BOMBARDIER
Toronto (de Havilland)
PROPRIETARY INFORMATION

PPS 15.02

PRODUCTION PROCESS STANDARD

Identification Coding of Electrical and Electronic Wires and Cables

Issue 20
- This standard supersedes PPS 15.02, Issue 19.
- Vertical lines in the left hand margin indicate changes over the previous issue.
- Direct PPS 15.02 related questions to michael.wright@aero.bombardier.com.
- This PPS is effective as of the distribution date.

Approved By:	*Ken Quon*, for	(Bruce Campbell)	June 2, 2016
	Materials Technology		
	Stephen Pitt	(Stephen Pitt)	June 2, 2016
	Quality		
Perpared By:	*Michael Wright*	(Michael Wright)	May 30, 2016
	PPS Group		

Table of Contents

Section & Title **Page**

Figures

1 Scope

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for identification coding of wires and cables used in electrical and electronic wiring systems. However, this coding shall in no way conflict with the requirements for part marking electrical and electronic parts and assemblies (including wires and cables) as specified in PPS 15.01.

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.

1.1.4 Identify cable termination and co-axial cables according to the instructions on the engineering drawing.

1.1.5 Refer to PPS 15.01 for the procedure and requirements for part marking of electrical and electronic wires and cables. Part marking is not the same as identification coding and each are independently required.

1.1.6 Position connector identification sleeves or cable markers (as specified by the engineering drawing) on wire harnesses terminating at connectors according to PPS 9.22.

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 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 9.04 - Assembly and Installation of Electrical and Electronic Wires and Cables.

3.2.2 PPS 9.22 - Assembly of Connectors.

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

3.2.4 PPS 13.26 - General Subcontractor Provisions.

3.2.5 PPS 15.01 - Part Marking.

3.2.6 PPS 15.04 - Use of Felt Tip Markers for Marking Aircraft Parts and Assemblies.

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 Identification tape:

- BACT19B-T, PVF (polyvinyl fluoride), 1.5" X 2.9" strips, pressure sensitive, adhesive backed.
- Brady B-437, PVF (polyvinyl fluoride) “Tedlar”, thermal transfer printable label stock, pressure sensitive, adhesive backed.

4.1.3 DSC 347 heat shrinkable sleeving, wrap around markers and tie-wrap type cable markers.

4.1.4 Raychem HT-SCE heat shrinkable sleeves.

4.1.5 Typewriter ribbons for marking the identification code on BACT19B-T identification tape: Hytype II, Columbia 7900, or Brady R2051.

4.1.6 Printer ribbon:

- Critchely 1330-0036-00 (for Epson printer) for marking the identification code on BACT19B-T identification tape.
- Nukote BM 325 (for Raven or Panasonic printer) for marking the identification code on DSC 347 heat shrinkable sleeves, wrap around cable markers and tie-wrap type cable markers.
- Brady Series R4300 or R6200 black ribbon (for Brady THT Model 300X thermal transfer printer) for marking the identification code on Brady B-437 identification tape.
- Raychem TMS-101-RIBBON-4HT, for TMS-101TT thermal transfer printer for marking the identification code on HT-SCE sleeves.

4.1.7 Rework markers: tie on cable marker tags (DSC 347-CM-SCE-1/2-6H-9) and wrap around sleeves with heat activated adhesive (DSC 347-RMK6-WM).

4.2 Equipment

4.2.1 UV laser wire marking machine (e.g., Spectrum or Laselec).

4.2.2 Dot matrix printers:

- Epson FX 1050 for marking BACT19B-T identification tape.
- Raven RP-9105 or Panasonic 2180 () 9 pin dot matrix printers for marking DSC 347 heat shrinkable sleeves, wrap around cable markers and tie-wrap type cable markers.

4.2.3 Thermal transfer printers:

- Raychem TMS-101TT for marking identification codes on HT-SCE sleeves.
- Brady THT Model 300X, for marking identification codes on Brady B-437 identification tape.

5 Procedure

5.1 General

5.1.1 Identification coding of aircraft electrical and electronic wires and cables consists of applying a specific wire code onto the wire insulation (either directly or by means of tape, sleeves or markers) to facilitate identification of the wire during assembly and installation.

