GORE® Aerospace Ethernet Cables

Termination Instructions

MIL-DTL-38999 General Purpose Connector System

The following procedures are based on Gore's best practices for terminating GORE® Aerospace Ethernet Cables with the MIL-DTL-38999 General Purpose Connector. Following these procedures will enable you to maximize the performance of your assembly.

IMPORTANT: Based on Gore's testing, Ethernet Cat6a performance can be achieved using the MIL-DTL-38999 Connector System with respect only to the specific data channel. However, Gore cannot guarantee signal integrity due to the wide variety of configurations available for this connector system and application-specific conditions. Therefore, the only way to ensure installed performance of this connector system is to test the specific design under actual operating conditions using frequency domain analytical tools.

In addition, Gore recommends that design engineers select adjacent contact positions for wires within each pair and separate each pair in the pin field. Gore's unique design includes a shield around each pair that controls impedance and reduces crosstalk delivering reliable Ethernet Cat6a performance even when the pairs are separated. Due to the many ways design engineers can install wires through the connector, Gore selected an arbitrary wiring pattern based on proper design principles for Ethernet connector systems. Lastly, Gore's best practices conclude before a backshell is attached due to the broad range of backshell options available on the market.

Preparing the Cable and Parts

1. Gather the tools and materials required for assembly and termination (Figures 1—10).
2. Verify that you have the correct parts for your assembly by checking the part numbers for the connectors and GORE® Aerospace Ethernet Cables listed on your drawing.
3. Cut two 1.0-inch pieces of 0.50-inch thin-walled adhesive-lined tubing (TAT) for environmental protection.
4. Cut the cable to the desired assembly length minus 0.9 inches to allow for the length of the connectors (i.e., 0.5 in. for the plug connector and 0.40 in. for the receptacle connector).
5. Print any labels required by the end-user, and slide the center label onto the cable.
6. To identify the end for the receptacle connector, place a piece of tape on the end in which the pairs rotate clockwise in order of orange → green → brown → blue (Figure 11). If this orientation is not available in the assembly drawing, correlate the respective pairs logically to the contact positions — ensuring the shortest and most direct route for each pair in the connector to minimize crossing between the pairs.

Figure 1: Needle nose pliers, scalpel, tweezer scissors, and hand strippers

Figure 2: Cutters

Figure 3: Crimpers (M22520/2-01 / AFM8)

Figure 4: Socket positioner (K41)

Figure 5: Pin positioner (K-42)

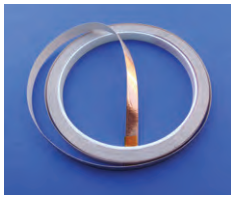

Figure 6: Copper foil tape[1] (3M-3313)

Figure 7: Probe/pick

Figure 8: Braid brush

Figure 9: Heat gun

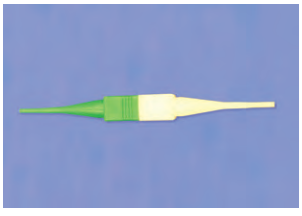

Figure 10: Contact insertion tool (M81969/14-01)

Figure 11: Pairs configuration at pin end

[1] Gore recommends using copper foil tape instead of polyimide tape during termination procedures because copper tape is easier to use and improves signal integrity.

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Terminating the Receptacle Connector (Termination A)

1. If specified for the particular assembly, slide the labels, solder sleeve ground leads, heat shrink sleeving, strain reliefs, and backshells onto the cable. There may be other items to slide onto the connector as well; therefore, be sure to slide all items that cannot be slipped over the connector once the contacts are installed.

2. Measure and mark the cable 0.5 inches from the receptacle end of the cable (Figure 12).

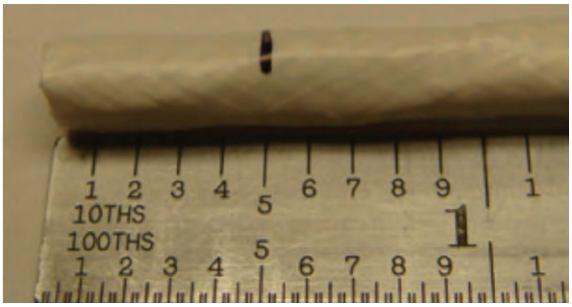

Figure 12: Marking the cable

3. Using a scalpel or work knife, slit the cable's jacket from the edge to the mark. Note that damage to the underlying braid in this area will be trimmed away at a later step (Figure 13).

