DE HAVILLAND AIRCRAFT OF CANADA LIMITED

PPS 9.52

PRODUCTION PROCESS STANDARD

PROPRIETARY INFORMATION

STOWAGE OF ELECTRICAL WIRES AND CONNECTORS

Issue 2
- This standard supersedes PPS 9.52, Issue 1.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to christie.chung@dehavilland.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

Prepared By:		(Christie Chung)	January 17, 2020
	PPS Group		
Approved By:		(Stephen Mabee)	January 17, 2020
	M&P Engineering		
		(Roger Moore)	January 17, 2020
	Quality		

Signed original on file. Validation of paper prints is the responsibility of the user.

Issue 2 - Summary of Changes (over the previous issue)

The following summaries are not detailed and are intended only to assist in alerting PPS users to changes which may affect them. Refer to the applicable sections of this PPS for detailed procedure and requirements.

- Replaced throughout PPS where “Bombardier” is specified with “De Havilland Aircraft of Canada Limited” or “De Havilland Canada”.
- Specified the maximum temperature for heat shrinkable tubing, M23053/5 (135°C max.) and M23053/8 (175°C max.).
- Specified Steinel HG 2520E as an example of an acceptable hot air gun.
- Specified that installed stowing materials temperature rating shall be compatible with the service temperature requirements of the wire or terminals.
- Specified that the wires to be stowed shall be secured by tying them to a wire bundle run or a structural member.
- Specified that wires with stripped ends shall have the protruding strands cut flush with the end of the wire insulation prior to the installation of the insulating medium.
- Specified that wire identification numbers shall be unique and clearly visible on wires which require stowing.
- Added option of TC Caps for stowage of wires and wire bundles.
- Specified to refer to PPS 31.17. for applicable safety precautions for handling and usage of solvents.

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for stowage of electrical wires and connectors.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall 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.

1.2 The stowage of wiring and components is strictly prohibited within fuel tanks/cells, areas where fuel vapour is commonly present, and within or in proximity to any moving flight control device or surface.

2 HAZARDOUS MATERIALS

2.1 Before receipt at De Havilland Canada, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the De Havilland Canada 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 De Havilland Canada Environment, Health and Safety Department.

3 REFERENCES

3.1 PPS 13.26 - General Subcontractor Provisions.

3.2 PPS 13.34 - Installation of Plastic Cable Ties.

3.3 PPS 31.17 - Solvent Usage.

4 MATERIALS AND EQUIPMENT

4.1 Materials

4.1.1 Unless otherwise specified in this section, use only the materials specified. Use of superseding or alternative materials is not allowed.

4.1.2 Heat shrinkable tubing, bulk length, M23053/5 (135°C max.) or M23053/8 (175°C max.). See Figure 1 for a part number breakdown.

