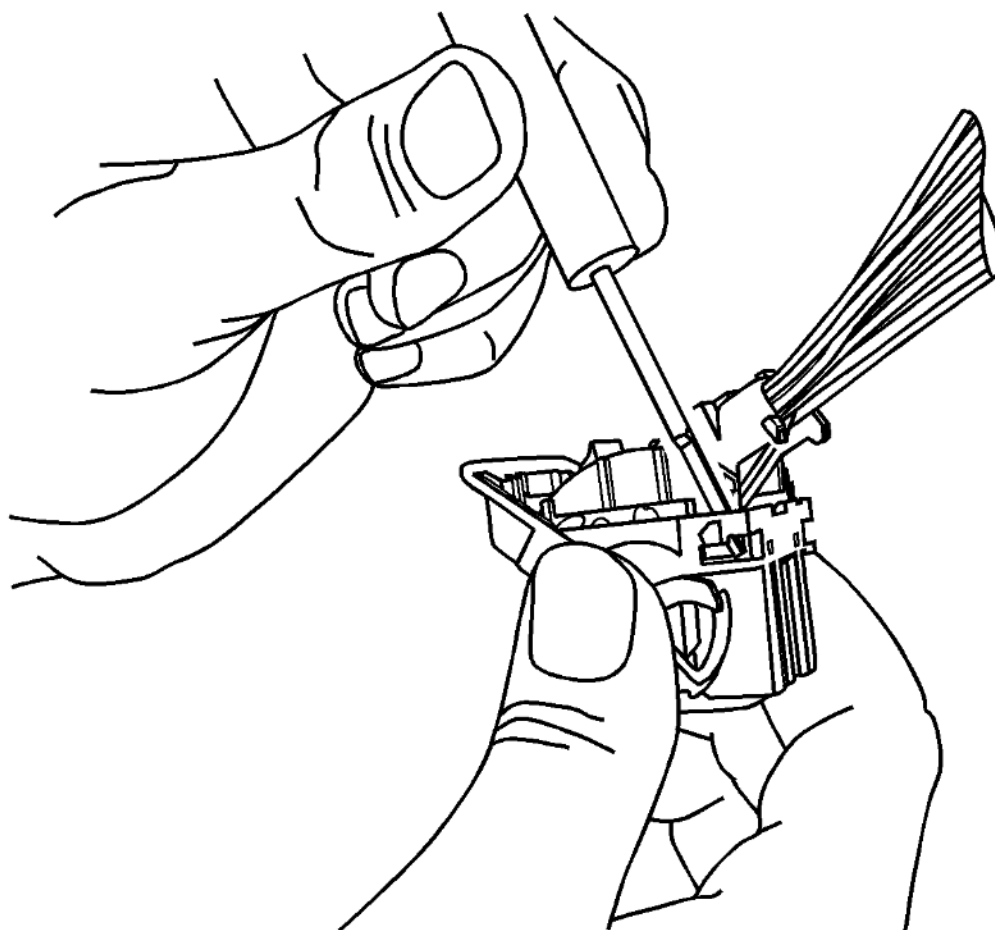


Fig. 200: Releasing Wire Dress Cover Locking Tabs
Courtesy of GENERAL MOTORS COMPANY

