BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 9.49

PRODUCTION PROCESS STANDARD

Installation of Open Conduit

Issue 1
- This is a new standard.
- Direct PPS 9.49 related questions to michael.wright@aero.bombardier.com.
- This PPS is effective as of the distribution date.
- Validation of paper prints is the responsibility of the user. Signed original on file.

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1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for installation of DSC 590 and S8021 open conduit.

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.

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 Site) 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 General

3.1.1 Unless a specific issue is indicated, the issue of the reference documents specified in this section in effect at the time of manufacture shall form a part of this specification to the extent indicated herein.

3.2 Bombardier Toronto (de Havilland) Process Specifications

3.2.1 PPS 13.26 - General Subcontractor Provisions.

3.2.2 PPS 13.34 - Installation of Plastic Cable Ties.

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 Open conduit, self-wrapping, protective, to Bombardier Toronto (de Havilland) DSC 590 or Bombardier Aerospace S8021, as specified by the engineering drawing or wiring list.

4.1.3 Plastic cable ties as specified in PPS 13.34.

4.1.4 MIL-T-43435 Type I, Finish B, Size 2, braided nylon lacing tape.

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.

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

4.2 **Equipment**

4.2.1 Open conduit installation tool (e.g., two-head Roundit tool, as shown in the adjacent figure).

4.2.2 Good quality paper scissors for cutting open conduit. It is important to make sure that a gap does not exist between the blades of the scissors to avoid fraying.

Two-head Roundit installation tool

5 **Procedure**

5.1 **General**

5.1.1 Install DSC 590 or S8021 open conduit over wire bundles and assemblies only when specified by the engineering drawing or wiring list.

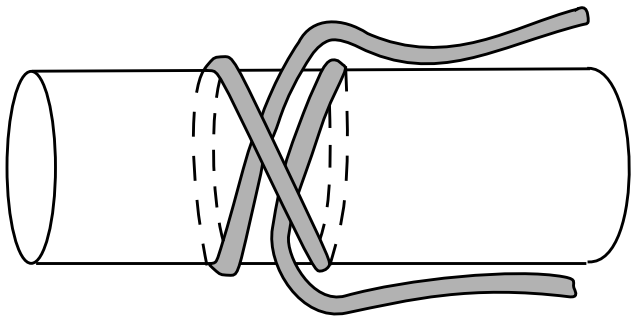
5.1.2 There must be no ties or wire splices inside open conduit.

5.1.3 Unless the engineering drawing or wiring list specifies the use of high temperature resistant ties, or in areas of high (above 200°F) operating temperature (e.g., nacelles forward of the firewall), secure open conduit as specified herein with plastic cable ties according to PPS 13.34 or nylon lacing tape (ref. para. 4.1.4) ties.

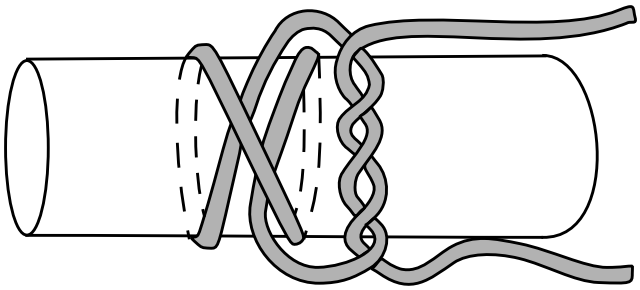
If the engineering drawing or wiring list specifies the use of high temperature resistant ties, or in areas of high (above 200°F) operating temperature (e.g., nacelles forward of the firewall) secure open conduit as specified herein with fiberglass lacing tape (ref. para. 4.1.5) ties,

Tie nylon lacing tape and fiberglass lacing tape ties as follows:

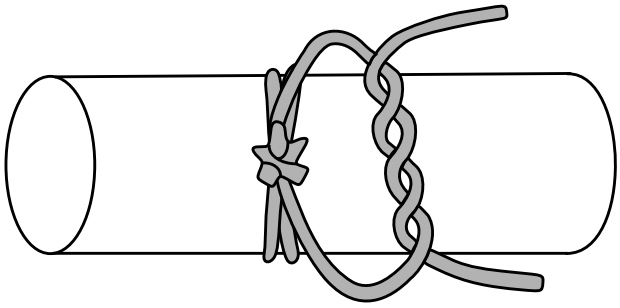
Step 1. Form a clove hitch around the wire bundle as shown below.



