BOMBARDIER

Toronto Site

PROPRIETARY INFORMATION

PPS 38.02

PRODUCTION PROCESS STANDARD

INSTALLATION OF HEATING AND INSULATING BLANKETS

Issue 12
- This standard supersedes PPS 38.02, Issue 11.
- Vertical lines in the left hand margin indicate technical changes over the previous issue.
- Direct PPS related questions to christie.chung@aero.bombardier.com or (416) 375-7641.
- This PPS is effective as of the distribution date.

- **THIS STANDARD SPECIFIES MANUFACTURING PROCESSES WHICH ARE CRITICAL TO THE FLAMMABILITY REQUIREMENTS AND TRANSPORT CANADA CERTIFICATION OF BOMBARDIER AIRCRAFT.**
- **IT IS IMPERATIVE THAT THE PROCEDURE SPECIFIED HEREIN BE STRICTLY ADHERED TO.**
- **THE CURRENT ISSUE OF THIS PPS AND ANY SUBSEQUENT REVISIONS TO THE PROCEDURE AND REQUIREMENTS SPECIFIED HEREIN SHALL BE AUTHORIZED BY AN UNDERSIGNED TRANSPORT CANADA DESIGN APPROVAL DESIGNEE (DAD).**

(Stan Giri, DAD 275) October 19, 2016

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PPS Group

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Materials Technology

(Stephen Pitt) October 26, 2016

Quality

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1 SCOPE

1.1 This Production Process Standard (PPS) specifies the procedure and requirements for the following:

- Installation of DASH 8 Series 100, 200 and 300 heating blankets; and
- Installation of DASH 8 Series 400 secondary, inboard “top cover” thermal/acoustic insulating blankets meeting the requirements of FAR 25.856 below the aircraft centre line.

1.1.1 This PPS complements the engineering drawings that specify its use as an authorized instruction. The procedure specified in this PPS shall 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. Similarly, the procedure and requirements specified in this PPS are not applicable when use of a BAPS, MPS, LES or P. Spec. is specified.

2 HAZARDOUS MATERIALS

2.1 Before receipt at Bombardier Toronto, all materials shall be approved and assigned Material Safety Data Sheet (MSDS) numbers by the Bombardier Toronto 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 Environment, Health and Safety Department.

3 REFERENCES

3.1 Federal Aviation Regulations Part 25 - Para. 25.856 Amdt 25-111.

3.2 PPS 13.26 - General Subcontractor Provisions.

3.3 PPS 13.27 - Trimming of Insulation Blankets.

4 MATERIALS AND EQUIPMENT

4.1 Materials

4.1.1 Thermal/Acoustic Insulating Blankets

4.1.1.1 Thermal/acoustic insulation blankets, meeting FAR 25.856, as specified on the engineering drawing.

4.1.1.2 Blanket securing hardware as specified on the engineering drawing (see Table I).

4.1.1.3 One of the following securing tapes:

- DSC 91-21 flame retardant insulation tape, pressure sensitive, white, 2.0" width typ. For special applications, a wider width tape may be used.
- DSC 91-23 reinforced polyether ether ketone (PEEK) flame retardant tape, pressure sensitive, opaque white, 2.0" width typ. For special applications, a wider width tape may be used.
- DSC 91-26 polyether ether ketone (PEEK) flame retardant tape, pressure sensitive, dull white, 2.0" width typ. For special applications, a wider width tape may be used.

4.1.2 Heating Blankets

4.1.2.1 Heating blankets as specified on the engineering drawing.

4.1.2.2 Stainless steel wire (QQ-W-423, FORM I, Composition FS304, Condition A), 0.020" diameter.

4.1.2.3 Polyamide (nylon) lacing tape (MIL-T-43435, Type 1, Finish B, Size 5).

4.2 Equipment

4.2.1 Heating Blankets

4.2.1.1 Side cutting pliers.

4.2.1.2 Wire twister pliers (e.g., M-84).

5 PROCEDURE

5.1 Installation of Secondary, Inboard “Top Cover” Thermal/Acoustic Insulating Blankets Below the Aircraft Centre Line for Burnthrough Protection

5.1.1 General

5.1.1.1 Inspect insulating blankets before installation and ensure the following are met. If **any** of the specified conditions are not met, the insulating blanket is not acceptable and shall be discarded and replaced:

- There shall be no separation of, or damage to, the core material (i.e., if cuts or tears extend through the bagging film to the core material, the insulating blanket is not acceptable and shall be discarded and replaced).
- There shall be no moisture found within the insulation.
- Insulation blankets shall be free of all defects which include penetration, rips, tears, excess film shrinkage, or pinholes caused by processing, handling or utilization of defective raw materials.