4. Pivot connector wire dress cover while removing from the connector body.

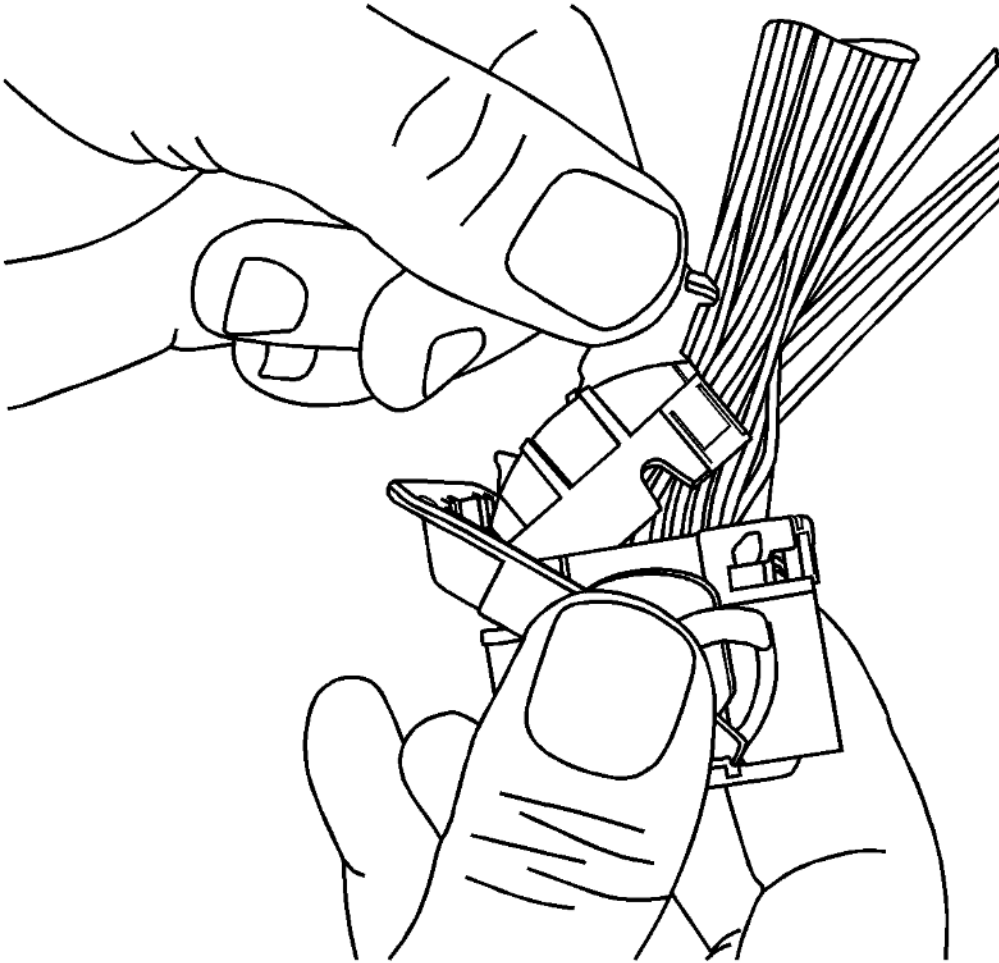


Fig. 201: Pivoting Connector Wire Dress Cover
Courtesy of GENERAL MOTORS COMPANY

5. Using terminal tool J-38125-11A or equivalent, remove the TPA by lifting straight off the connector body.

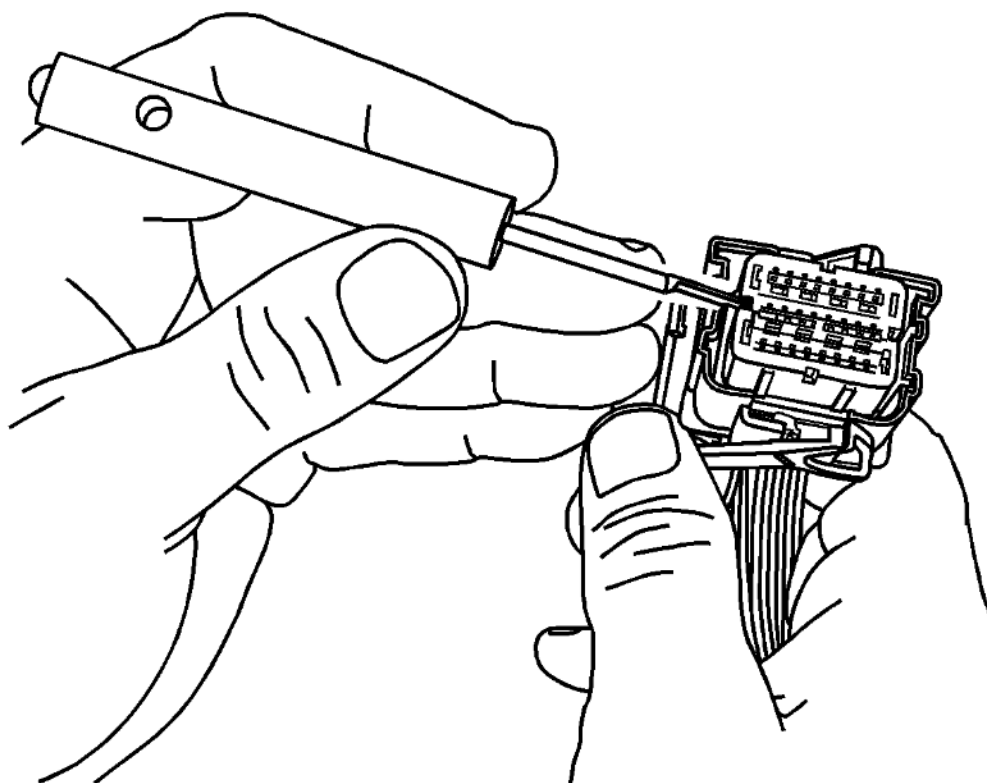


Fig. 202: Using Terminal Tool 12094430
Courtesy of GENERAL MOTORS COMPANY

6. Using terminal release tool J-38125-215A, place the tip of the tool on the outside edge next to the terminal and depress the lock tab and remove the rear of the connector body.

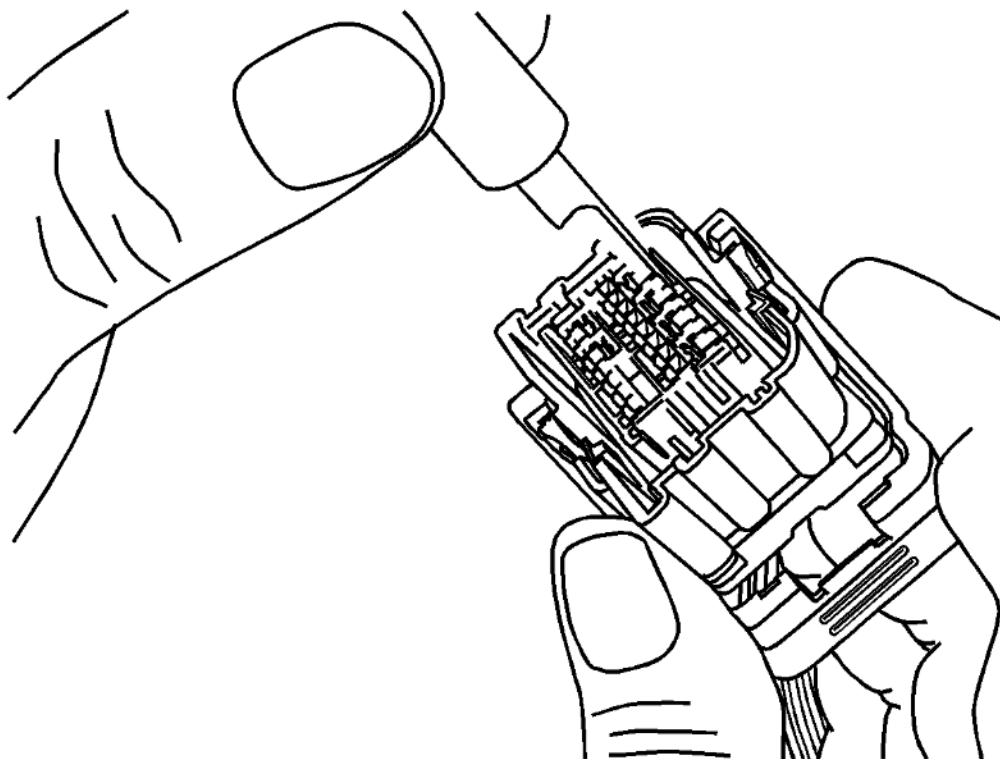


Fig. 203: View of Terminal Release Tool J-38125-215A & Rear of Connector Body
Courtesy of GENERAL MOTORS COMPANY

Terminal Repair Procedure

Use the appropriate terminal and crimper in order to replace the terminal.

YAZAKI CONNECTORS (2-WAY)

Special Tools

- EL-38125-550 Terminal Release Tool Kit
- EL-38125-580 Terminal Release Tool Kit
- J-38125-553 Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. Disconnect the connector from the component.
2. Insert a small flat-blade tool in the slot below the front loaded terminal position assurance (TPA) and pry up.