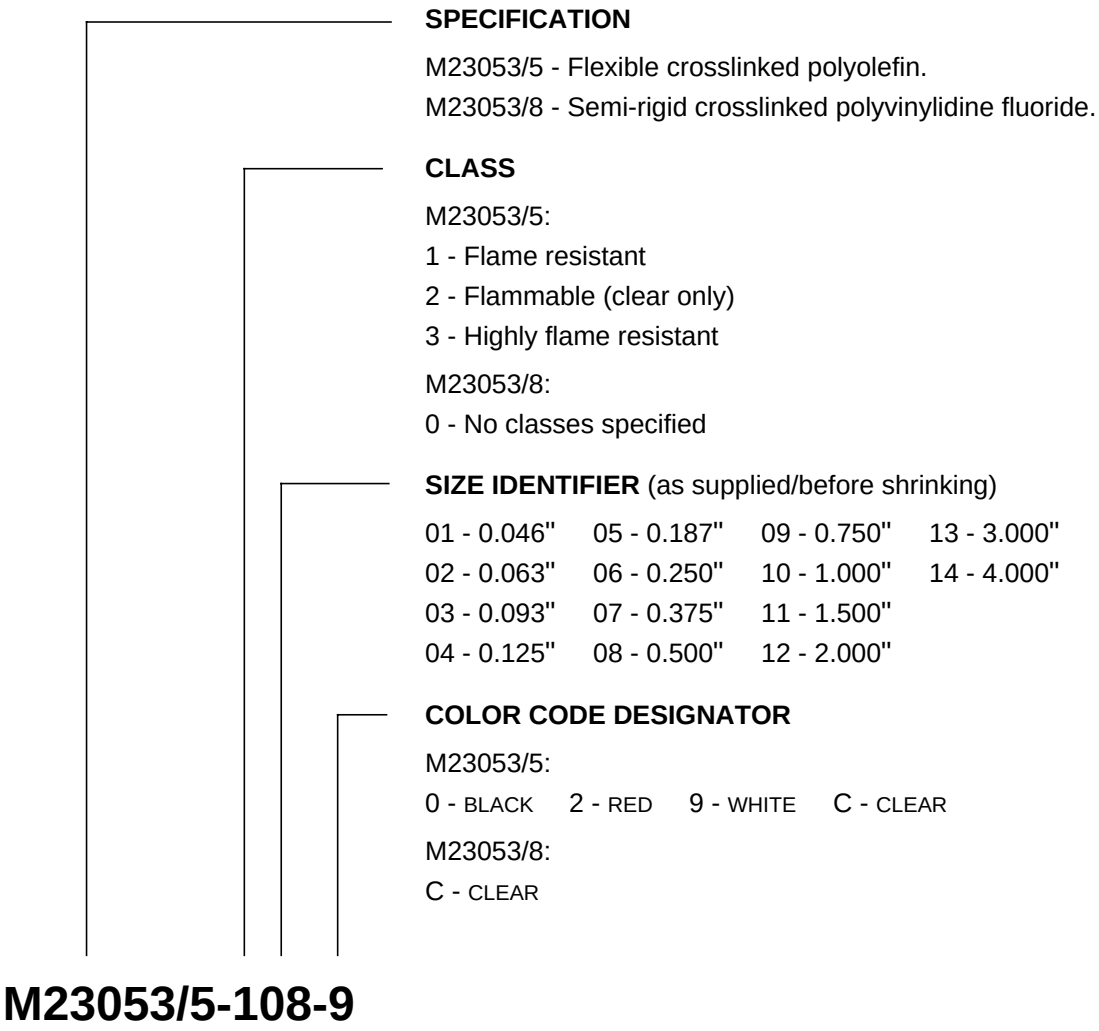


FIGURE 1 - PART NUMBER BREAKDOWN FOR HEAT SHRINKABLE TUBING

4.1.3 Semi-rigid, Flame-Retardant Polyolyolefin Caps (TC Caps), Tyco.

4.1.4 Guideline tape, fire resistant, filler - Freudenberg-NOK Inc. #52672 Guideline tape or insulation tape to A-A-59163 (e.g., Freudenberg-NOK Inc. #50215).

4.1.5 Fiberglass lacing tape, silicone resin impregnated, size 3 (0.077" - 0.094" wide and 0.013" - 0.019" thick) to A-A-52083-F-3.

4.1.5.1 The following fiberglass lacing tape may be used to depletion of the existing stock but thereafter only fiberglass lacing tape to A-A-52083-F-3 shall be used.

- A-A-52083-C-2, A-A-52083-C-3 or A-A-52083-D-2
- MIL-T-43435 Type IV, Finish F

4.1.6 Nylon lacing tape, braided, to MIL-T-43435 Type I, Finish B, Size 2.

4.1.7 Polyethylene film or bag, 0.006" to 0.012" thick, commercial grade.

4.2 Equipment

4.2.1 Hot air gun, complete with reflector (e.g., Steinel HG 2520E or Steinel STEI-HG 2310-BB). For safety reasons, it is recommended that hot air guns include a power interrupt reset feature which will prevent an unattended heat gun from resuming heat (e.g., after a power failure).

4.2.1.1 Whenever using a hot air gun or heat gun, take care to ensure not to use too high a heat setting. The heat setting used shall be appropriate to the task the hot air gun is being used for without causing damage to parts or surrounding structure. If necessary, use heat guards to protect surrounding structure. If unsure what heat setting to use, start at a lower temperature setting and increase slowly to determine the proper setting.

5 PROCEDURE

5.1 General

5.1.1 Except as noted in paragraph 5.1.1.1 or paragraph 5.1.1.2, tie wire assemblies and secure heat shrinkable sleeves and Guideline tape when stowing wires or connectors using self-locking plastic cable ties. Install plastic cable ties according to PPS 13.34.

