



Wire Locking of Electrical Connectors and Switches

80-T-40-3202

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All directives are originally compiled, checked and approved in the German language.
In case of discrepancies which could result from possible translation errors or wrong interpretation of the English text, the German version of these directives shall always be binding.

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1 SCOPE AND APPLICATION

This process specification describes the installation of lock wires on electrical connectors and switches. Wire locking serves to prevent inadvertent loosening of connectors and switches due to their own movement, to vibrations, voltages, shocks, torsional strains etc.

2 RELATED DOCUMENTS

74-T-FF01-00	Inspection Marks
74-T-FF13-00	Binding Nature of Inspection Marks
74-T-FF16-00	Closing of Zones with Lead Seals or Paper Seals
80-T-34-3011	Wire Locking
80-T-34-3050	Tightening of Screws and Nuts
80-T-40-3050	Torques for the Final Installation of Electrical Components
LN 9424	Lock wire, drawn, corrosion-resistant

3 PREREQUISITES

3.1 Manufacturing documents

The manufacturing documents must contain a reference to this process specification. The lock wire (wire diameter and standard, e.g. LN 9424) must be specified. Only the specified lock wire shall be used. The usual safetying method is the double-twist method. If wire locking is to be performed according to the single-wire method, this must be indicated in the manufacturing documents.

Note: For the definition of the terms "single-wire" and "double-twist method", refer to 80-T-34-3011!

3.2 Personnel

Personnel carrying out the work shall be adequately instructed and familiar not only with the materials and tools but also with the contents of this process specification.

4 MATERIALS AND EQUIPMENT

4.1 Materials

The parts to be secured (electrical connectors or switches, nuts, screw heads etc.) must be provided with locating holes or slits for the lock wire. If required in the manufacturing documents, the components must be torque-tightened per 80-T-40-3050 or 80-T-34-3050 before the lock wire is installed.

4.2 Equipment

Only tools and lockwire pliers in perfect condition shall be used.

5 PROCESS

Caution: **Lock wire may only be used once!**

Use the wire corresponding to the hole diameter.

When introducing the wire into the hole, make sure that the wire does not peel.

The lock wire must not excessively be bent over sharp edges, stops etc.

To avoid excessive twisting and thus overtensioning of the lock wire during twisting, the admissible number of turns per 80-T-34-3011, depending on wire diameter, shall be observed.

All parts must be secured in such a manner that a slight tension is applied to the wire in the direction contrary to the direction of rotation of the parts when loosening.

In the case of screws and bolt heads, make sure that the wire loop is passed round the bolts downwards and cannot slide above the head, which could cause loosening of the connection.

The protruding ends of the wire must be twisted over a length of approx. 15 to 20 mm. Here again, excessive twisting and thus overtensioning of the wire must be avoided (see admissible number of turns per 80-T-34-3011). Then shorten the protruding ends of the wire to a length of approx. 10 mm and fold them backwards or downwards to avoid damage and injuries.

Caution: **No cut-off wire ends must be left in the aircraft!**

5.1 Locking methods for electrical connectors and switches

There are different methods of securing electrical connectors against inadvertent loosening. The method to be preferred in each case is determined by the design and the connector type.

Caution: **In all the cases illustrated in this specification, wire locking is shown for right-handed threads. For left-handed threads, wire locking must be performed in the opposite direction.**

A few examples of wire locking on electrical connectors and switches are illustrated hereafter.

