



Connector Service Manual

Rev C

Contents

1. Connector Introduction
2. Service Tools
3. Working with d-sub connectors
4. Working with crimp connectors
5. Working with power connectors
6. Working with coax connectors



Connector Introduction

The Vertical Power system uses two types of connectors.

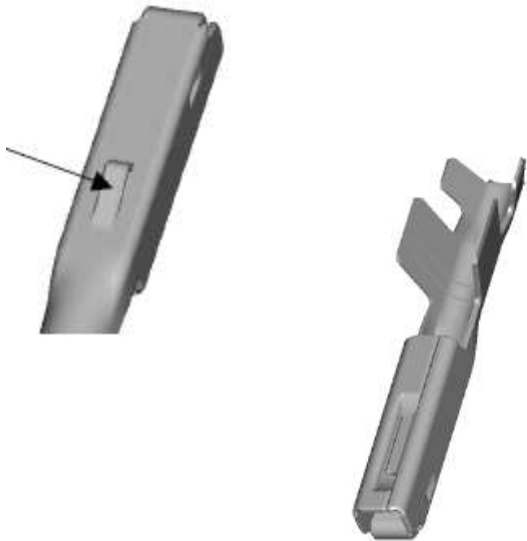
- Power connectors
 - Can handle up to 18 amps of current per pin and are used to provide power to lights, avionics, contactors, etc. These are used on the Control Unit. Each CU has an 8, 10, 12, and 16 pin connector minimizing the risk of a mis-match.
- D-sub (d-subminiature) connectors
 - For use with low-current circuits such as data signals, position sensor feedback, micro-switches, and trim motors. These are used on the Control Unit and Display Unit. Each d-sub connector is unique to minimize the risk of a mis-match.



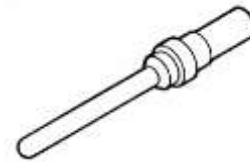
Terminals

Power Connector Sockets

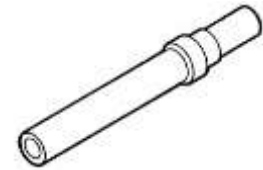
Orientation
Feature



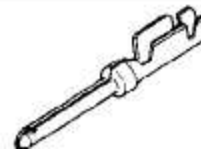
D-sub Pins & Sockets



Machined-Barrel Pin



Machined-Barrel Socket
(not used)



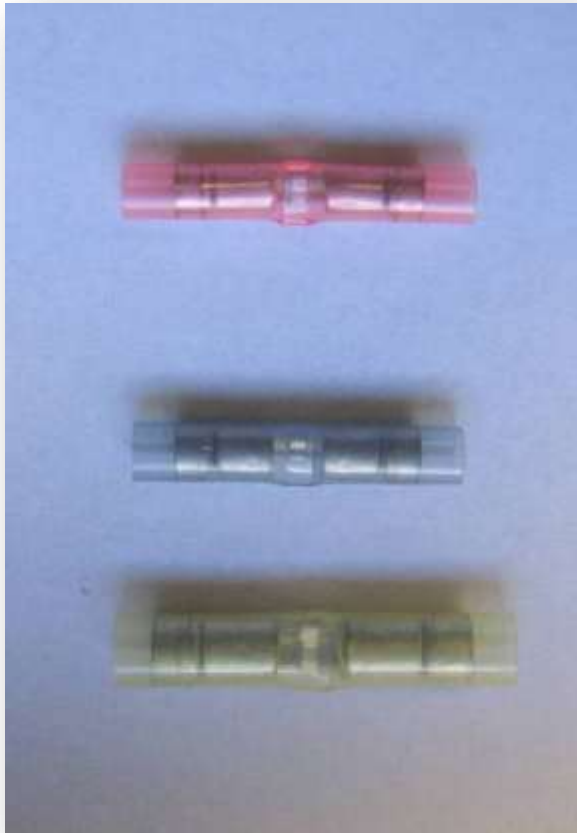
Crimp Pin
(not used)