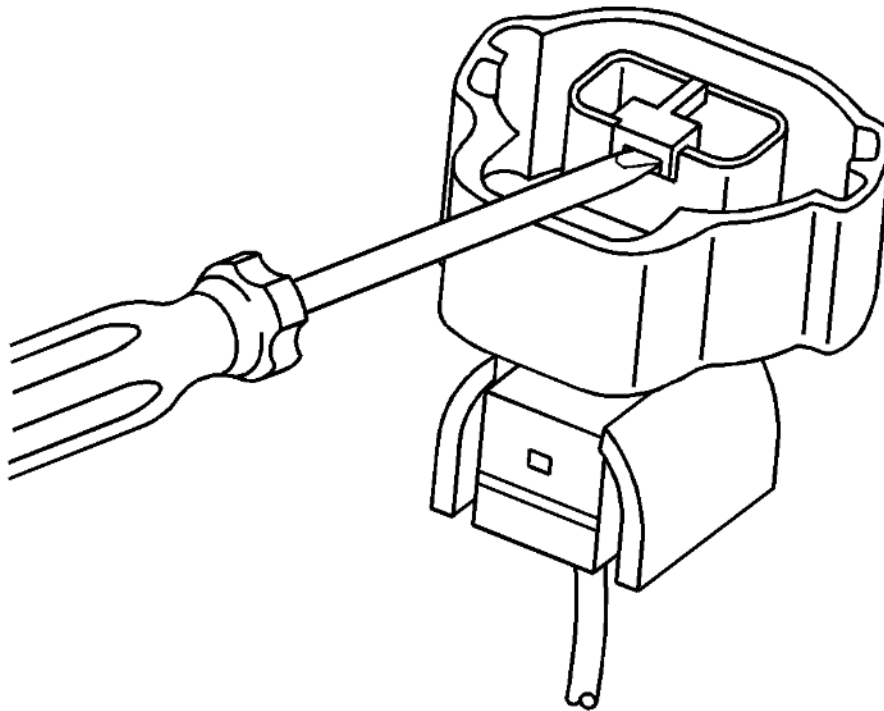


Fig. 204: Identifying Terminal Position Assurance (Yakazi)
Courtesy of GENERAL MOTORS COMPANY

3. Remove the TPA by pulling it out of the connector.
4. Push the wire side of the terminal that is being removed toward the connector and hold it in position.
5. Insert the J-38125-553 on a slight upward angle into the cavity below the terminal to be removed. Ensure that the pointed on the end of the tool is facing the bottom of the terminal and it stays in contact with the terminal until it stops on the plastic terminal retainer.

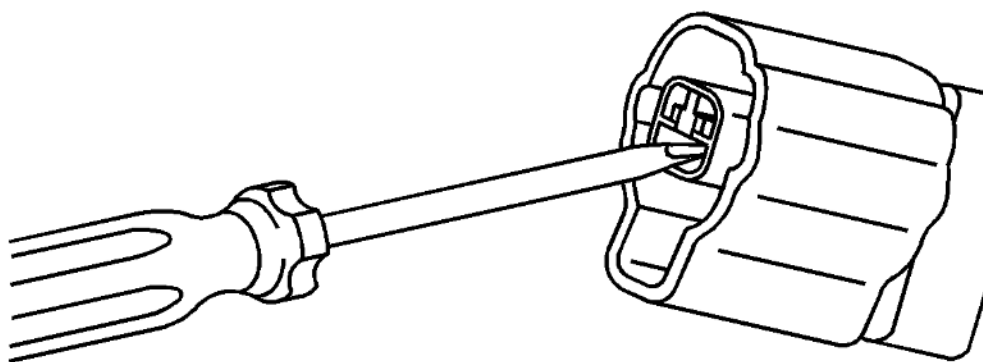


Fig. 205: View Of Inserting Tool Into Terminal Cavity (Yakazi)
Courtesy of GENERAL MOTORS COMPANY

6. Gently pry the plastic terminal retainer down and carefully pull the terminal out of the connector. Always remember never use force when pulling a terminal out of a connector. If the terminal is difficult to remove, repeat the entire procedure.

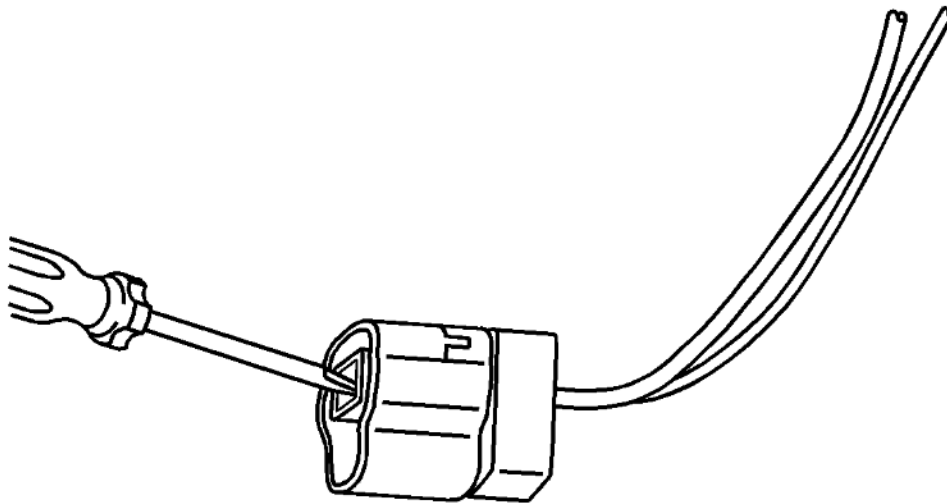


Fig. 206: View Of Pulling Terminal Out Of Connector (Yakazi)
Courtesy of GENERAL MOTORS COMPANY

7. Repair the terminal by following **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
8. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

YAZAKI CONNECTORS (16-WAY)

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **J-38125-215** Terminal Release Tool

For equivalent regional tools, refer to **Special Tools** .

