BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 9.03

PRODUCTION PROCESS STANDARD

Fitting Connectors to Coaxial Cables

Issue 12
- This standard supersedes PPS 9.03, Issue 11.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- Direct PPS related questions to PPS.Group@aero.bombardier.com or (416) 375-4365.
- This PPS is effective as of the distribution date.

Prepared By:	(Michael Wright)	June 25, 2012
	Production Process Standards (PPS)	
Approved By:	(L.K. John)	June 26, 2012
	Materials Technology	
	(B. DeVreede)	June 28, 2012
	Quality	

Table of Contents

Sections **Page**

Tables

Figures

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for assembly of radio frequency (RF) connectors to coaxial cables.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS must be followed to ensure compliance with all applicable specifications. In general, if this PPS conflicts with the engineering drawing, follow the engineering drawing. The requirements specified in this PPS are necessary to fulfil the engineering design and reliability objectives.

1.1.2 Refer to PPS 13.26 for the subcontractor provisions applicable to this PPS.

1.1.3 Procedure or requirements specified in a Bombardier BAPS, MPS, LES or P. Spec. **do not** supersede the procedure or requirements specified in this PPS. Similarly, the procedure and requirements specified in this PPS are not applicable when use of a BAPS, MPS, LES or P. Spec. is specified.

2 Hazardous Materials

2.1 Before receipt at Bombardier Toronto (de Havilland), all materials must be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto (de Havilland) Environment, Health and Safety Department. Refer to the manufacturer's MSDS for specific safety data on any of the materials specified in this PPS. If the MSDS is not available, contact the Bombardier Toronto (de Havilland) Environment, Health and Safety Department.

3 References

3.1 PPS 9.07 - Soldering of Electrical Terminals.

3.2 PPS 9.24 - Wire and Cable Stripping.

3.3 PPS 9.36 - Crimping Electrical Contacts.

3.4 PPS 9.46 - Assembly of Twinax Connectors.

3.5 PPS 10.16 - Installation of Heat Shrinkable Tubing, Tape and Identification Sleeves.

3.6 PPS 13.26 - General Subcontractor Provisions.

4 Materials and Equipment

4.1 Materials

4.1.1 Coaxial cables as specified on the engineering drawing or wiring list.

4.1.2 RF connectors and K-Grip adapters as specified on the engineering drawing or wiring list.

4.2 Equipment

4.2.1 Crimping tools as specified in Table 1.

4.2.2 Open end wrenches for tightening clamp nuts.

5 Procedure

5.1 General

5.1.1 Handle coaxial cables carefully during all stages of assembly to prevent damage to the dielectric. Also, flattening to any extent or excessive bending of the cable will change its electrical characteristics.

5.1.2 Strip coaxial cables according to PPS 9.24.

5.1.3 Refer to PPS 9.46 for the procedure and requirements for assembly of twinax connectors (e.g., Emteq BTW1M1F-X) to twinaxial cable.

5.2 Assembly of Connectors to Cables Using K-Grips

5.2.1 Assemble connectors to coaxial cables using K-Grips as follows (see Figure 1):

Step 1. Slide the K-Grip outer sleeve over the cable.

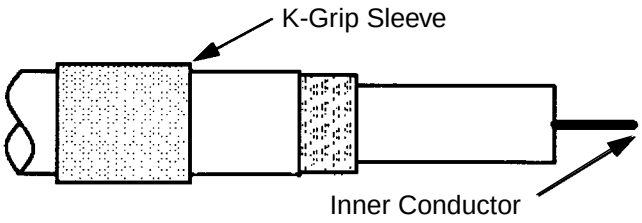
Step 2. Assemble the clamp nut to the K-Grip adapter and slide the assembly onto the cable so that the inner sleeve slips under the braided shield and push firmly until the inner sleeve bottoms.

Step 3. Slide the outer sleeve over the braided shield so that it butts against the K-Grip adapter and crimp using the tool specified in Table 1.

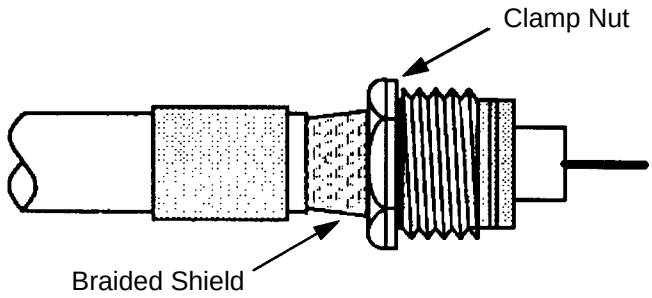
Step 4. For solder type contacts, tin the exposed inner conductor and contact and solder into place according to PPS 9.07. If soldering DSC371-1 tri-axial cable to coaxial connectors, use a minimum amount of flux and take care when solvent cleaning to avoid allowing the solvent between the copper braid and the dielectric sleeving as capillary action will draw excess solvent between the copper braid and the dielectric causing oxidation of the copper braid.

For crimp type contacts, crimp the contact to the centre conductor according to PPS 9.36.

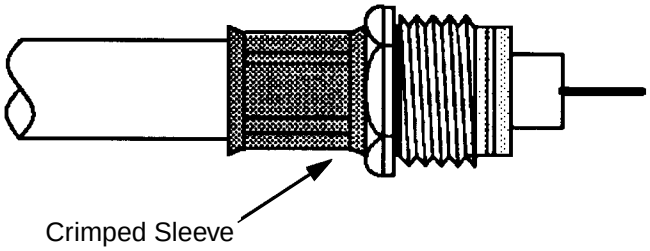
Step 5. Thread the conductor body onto the K-Grip adapter and tighten using the proper size wrenches.