Figure 13: Slitting the cable jacket

4. Using needle-nose pliers, gently pull the outer jacket down the cable until you have exposed approximately 2.0 inches of braid (Figure 14).

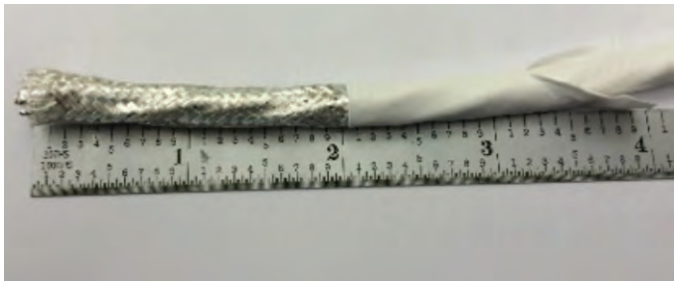

Figure 14: Exposing the braid

5. With your fingers, loosen the braid and push it gently back over the cable to expose approximately 2.0 inches of the foil (Figure 15).

Figure 15: Exposing the foil

6. Trim the white filler in the center as far as possible.

7. Mark the foil of each pair at 0.6 inches from the end to indicate the shield reference plane (Figure 16).

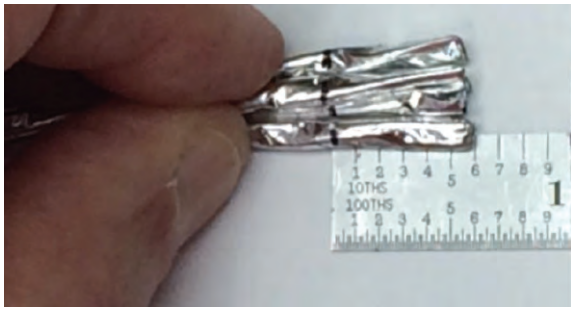

Figure 16: Marking the foil

8. Cut a 0.25-inch piece of copper foil tape (3M-3313) at 0.50 inches for each pair of the cable. Wrap a piece around each pair 0.6 inches from the end of the cable (Figure 17). Wrap the tape in the same direction as the foil shield is wrapped.

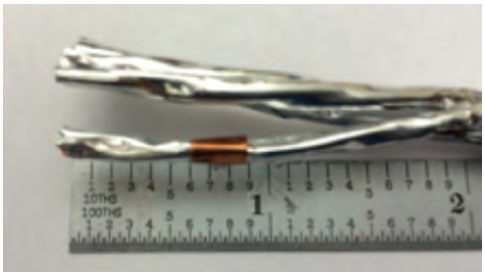

Figure 17: Wrapping the pair

9. With cutters, cut the foil edge where it meets the copper foil tape. Then, tear the foil along the tape edge to leave a clean edge at the copper tape reference plane (Figure 18). Repeat this step for each pair.

Figure 18: Removing the foil edge

10. Mark each pair 0.15 inches from the end of the cable or as recommended by the contact manufacturer (Figure 19).

Figure 19: Marking each pair

11. Install the K40 positioner for the socket contact into the M22520/2-01, and select setting 3 (for 24 AWG gauge size). To prevent stray wire stands during crimping, strip and crimp one primary at a time (Figures 20 — 21).

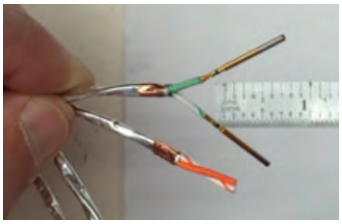

Figure 20: Stripping and crimping the contacts

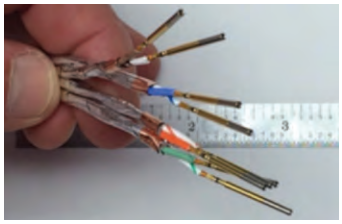

Figure 21: Wires crimped

12. With your fingers, hold each pair and gently push each contact into the correct position simultaneously into the connector to maintain impedance control and crosstalk protection from the foil shield. If necessary, use the green end of the contact insertion tool (M81969/14-01) to ensure the contacts are seated properly in the connector (Figure 22). Using the white end of the contact insertion tool, release (not remove) each contact 0.1 to 0.2 inches. With your fingers, gently remove the pair of wires from the connector (Figure 23).

NOTE: Each contact is released (not removed), using the contact insertion tool. Then, both contacts can be removed together.