5.2 Applicability of Marking

5.2.1 Unless otherwise specified by the engineering drawing or wiring list, and except as noted below, mark all electrical and electronic wires and cables with the identification code.

- Bonding jumper wires and wires less than 6" in length do not require identification coding.
- If specified on the engineering drawing, identify wires installed on spare pins of connectors, such as potted connectors, by the pin designation and the wire size.

5.3 Identification Codes for Pre-Twisted Wire and Multi-Conductor Assemblies

5.3.1 Except as noted below, include the individual conductor identification code of the group in the identification code for multi-conductor cables and pre-twisted wire assemblies. It is acceptable to place the identification code on each conductor or on one sleeve as shown in Figure 1.

- If the colour code is specified on the wiring list, the multi-conductor or pre-twisted wire assembly may be identified by the lowest conductor identification code in the group as shown in Figure 2.
- On DASH 8 series 100, 200, and 300 and previous aircraft, if the system identification code is followed by a “W” (for multi-conductor cables) or a “TW” (for twisted wire assemblies), the multi-conductor cable or pre-twisted wire assembly may be identified by the system identification code, followed by the letter “W” or “TW”, followed by the applicable suffix (see Figure 3).
- On DASH 8 series 400 aircraft, if the system identification code is followed by a “W” (for multi-conductor cables) or a “T” (for twisted wire assemblies), the multi-conductor cable or pre-twisted wire assembly may be identified by the system identification code, followed by the letter “W” or “T”, followed by the segment number, the wire gauge, and the susceptibility code (see Figure 4). The system identifier may include a “1”, “1-”, “2”, or “2-” to identify system 1 or system 2 of a dual system.

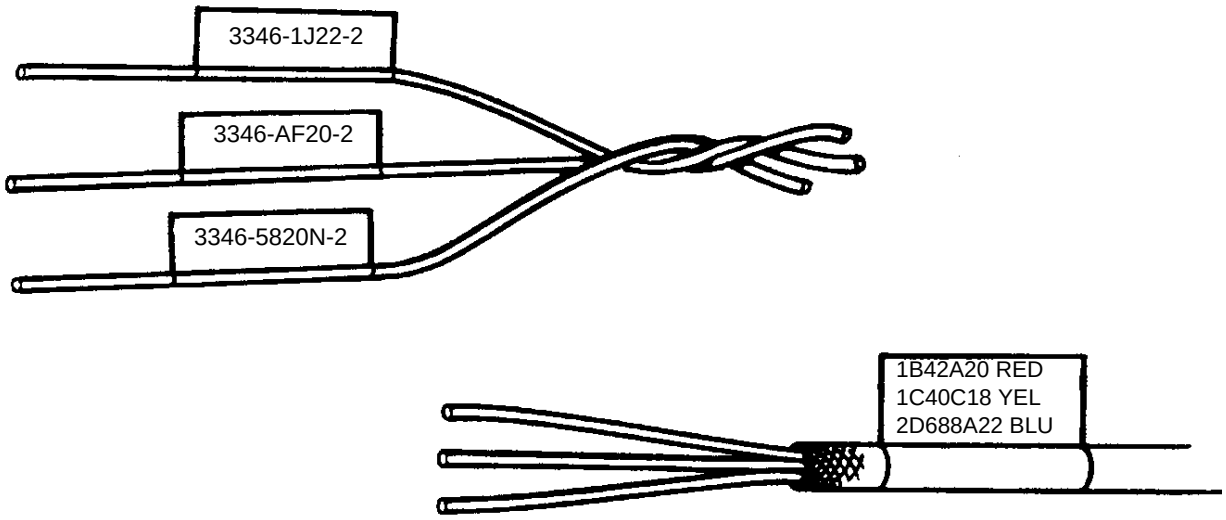
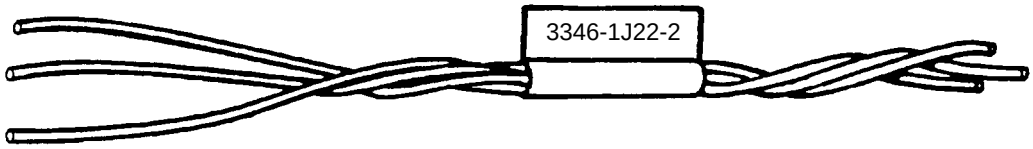
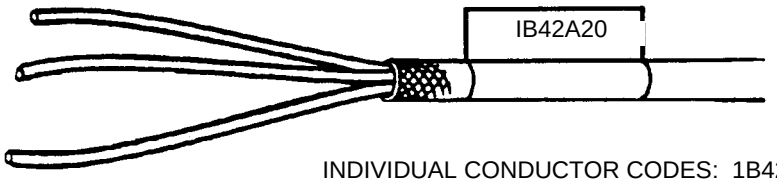