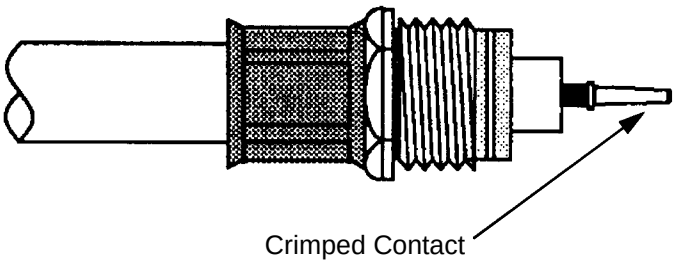
Slide the K-Grip outer sleeve over the cable.



Assemble the clamp nut to the K-Grip adapter and slide the assembly onto the cable so that the inner sleeve slips under the braided shield and push firmly until the inner sleeve bottoms.



Slide the outer sleeve over the braided shield so that it butts against the K-Grip adapter and crimp using the tool specified in Table 1.



Crimp or solder the contact (as required) to the inner conductor.

Figure 1 - Assembly of K-Grips

Table 1 - K-Grip & Integral Cable Grip Ferrule Crimping Tools

CONNECTOR OR K-GRIP	CRIMP TOOL	
	FRAME	DIE
KS89-04	KINGS 683-51470-3	NOT APPLICABLE
KS89-05	KINGS KTH 1000	KINGS KTH 2001 or M22520/5-19
KS89-08	KINGS 683-51470-3	NOT APPLICABLE
KS89-10	KINGS KTH 1000	KINGS KTH 2001
KS89-24	KINGS KTH 1000	KINGS KTH 2004
CNR122	M22520/5-1, DANIELS DMC HX4, DANIELS DMC PH4000 or Schleuniger CT1-310060 die holder for use with the Schleuniger CT32 pneumatic crimping machine	M22520/5-33
CNR722		M22520/5-19
CNS122		M22520/5-33
CNS822		M22520/5-61
CTR722		M22520/5-19
CTS722		M22520/5-19
1-225550-3	AMP 220015-1	NOT APPLICABLE
1-225554-1		

Note 1. Crimp Emteq connectors according to Table 4.
Note 2. Crimp Radiall connectors according to section 5.5.

5.3 Assembly of Integral Cable Grip Connectors

5.3.1 Assemble connectors using integral cable grips to coaxial cables as follows:

Step 1. Strip the cable according to PPS 9.24.

Step 2. Slide the outer sleeve over the cable.

Step 3. For solder type contacts, tin the exposed inner conductor and contact and solder into place according to PPS 9.07.

For crimp type contacts, crimp the centre contact to the centre conductor according to PPS 9.36.

Step 4. Insert the centre contact into the connector until it locks firmly into position ensuring that the braid slides over the support sleeve of the connector.

Step 5. Slide the outer sleeve over the braid and support sleeve and crimp using the tool specified in Table 1.

5.4 Assembly of Emteq Connectors

5.4.1 Assemble Emteq connectors to coaxial cables as follows:

Step 1. Slide the connector black adhesive heat shrink and the crimp tube onto the coaxial cable. If more than one crimp tube was supplied with the connector, when terminating RG-142, RG400, PFLX140-500 or PFLX200-XXX cable, use the gold coloured crimp tube; when terminating PFLX195-500 or TFLX130-100 cable, use the silver coloured crimp tube.

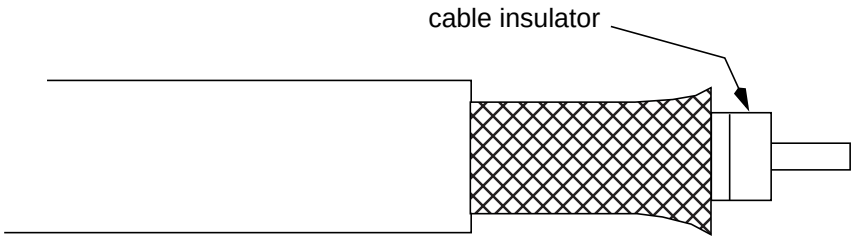
Step 2. Strip the coaxial cable end to the dimensions specified in Table 3. Be careful to avoid nicking the centre conductor or the shield braid. Do not remove the inner foil shield from the dielectric.

Step 3. Install the cable insulator onto the centre conductor, butting it up against the cable dielectric.

Step 4. Tin the centre conductor according to PPS 9.07.

Step 5. For straight type connectors only, solder the contact onto the centre conductor according to PPS 9.07, butting the contact up against the cable insulator leaving no gaps. Take care not to overheat the contact and swell the dielectric and/or cable insulator. Refer to Table 4 for recommended solder temperatures.

Step 6. Flare the outer shield braid by gently rotating the centre conductor and dielectric and then finish to flare out as shown below without disturbing the inner foil shield. Do not remove the inner shield from the dielectric.



Step 7. Insert the contact (straight type connectors) or cable end (90° type connectors) into the connector body with the inner foil shield inside the connector body and the braided shield over the outside. For straight type connectors insert until the contact snaps into place. For 90° type connectors, insert the centre conductor into the slot of the contact until the cable insulator butts against the contact.

Step 8. For 90° type connectors, solder the centre conductor to the contact according to PPS 9.07. Take care not to overheat the contact and swell the dielectric and/or cable insulator. Refer to Table 4 for recommended solder temperatures.