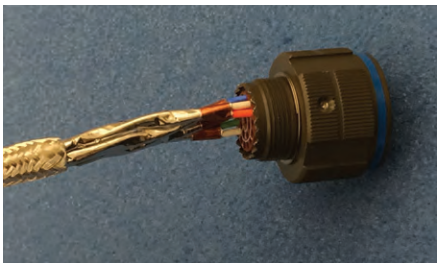

Figure 22: Inserting contacts into connector

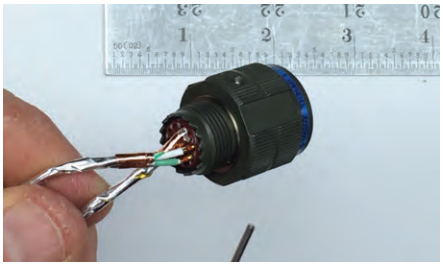

Figure 23: Releasing the pair from the connector

13. Gently slide the braid back toward the connector, and trim any excess where the braid meets the connector (Figures 24 — 25). The spread of the pairs will dictate where the end of the braid should be trimmed. The braid should end where the branching of the pairs exceeds the original cable diameter.

Figure 24: Sliding the braid back

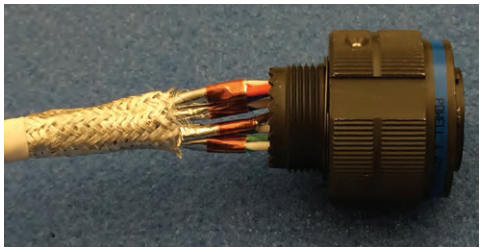

Figure 25: Trimming the braid

14. **OPTIONAL:** Slide the solder sleeve ground lead over the braid and cover the end of the braid, ensuring no strands of braid are exposed (Figure 26). If a solder sleeve is NOT used, then with your fingers or needle-nose pliers, gently pull the outer jacket over the end of the braid and trim the jacket to ensure the end does not fray (Figure 27).

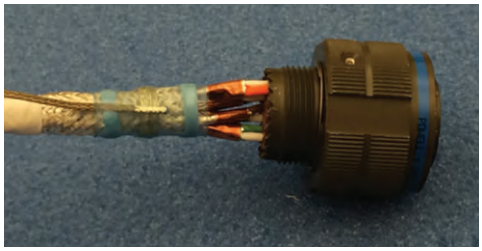

Figure 26: Sliding the solder sleeve ground lead (S200-5-01)

Figure 27: Returning the outer jacket

15. Using a heat gun, shrink down the sleeve, ensuring that the solder pre-form has melted and wicked into the braid (Figure 28).

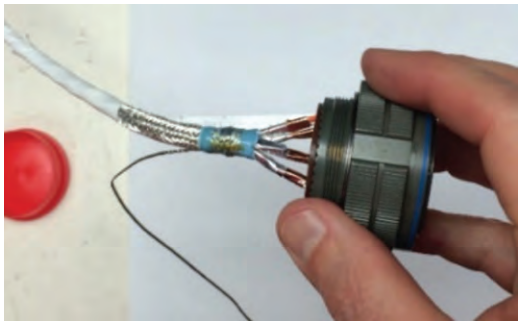

Figure 28: Shrinking the sleeve

16. With your fingers, gently pull the outer jacket back toward the solder sleeve and trim the excess jacket (Figure 29). The orientation of the braid lead can vary based on the assembly specification, connectors, backshells or contact position.

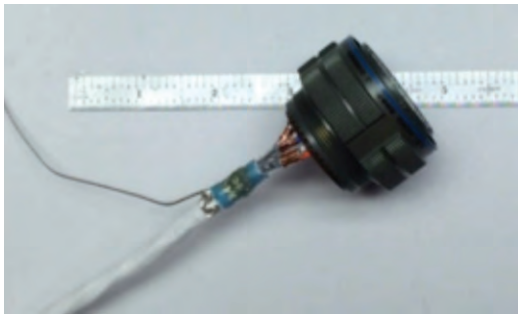

Figure 29: Returning the outer jacket

17. Finish the remaining wiring in the connector for the specified design. Repeat Steps 1 — 16 if more data cables are in the connector.

18. Attach the selected backshell and terminate the braid lead as fitting for the selected backshell.

Terminating the Plug Connector (Termination B)

1. If specified for the particular assembly, slide the labels, solder sleeve ground leads, heat shrink sleeving, strain reliefs, and backshells onto the cable. There may be other items to slide onto the connector as well; therefore, be sure to slide all items that cannot be slipped over the connector once the contacts are installed.