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

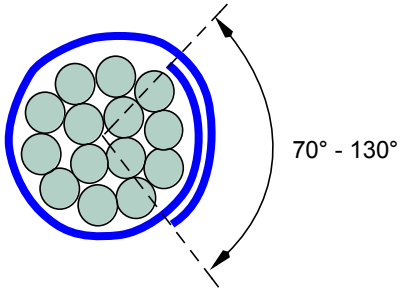


Step 3. Complete the second portion of a square knot, again with an extra turn, as shown and pull tight.



5.2 General Installation

5.2.1 Install DSC 590 and S8021 conduit as follows:



Step 1. Use the size of DSC 590 or S8021 open conduit specified in Table 8 (the correct size open conduit will overlap approximately 70° - 130° when installed around the wire bundle as shown; a tracer on the conduit, if any, indicates maximum operating diameter).

Table 1. **DSC 590 and S8021 Open Conduit selection**

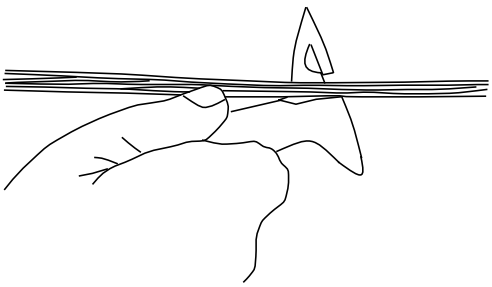
Bundle Diameter	S8021 Open Conduit	DSC 590 Open Conduit
3/16" or less	S8021-1 or S8021A1	DSC590-1
3/16" - 5/16"	S8021-2 or S8021A2	DSC590-2
5/16" - 1/2"	S8021-3 or S8021A3	DSC590-3
1/2" - 3/4"	S8021-4 or S8021A4	DSC590-4
3/4" - 1"	S8021-5	DSC590-5
1" - 1 1/4"	S8021-6	DSC590-6
1 1/4" - 1 1/2"	S8021-7	DSC590-7

Step 2. Cut the open conduit to length in a single pass using a suitable cutting tool (e.g., scissors).

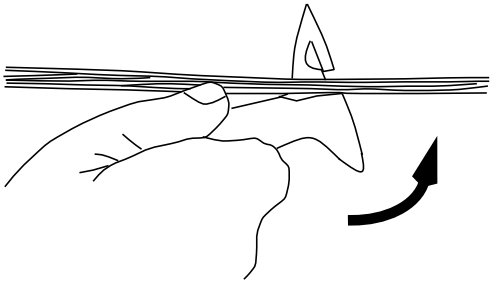
Step 3. Select the appropriate size open conduit installation tool (ref. para. 4.2.1) to install the conduit on the wire bundle.

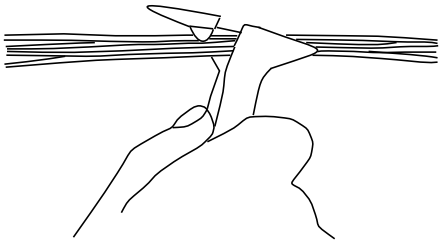
Step 4. Group all the appropriate wires of the wire bundle on the lateral aperture of the appropriate tool head (i.e., the tool head size must match the bundle and conduit size).

Step 5. Fit the tool over the wire bundle.

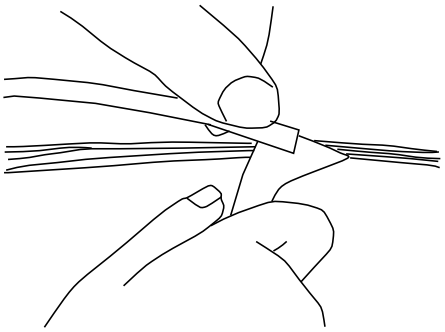


Step 6. Rotate the handle to position the tool for installing conduit.