Step 9. Slide the crimp tube over the braid and up against the connector body and crimp using a M22520/5-01 crimp tool and the crimp die/hex side specified in Table 4. Position the crimp dies so that the crimp will be as close as possible to centred over the area where the cable braided shield has been fitted over the connector body, as shown in Figure 2; it is imperative that the cable braided shield fitted over the connector body extend through the crimped area.

Step 10. For 90° type connectors, add the "O" ring to the access cap and thread the access cap onto the connector until tight.

Step 11. Except for ARINC connectors, slide the black adhesive heat shrink up over the rear end of the connector body. For ARINC connectors, slide the black adhesive heat shrink up to butt against the rear of the the connector body.

Step 12. Shrink the black adhesive heat shrink in place according to PPS 10.16, completely covering the crimp tube and also the rear part of the connector body, if possible as shown in Figure 2.

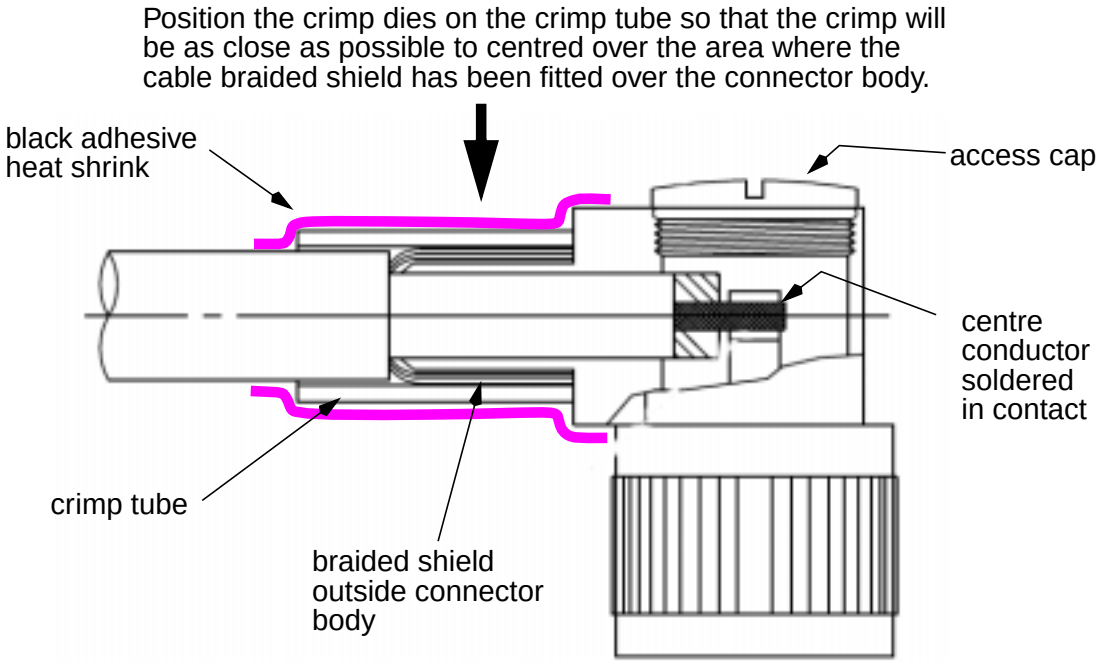
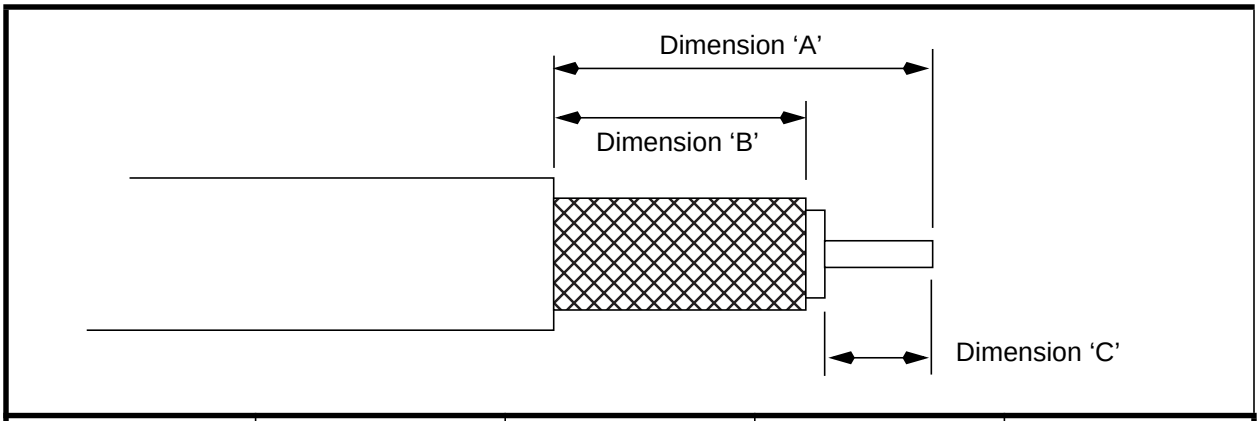