Terminal Removal Procedure

1. While depressing the lock, pull the two connector halves apart.

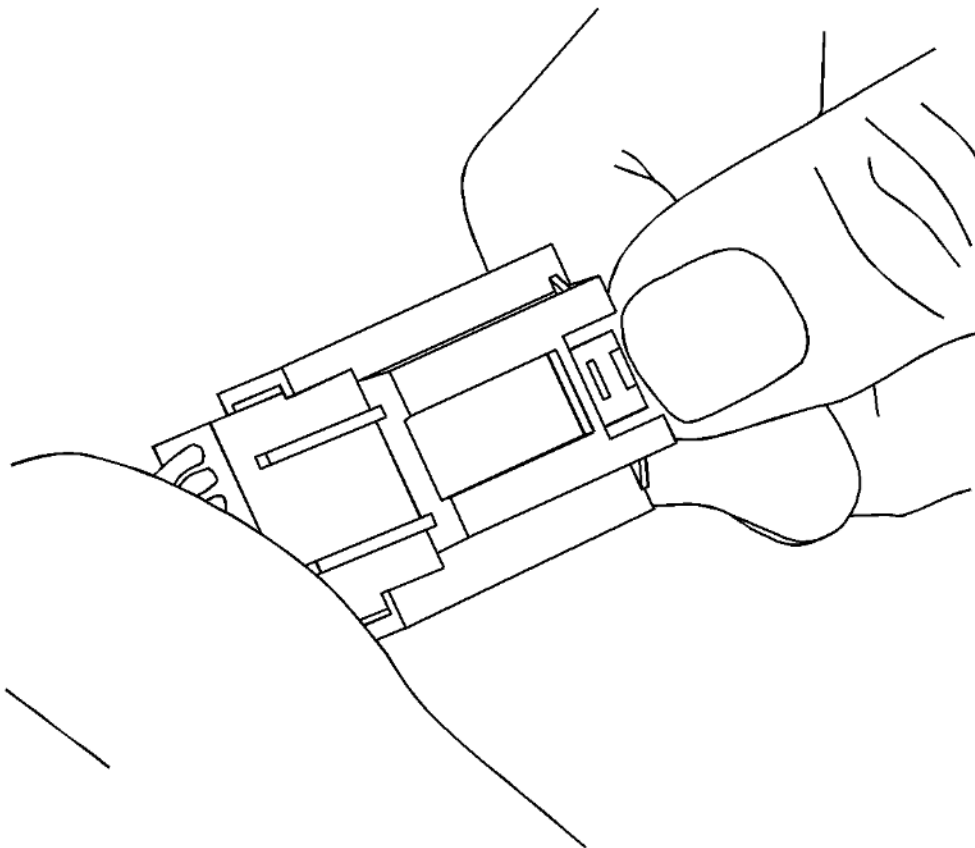


Fig. 207: Pulling Two Connector Halves Apart
Courtesy of GENERAL MOTORS COMPANY

2. Use a small flat-blade tool to very carefully push the TPA towards the face of the connector on both sides of the connector.

NOTE: **The terminal position assurance (TPA) is fragile and may break if not done carefully.**

3. View of the male half of the connector with female terminals.

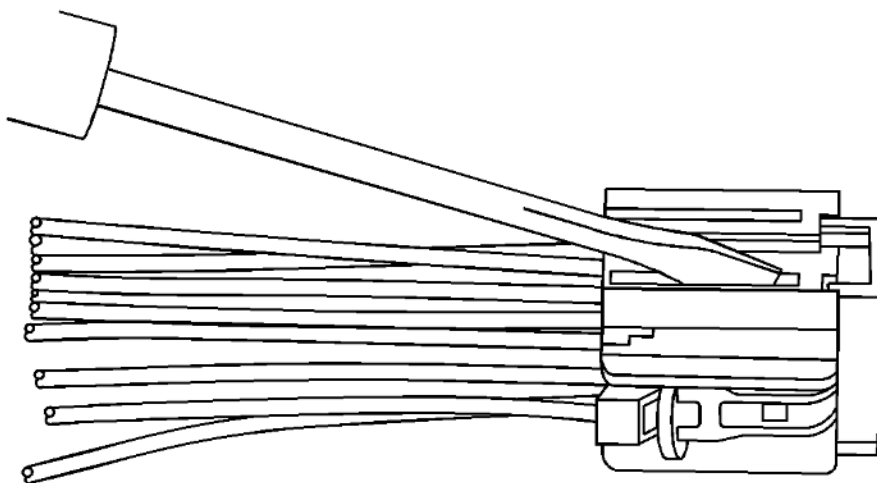


Fig. 208: View Of Male Connector Half & Female Terminals
Courtesy of GENERAL MOTORS COMPANY

4. View of the female half of the connector with male terminals.

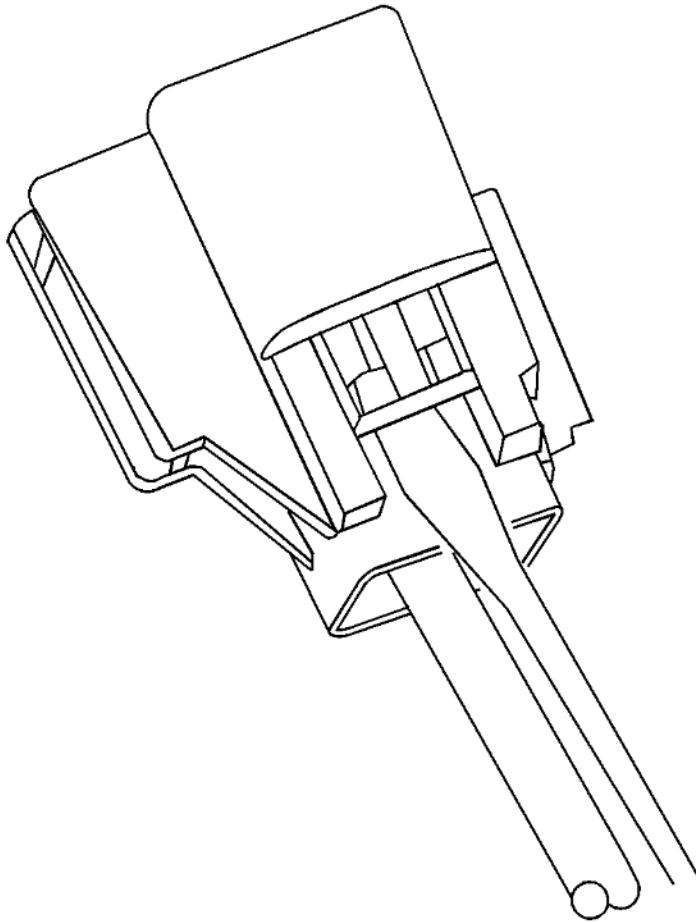


Fig. 209: View Of Female Half Of Connector With Male Terminals
Courtesy of GENERAL MOTORS COMPANY

5. Use the J-38125-215 tool to release the terminals by inserting the tool into the terminal release cavity.
6. View of the female half of the connector with male terminals.