2. Measure and mark the cable 0.5 inches from the plug end of the cable (Figure 30).

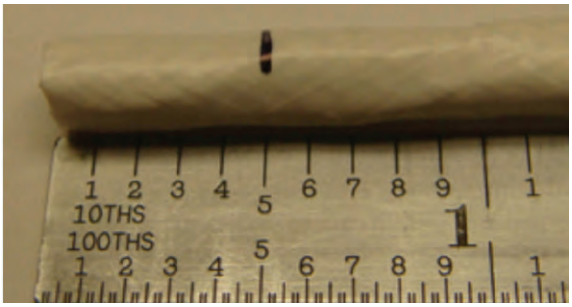

Figure 30: Marking the cable

3. Using a scalpel or work knife, slit the cable's jacket from the edge to the mark. Note that damage to the underlying braid in this area will be trimmed away at a later step (Figure 31).

Figure 31: Slitting the cable jacket

4. Using needle-nose pliers, gently pull the outer jacket down the cable until you have exposed approximately 2.0 inches of braid (Figure 32).

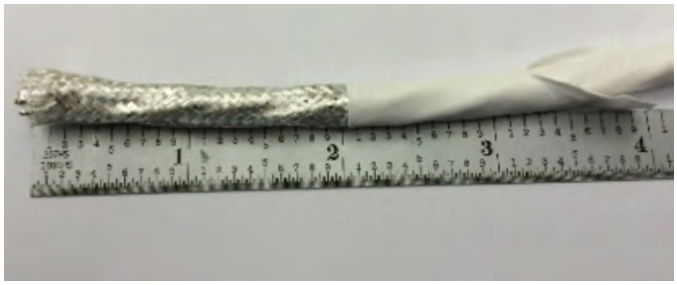

Figure 32: Exposing the braid

5. With your fingers, loosen the braid and push it gently back over the cable to expose approximately 2.0 inches of the foil (Figure 33).

Figure 33: Exposing the foil

6. Trim the white filler in the center as far as possible.

7. **OPTIONAL:** Mark the foil of each pair at 0.6 inches from the end to indicate the shield reference plane (Figure 34).

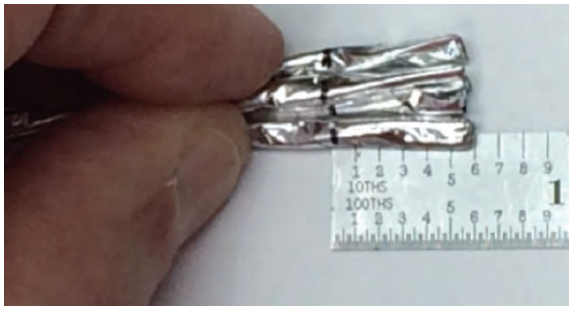

Figure 34: Marking the foil

8. Cut a 0.25-inch piece of copper foil tape (3M-3313) at 0.50 inches for each pair of the cable. Wrap a piece around each pair 0.6 inches from the end of the cable (Figure 35). Wrap the tape in the same direction as the foil shield is wrapped.

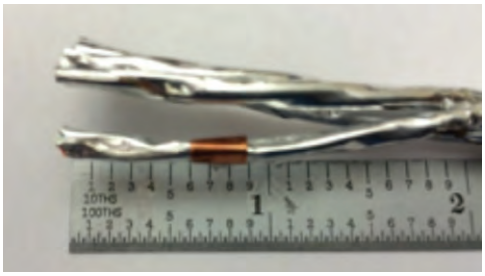

Figure 35: Wrapping the pair

9. With cutters, cut the foil edge where it meets the copper foil tape. Then, tear the foil along the tape edge to leave a clean edge at the copper tape reference plane (Figure 36). Repeat this step for each pair.

Figure 36: Removing the foil edge

10. Mark each pair 0.15 inches from the end of the cable or as recommended by the contact manufacturer (Figure 37).

Figure 37: Marking each pair

11. Install the K42 positioner for the socket contact into the M22520/2-01, and select setting 3. To prevent stray wire stands during crimping, strip and crimp one primary at a time (Figure 38). Use strippers (45-125) or equivalent for 24 AWG gauge size.