5.1.1.2 Insulating blankets are susceptible to damage such as tears and cuts. For compliance with flammability regulations, integrity of the insulating blanket shall be ensured. Take care to avoid any damage to insulating blankets at all times. In the event of damage, see PPS 13.27 for the limitations to repair without Bombardier MRB authority. The insulating blanket shall be discarded and replaced if the damage exceeds the requirements specified in PPS 13.27.

5.1.1.3 If necessary, trim insulating blankets according to PPS 13.27 to allow for proper fit and installation of the insulating blanket on the aircraft. See PPS 13.27 for limitations and further requirements. However, do not modify insulating blankets size or geometry unless explicitly otherwise specified on the engineering drawing.

5.1.1.3.1 To minimize use of spring clips at slits, where a blanket flap/tab requires trimming to allow for pipe/tube penetration through the flap/tab, create a narrow slot of sufficient size (i.e., do not cut larger than required) and seal edges using tape (see paragraph 4.1.1.3) according to PPS 13.27. See Figure 1.

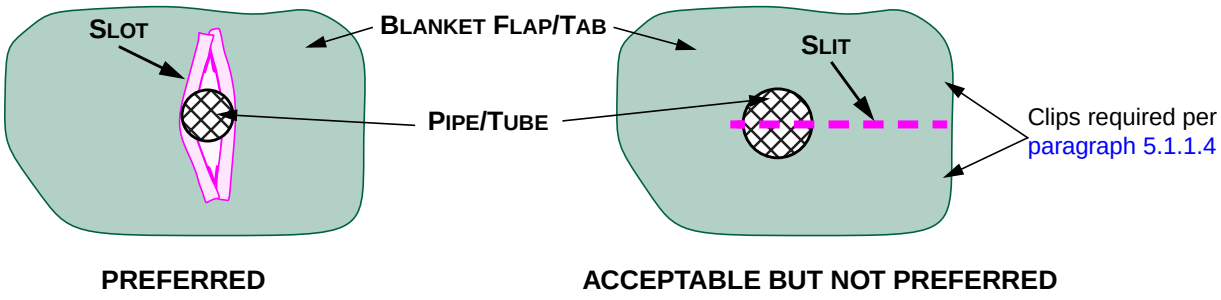
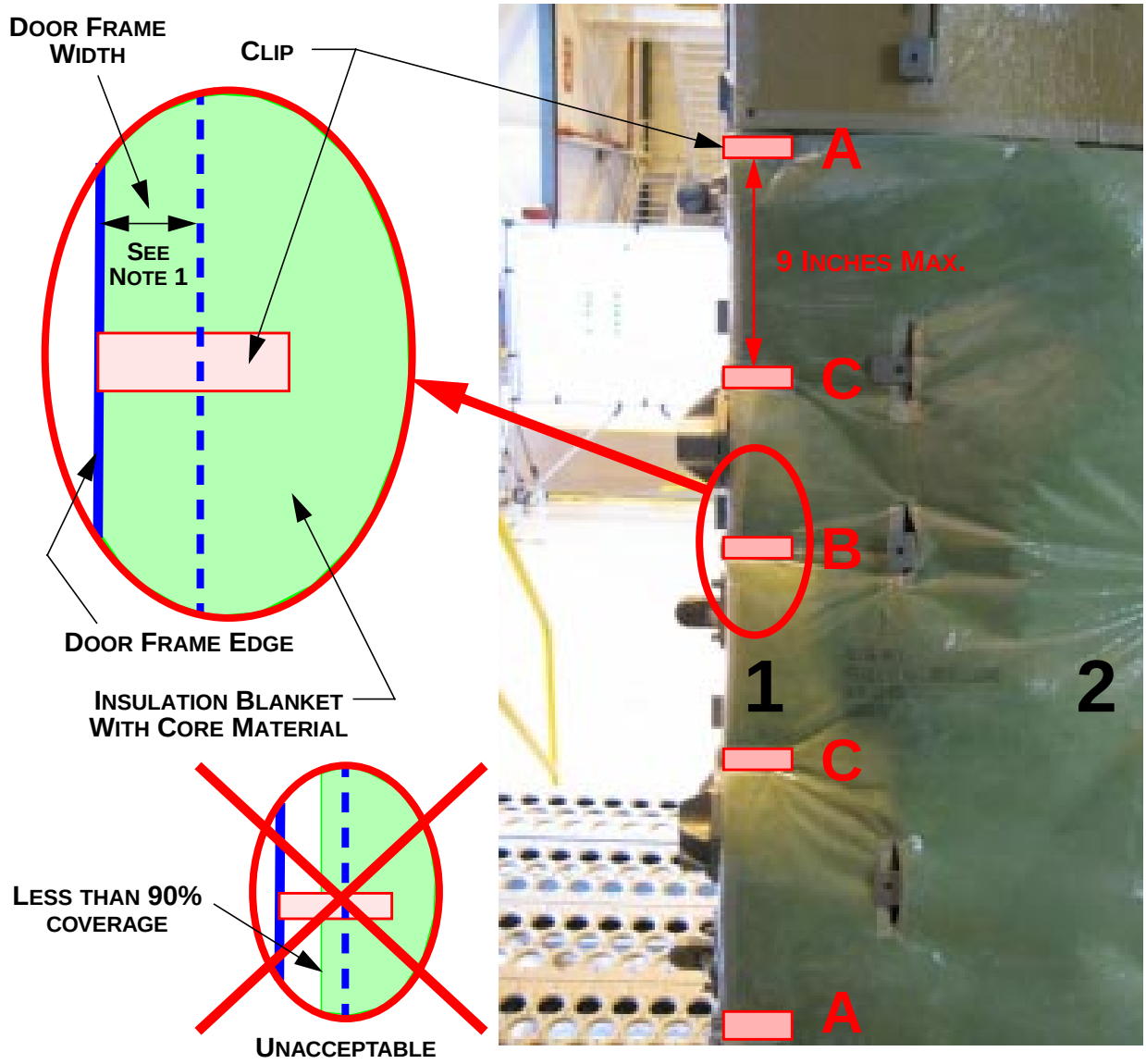