Figure 1 - Identification of Pre-Twisted Wire and Multi-Conductor Assemblies with Individual Conductor Codes



INDIVIDUAL CONDUCTOR CODES: 3346-1J22-2
3346-5820N-2
3346-AF20-2



INDIVIDUAL CONDUCTOR CODES: 1B42A20 RED
1C40C18 YEL
2D688A22 BLU

Figure 2 - Identification of Pre-twisted Wire and Multi-Conductor Assemblies with the Lowest Individual Conductor Code

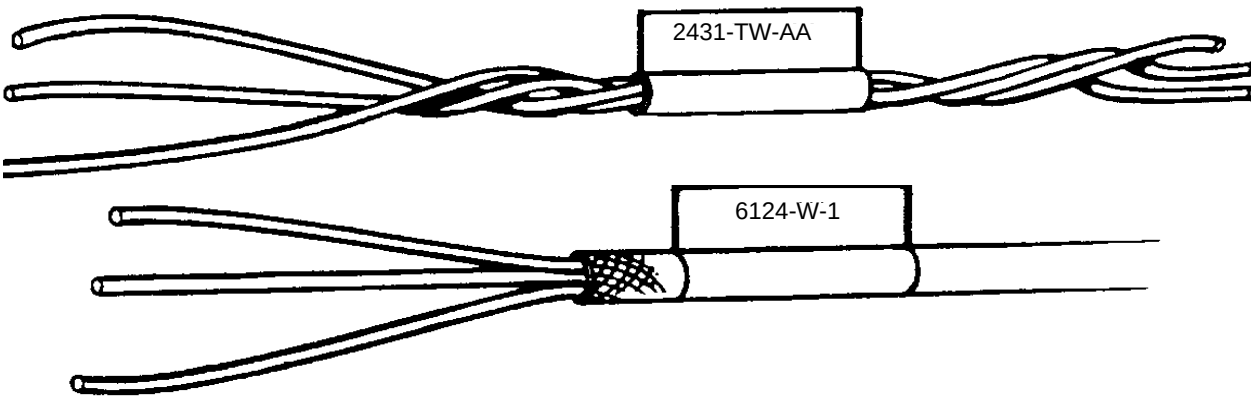
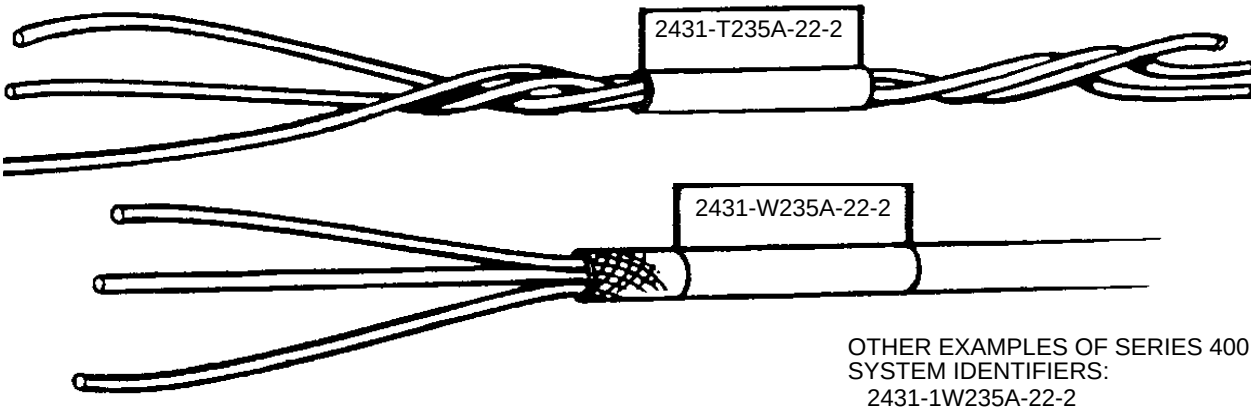