5.1.1 Typical wire locking

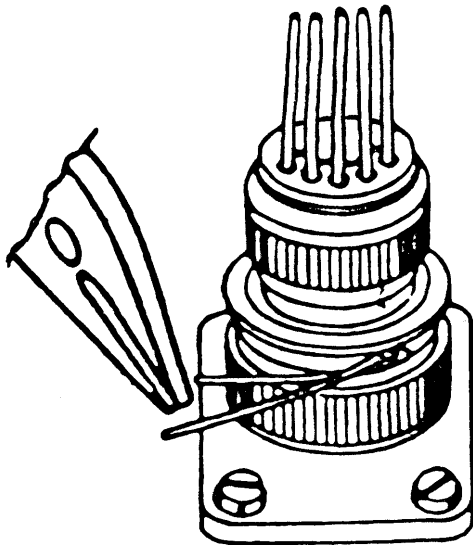


Figure 1:
Seize the wire ends with the lockwire pliers and twist them

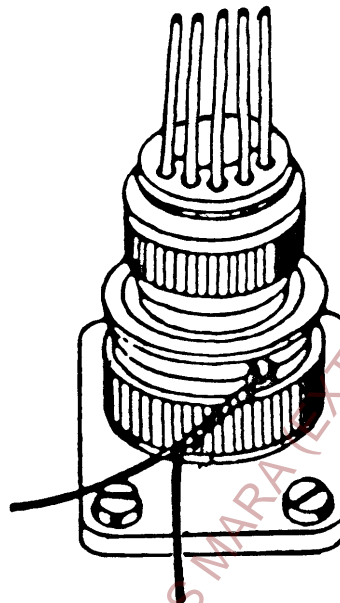


Figure 2:
Twist the wire ends over a sufficient length

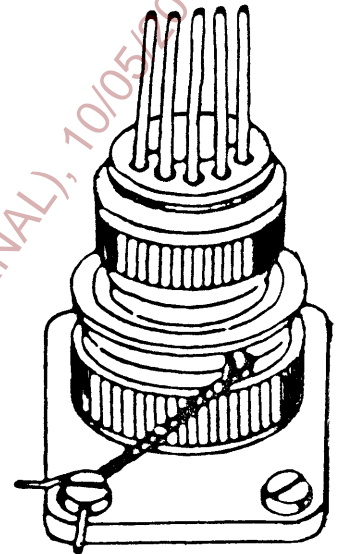


Figure 3:
Pass one wire end through the hole provided for this purpose

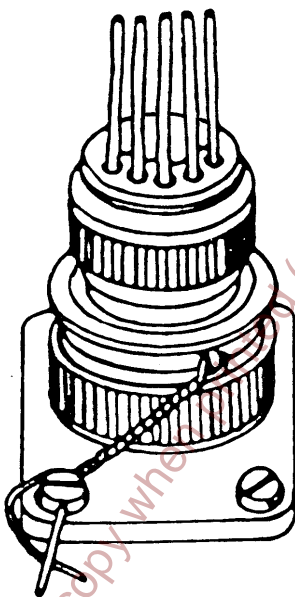


Figure 4:
Pass the other wire end round the socket head screw and fold it back

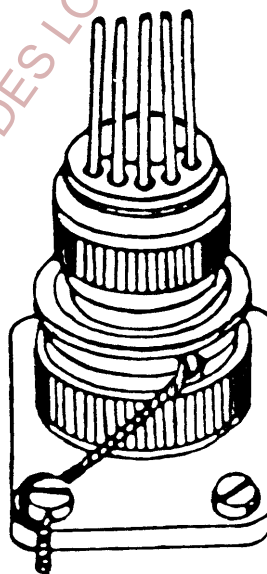


Figure 5:
Twist the wire ends another 15 to 20 mm

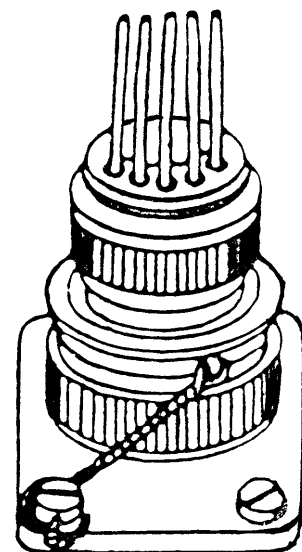


Figure 6:
Cut the protruding wire ends to approx. 10 mm and bend them downwards or upwards

5.1.2 Wire locking on screwed locking plates

On plates with sufficient material, the angles can be folded downwards by 45° to provide a retaining tongue for the lock wire (see Fig. 7).