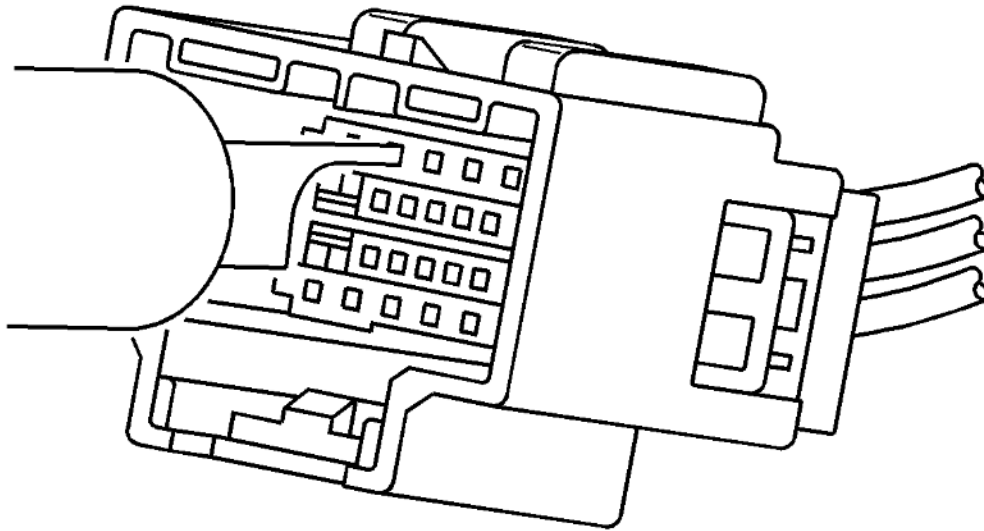


Fig. 210: Using Removal Tool On Female Half Of Connector
Courtesy of GENERAL MOTORS COMPANY

7. View of the male half of the connector with female terminals.

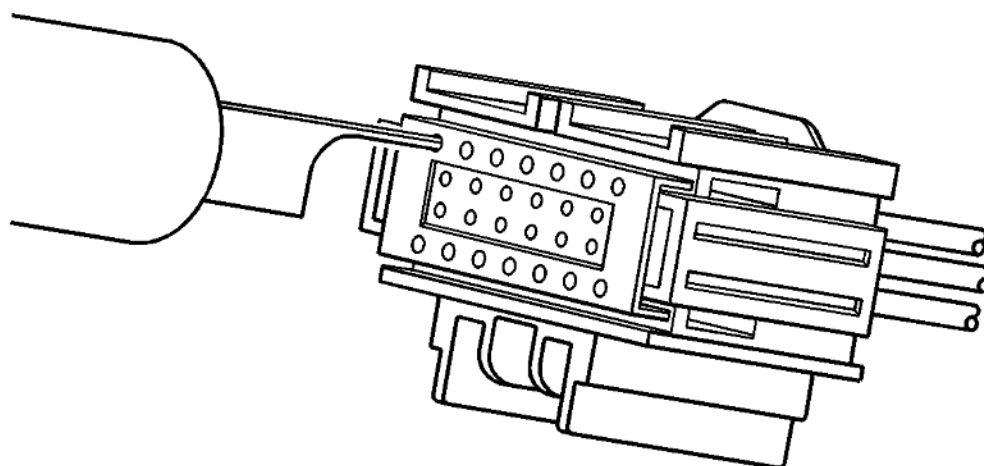


Fig. 211: Using Removal Tool On Male Half Of Connector
Courtesy of GENERAL MOTORS COMPANY

8. While holding the removal tool in place, gently pull the wire out of the back of the connector. Always remember never use force when pulling a terminal out of a connector.
9. Repair the terminal by following **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
10. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

REPAIRING CONNECTOR TERMINALS (TERMINATED LEAD REPAIR)

Special Tools

EL-38125-10 Splice Sleeve Crimp Tool

For equivalent regional tools, refer to **Special Tools** .

NOTE: All repairs near the engine manifold, turbo engine and all exhaust pipes should follow the High Temperature Wiring Repairs procedures.

For high temperature wiring repairs, refer to **High Temperature Wiring Repairs**.

Terminated leads are terminals that are crimped onto wires. The terminated lead can be used throughout the vehicle since it is designed for temperatures up to 150°C. The length of the wire is 450 mm.

1. Use the connector end view to identify the correct terminated lead.
2. The terminated lead package should include a DuraSeal splice sleeve. If not, use the chart to in Splicing Copper Wire Using Splice Sleeves to identify the correct DuraSeal splice sleeve, refer to **Splicing Copper Wire Using Splice Sleeves**.

REPAIRING CONNECTOR TERMINALS (TERMINAL REPAIR)

Special Tools

- J-38125-580 Terminal Repair Kit
- J-38125-6 Crimp Tool
- J-38125-7 Crimp Tool
- J-38125-8 Crimp Tool
- J-38125-64 Crimp Tool
- J-38125-101 Crimp Tool
- J-38125-641 Crimp Tool
- J-38125-642 Crimp Tool
- J-38125-643 Crimp Tool

For equivalent regional tools, refer to **Special Tools** .

Use the following repair procedures to repair each type of terminal:

- For push to seat terminals, refer to **Delphi Connectors (Weather Pack)**, **Delphi Connectors (Pull To Seat)**, **Delphi Connectors (Push To Seat)**, **Delphi Connectors (12-Way)**, **Delphi Connectors (Micro.64)**, **Delphi Connectors (Steering Gear)**, **Delphi Connectors (Micro-Pack 100W)**.
- For pull to seat terminals, refer to **Delphi Connectors (Weather Pack)**, **Delphi Connectors (Pull To Seat)**, **Delphi Connectors (Push To Seat)**, **Delphi Connectors (12-Way)**, **Delphi Connectors (Micro.64)**, **Delphi Connectors (Steering Gear)**, **Delphi Connectors (Micro-Pack 100W)**.

NOTE: The first step for all terminal repairs is to find the connector end view in SI.

Cable Seal Terminals

1. Cut off the terminal between the core and the insulation crimp to minimize any wire loss.

2. Remove the old seal.
3. Apply the correct cable seal, per the wire gauge size, from the kit. Slide the seal back along the wire to enable removal of the insulation.
4. To minimize wire loss, remove only the insulation required.
5. Using the connector end view, determine the correct crimp tool and crimp jaw.
6. Align the seal with the end of the cable insulation.
7. Position the stripped wire and seal in the terminal.
8. Hand Crimp the core wings first.
9. Hand Crimp the insulation wings around the seal and the cable.
10. Solder all of the hand crimp terminals except the Micro-Pack 100 and 0.64 sizes.