Figure 2 - Emteq 90° Connector/Cable Assembly

Table 2 - Emteq Connector Wire Preparation Cross Reference

EMTEQ CONNECTOR	WIRE PREP. PER TABLE 3
A41130-1	ES-105-26
A41195-1	ES-105-1
A41240-1	ES-105-1
A41340-1	ES-105-6
A41400-1	ES-105-6
A41500-1	ES-105-6
A43240-1	ES-105-16
A45195-1	ES-105-19
A45195-2	ES-105-4
A61130-1	ES-105-26
A61195-1	ES-105-1
A61240-1	ES-105-1
A61340-1	ES-105-6
A61400-1	ES-105-6
A65130-1	ES-105-12
A65195-1	ES-105-12
A6M1130-1	ES-105-26
A6M1195-1	ES-105-1
A6M1240-1	ES-105-1
A6M1340-1	ES-105-6
A6M1400-1	ES-105-6
A6M1500-1	ES-105-6
A47195-1	ES-105-18
BFS130-1	ES-105-3
BFS130-2	ES-105-3
BFS195-1	ES-105-3
BFS195-2	ES-105-3
BFS240-1	ES-105-3
BFS240-2	ES-105-7
BFS340-1	ES-105-7
BFS340-2	ES-105-7
BMR130-1	ES-105-27
BMR130-2	ES-105-19
BMR195-1	ES-105-2
BMR195-2	ES-105-19
BMR240-1	ES-105-2
BMR240-2	ES-105-19
BMR340-1	ES-105-5
BMR400-1	ES-105-5
BMR500-1	ES-105-10
BMR500-2	ES-105-61
BMS130-1	ES-105-1
BMS195-1	ES-105-1
BMS240-1	ES-105-1
BMS340-1	ES-105-7
BMS400-1	ES-105-7
BMS500-1	ES-105-11
CMR130-1	ES-105-27
CMR195-1	ES-105-2
CMR240-1	ES-105-2
CMR340-1	ES-105-5
CMR500-1	ES-105-10
CMS130-1	ES-105-28
CMS195-1	ES-105-1
CMS240-1	ES-105-1
CMS340-1	ES-105-6
CMS500-1	ES-105-6
HMR195-1	ES-105-2
HMR240-1	ES-105-2
HMR340-1	ES-105-5
HMR500-1	ES-105-10
HMS195-1	ES-105-4
HMS240-1	ES-105-4
HMS340-1	ES-105-7
HMS500-1	ES-105-6
NFS130-1	ES-105-26
NFS130-2	ES-105-25
NFS195-1	ES-105-1
NFS195-2	ES-105-9
NFS240-1	ES-105-1
NFS240-2	ES-105-9
NFS340-1	ES-105-6
NFS340-2	ES-105-8
NFS400-1	ES-105-6
NFS400-2	ES-105-8
NFS500-1	ES-105-6
NFS500-2	ES-105-6
NMR130-1	ES-105-27
NMR195-1	ES-105-2
NMR240-1	ES-105-2
NMR340-1	ES-105-5
NMR400-1	ES-105-5
NMR500-1	ES-105-10
NMS130-1	ES-105-24
NMS195-1	ES-105-4
NMS240-1	ES-105-4
NMS340-1	ES-105-50
NMS400-1	ES-105-49
NMS500-1	ES-105-6
SMR130-1	ES-105-27
SMR195-1	ES-105-2
SMR240-1	ES-105-2
SMR340-1	ES-105-5
SMS130-1	ES-105-1
SMS195-1	ES-105-1
SMS240-1	ES-105-1
SMS340-1	ES-105-7
TFS130-2	ES-105-3
TFS195-2	ES-105-3
TFS240-2	ES-105-3
TFS340-2	ES-105-7
TFS500-2	ES-105-11
TMR130-1	ES-105-27
TMR130-2	ES-105-19
TMR195-1	ES-105-2
TMR195-2	ES-105-19
TMR240-1	ES-105-2
TMR240-2	ES-105-19
TMR340-1	ES-105-5
TMR340-2	ES-105-7
TMR400-1	ES-105-5
TMR500-1	ES-105-10
TMS130-1	ES-105-1
TMS195-1	ES-105-1
TMS240-1	ES-105-1
TMS340-1	ES-105-7
TMS400-1	ES-105-7
TMS500-1	ES-105-11
UMS195-1	ES-105-20
UMS240-1	ES-105-20

Table 3 - Emteq Connector Termination - Cable Stripping Data



WIRE PREPARATION	CONNECTOR STYLE	DIMENSION 'A'	DIMENSION 'B'	DIMENSION 'C'
ES-105-1	Straight	0.577"	0.312"	0.265"
ES-105-2	90°	0.810"	0.340"	0.220"
ES-105-3	Straight	0.715"	0.312"	0.265"
ES-105-4	Straight	0.675"	0.312"	0.265"
ES-105-5	90°	0.925"	0.420"	0.300"
ES-105-6	Straight	0.725"	0.390"	0.335"
ES-105-7	Straight	0.775"	0.420"	0.300"
ES-105-8	Straight	0.895"	0.420"	0.335"
ES-105-9	Straight	0.790"	0.312"	0.310"
ES-105-10	90°	1.105"	0.420"	0.365"
ES-105-11	Straight	0.920"	0.420"	0.335"
ES-105-12	Straight	0.500"	0.250"	0.250"
ES-105-16	Straight	0.672"	0.312"	0.265"
ES-105-18	Straight	0.795"	0.312"	0.265"
ES-105-19	Straight	0.755"	0.312"	0.265"
ES-105-20	Straight	0.860"	0.312"	0.245"
ES-105-24	Straight	0.738"	0.375"	0.265"
ES-105-25	Straight	0.880"	0.402"	0.310"
ES-105-26	Straight	0.705"	0.393"	0.312"
ES-105-27	90°	0.810"	0.340"	0.220"
ES-105-28	Straight	1.035"	0.530"	0.330"
ES-105-49	Straight	0.805"	0.420"	0.285"
ES-105-50	Straight	0.845"	0.420"	0.285"
ES-105-61	Straight	1.047"	0.420"	0.377"

