

9. FORMING WIRES INTO CABLES AND HARNESSSES

9.1 General

Wiring shall be assembled in interconnecting cables or harnesses as described herein (Requirement). Fabrication methods and assembly techniques that assure the production of high quality interconnecting cables and harnesses shall be used (Requirement).

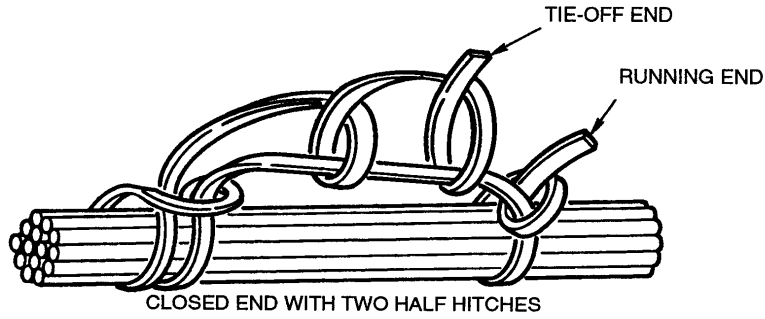
9.2 Lacing for Trunk, Branches, and Breakouts

When engineering documents specify the use and type of lacing, the following requirements shall apply. Lacing tie-ends shall be trimmed (Requirement). When knots are staked (see Figure 9-7), the necessary compounds, as well as any special design requirements, shall be specified (Requirement).

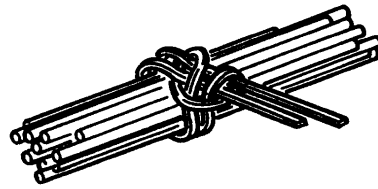
9.2.1 Starting Stitch. Harnesses laced with single tape shall initially be tied with a starting stitch (Requirement). Single-tape starting stitches shall be the same as a spot tie with a running end (see item 2 of this paragraph), or as shown in Figure 9-1 View A (Requirement). Starting stitches for double lacing shall be as shown in Figure 9-1 View B (Requirement). Starting stitches shall not place stress on wire terminations (Requirement).

9.2.2 Spot Ties. Spot ties shall consist of a clove hitch followed by a square knot as shown in Figure 9-2 or other non-slip knots (Requirement). See Table 9-1 for spot tie spacing.

9.2.3 Closing Stitch. Single or double lacing tape shall be terminated with a closing stitch as shown in Figure 9-3 (Requirement). Lacing shall be terminated at every major breakout or branch and at the extremity of the harness (Requirement). (Major breakouts normally contain a large percentage of the wire volume, such as 25 to 30 percent or more.) The stitching shall terminate close to the extremity of the harness but shall not stress the wire terminations (Requirement). Closing and starting stitches at branches and breakouts shall be next to the breakout (Requirement). An alternate closing stitch method is shown in Figure 9-4. Single or small multiple breakouts of two or three wires need not have closing and starting stitches, but may have running lockstitches on each side (Figure 9-5).

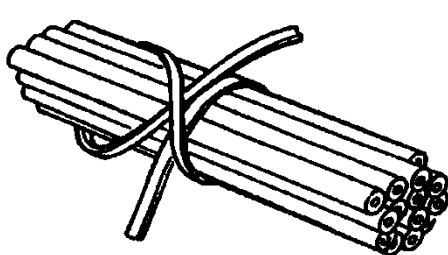


A. STARTING STITCH, SINGLE TAPE

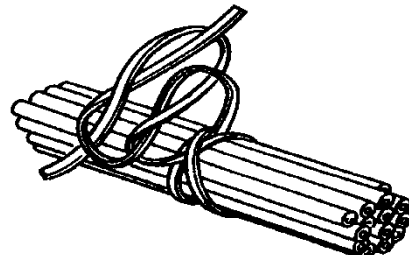


B. STARTING STITCH, DOUBLE TAPE

Figure 9-1. Starting Stitch



A. CLOVE HITCH



B. CLOVE HITCH AND SQUARE KNOT

Figure 9-2. Spot Tie (Typical)

Table 9-1. Spot Tie, Plastic Strap, and Stitch Spacing Dimensions

Harness Diameter mm (Inches)	Maximum Distance Between Harness Ties mm (Inches)
6.4 (0.25) or less	19.1 (0.75)
12.7 (0.50)	38.1 (1.50)
25.4 (1.00)	50.8 (2.00)
Larger than 25.4 (1.00)	76.2 (3.00)