Unsealed Terminals

1. Cut off the terminal between the core and the insulation crimp to minimize any wire loss.
2. To minimize wire loss, remove only the insulation required.
3. Position the stripped wire in the terminal.
4. Hand Crimp the core wings first.
5. Hand Crimp the insulation wings around the cable.
6. Solder all of the hand crimp terminals except the Micro-Pack 100 and 0.64 sizes.

Micro-Pack 100W Size Terminal

The Micro-Pack 100W connectors have small terminals that are difficult to handle and hold when crimping. In order to aid the technician when crimping these terminals, a new crimping tool was developed. The J 38125-101 (W jaw) crimping tool was developed to crimp Micro-Pack 100W terminals. The J 38125-101 (W jaw) crimping tool has a terminal holding block that will hold the terminal in place while the terminal is being crimped. After the terminal is removed from the connector perform the following procedure in order to repair Micro-Pack 100 terminals.

1. Cut the wire as close to the terminal as possible.
2. Strip 5 mm (3/16 in) of insulation from the wire.

NOTE: After cutting the damaged terminal from the wire, determine if the remaining wire is long enough to reach the connector without putting a strain on the wire. If the wire is not long enough, splice a small length of the same gauge wire to the existing wire, then crimp the new terminal on the added wire.

3. Depress the spring loaded locator of the J 38125-101 (W jaw) crimping tool until the terminal holder is completely visible.

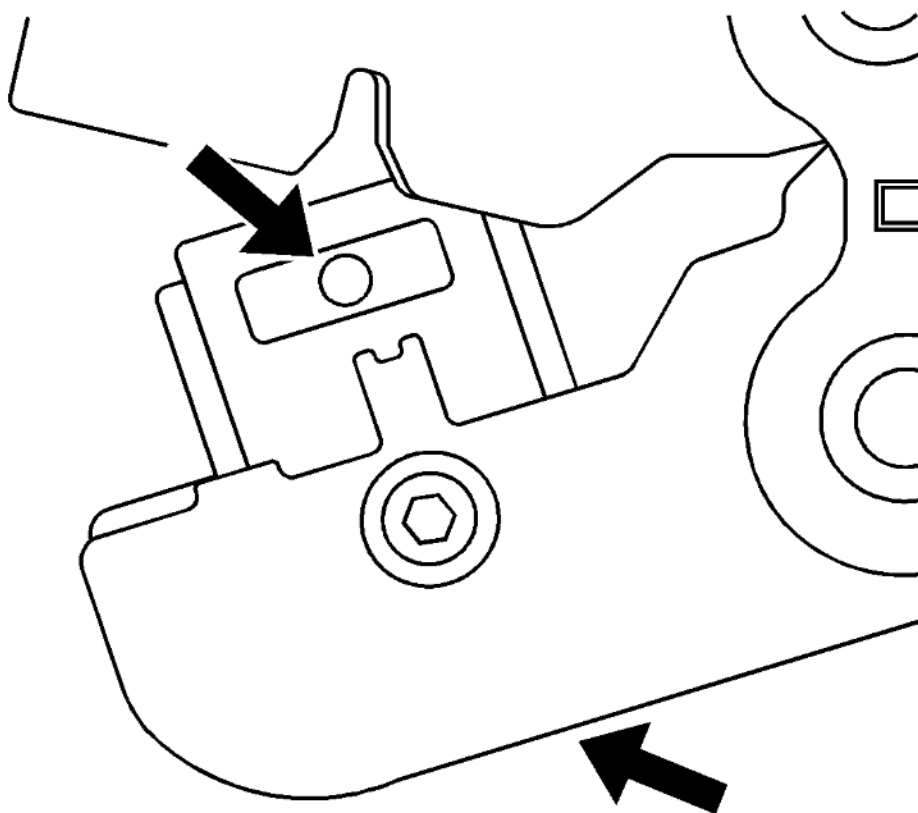


Fig. 212: Identifying Crimping Tool Spring Loaded Locator
Courtesy of GENERAL MOTORS COMPANY

4. Insert the terminal into the crimp tool until the core wings are flush with the anvil on the crimp tool. Be sure that the wings are pointed toward the crimp tool former and release the spring locator. The locator will hold the terminal in place. Inspect the alignment of the terminal wings with the crimp tool former. If the terminal wings are wider than the crimp tool former, remove the terminal and bend the terminal wings in slightly.

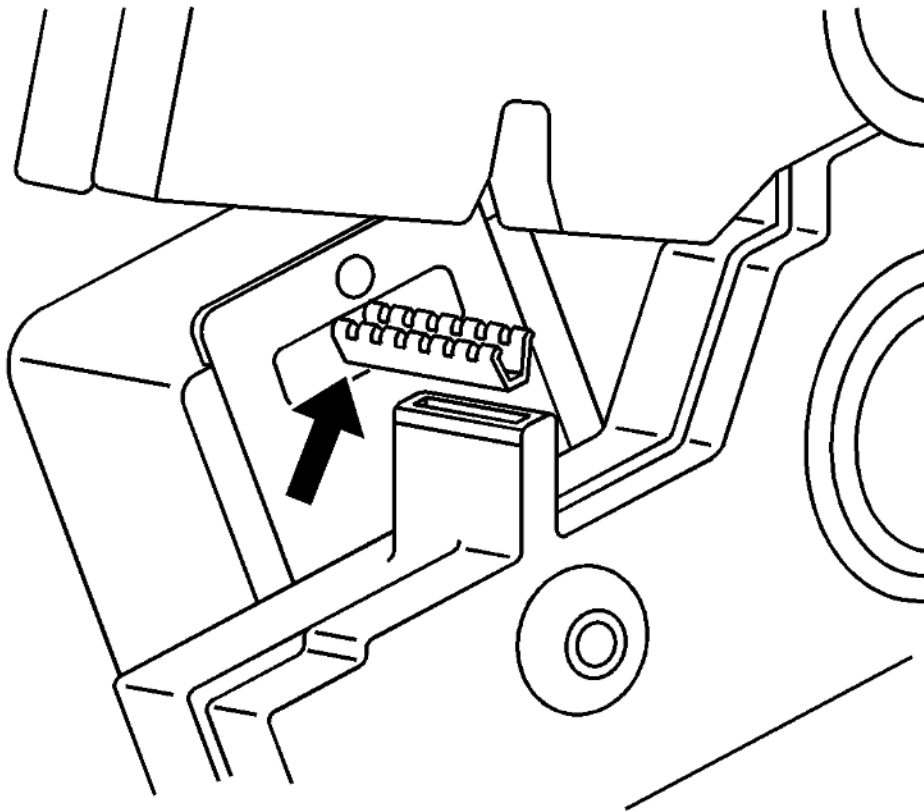


Fig. 213: Locating Terminal In Crimping Tool
Courtesy of GENERAL MOTORS COMPANY

5. Place stripped wire into terminal.
6. Crimp the new terminal to the wire. If a jam occurs, press the emergency release to open applicator.