Table 4 - Emteq Connector Assembly Data

CABLE TYPE	RECOMMENDED SOLDER TEMPERATURE	M22520/5 CRIMP DIE (Note 1)	HEX SIDE
PFLX175-075-XX	700 - 750°F	-43	B
RG-142 B/U	700 - 750°F	-19	B
PFLX140-XXX	700 - 750°F	-41	B
PFLX195-XXX	700 - 750°F	-19	B
PFLX200-XXX	700 - 750°F	-19	B
PFLX240-XXX	700 - 750°F	-43	A
PFLX340-XXX	750 - 800°F	-35	A
PFLX400-XXX	800 - 850°F	-61	A
PFLX500-XXX	800 - 850°F	-21	A
TFLX125-075-XX	700 - 750°F	-41	B
TFLX130-XXX	700 - 750°F	-41	B
TFLX165-XXX	700 - 750°F	-19	B
TFLX205-XXX	700 - 750°F	-43	A
TFLX225-XXX	700 - 750°F	-43	A
TFLX295-XXX	750 - 800°F	-35	A
TFLX480-XXX	800 - 850°F	-27	A

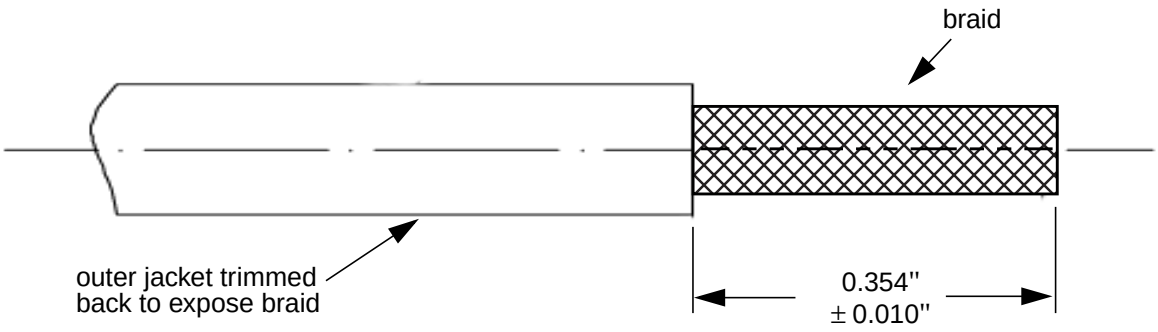
Note 1. Crimp using a M22520/5-01 basic crimp tool.

5.5 Assembly of Radiall Connectors

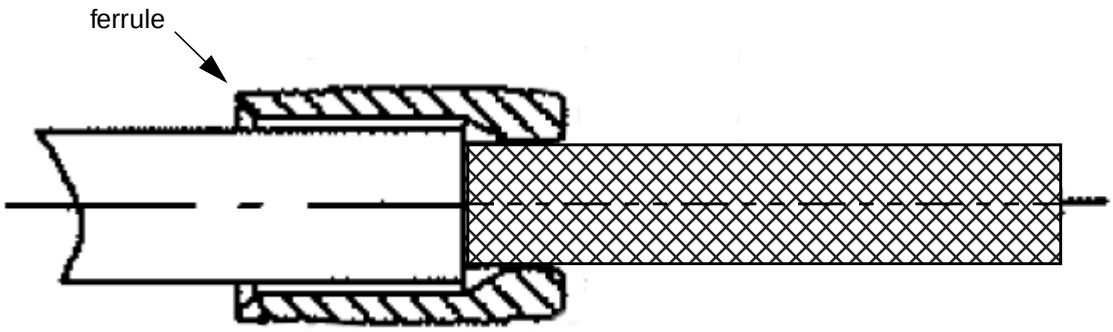
5.5.1 Assembly of Radiall 620 022 Connectors

5.5.1.1 Assemble Radiall 620 022 connectors as follows:

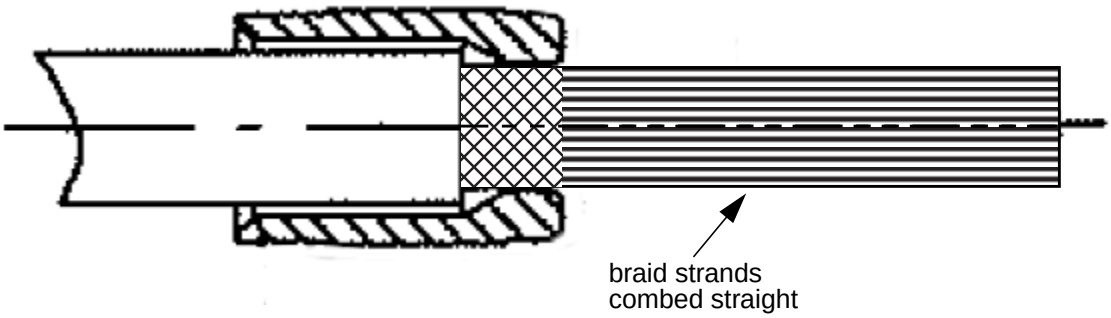
Step 1. Strip the outer jacket from the end of the coaxial cable as shown below:



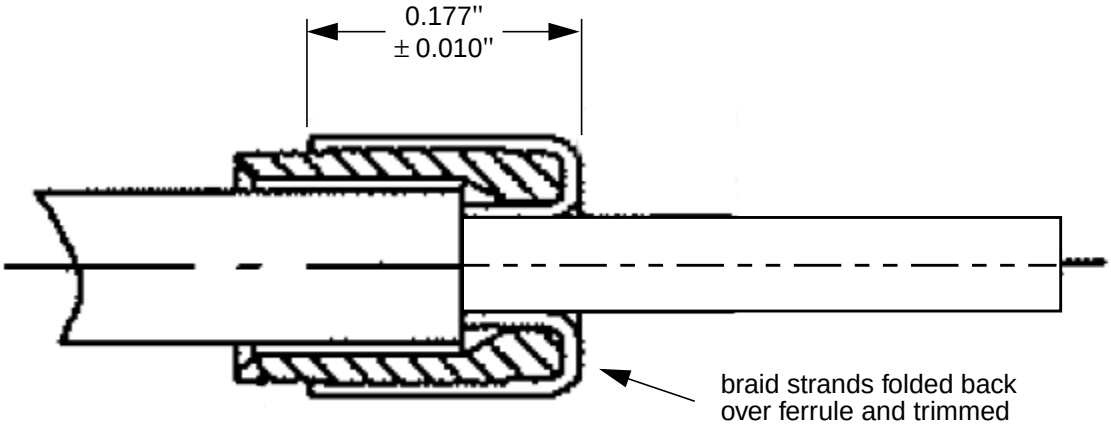
Step 2. Slide the ferrule over the braid until it butts against the end of the outer jacket as shown below:



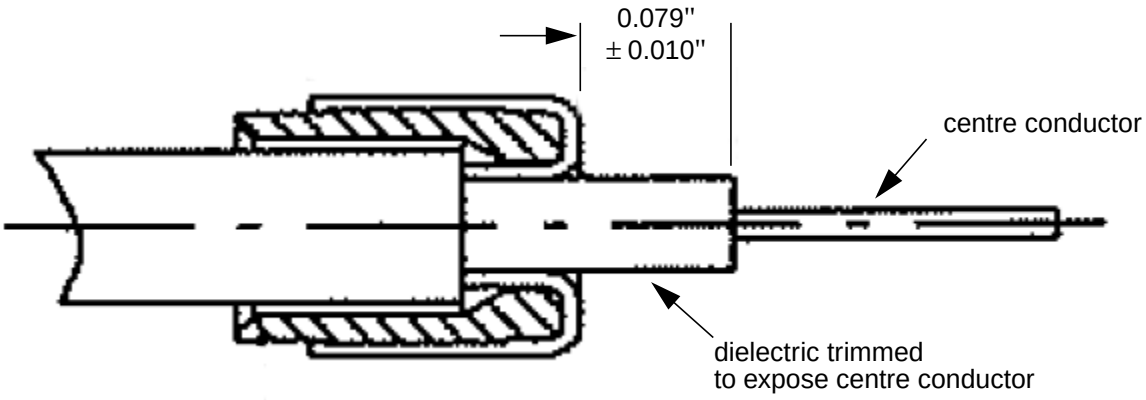
Step 3. Comb the braid until all strands are straight as shown below:



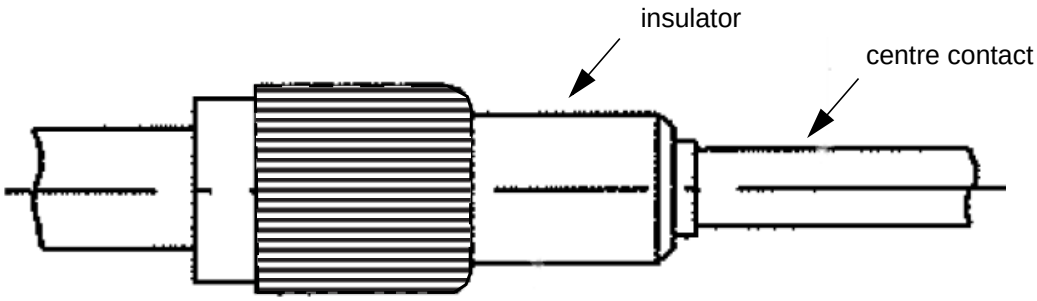
Step 4. Fold the braid strands back over the ferule and trim as shown below:



Step 5. Trim the end of the exposed dielectric as shown below:

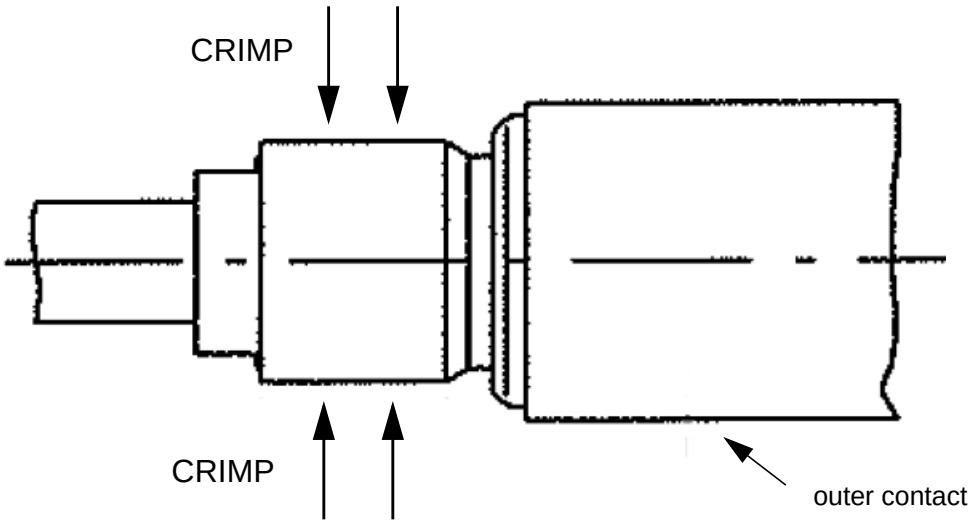


Step 6. Slide the bushing (insulator) over the dielectric and the centre contact over the centre conductor as shown below:



Step 7. Crimp the centre contact in place using a M22520/2-01 crimp tool according to PPS 9.36.