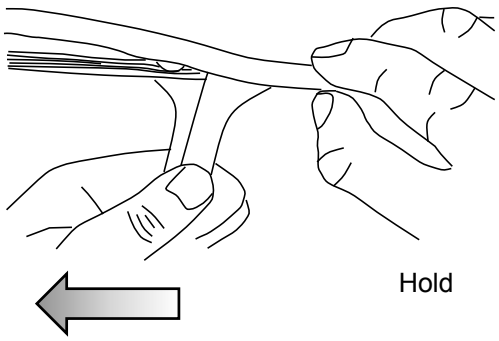
Step 7. Slip one end of the conduit over the nose cone of the installation tool head and onto the wire bundle.



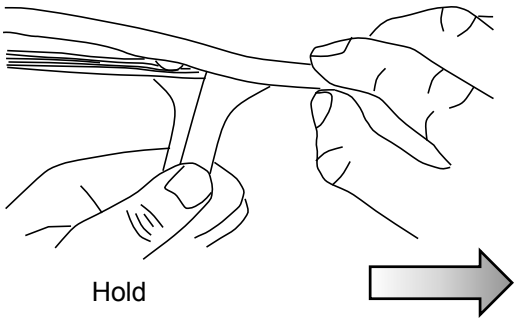
Step 8. For the application of long conduit lengths, it is recommended to hold the end of the conduit which has been slipped over the wire bundle in place and slide the tool along the bundle, installing the conduit in the process.

For short conduit lengths, it is recommended to hold the tool in place and continue to slide the conduit over the tool and onto the wire bundle.

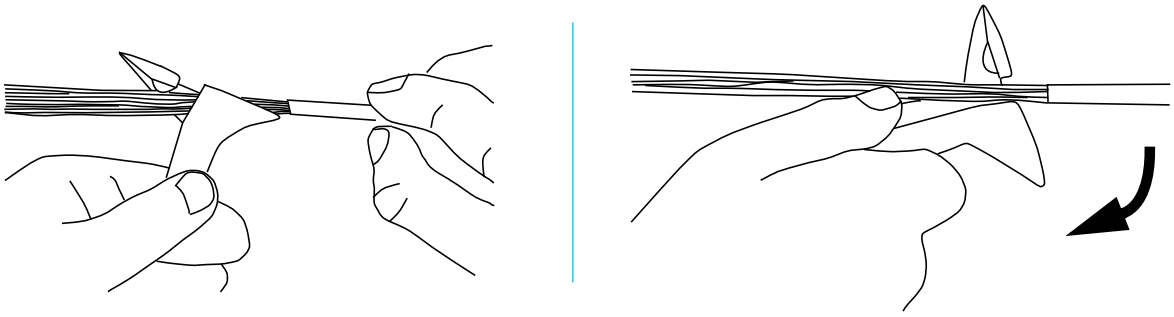
For long conduit lengths



For short conduit lengths



Step 9. When the conduit is fully installed, remove the tool from the wire bundle. Rotate the tool handle to remove the tool from the bundle.



Step 10. Except for open conduit ends which terminate within a connector backshell or strain relief, secure the ends of open conduit on the wire bundle approximately 3/4" from each end of the conduit using plastic cable ties or lacing tape ties.

Step 11. Also secure the open conduit on the wire bundle approximately evenly along the length of the conduit using plastic cable ties or lacing tape ties such that the maximum spacing of ties and conduit terminations does not exceed 6" (e.g., for an 8" length of open conduit secure the open conduit at each terminating end and with an additional tie approximately in the middle of the length of open conduit approximately 4" from each end; or, for a 21" length of open conduit secure the open conduit at each terminating end and with additional ties along the length of the open conduit spaced approximately every 5”).

5.3 **Breakouts**

5.3.1 At wire bundle breakouts, secure the open conduit, wire bundle and/or wire bundle breakout(s) according to the applicable figure specified in Table 2.

