

Cable Harness Assembly

Introduction

When a product contains electrical wiring, the wires or cables and connectors are usually laid out on a board on which a drawing of the wire runs has been mounted and a series of pins have been arranged to maintain the position of the wires. The ends of the wires are either inserted into connectors or terminals or temporarily gripped in coiled spring devices mounted on the board. The connectors or terminals are inserted into fixtures on the board before the wires are laid. After all wires are laid, the body and legs of the harness are tied or taped.

The completed harness assembly will later be installed in the product by arranging and clamping the harness body and legs within the product framework and making the various connections.

The assembly of the harness can be analyzed using the operations contained in DFA's Operation Library, as you can see in the following exercise.

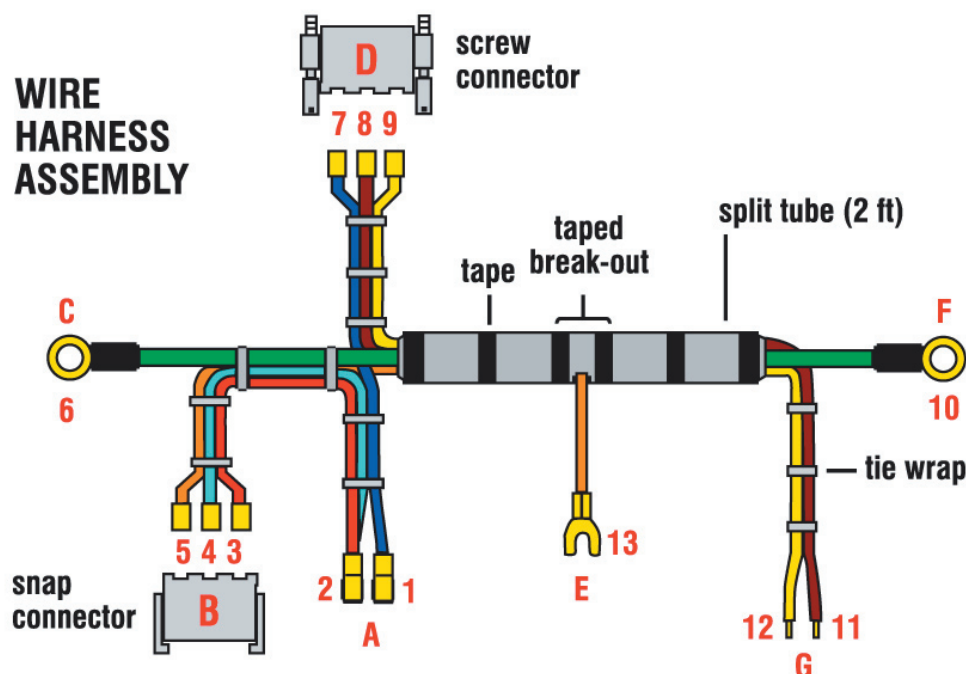
A step-by-step wire harness assembly

The following exercise completes a DFA analysis of the wire harness assembly shown in the diagram and wire run specification table. The diagram is also included with the *harness.dfx* file in the Picture box for the main assembly.

You can see in the table on the next page that each wire is identified w1, w2, etc., its length given, and its termination points A, B, C, etc., numbered and their type given.

We will now complete a partial DFA analysis of the example wire harness.

1. Open the partially completed wire harness analysis, **harness.dfx** (installed with DFA in the *\data\samples* subfolder.)
2. Observe that wires w1 through w5 have already been entered on the Structure Chart and their DFA questions answered. We now add the last two wires on the table, w6 and w7, to the Structure Chart. Because these wires have the same characteristics, we use one entry with a repeat count of 2 to describe them.
3. Click on the last entry in the Structure Chart, add a part and name it **wire w6 and w7**.



DFA Product Simplification

Wire run list			
Wire	Length, ft	From	To
w1 flexible	5	A1 lug	D7 lug & insert
w2 flexible	2	A2 lug	B3 lug & insert
w3 flexible	2	A2 lug	B4 lug & insert
w4 flexible	4	B5 lug and insert	E13 fork lug
w5 stiff	5	C6 ring lug & slve	F10 ring lug & sleeve
w6 flexible	8	D8 lug and insert	G11 tin
w7 flexible	8	D9 lug and insert	G12 tin

4. Enter **2** for the repeat count.
5. For envelope shape, choose the cylinder and enter a diameter of **0.1** and a length of **96 in**.
6. Choose *Connect other items* for the Item function.
7. For Handling difficulties, choose *Item is flexible*.
8. Accept the default Securing process, *Added not secured*.

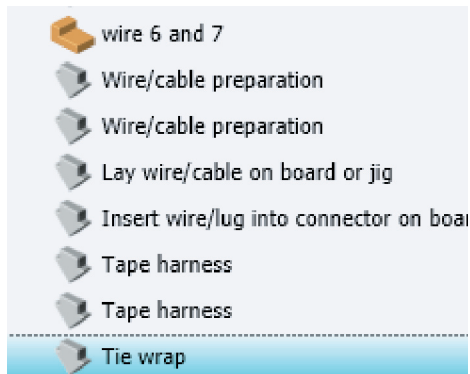
You have now answered the questions relating to the acquisition of the wires and placing them on the board ready to lay them in. Now we include the preparation of the wires in our analysis.

11. Choose *Operation* from the *Insert* menu. In the Operations dialog, expand the category *Wire harness*.
12. Choose *Wire/cable preparation* and click **Insert**. Accept the default *Single wire*, change the repeat count to **2** and accept the default *Tool fetching time*. Change the Preparation to *Strip & crimp lug*.
13. Add another Wire/cable preparation operation to the Structure Chart after the first. Accept the default *Single wire*, change the repeat count to **2** and accept the default *Tool fetching time*. Change the Preparation to *Strip & tin*.
14. Now add the operation *Lay wire/cable on board or jig* to the Structure Chart. Accept the default of a *Single flexible wire*. Change the repeat count to **2** and edit the *Length of the laid path* to **96 in**.
15. Choose *Insert wire/lug into connector on board* and click **Insert**. Accept the default of *One row*. Change the repeat count to **4**.

We have now described the preparation of the wires, their acquisition and laying in on the board, at the same time inserting or securing the ends. We will complete the cable harness assembly by adding and taping the split tube and adding the ties.

16. Choose and add *Tape harness*. Accept the default of *Tape harness one turn* and change the repeat count to **4**.
17. Choose and insert another *Tape harness*. Choose *Tape harness breakout*.
18. Choose and insert *Tie wrap*. Change the repeat count to **12**.

You have now completed the wire harness DFA analysis. Your additions to the Structure Chart should now look like the following:



This procedure for preparing wires and placing them on a lay-in board, as illustrated in this exercise, is used for normal complexity cable harnesses typically occurring in the automobile and consumer electronics and appliance industries. If your product requires only a few wires, they will typically be installed one at a time into the product. If the cable harness used in your product is extremely complex, such as those used in the aerospace and defense industries, the wires are typically prepared after placement on the lay-in board. The DFA Operation Library can be used to analyze all these types of cable harness assembly, but your analysis should be modified accordingly.