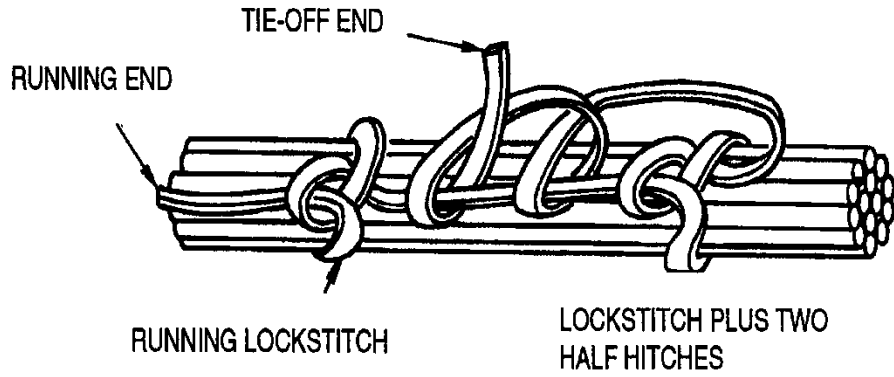


Figure 9-3. Closing Stitch and Single Tape--Illustration

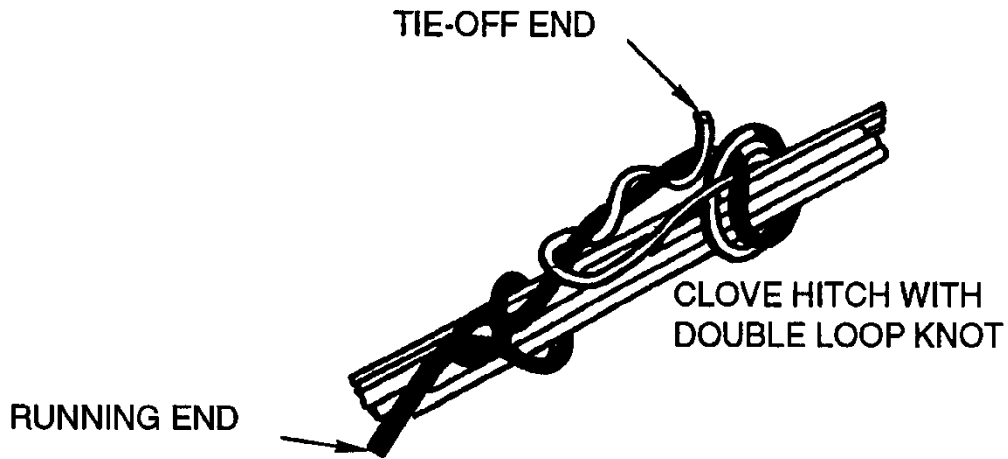


Figure 9-4. Alternate Closing Stitch and Single Tape—Illustration

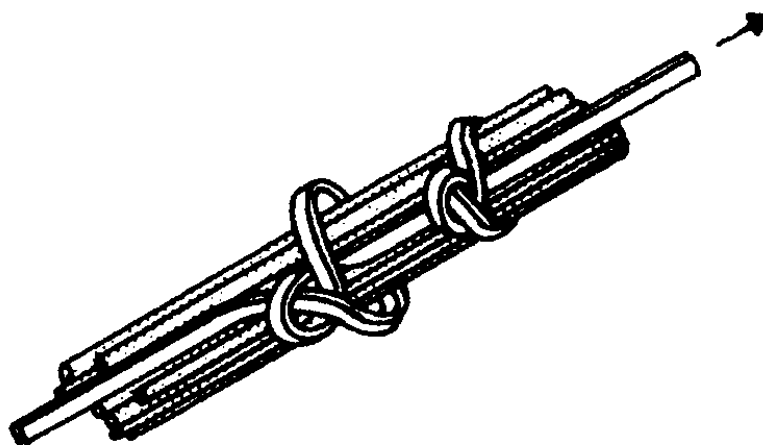


Figure 9-5. Running Lockstitch

9.2.4 Running Lockstitch. Continuous lacing shall be achieved using running lockstitches as shown in Figure 9-5 (Requirement).

9.2.5 Stitch Spacing. Lacing stitches and spot ties shall be placed as detailed in Table 9-1 (Requirement). A tie or stitch shall be placed immediately before and immediately after any breakout of the wire or cable from the harness (Requirement). Dimensions from the connector or connector accessories to start of harness tie are given in Table 9-2.

Table 9-2. Distances From Connectors or Connector Accessories to Beginning of Harness Ties

Harness-Bundle Diameter mm (inches)	Distance From Connector or Connector Accessory to Start of First Tie mm (inches)
Less than 12.7 (.5)	25.4 - 50.8 (1 - 2)
12.7 to 25.4 (.5) (.5 to 1)	50.8 - 76.2 (2 - 3)
25.4 (1) or larger	76.2 - 101.6 (3 - 4)

9.2.6 Flat Stitching. Flat stitching shall utilize either of the stitches pictured in Figure 9-6 (Requirement).

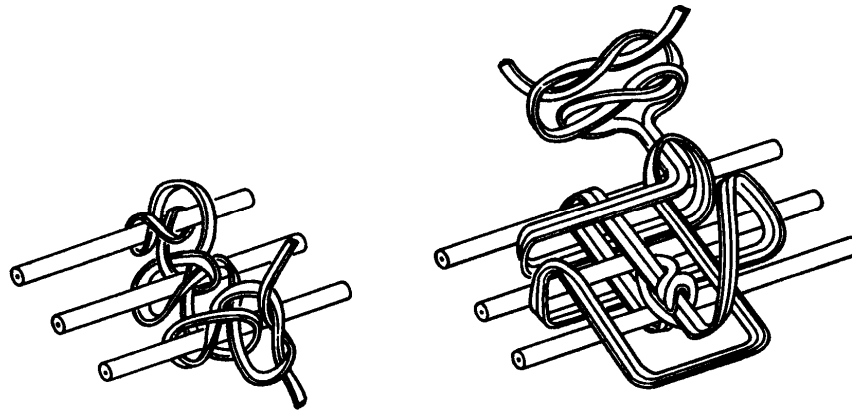


Figure 9-6. Flat Lacing Stitches

9.2.7 Large Breakouts. Lockstitching shall terminate with a closing stitch before each large breakout or branch of the harness (Requirement). The lacing shall start anew with a starting stitch on the opposite side of the breakout on each branch (Requirement).