Table 2. **Breakouts**

Breakout Scenario	Figure
Main bundle covered with open conduit, breaking out into multiple branches, also covered with open conduit	Figure 1
Main bundle covered with open conduit, with a breakout covered with open conduit	Figure 2
Main bundle covered with open conduit, with a breakout not covered with open conduit	Figure 3
Main bundle not covered with open conduit, with a breakout covered with open conduit	Figure 4

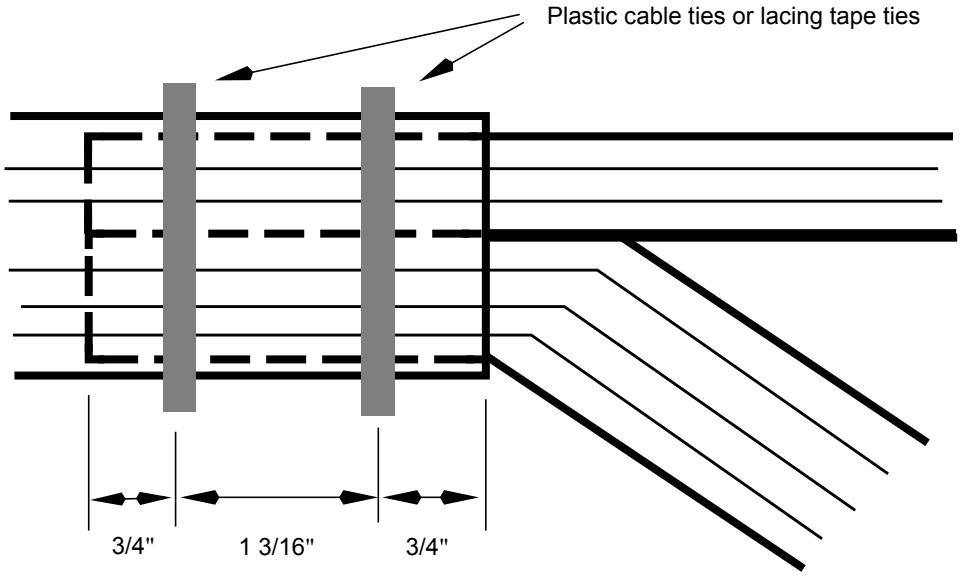


Figure 1. **Main Bundle Covered with Open Conduit, Breaking out into Multiple Branches, Covered with Open Conduit**

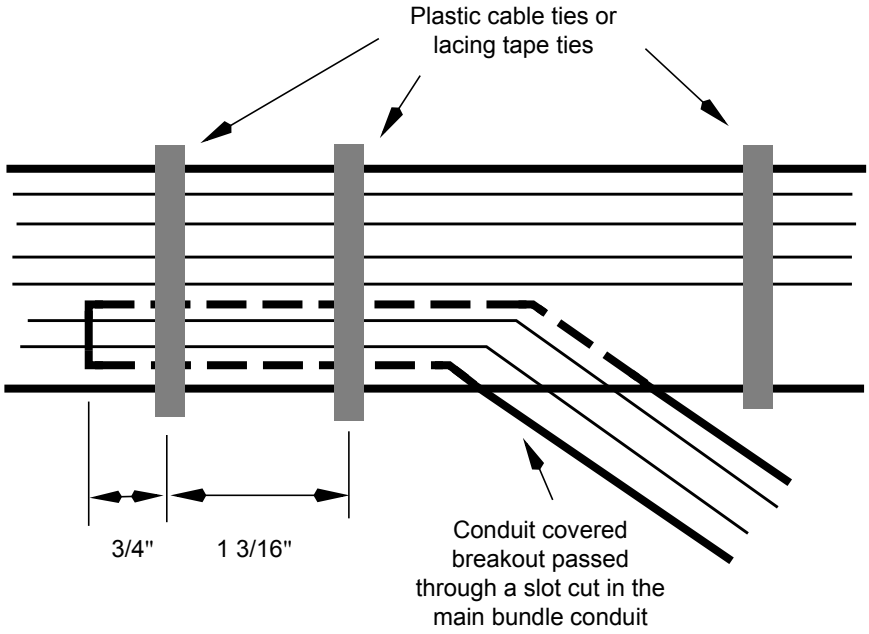


Figure 2. **Main Bundle Covered with Open Conduit, with a Breakout Covered with Open Conduit**