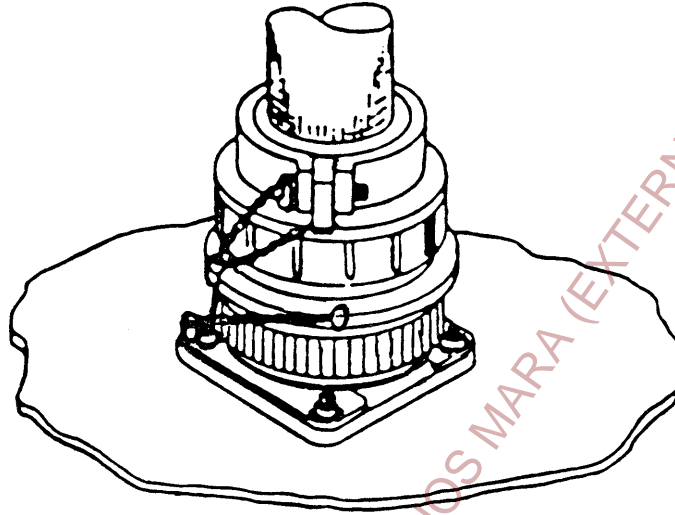


Figure 7

The hole for the lock wire in the screwed locking plate must be half-way between two nuts. Before the angles of the locking plate are folded back, the lockwire must be passed through the hole in the locking plate (see Fig. 8).

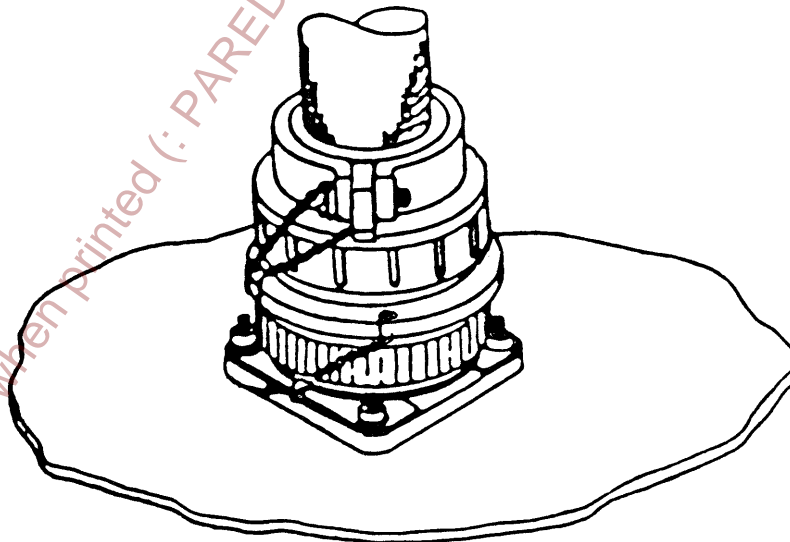


Figure 8

5.1.3 Wire locking on firmly installed electrical connectors/Attachment on structure

Before wire locking the nuts (Fig. 9), these must be tightened with the specified torque. Refer to 80-T-3050 or to the manufacturing documents for indications on the tightening torques.