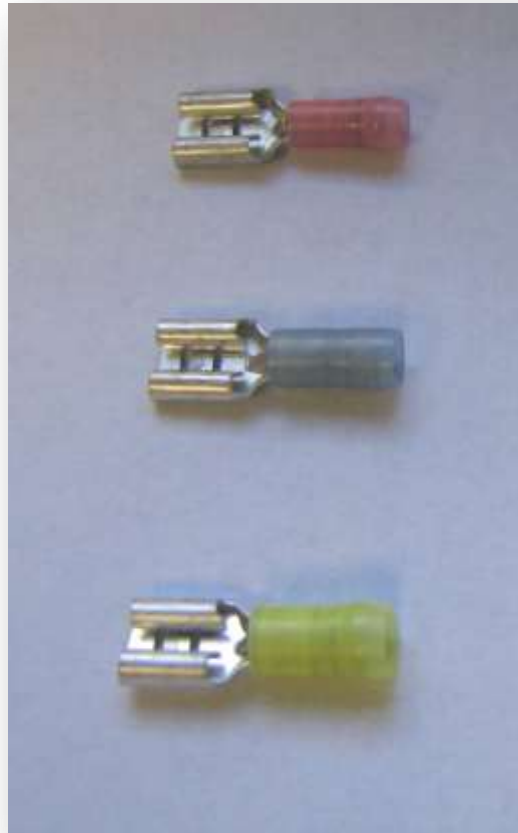
Crimp Socket
(not used)

Types of Crimp Connectors

Butt Connectors



Spade Connectors



Ring Connectors



Note: All connectors shown are mil-spec

D-sub Connector Service Tools

- Crimping Tool
 - The machined-barrel sockets on the d-sub connectors should be crimped with a tool like this one. It applies even pressure around the barrel.
- Pin Removal Tool



Standard d-sub tool is red/white. High density d-sub tool is green/white.

Wire Strippers

(for homebuilder use)

Not Recommended!



Better



Best



Insulated Terminal Crimp Tools

(for homebuilder use)

Not Recommended!



Better



Single crimp

Best



Double crimp

Power Connector Service Tools

Crimping Tool

- The sockets on the power connectors must be crimped with the correct crimping tool. Vertical Power provides a variety of wiring harnesses and extra wires with crimped terminals installed to eliminate the need for this tool.
- If you choose to build your own harness or need this tool for any reason, Vertical Power rents and sells this tool.

Terminal Removal Tool

- The terminals are released using this tool.

Small screwdriver

- 2mm or 3mm head



Reading Wire Markings

Mil-spec wire is marked along its length

Mil-spec 22759/16

18 gauge wire

M
2
2
7
5
9
/
1
6
-
1
8

2
7
4
7
8



Wire Specifications

Mil-W-22759/16 Single Conductor, Non-Shielded

Wire gauge	Max diameter (in)	Weight per foot (lbs)	Pull Test (lbs)
24	.047	.00257	
22	.054	.00368	15
20	.062	.00536	19
18	.073	.00789	38
16	.081	.00995	50
14	.095	.0149	70
12	.117	.0226	110
10	.142	.0351	150
8	.202	.0635	
6	.253	.0999	
4	.318	.157	
2	.392	.239	
1/0	.485	.391	
2/0	.553	.504	

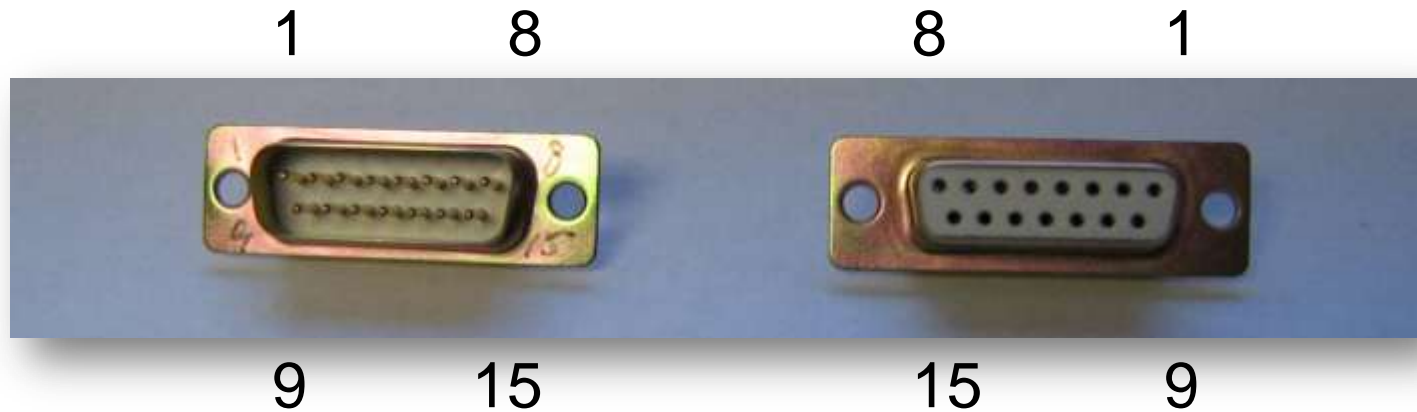


Working with d-sub Connectors

D-sub Connector Numbering

Note that numbering is reversed for male and female connectors.