Figure 3 - Identification of Pre-twisted Wire and Multi-Conductor Assemblies with the System Identification Code - DASH 8, Series 100, 200, and 300 Aircraft



OTHER EXAMPLES OF SERIES 400 SYSTEM IDENTIFIERS:
2431-1W235A-22-2
2431-1-W235A-22-2
2431-2W235A-22-2
2431-2-W235A-22-2

Figure 4 - Identification of Pre-Twisted Wire and Multi-Conductor Assemblies with the System Identification Code - DASH 8, Series 400 Aircraft

5.4 Coding Method

5.4.1 For laser codable wires and cables, imprint the identification code directly onto the wire or cable according to section 5.7. For wires and cables which are not laser codable, indirectly mark cables and wires according to section 5.6.

5.4.2 If engineering changes or revisions require re-working of a harness, it is acceptable to use DSC 347 tie on cable marker tags or wrap around markers (ref. para. 4.1.3) with heat activated adhesive for re-identification of the affected wires or harness. Mark the identification code on the tags or wrap around sleeves using a permanent felt tip marker according to PPS 15.04.

5.5 Positioning of Identification Codes

5.5.1 Except when required to ensure the identification of the wire at a break out, place direct code imprints at no more than 4" intervals for a minimum of 4 feet at the beginning and end of the wire; for wires which break out, place direct code imprints at no more than 3" intervals for a minimum of 4 feet at the beginning and end of the wire. In addition to the direct code imprints at the beginning and end of the wire, also place direct imprints at no more than 18" intervals along the length of the wire. Bonding jumper wires and wires less than 6" in length do not require identification coding.

5.5.2 Except as noted below, locate indirect code markings within 3" of each terminating end or junction and also at no more than 6 foot intervals along the length of the wire.

- Provide sufficient length between the termination and the indirect code marking for at least 2 service replacements of terminations.
- Indirect code markings may be staggered as required to avoid a build up in the diameter of wire bundles.
- If a single sleeve, tape or marker is used to identify multi-conductor cables or twisted wire assemblies, locate the code marking as close to the termination as practicable while allowing for the separation of the individual conductors.
- For wires 6" - 12" in length, it is acceptable to apply a single indirect code marking within 3" of either terminating end.
- Bonding jumper wires and wires less than 6" in length do not require identification coding.

5.5.2.1 For wires, pre-twisted wires and multi-conductor assemblies to be covered with an overbraid shield or non-conductive conduit (e.g., S8021), position the indirect code marking tape or sleeves on the wires, pre-twisted wires and multi-conductor assemblies (i.e., such that the identification tape or sleeves will be located **within** the overbraid shield or non-conductive conduit). Part marks, as specified in PPS 15.01, for the overall assembly which includes an overbraid shield or non-conductive conduit shall be placed on the outside of the overbraid shield or non-conductive conduit.

5.6 Indirect Identification Code Marking

5.6.1 General

5.6.1.1 Unless otherwise specified on the engineering drawing or wiring list, use identification tape (ref. para. 4.1.2) for indirect identification code marking. Apply the identification code marking to tape and install the tape to wires, cable or bundles according to section 5.6.2.

5.6.1.2 If the engineering drawing or wiring list specifies identification coding using DSC 347 sleeves or cable markers, apply identification code marks to the DSC 347 sleeves or cable markers and install the DSC 347 sleeves or cable markers according to section 5.6.3.