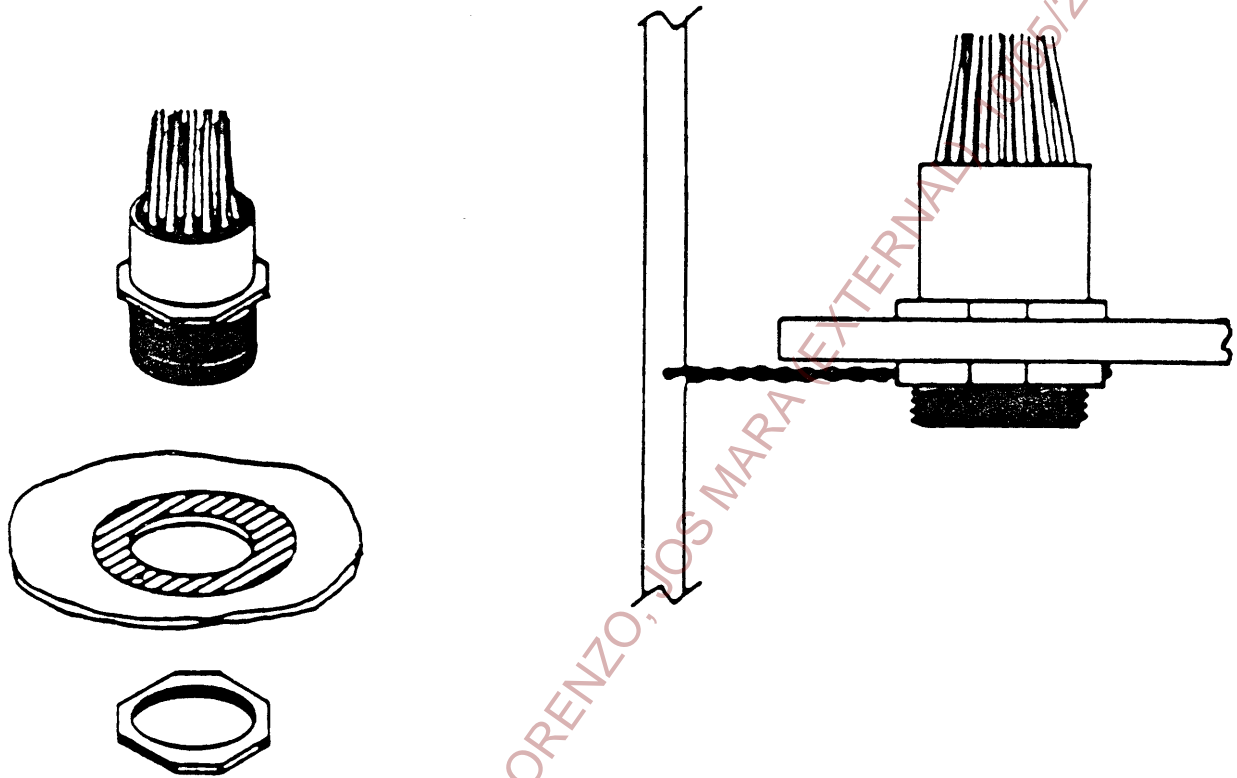


Figure 9

The length of the lock wire up to the component (structure) shall be max. 150 mm!

If it is not possible to proceed as detailed above, consult the responsible Design Office or Quality Assurance department.

5.1.4 Different electrical connectors

Example I:

Attachment on adjacent structure (Fig. 10). Length of lock wire max. 150 mm! If it is not possible, consult the responsible Design Office or Quality Assurance department.

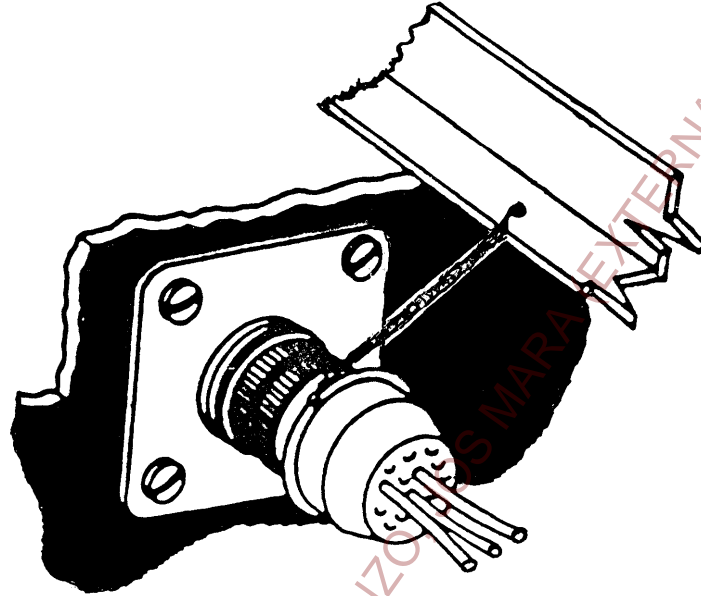


Figure 10

Example II:

Wire locking on MS electrical connectors (Fig. 11)

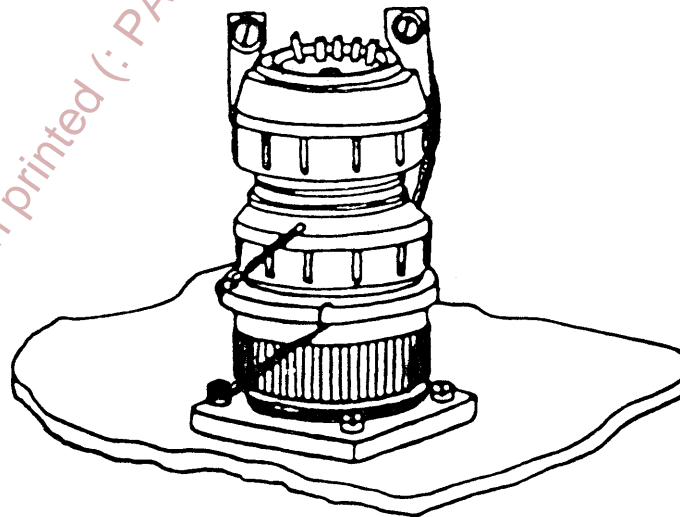


Figure 11

Example III:

Wire locking on a 90° electrical connector (Fig. 12)

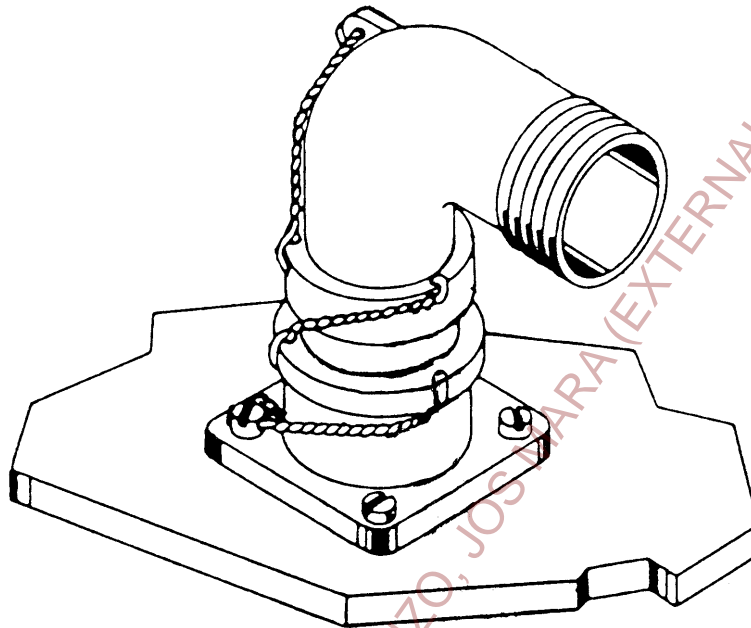


Figure 12

5.1.5 Wire locking of a connector during pre-assembly

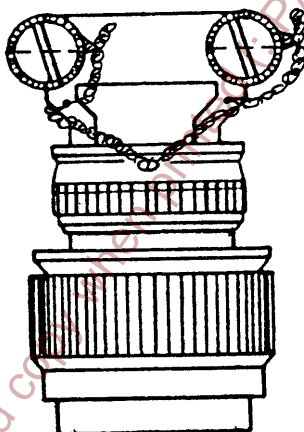
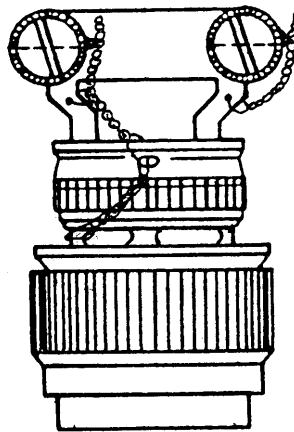


Figure 13: without fixed point



with fixed point

5.2 Wire locking on strain reliefs of electrical connectors

Example:

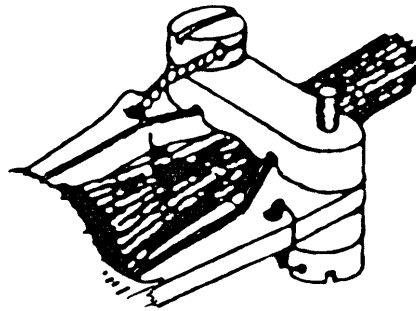


Figure 14

Make sure that the lock wire does not come into contact with the cables!

5.3 Locking of emergency devices

Example:

Emergency devices (emergency switches) are locked as shown in Figure 15. A breaking wire made of annealed copper is used (see manufacturing documents). It must be ensured that the wire breaks easily in case of emergency.