15 pin connectors show for example.



D-sub Terminal Install

Step 1: Mark the pin numbers on both sides of the d-sub with a Sharpie



Step 2: Strip the end of the wire



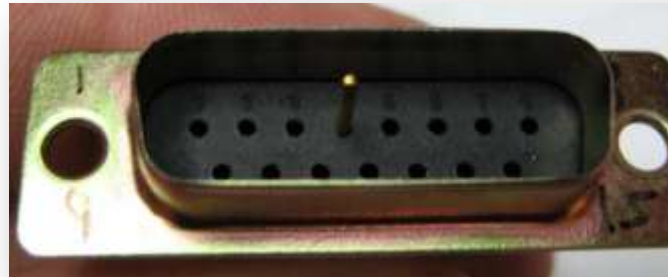
Step 3: Install terminal into crimper tool, ensuring crimp tool is adjusted to the proper height. The head of the terminal should be flush with the top of the tool.



Step 4: Crimp terminal to wire.



Step 5: Insert terminal into connector assembly until you hear a slight click. Give the wire a tug to make sure it is fully seated. Visually inspect the other face of the connector to verify proper placement of the terminal.



D-sub Pin Removal

Step 1: Insert white side of removal tool into connector. Carefully wrap metal prongs around the wire.

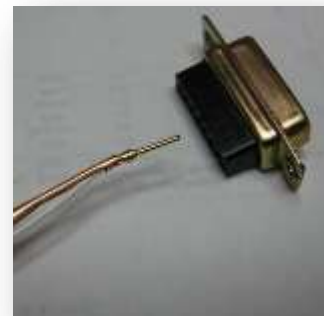


White end (wrong side pictured)

Step 2: Push down on tool until you feel it seat around the terminal. Note: you may have to fish around for a bit until it seats properly.



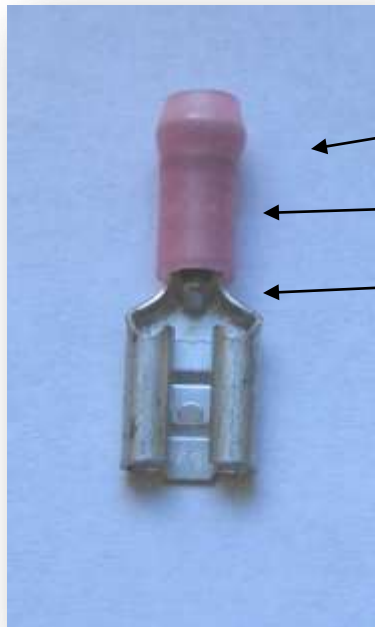
Step 3: Gently pull the wire and the tool together out of the connector.



Also see: http://aeroelectric.com/articles/D-Sub_Pin/Pin-Extraction.html

Working with Crimp Connectors

Anatomy of a Good Crimp Connector



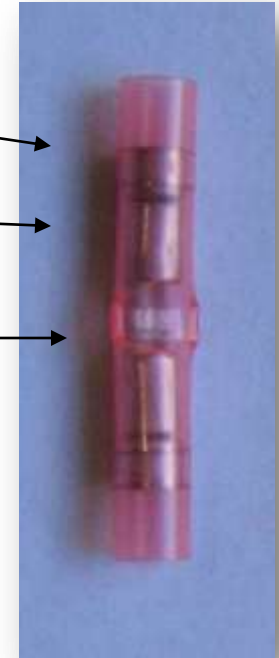
Nylon insulation, usually translucent (vinyl is opaque - don't use).