5.6.1.3 For the purposes of identification coding of electrical and electronic wires and cables, use of Kynar (M23053/8) heat shrink tubing has been replaced by Raychem HT-SCE sleeves. If the engineering drawing or wiring list specifies identification coding using M23053/8 or Raychem HT-SCE heat shrinkable sleeves, apply identification code marks to Raychem HT-SCE heat shrinkable sleeves and install the heat shrinkable sleeves according to section 5.6.4.

5.6.2 Tape Marking

5.6.2.1 Unless otherwise specified on the engineering drawing or wiring list, accomplish indirect code marking using identification tape (ref. para. 4.1.2).

5.6.2.2 Mark identification tape with the identification code repeated several times along the length of the strip. After application, allow the ink on the identification tape to air dry momentarily.

- For BACT19B-T identification tape, apply the identification code using a suitable typewriter (e.g., computer driven) equipped with a Hytype II, Columbia 7900 or Brady R2051 ribbon or an Epson FX 1050 printer equipped with a Critchely 1330-0036-00 ribbon,
  If needed, it is also acceptable to mark BACT19B-T tape using a permanent felt tip marker according to PPS 15.04; however use of a typewriter or printer is preferred. If marking the identification code on BACT19B-T tape using a permanent felt tip marker, it is not necessary to repeat the code several times.
- For Brady B-437 identification tape, apply the identification code using a Brady THT Model 300X thermal printer equipped with a Brady Series R4300 or R6200 black ribbon. It is not acceptable to use a permanent felt tip marker to mark B-437 identification tape.

5.6.2.2.1 Discard typewriter or printer ribbons that have exceeded their expiry dates.

5.6.2.3 Apply the tape by attaching the center of the tape strip to the wire, cable or bundle and pressing the two ends of the tape firmly together to form a flag approximately 1/2" high (see Figure 5). If the outside diameter of the wire, cable or bundle is greater than 3/16", apply the tape by attaching the bottom end of the strip to the wire, cable or bundle and wrapping the strip around, ensuring that the ends overlap at least one-half revolution (see Figure 6).

5.6.2.4 Locate the tape markings such that ties, clamps, supporting devices, shielding and terminals do not have to be removed to read the identification code after installation.

5.6.2.5 If possible, orient tape markings so that the wire or wire bundle does not have to be twisted to read the identification code after installation.