Micro 0.64 Size Terminal

The Micro 64 connectors have small terminals that are difficult to handle and hold when crimping. In order to aid the technician when crimping these terminals, a new crimping tool was developed. The J 38125-64 (M jaw) was developed to crimp Micro 64 terminals. The J-38125-64 crimping tool has a terminal holding block that will hold the terminal in place while the terminal is being crimped. The J-38125-64 crimping tool is also designed to crimp both the wire and the insulation at the same time.

After the terminal is removed from the connector perform the following procedure in order to repair Micro 64 terminals.

NOTE: After cutting the damaged terminal from the wire, determine if the remaining

wire is long enough to reach the connector without putting a strain on the wire. If the wire is not long enough, splice a small length of the same gauge wire to the existing wire, then crimp the new terminal on the added wire.

1. Cut the wire as close to the damaged terminal as possible.
2. Strip 5 mm (3/16 in) of insulation from the wire.
3. Depress the spring loaded locator of the crimping tool until the terminal holder is completely visible.

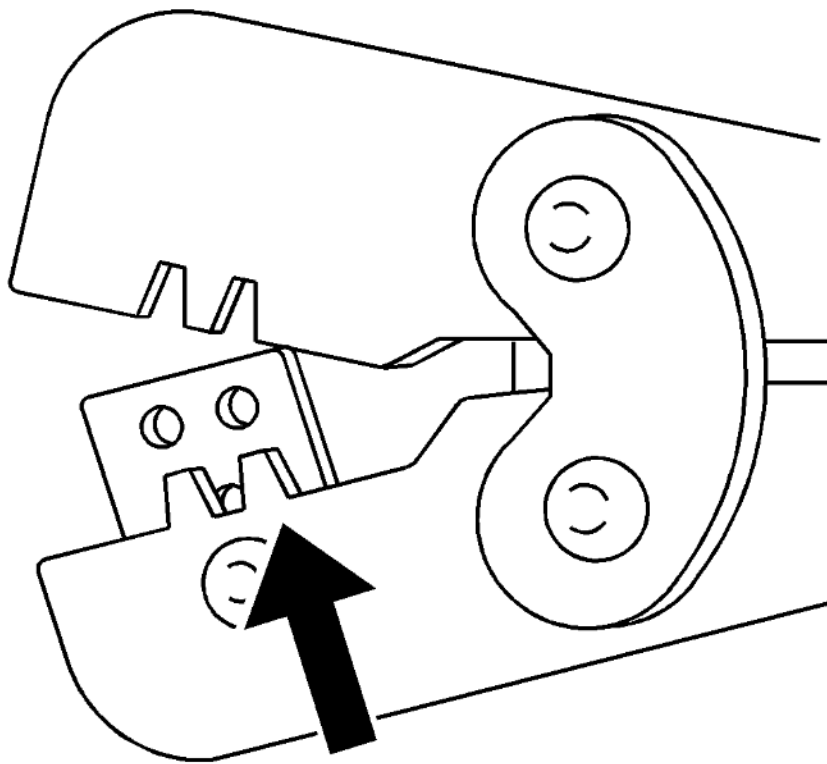


Fig. 214: Identifying Crimping Tool Spring Loaded Locator
Courtesy of GENERAL MOTORS COMPANY

4. Insert terminal into the appropriate terminal holder until it hits bottom and stops. The correct terminal holder is determined by the wire size. Also ensure that the terminal wings are pointing towards the former on the tool and the release locator.

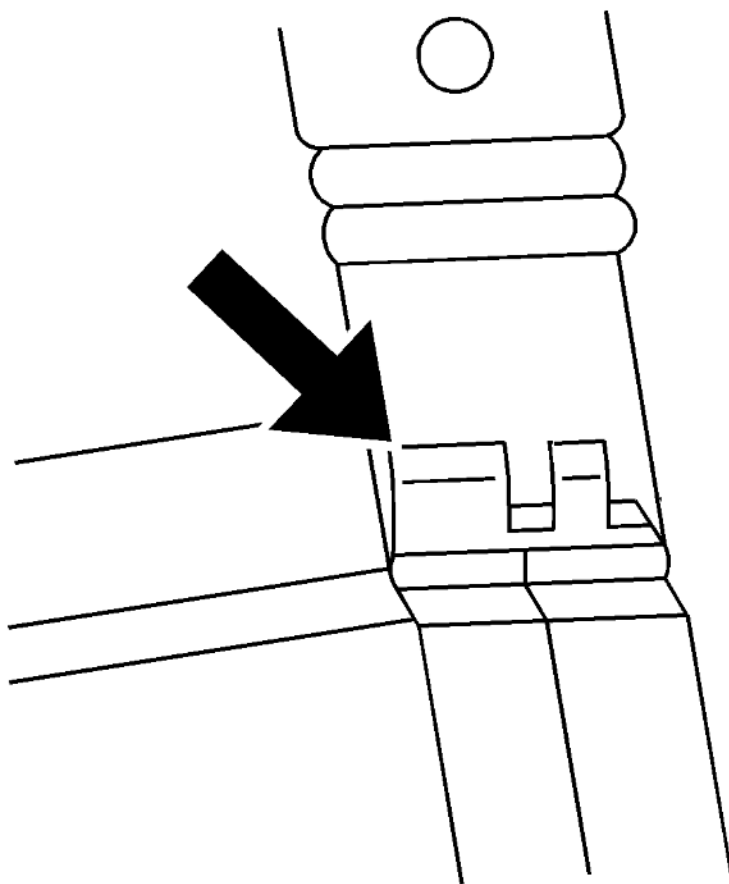


Fig. 215: Identifying Terminal Holder
Courtesy of GENERAL MOTORS COMPANY

5. Insert the stripped cable into the terminal. Insulation should be visible on both sides of the terminal insulation wings.
6. Compress the handles until the ratchet automatically releases.
7. Place the terminal into the appropriate cavity and assemble the connector.