Brazed seam

Tang to stop wire

Window to examine wire end

Wire gauge marked on connector



High-quality connectors have the wire gauge stamped on the metal, and the insulation is translucent (nylon)

Crimping, Part 1

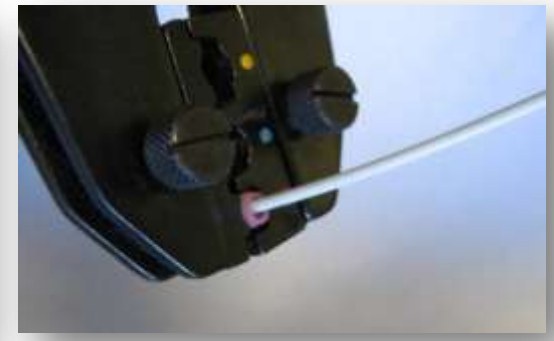
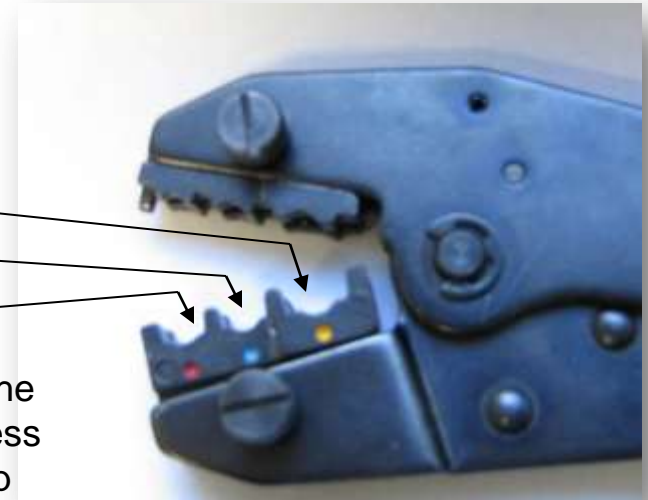
1. Strip wire.



2. Insert connector into the proper location on the crimp tool.

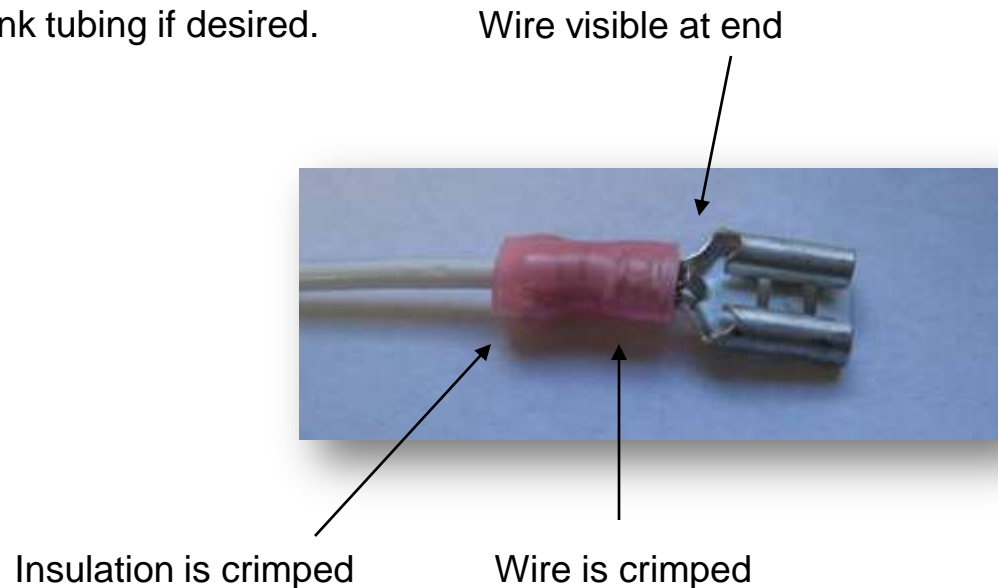
3. Place the open end on the side with the colored dots. Adjust the location so the opposite side is just outside the crimp tool. Press just enough to hold the terminal while inserting the wire. Crimp until it bottoms out. A ratcheting crimper ensures you have crimped the connector properly.

12-10ga
16-14ga
22-18ga



Crimping, Part 2

4. Remove terminal from crimper and Inspect form proper crimp.
5. Tug on the wire.
6. Tug on the wire again.
7. Insulate with heat shrink tubing if desired.



Vibration

Even with the best crimp, vibration can cause wires to fail near the connector. Reducing the negative effects of vibration can increase the life of the connection.