5.1.1.1 If the engineering drawing or wiring list specifies the use of high temperature resistant ties and in areas of high operating temperature, secure heat shrinkable sleeves and Guideline tape using fiberglass lacing tape (see paragraph 4.1.5). An area in which the operating temperature exceeds 200°F is an area of high operating temperature (e.g., nacelles forward of the firewall). If there is any doubt as to whether or not a high temperature resistant tie is required, consult Liaison Engineering. Tie fiberglass lacing tape according to section 5.4.

5.1.1.2 If it is not practical to install plastic cable ties (such as in confined areas in which the installation gun does not fit), tie wire assemblies using braided nylon lacing tape (see paragraph 4.1.6) or fiberglass lacing tape (see paragraph 4.1.5) according to paragraph 5.4.1. Trim the tied ends to a length of approximately 1/2". **Do not** use braided nylon lacing tape or fiberglass lacing tape in fuel tank areas.

5.1.2 Installed stowing materials temperature rating shall be compatible with the service temperature requirements of the wire or terminals.

5.1.3 When cutting heat shrinkable tubing to length, all cuts shall be clean, square and free of burrs to prevent splitting as a result of shrinking.

5.1.4 Before applying heat shrinkable tubing or heat shrinkable end caps, ensure that the area over which the tubing is to be applied is clean and free of grease or oil. If necessary, solvent clean parts according to PPS 31.17 before assembling and shrinking the tubing in place.

5.2 Stowage of Electrical Wires

5.2.1 General

5.2.1.1 The wires to be stowed shall be secured by tying them to a wire bundle run or a structural member.

5.2.1.2 Wires with stripped ends shall have the protruding strands cut flush with the end of the wire insulation prior to the installation of the insulating medium.

5.2.1.3 Wire identification numbers shall be unique and clearly visible on wires which require stowing.

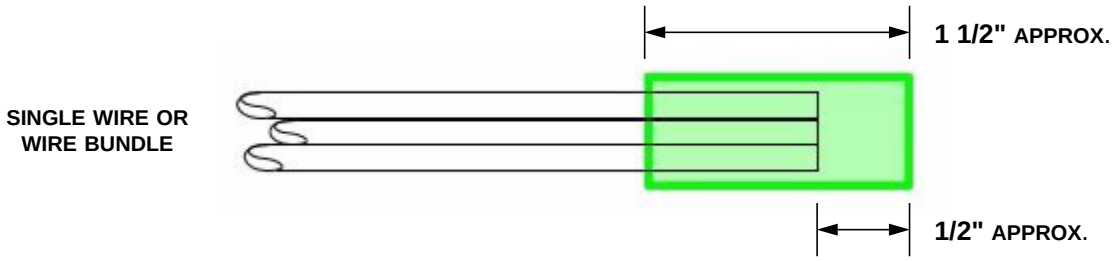
5.2.1.4 If the engineering drawing specifies stowage of electrical wires or bundles, stow wires or bundles either using the heat shrinkable sleeving according to section 5.2.2 or TC heat shrinkable end caps according to section 5.2.3.

5.2.2 Heat Shrinkable Sleeving

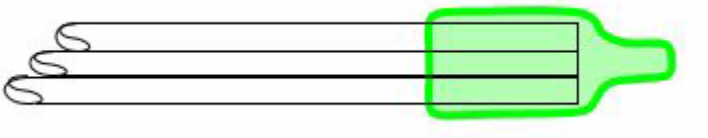
5.2.2.1 Using heat shrinkable sleeving, stow wires or wire bundles as follows:

Step 1. Cut a 1 1/2" length of heat shrinkable sleeving (M23053/5 or M23053/8) with a pre-shrunk diameter as close as possible to the outside diameter of the wire or bundle.

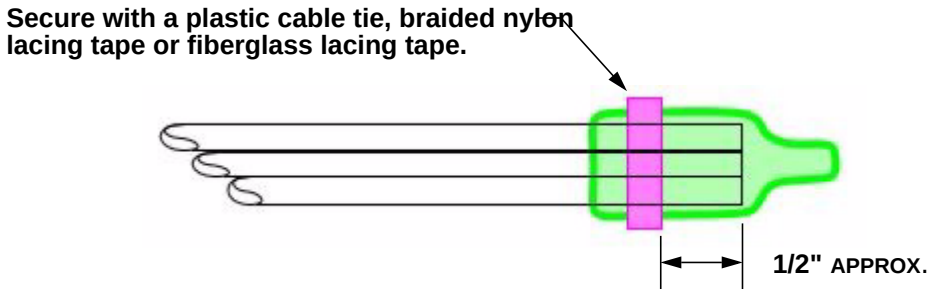
Step 2. Position the heat shrinkable sleeving so that it will overlap approximately 1" over the wire or bundle leaving approximately 1/2" hanging off the end as shown below. For wires with contacts or lugs installed, position the heat shrinkable sleeving in the same manner (i.e., approximately 1" overlap over the wire and 1/2" of heat shrinkable sleeving extending beyond the end of the contact or lug).