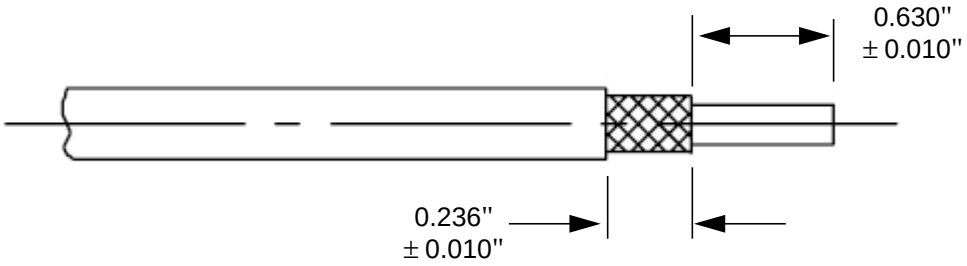
Step 8. Slide the cable assembly into the outer contact as shown below, and crimp using a M22520/5-01 crimp tool with a M22520/5-5 die (Hex B).



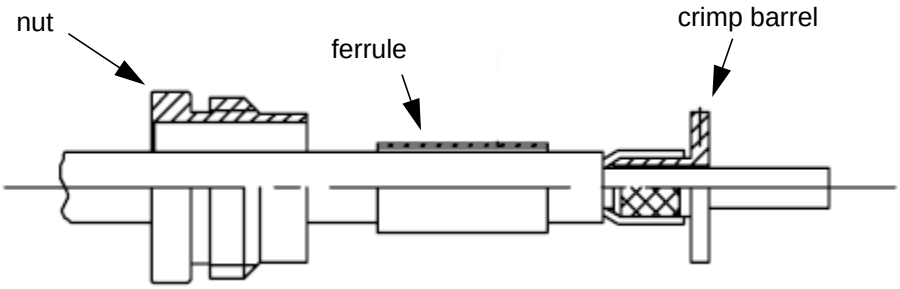
5.5.2 Assembly of Radiall 620 146 Connectors

5.5.2.1 Assemble Radiall 620 146 connectors as follows:

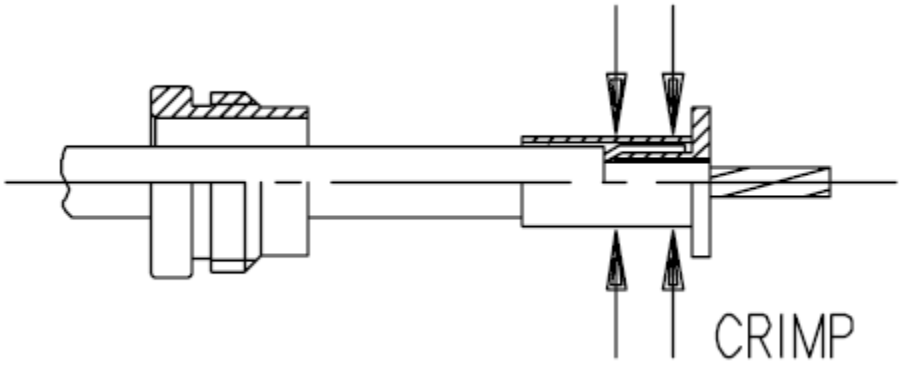
Step 1. Strip the outer jacket from the end of the coaxial cable and trim back the exposed braid as shown below:



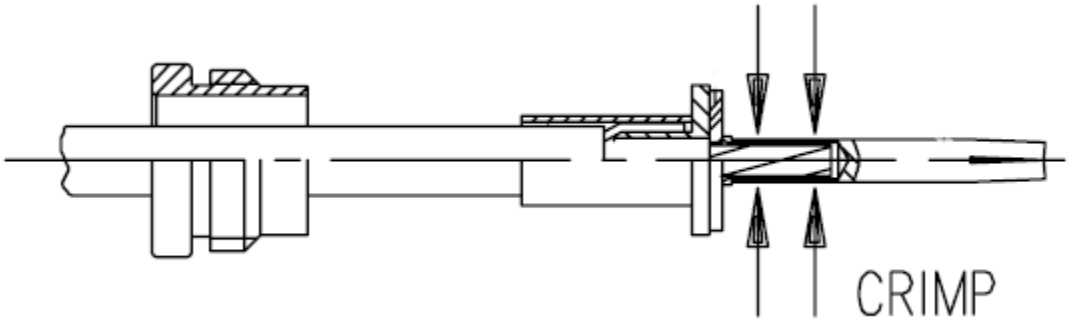
Step 2. Slide the nut and ferrule over the end of the coaxial cable, flare the braid, slide the crimp barrel over the dielectric and position the braid on the knurled area of the crimp barrel as shown below:



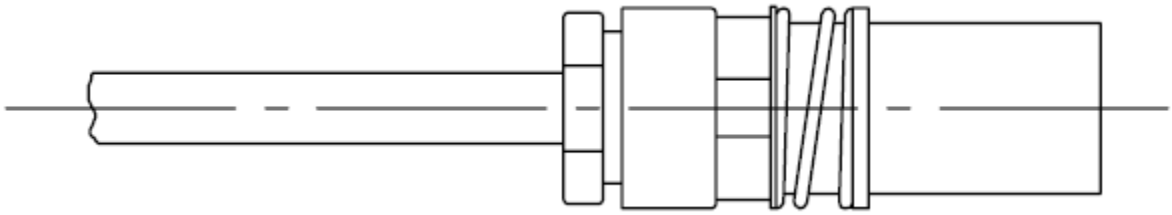
Step 3. Slide the ferrule over the braid and crimp as shown below; for RG 142 and PFLX195-500 coaxial cable, crimp the ferrule using a M22520/5-01 crimp tool with a M22520/5-05 (Hex A) or M22520/5-45 (Hex B) die. After crimping, trim the end of the dielectric flush with the end of the crimp barrel to expose the centre conductor. as shown below:



Step 4. Slide the dielectric washer and the centre conductor over the exposed centre conductor and crimp the centre conductor in place as shown below. For RG 142 and PFLX195-500 coaxial cable, crimp the centre conductor using a M22520/1-01 crimp tool with a M22520/1-13 positioner/turret according to PPS 9.36.



Step 5. Slide the cable assembly into the outer contact as shown below, and then screw/tighten the clamp nut with 10 -15 in.lbs.



5.6 Use of Schleuniger CT32 Pneumatic Crimp Tool

5.6.1 Install upper and lower die holders as follows (see Figure 3):

Step 1. Press and hold down the pneumatic foot pedal. This will stop the machine in a full stroke position.

Step 2. Disconnect the compressed air supply.

Step 3. Unscrew the screws holding the lower and upper plates and slide the plates to the side.

Step 4. Mount the upper die holder on to the upper T-Bolt.

Step 5. Mount the lower die-holder on to the lower T-Bolt.

Step 6. Slide the lower and upper plates back into position

Step 7. Screw in the screws holding the lower and upper plates.

Step 8. Tighten the upper and lower T-Bolts by turning the nut with a hex driver.

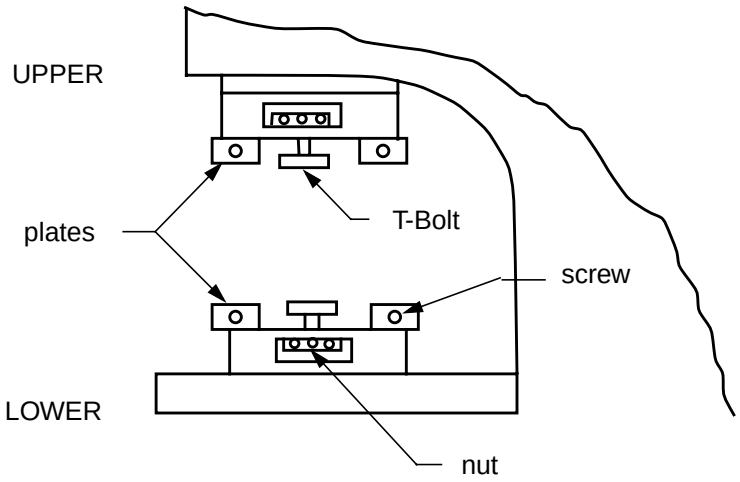


Figure 3 - Schleuniger CT32: Set-Up for Installation of Die Holders

5.6.2 Except when changing from one Schleuniger die to another Schleuniger die, adjust the crimp height whenever a die or die holder is changed as follows:

Step 1. Disconnect the machine from the compressed air supply.

Step 2. Loosen the two front set screws.

Step 3. Pull the machine approximately 2” over the edge of the workbench.

Step 4. Turn the adjustment screw counter clockwise and manually position (push down) the lower jaw until it is at the lower most position.

Step 5. Install the appropriate die set (upper and lower dies).

Step 6. Reconnect the compressed air supply.

Step 7. Fully close the speed control valve.

Step 8. Press and hold the foot pedal.

Step 9. Slowly open the speed control valve until the full crimping position has been reached. Press the release button **immediately** if the two die halves do not line up.

Step 10. Turn the adjustment screw clockwise until the die halve “bottom out” against each other.

Step 11. Release the foot pedal to complete the cycle.

Step 12. Turn the adjustment screw an additional 1/4 turn clockwise (90°) **and no more**.

Step 13. Re-tighten the two front set screws.

Step 14. Push the machine back into its operating position.

5.6.3 If the dies become blocked during the crimp cycle and the machine does not complete the crimp the dies will remain closed until the release button is pressed.

5.6.4 Operate the Schleuniger CT32 crimping machine as follows:

Step 1. If necessary, install the appropriate die holders and dies as specified in paragraph 5.6.1.

Step 2. If necessary, adjust the crimp height as specified in paragraph 5.6.2.

Step 3. Using the locating device, position the contact to be crimped in the die.

Step 4. Insert the stripped wire into the wire barrel of the contact.

Step 5. Press the foot pedal to actuate the crimp machine. If the dies become blocked during the crimp cycle and the machine does not complete the crimp, press the release button to release the dies; the crimps formed in such a case are not acceptable.

Step 6. When the crimp cycle is complete, remove the crimped contact/wire assembly from the crimping machine.

6 Requirements

6.1 Check solder connections according to PPS 9.07 before assembly of the connector body.

6.2 Check all completed cable assemblies for continuity and short circuits.

6.3 Traces of oxidation of the copper braid surface caused by excess solvent being drawn between the copper braid and the dielectric of DSC371-1 tri-axial cable is not desirable, but is acceptable.

7 Safety Precautions

7.1 Observe general shop safety precautions when performing the procedure specified herein.

8 Personnel Requirements

8.1 Personnel responsible for assembly of radio frequency (RF) connectors to coaxial cables must have a good working knowledge of the procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.