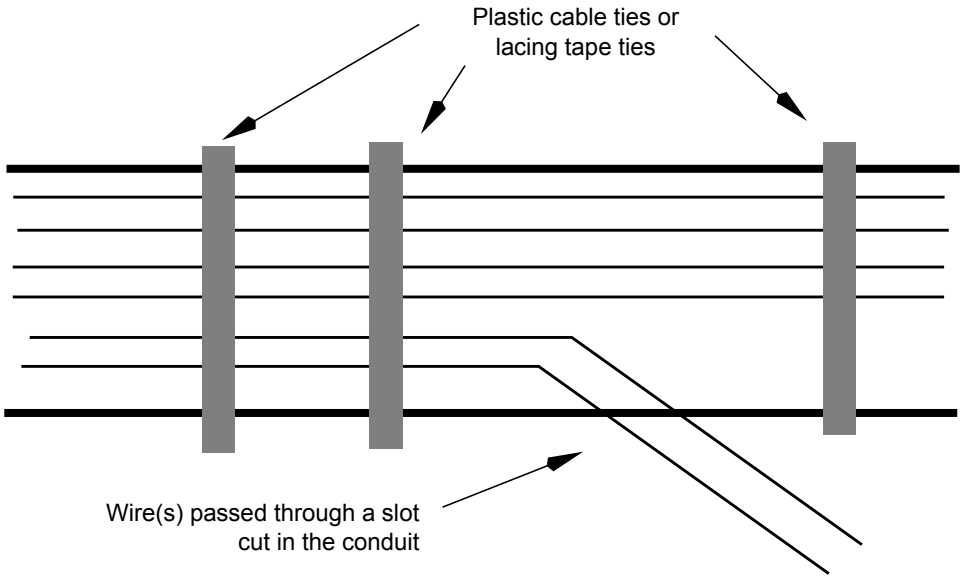


Figure 3. **Main Bundle Covered with Open Conduit, with a Breakout Not Covered with Open Conduit**

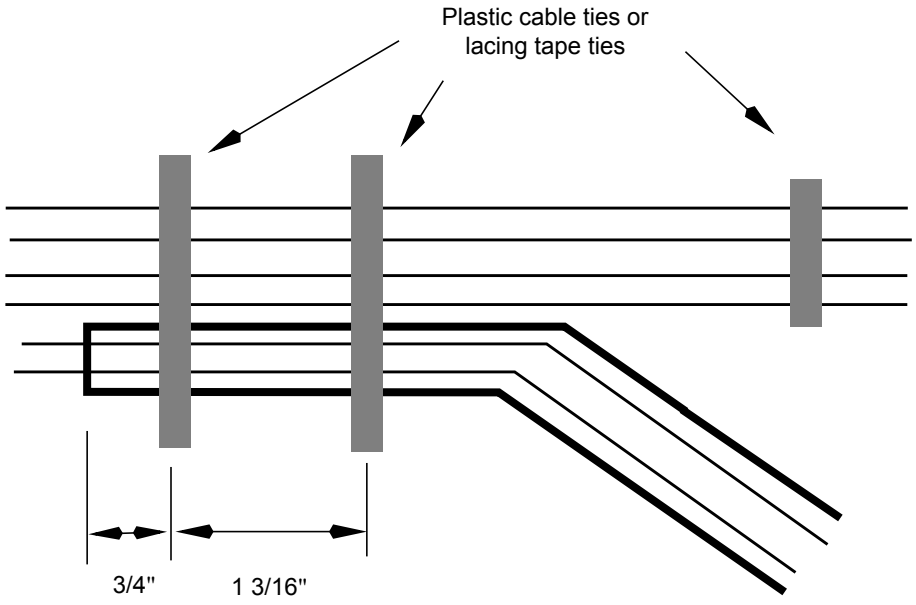


Figure 4. **Main Bundle Not Covered with Open Conduit, with a Breakout Covered with Open Conduit**

6 Requirements

6.1 There must be no ties or wire splices inside open conduit.

6.2 Ensure that the correct size open conduit has been used (i.e., with an overlap of approximately 70° - 130° when installed around the wire bundle).

6.3 Ensure that open conduit is properly secured using plastic cable ties or lacing tape ties at terminations, breakouts and along the length of the conduit such that the maximum spacing of ties and conduit terminations does not exceed 6".

7 Safety Precautions

7.1 **The safety precautions specified herein are specific to Bombardier Toronto (de Havilland) to meet Canadian Federal and Provincial government environmental, health and safety regulations. It is 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 general shop safety precautions when performing the procedure specified herein.**

8 Personnel Requirements

8.1 Personnel must have a good working knowledge of the applicable procedure and requirements as specified herein and must have exhibited their competency to their supervisor.