Step 3. Shrink the heat shrinkable sleeving in place using a hot air gun.



Step 4. Secure the heat shrinkable sleeving to the wire or bundle approximately 1/2" from the end of the wire or bundle.



5.2.3 TC Caps

5.2.3.1 Do not use TC end caps in the following situations:

- Conductor size 10 AWG or larger or on a coaxial cable.
- Areas where the temperature exceed 275°F.

5.2.3.2 If not specified on the engineering drawing, select an end cap according to Table I where the wire diameter is smaller than dimension “C”, but is not to be smaller than dimension “D”.

TABLE I - TYCO END CAP DIMENSIONS

TYCO PART NUMBER	C (INCH)	D (INCH)	RECOMMENDED WIRE	COLOUR
TC 4001	0.063	0.030	24 AWG (6, 8 & 10 mil insulation) 22 AWG (6, 8 & 10 mil insulation) 20 AWG (6, 8 & 10 mil insulation) 18 AWG (6 & 8 mil insulation)	White
TC 4003	0.125	0.050	18 AWG (10 mil insulation) 16 AWG (6, 8 & 10 mil insulation) 14 AWG (6, 8 & 10 mil insulation) 12 AWG (6, 8 & 10 mil insulation)	Red
TC 4005	0.250	0.100	12 AWG (6, 8 & 10 mil insulation) 10 AWG (6, 8 & 10 mil insulation) 8 AWG (6, 8 & 10 mil insulation)	Grey

AS SUPPLIED BY TYCO

AFTER UNRESTRICTED RECOVERY

5.2.3.3 Using TC heat shrinkable caps, stow wires or wire bundles as follows:

Step 1. Hold the wire ends vertically facing up and place end cap so that wire reaches the end of the cap.

Step 2. Shrink the TC Cap in place using a hot air gun. Do not apply heat for more than 20 seconds at any one position. Remove heat and allow the area to cool for a minimum of 5 seconds before applying heat again.

- As shrinkage takes place, move the hot air gun slowly towards area where shrinkage has not occurred. Do not leave partially shrunk areas as the gun is moved.
- Stop heating when end cap flows axially along the wire.

Step 3. Once installed and cooled down, check to ensure the cap has properly adhered to the wire by gently pulling the cap while holding the wire/cable. There should be no movement.

Step 4. Check to ensure end caps is free of cracks, voids between the end cap and insulation.

Step 5. Verify that there is no indication of overheating (insulation damage, burnt end cap, etc.).

FIGURE 2 - INSTALLED TC CAPS

5.3 Stowage of Connectors

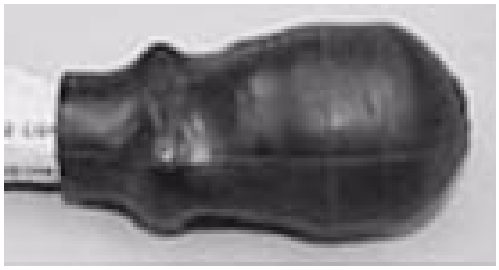
5.3.1 If the engineering drawing or wiring list specifies stowage of a connector, stow the connector as follows unless otherwise specified:

Step 1. Tighten the metal dust caps specified on the engineering drawing or wiring list onto the connector. If the engineering drawing or wiring list does not specify the metal dust cap to be used, refer to Liaison Engineering. Plastic dust caps are not suitable for stowage of connectors and are not an acceptable substitute for the metal dust caps specified.

Step 2. Wrap the capped connector with Guideline tape (see paragraph 4.1.4) with an approximate 50% overlap, as shown in the following figure.

Step 3. Secure the Guideline tape using cable ties, braided nylon lacing tape or fiberglass lacing tape, as specified herein.