D-sub connectors



Wires can vibrate within the connector housing



Orange or black silicon tape can reduce vibration

Crimp connectors



Wires can vibrate near the connector



Heat shrink can reduce vibration

Working with Power Connectors

Power Connector Crimping Terminals - 1

Step 1: Ensure the crimping tool is properly set up. The back of the tool should be configured with the white side up to accept female terminals. If the black, or male, side is up, lift on the center knob and rotate the assembly (with the crimper open) to the correct position. A ratchet mechanism ensures the crimper is fully engaged. If you need release the crimper while it is locked, press the release as shown.

Correct



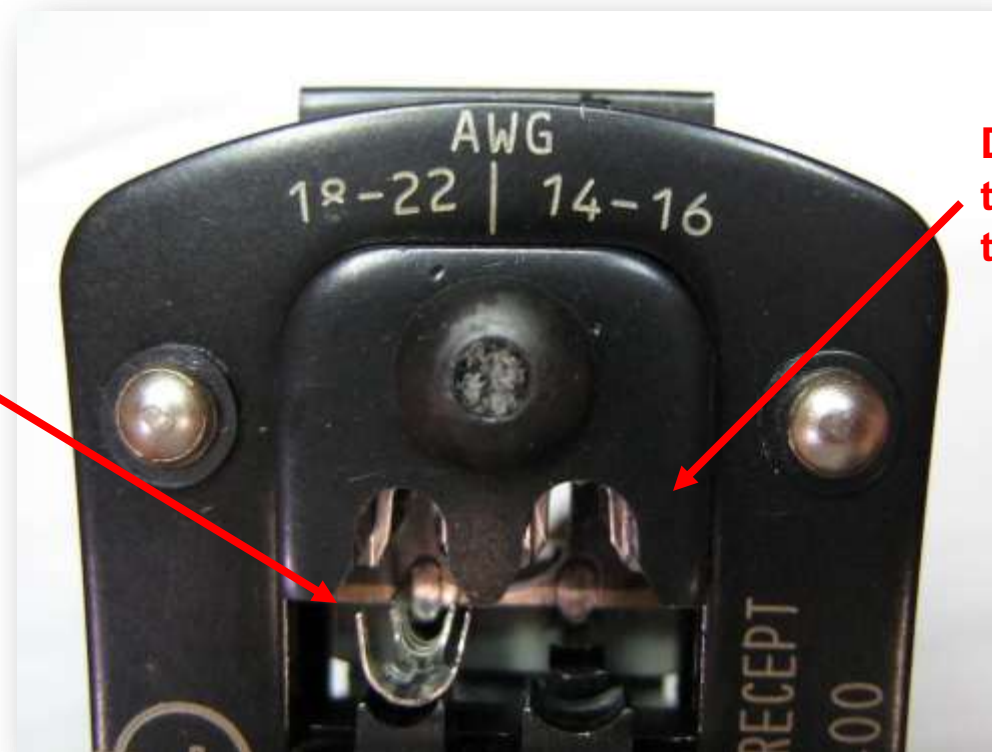
Incorrect



Power Connector Crimping Terminals - 2

Step 2: Insert the terminal into the proper location on the crimper as indicated by the AWG (wire gauge) size. Terminals provided by Vertical Power should go into the 18-22 crimp location (even 14 gauge wire).

**Terminal inserted
in crimper here**



**Don't use
this side for
tefzel wire**

Power Connector Crimping Terminals - 3

Step 3: Once the terminal is inserted, push down on the small lever on the back of the crimper. This acts as a 'backstop' for the wire so that it does not go too far into the terminal.



Power Connector

Crimping Terminals - 4

Step 4: Strip the correct amount of insulation from the wire. The exposed wire should be just long enough to fit in the crimp area.

Step 5: Insert wire into terminal in crimper so that wire butts up against lever on back. Hold wire against bottom of terminal so that crimp can go all the way around the wire. You may want to practice on a few wires to get the hang of it.