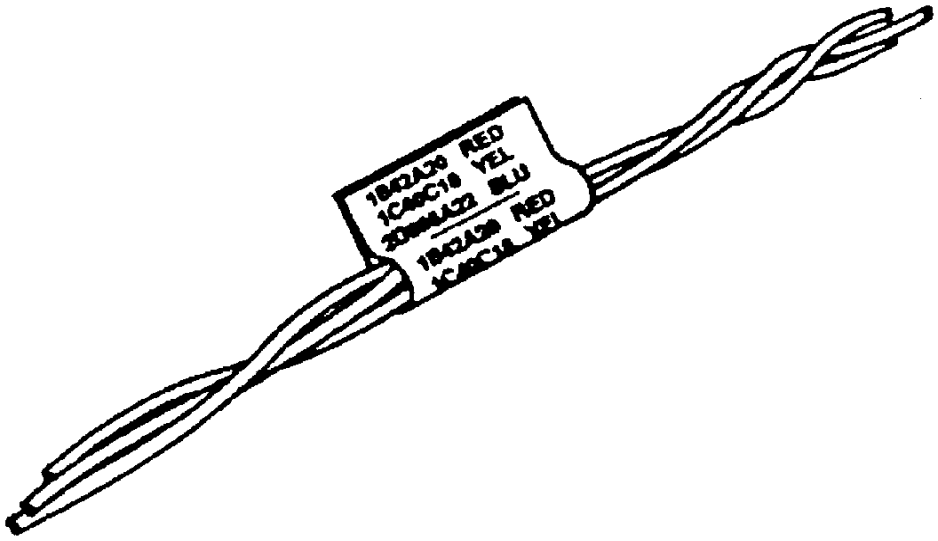


Figure 5 - Flag Method for Tape Markers

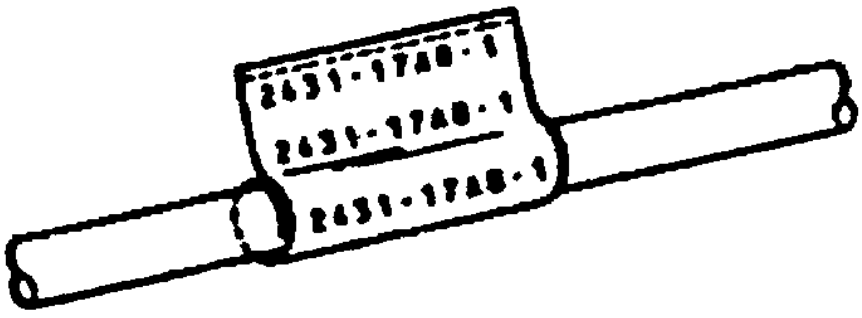


Figure 6 - Wrap Around Method for Tape Markers

5.6.3 Identification Coding using DSC 347 Sleeves or Cable Markers

5.6.3.1 Imprint the identification code on DSC 347 heat shrinkable sleeves, wrap around cable markers and tie-wrap type cable markers using a Raven RP-9105 or Panasonic 2180 () 9 pin dot matrix printer equipped with a Nukote BM 325 ribbon.

5.6.3.2 Shrink identification coded sleeves in place according to PPS 10.16 before assembly of wires, cables or bundles to connectors, terminal lugs, etc. Ensure that the shrunk sleeves fit closely without being tight or binding.

5.6.3.3 Shrink identification coded wrap-around cable markers onto the wire, cable or bundle according to PPS 10.16.

5.6.3.4 Secure identification coded tie-wrap cable markers by tying both ends with self-locking plastic cable ties according to PPS 9.04. Use tie-wrap cable markers only to identify multi-conductor cables and wire bundles 1 1/2" in diameter and greater.

5.6.4 Raychem HT-SCE Sleeves

5.6.4.1 Mark the identification code on Raychem HT-SCE sleeves using a suitable thermal transfer printer (ref. para. 4.2.3). In place of use of a thermal transfer printer it is acceptable (but not recommended) to apply the identification code to HT-SCE sleeves using a 9 pin dot matrix printer; however, after such application the identification code must be allowed to “dry” for a minimum of 24 hours undisturbed.

5.6.4.2 Install HT-SCE sleeves before assembly of wires to connectors, terminal lugs, etc. according to PPS 10.16. Ensure that installed sleeves fit closely without being tight or binding.

5.7 Direct Identification Code Marking

5.7.1 For laser codable wires and cables, use a laser wire marking machine (ref. para. 4.2.1) to imprint codes directly onto single wire and cables according to the manufacture’s operating instructions. If it is not practical to wire mark cables or wires using the direct identification code marking method, mark cables and wires indirectly according to section 5.6.

6 Requirements

6.1 The identification code applied to multi-conductor cables or twisted wire assemblies shall be as specified in section 5.3.

6.2 Wires and cables shall have identification coding spaced as specified herein.

6.3 The imprinted characters shall be either horizontal or vertical and be of sufficient size to be legible and of a permanent nature. The imprinted characters shall suitably contrast the marker and the wire or cable.

6.4 The method of marking shall not impair the characteristics of the wire or cable.

6.5 Markings, tape or sleeves shall be located so that they are not obscured by clamps, etc., and are readable when the terminals are connected to posts or other fittings.

6.6 Except when using flag method for tape labels, identification sleeves or tape labels shall not have been cut. If the flag method is used, the flag height shall have been trimmed to approximately 1/2".

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 responsible for identification coding of electrical and electronic wires and cables must have a good working knowledge of the procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.

9 Maintenance of Equipment

9.1 Maintain and operate the marking machines according to the manufacturer's manuals.

10 Additional Information

10.1 Refer to Figure 7 for a breakdown of DASH 8 aircraft identification codes.

10.2 In addition to the identification code, shop aid information may be imprinted on the wire or cable as shown in Figure 8 for 4 feet at the beginning and end of the wire. The shop aid code will be separated from the identification code by means of a dot or square as shown.