Step 4. Only if specified by the engineering drawing or wiring list, cover the Guideline tape wrapped and capped connector with a heat shrinkable end cap and shrink in place.



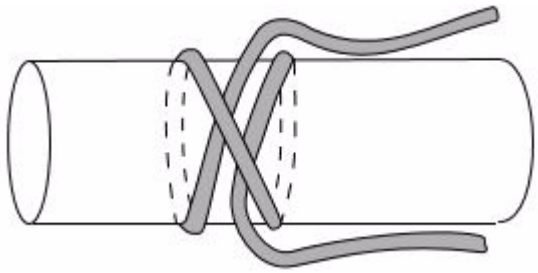
Step 5. Secure the assembly to cable runs or to the structure using cable ties, braided nylon lacing tape or fiberglass lacing tape as specified herein, to prevent the assembly from swinging.

5.3.2 Uncoupled plugs and receptacles shall be protected from damage and contamination during storage or movement between work-stations. If the engineering drawing specifies “Bag Connector”, after the stowage procedure as specified herein, enclose uncoupled plugs and receptacles in a folded polyethylene film or bag (see paragraph 4.1.7), and spot tie them within one inch of the connector. Protected connectors shall be spot tied to cable runs or secure to a structure to avoid swinging and causing damage to themselves or to adjacent wiring. Seal bags using Guideline tape (do not use adhesive tape).

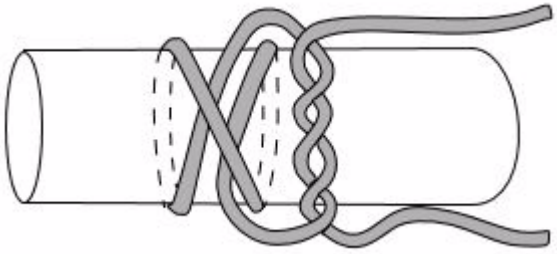
5.4 Tying of Fiberglass and Braided Nylon Lacing Tape

5.4.1 Tie fiberglass or nylon lacing tape as follows:

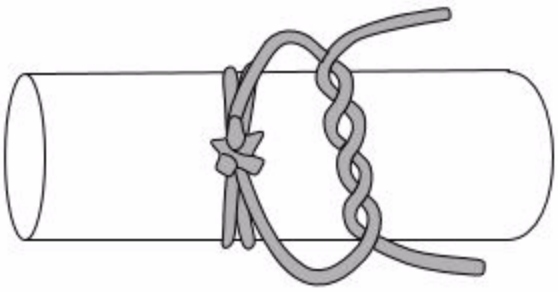
Step 1. Form a clove hitch around the Guideline tape as shown below.



Step 2. Over the clover hitch, form the first portion of a square knot plus an extra turn as shown and pull tight.



Step 3. Complete the second portion of a square knot, again with an extra turn, as shown and pull tight.



Step 4. Trim the tie ends to a length of approximately 1/2".

6 REQUIREMENTS

6.1 Ends of wires or connectors installed for alternate or future use shall be stowed according to the procedure specified herein.

6.2 If the engineering drawing or wiring list specifies the use of high temperature resistant ties, and in areas of high (above 200°F) operating temperature (e.g., nacelles forward of the firewall), Guideline tape and heat shrinkable sleeves used for stowage shall be secured using fiberglass lacing tape.

6.3 Shrunk heat shrinkable sleeves and heat shrinkable end caps shall be free of cracks, looseness, edge peeling or signs of over heating.

7 DE HAVILLAND CANADA SAFETY PRECAUTIONS

7.1 The safety precautions specified herein are specific to De Havilland Canada to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is strongly recommended that other facilities consider these safety precautions; however, suppliers, subcontractors and partners are responsible for ensuring that their own environmental, health and safety precautions satisfy the appropriate local government regulations.

7.2 Observe standard plant safety precautions when performing the procedure specified herein.

7.3 Hot air guns develop extremely high temperatures at the screen nozzle. Exercise caution during handling to avoid burns. After the completion of operations, cool the heat gun by activating the switch to the cool position until the nozzle is cool enough to handle.

7.4 Refer to PPS 31.17 for the safety precautions for handling and using solvents.

8 PERSONNEL REQUIREMENTS

8.1 Personnel responsible for stowage of electrical wires and connectors shall have a good working knowledge of the applicable procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.