**Crimps
over insulation**

**Crimps
over wire**



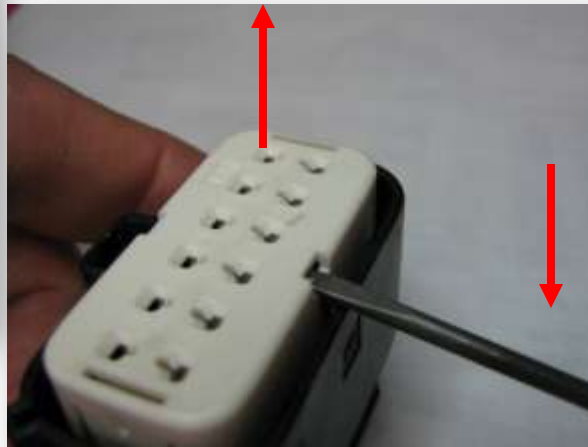
**Ensure wire is
inside entire
length of
crimp, with
little or no
excess
hanging out
the end.**



Power Connector Installing Terminals - 1

Step 1: Insert a small screwdriver (max width= 3.0 mm) into either pry point

Step 2: Using the housing as a pivot point gently pry out on the white insert, until it reaches pre-lock position (5.0 mm travel)



***The white insert should never be removed!
If it is removed, discard the entire connector. Do not attempt to re-assemble.***

Power Connector

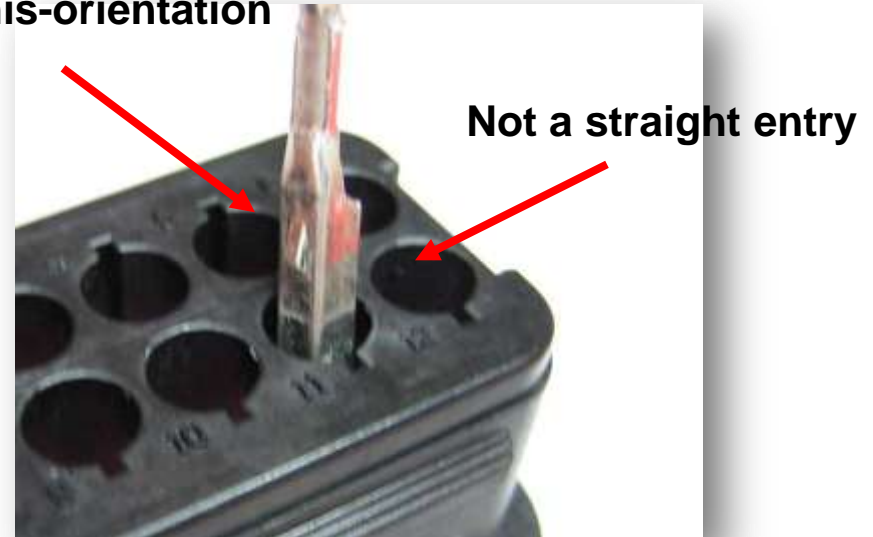
Installing Terminals - 2

Step 3: With the white insert still in the 'out' position, align the terminal to rear of connector. Align the orientation feature as shown and insert through appropriate opening. If resistance is encountered, retract the terminal and adjust the angle of insertion. Continue inserting the terminal until it stops with an audible click. Give the wire a slight tug to make sure it is seated properly. It should not come back out.



Orientation feature aligned with index

90° mis-orientation



Power Connector

Installing Terminals – 2a

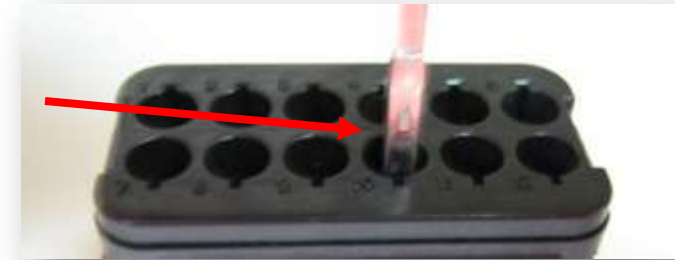
Troubleshooting:

The terminal should insert smoothly into the connector housing. If it does not, the following are the most likely causes:

1. **The terminal is rotating while you are inserting it.** The terminal must remain aligned until it is fully inserted.
2. **The tangs on the insulation crimp may not be fully closed.** Gently squeeze the tangs closed around the insulation with a pair of pliers.



3. **The white insert may have closed.** Open the insert.



Power Connector

Installing Terminals - 3

Step 4: With the terminals fully installed, the white insert can be seated into its final lock position by applying an even force to both ends until it comes to a stop, with an audible click. The white insert should move a distance of 5.0 mm (about 1/4").