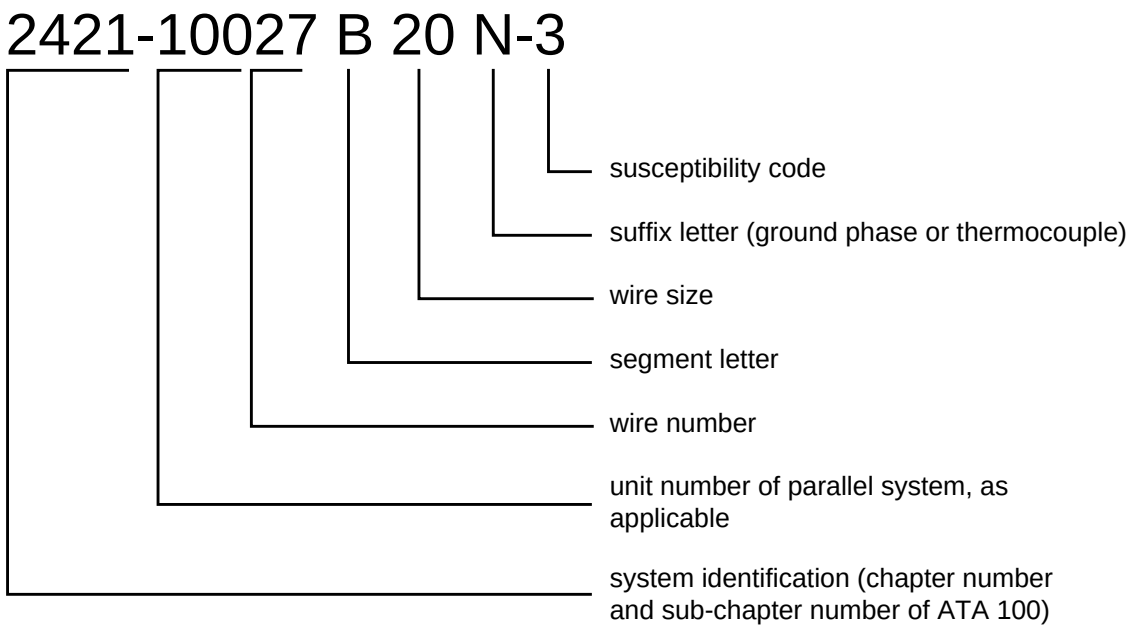


Figure 7 - DASH 8 Identification Code Breakdown

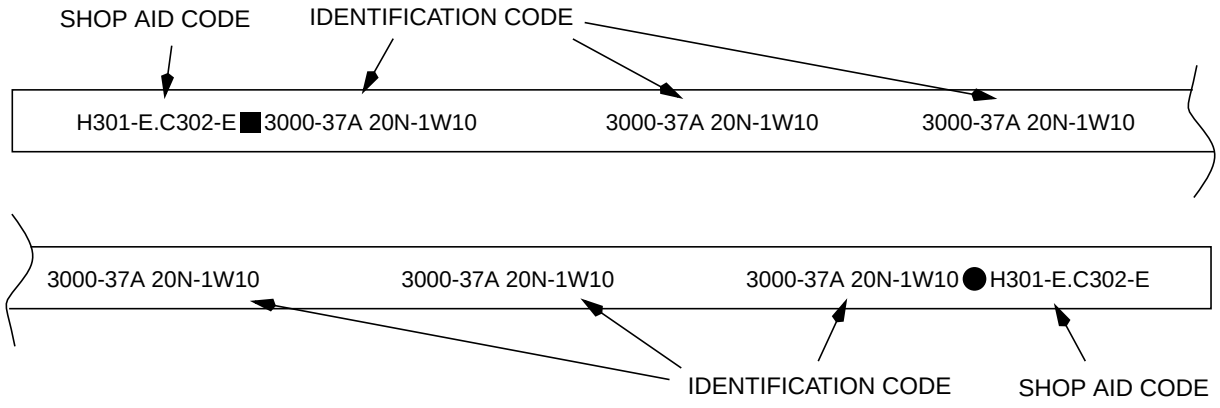


Figure 8 - Wire Sample - Addition of Shop Aid Identification Code