FIGURE 1 - NARROW SLOT VS SLIT FOR PIPE/TUBE PENETRATION

5.1.1.4 For blankets that are supplied with discontinuity on the flap/tab or where trimming was required on the flap/tab for proper fit (e.g., to avoid protrusions), add additional clips on either side of the discontinuity (i.e., blanket ends). Except for “above floor” door surrounds, ensure blanket ends are secured with at least one appropriate spring clip, no more than one inch from the blanket end. For “above floor” door surrounds, various hardware (e.g., door stops) may obstruct clip installation to meet this one inch requirement. However, install as close to the blanket ends as possible.

5.1.1.4.1 For “above floor” door surrounds, clips location is specified by the blanket manufacturer’s drawing and the blankets are supplied with markings to indicate placement of the appropriate clips. If such blankets are supplied without such markings, install all clips supplied as evenly spaced as possible while maintaining the distance requirements between two consecutive clips as specified in paragraph 5.1.1.6. Begin clip installation at the top and bottom of blanket ends. Figure 2 is labelled “A”, “B” and “C” to show the sequence of a 5 clip installation.

5.1.1.5 When terminating insulation blankets at “above floor” door surrounds, ensure that the blanket terminates and overlaps the door frame a minimum of 90% of the door frame width (see Figure 2). Ideally, the blanket should terminate completely at the door frame edge with the end blanket film tucked under as shown in Figure 2. To achieve this requirement, secure the blanket end at the door surround frame before clipping to the fuselage frame as the blanket flap/tab wrapping around the frame has more material to work with. Figure 2 is labelled “1” and “2” to show the sequence of installation.



NOTE 1. Ensure that the blanket terminates and overlaps the door frame a minimum of 90% of the door frame width. Ideally, the blanket should terminate completely at the door frame edge with the blanket film tucked under as shown in this figure.