TERMINAL REMOVAL

Special Tools

- **EL-38125-550** Terminal Release Tool Kit
- **EL-38125-580** Terminal Release Tool Kit
- **EL-35616** Terminal Test Probe Kit

For equivalent regional tools, refer to **Special Tools**.

NOTE: All repairs near the engine manifold, turbo engine and all exhaust pipes should follow the High Temperature Wiring Repair procedures.

1. Find the appropriate connector end view within the connector end view section. The connector end view has the following information:
 - Diagnostic probe tool
 - Terminal release tool
 - Terminal/terminated lead part numbers
2. Determine if a terminal is damaged.

NOTE: Not using the proper test kit probe may cause damage to the terminal(s) that are probed.

- Locate the diagnostic probe tool from the connector end view. The connector end view describes the color and part number to help the technician find and use the correct tool.
 - Connect the probe tool to the Digital Multimeter.
 - Insert the probe tool into the cavity and follow the procedures from Troubleshooting with a Digital Multimeter.
3. Disconnect the connector body to perform the repair.
 4. Use the following procedure to remove the terminal from the connector body.

NOTE: Several procedures for specific connector bodies are called out in the Wiring Repairs section.

- The terminal position assurance (TPA) and connector position assurance (CPA) should be removed before releasing the terminal for the connector body.
- Look at the connector end view to locate the cavity of the damaged terminal and find the proper terminal release tool from the terminal release tool kit.
- Insert the terminal release tool into the cavity.

NOTE: Using the incorrect terminal release tool can damage the connector body.

NOTE: Some terminals have a lever that must be disengaged before the terminal can be released.

5. Gently pull the wire out of the back of the connector.

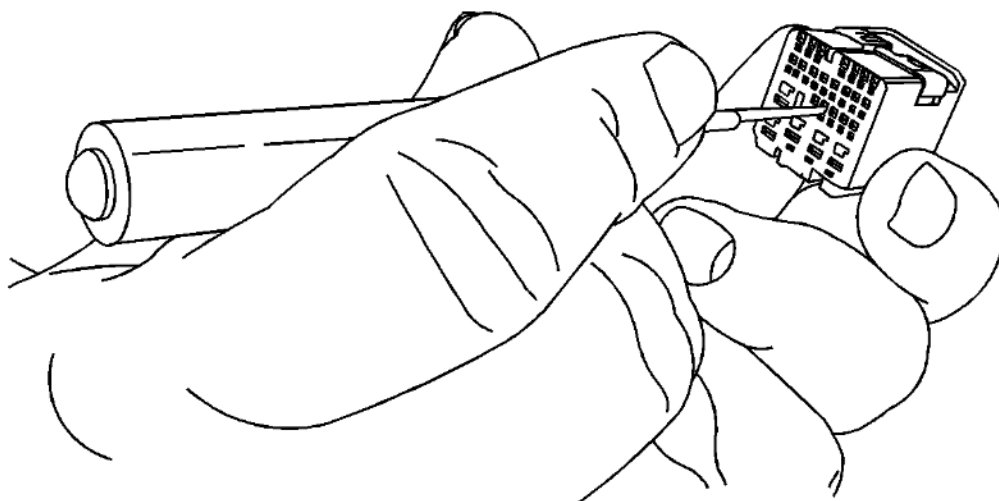


Fig. 216: Gently Pulling Wire Out Of Back Of Connector
Courtesy of GENERAL MOTORS COMPANY

6. Repair the terminal by following the **Repairing Connector Terminals (Terminated Lead Repair)**, **Repairing Connector Terminals (Terminal Repair)** procedure.
7. Insert the repaired terminal back into the cavity. Repeat the diagnostic procedure to verify the repair and reconnect the connector bodies.

IGNITION KEY CANNOT BE INSERTED, ROTATED OR REMOVED FROM THE IGNITION LOCK CYLINDER

Ignition Key Cannot Be Inserted, Rotated or Removed from the Ignition Lock Cylinder

Step	Action	Yes	No
1	1. Ensure the transmission shift lever is in the PARK position and the steering column is NOT in the locked position. 2. Verify the ignition key cannot be removed		

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And Traverse

	from the ignition lock cylinder. Can the ignition key be removed from the ignition lock cylinder?	Go to Step 4	Go to Step 2
2	Verify the ignition key cannot be turned to the OFF position. Can the ignition key be turned to the OFF position?	Go to Step 3	Go to Step 7
3	Verify the ignition key cannot be removed from the ignition lock cylinder. Can the ignition key be removed from the ignition lock cylinder?	Go to Step 7	Go to Step 12
4	Verify the ignition key cannot be fully inserted and rotated without sticking in any position. Can the ignition key be fully inserted into the ignition lock cylinder and be rotated without sticking in any position?	Go to Step 7	Go to Step 5
5	Inspect for an incorrect, worn or damaged ignition key. Is the ignition key incorrect, worn or damaged?	Go to Step 10	Go to Step 6
6	Inspect the ignition key. Clean the entire middle groove area of the side milled ignition key. Can the cleaned key be fully inserted into the ignition lock cylinder and be rotated without sticking in any position?	Go to Step 13	Go to Step 12
7	Verify the adjustment of the shift control cable. Refer to <u>Range Selector Lever Cable Adjustment</u> . Can the ignition key be turned to the OFF position and be removed?	Go to Step 13	Go to Step 8
8	Attempt to override the ignition lock solenoid on the ignition and start switch housing. Can the ignition key be turned to the OFF position and be removed?	Go to Step 9	Go to Step 12
9	Inspect the electrical system for improper operation. Refer to <u>Ignition Can/Cannot Be Turned Off with Transmission in Any Gear</u> and to <u>Testing for Intermittent Conditions and Poor Connections</u> . Can the ignition key be turned to the OFF position and be removed?	Go to Step 13	Go to Step 11
10	Replace the ignition key. Refer to <u>Adding Keys</u> . Did you complete the repair?	Go to Step 13	-
	Replace the floor shifter. Refer to <u>Automatic Transmission Range Selector Lever</u>		

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11	<u>Replacement</u> . Did you complete the repair?	Go to Step 13	-
12	Replace the ignition lock cylinder. Refer to <u>Ignition Lock Cylinder Replacement</u> . Did you complete the repair?	Go to Step 13	-
13	Operate the system in order to verify the repair. Did you correct the condition?	System OK	-