Push evenly until you hear a click



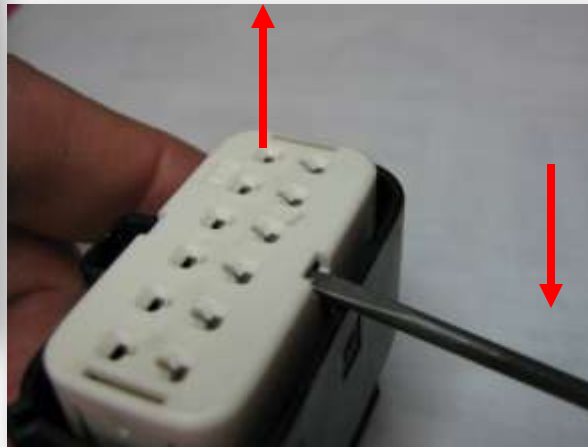
Locked



Power Connector Removing Terminals - 1

Step 1: Insert a small screwdriver (max width= 3.0 mm) into either pry point

Step 2: Using the housing as a pivot point gently pry out on the white insert, until it reaches pre-lock position (5.0 mm travel)



***The white insert should never be removed!
If it is removed, discard the entire connector. Do not attempt to re-assemble.***

Power Connector

Removing Terminals - 2

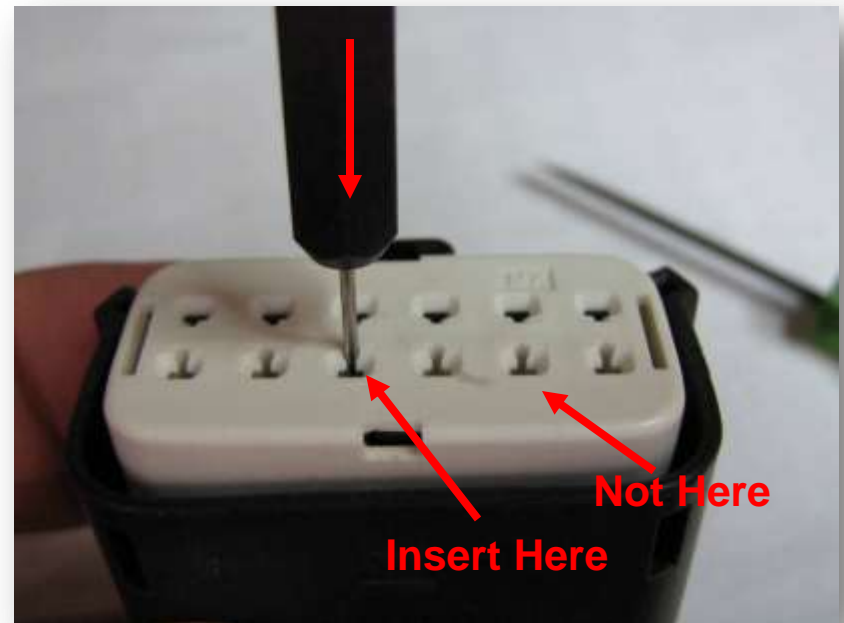
Step 3: Using the pin removal tool, insert the tip into the terminal service hole adjacent to the terminal to be serviced.

Step 4: Push down gently to release locking finger. You will hear a gently click. ***Do not apply any lateral force, as this may damage the connector or the terminal!***

Step 5: With the white insert still in the 'out' position, gently pull on the wire to release the terminal. If the terminal resists, the service tool may not be fully engaged. Remove the tool and re-try. Push the service tool further into the service opening to ensure that it has fully disengaged the locking finger.

Do not insert the tool into the terminal opening!

Do not use excessive force, excessive force can damage the connector!



Power Connector

Removing Terminals - 3

Step 6: The white insert can be seated into its final lock position by applying an even force to both ends until it comes to a stop, with an audible click. The white insert should move a distance of 5.0 mm (about 1/4").

Push evenly until you hear a click



Locked



Proper Crimping

GOOD



BAD, TERMINALS BENT



Working with Coax Connectors

Coax

- Here are links to sites which have good directions for coax connectors:
 - <http://www.terminaltown.com/Pages/Page2.html>
 - <http://www.extron.com/download/files/userman/cabtermkit-man.pdf>
 - <http://www.aeroelectric.com/articles/bnccrimp.pdf>
- Good all-around connector info:
 - http://aeroelectric.com/articles/Getting_Started.pdf