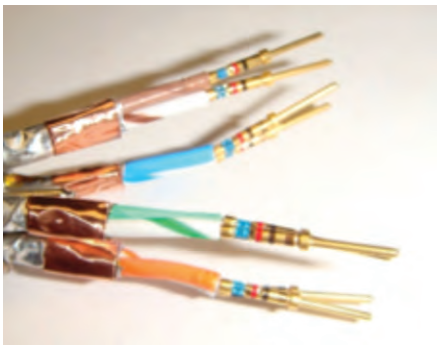

Figure 38: Stripping and crimping the contacts

12. With your fingers, hold each pair and gently push each contact into the correct position simultaneously into the connector to maintain impedance control and crosstalk protection from the foil shield. If necessary, use the green end of the contact insertion tool (M81969/14-01) to ensure the contacts are seated properly in the connector (Figure 39).

    NOTE: Each contact is released (not removed), using the contact insertion tool. Then, both contacts can be removed together.

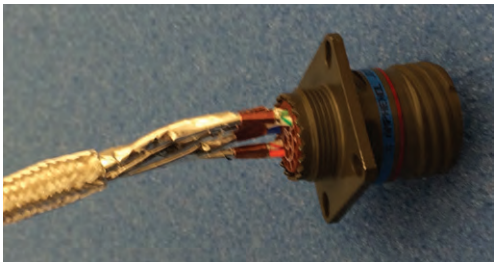

Figure 39: Inserting contacts into connector

13. Gently slide the braid back toward the connector, and trim any excess where the braid meets the connector (Figures 40 — 41). The spread of the pairs will dictate where the end of the braid should be trimmed. The braid should end where the branching of the pairs exceeds the original cable diameter.

Figure 40: Sliding the braid back

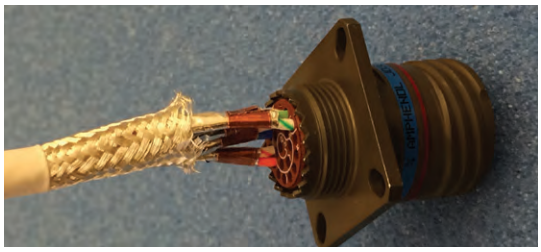

Figure 41: Trimming the braid

14. **OPTIONAL:** Slide the solder sleeve ground lead over the braid and cover the end of the braid, ensuring no strands of braid are exposed (Figure 42). If a solder sleeve is NOT used, then with your fingers or needle-nose pliers, gently pull the outer jacket over the end of the braid and trim the jacket to ensure the end does not fray (Figure 43).

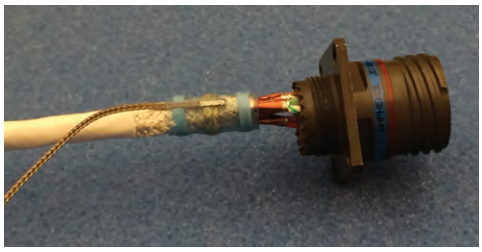

Figure 42: Sliding the solder sleeve ground lead (S200-5-01)

Figure 43: Returning the outer jacket

15. Using a heat gun, shrink down the sleeve, ensuring that the solder pre-form has melted and wicked into the braid (Figure 44).

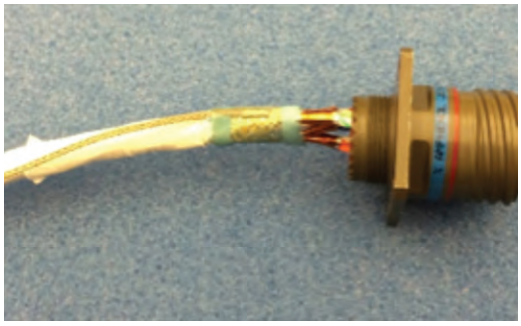

Figure 44: Shrinking the sleeve

16. With your fingers, gently pull the outer jacket back toward the solder sleeve and trim the excess jacket (Figure 45). The orientation of the braid lead can vary based on the assembly specification, connectors, backshells or contact position.

Figure 45: Returning the outer jacket

17. Finish the remaining wiring in the connector for the specified design. Repeat Steps 1 — 16 if more data cables are in the connector.

18. Attach the selected backshell and terminate the braid lead as fitting for the selected backshell.

19. Perform all required testing. At a minimum, verify proper wiring and continuity, and check for shorts. Local authorities and end-users may require additional testing. Gore recommends testing the final assembly using an advanced signal Integrity tester such as the Fluke Networks® DSX-5000 or equivalent.

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