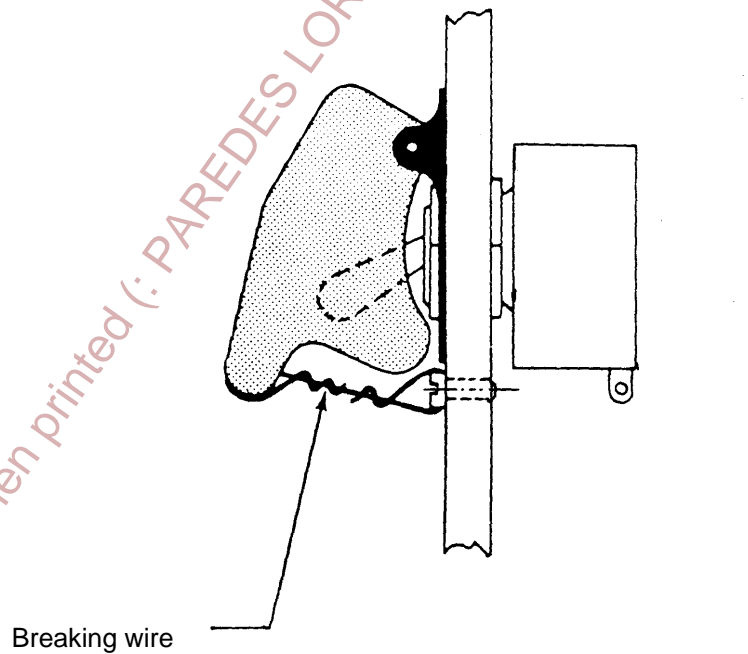


Figure 15

5.4 Lead sealing on screwed connectors

Example: When specified in the manufacturing documents, lead sealing must be performed as illustrated in Figure 16. A breaking wire made of annealed copper is used (see manufacturing documents). Lead sealing is performed taking into account specifications 74-T-FF01-00, 74-T-FF13-00 and 74-T-FF16-00. It must be ensured that the breaking wire does break if an emergency situation occurs.

Note: Lead sealing is not intended as wire locking!

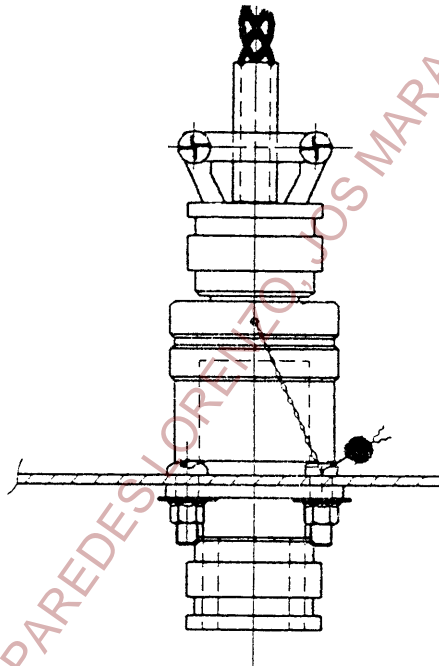


Figure 16: Lead sealing on screwed connectors

6 QUALITY ASSURANCE

Unless otherwise specified in process- or component-specific design, manufacturing or QA documents, the competent organization unit shall ensure that the following measures are taken.

- Check that the lock wire used (standard and diameter) is in compliance with the data in the manufacturing documents.
- Check that the maximum distance between the components to be locked is not exceeded.
- When loosening the fasteners, check that the wire is pulled in the opposite direction to the direction of rotation. Observe right-hand and left-hand threads! (This does not apply to lead sealing per 5.4!)
- Check that the wire is sufficiently taut, twisted and not over tensioned. Observe the admissible number of turns per 80-T-34-3011!
- Check that the wire shows no kinks, peeling or other damage.
- Check that the wire ends are correctly twisted (approx. 10 mm) and folded back. No cut-off wire ends must be left in the aircraft!
- Check that, independently of the manufacturing document requirements, all fasteners intended to be locked are secured with wire.

7 SAFETY AND HEALTH

Apply the local safety regulations.

It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

8 PROCESS FLOW CHART

- Determine whether the threads are right-hand or left-hand.
- Make sure that the connectors, screws, nuts etc. are firmly tightened; if they are not, torque-tighten them as specified.
- Insert and twist the lock wire.
- Twist, shorten and fold back the wire ends.