FIGURE 2 - TERMINATING BLANKETS AT ABOVE FLOOR DOOR SURROUNDS

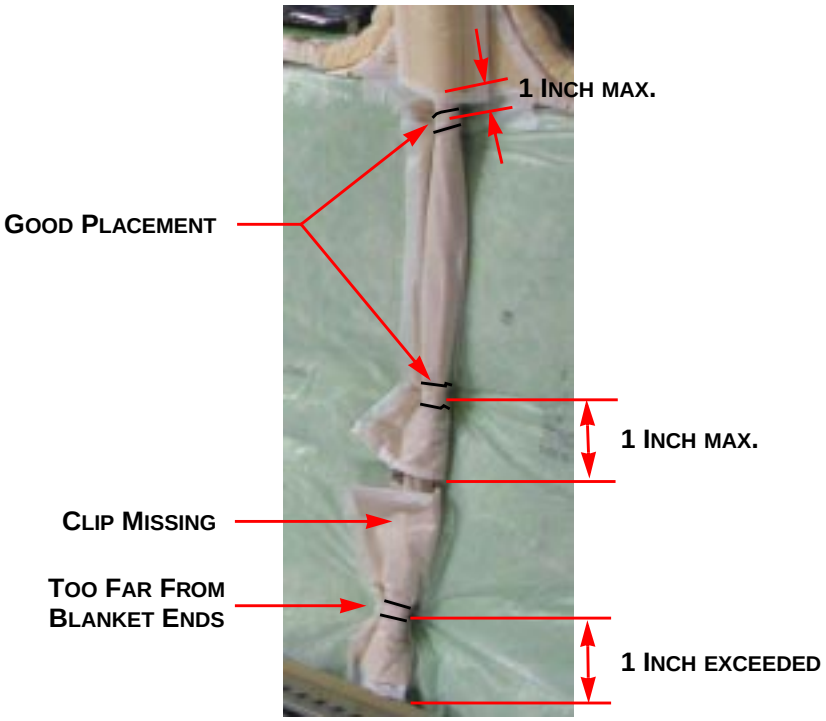


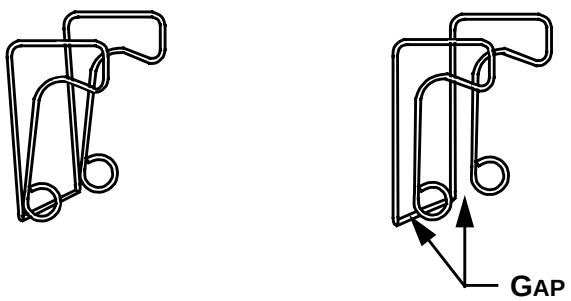
FIGURE 3 - SPRING CLIP DISTANCE FROM BLANKET ENDS

5.1.1.6 For CSP spring clips only (i.e., non-riveted clips), the maximum distance between two adjacent securing spring clips is 14 inches (see Figure 6). For CSP 520-4 spring clip and CSP 521-1 double clips utilized to secure insulation blankets terminating at door surrounds, the maximum distance between such clips is 9 inches. Insulation blankets to be installed at "above floor" door surrounds are supplied with markings to indicate the placement of the CSP 521-1 double clips to ensure that the requirement of the 9 inches between such clips is met. If blankets are supplied without such markings, install clips according to paragraph 5.1.1.4.1.

5.1.1.7 If necessary, use tape (see paragraph 4.1.1.3) to secure blankets in place prior to the installation of spring clips. There should be no, or minimal, movement of installed clips. If necessary, use tape (see paragraph 4.1.1.3) to reinforce the clip to the blanket, especially where flight control cables are in close proximity to the installed clips.

5.1.1.8 Check to ensure securing hardware are not deformed prior to installing, as this may result in an unacceptable loose installation. See the following CSP 520-1 clip depiction as an example.

ACCEPTABLE **UNACCEPTABLE**



5.1.2 Blanket Overlap

5.1.2.1 Any gaps in the insulation material provide a possible penetration route for fire to enter the cabin and/or cockpit. Insulating blankets shall completely cover the frames and joints to prevent a penetration route for fire to enter the cabin and/or cockpit.

5.1.2.2 A minimum overlap of two inches of the blanket flaps/tabs is required where blankets are overlapping the frame (see Figure 4). Figure 4 depicts overlap in one direction only; overlap in the opposite direction is also acceptable (2" requirement is measured from one blanket end to the second blanket end). Where only one blanket flap/tab is overlapping the frame, then the two inch minimum overlap does not apply, however, ensure the blanket flap/tab overlaps the frame completely or overlaps according to Figure 10 where the blanket flap/tab terminates at access door surrounds. All installed insulation blanket flaps/tabs should be suitably secured by the retaining clips with no or minimal movement (use tape as specified in paragraph 4.1.1.3 as necessary to secure the blanket ends).

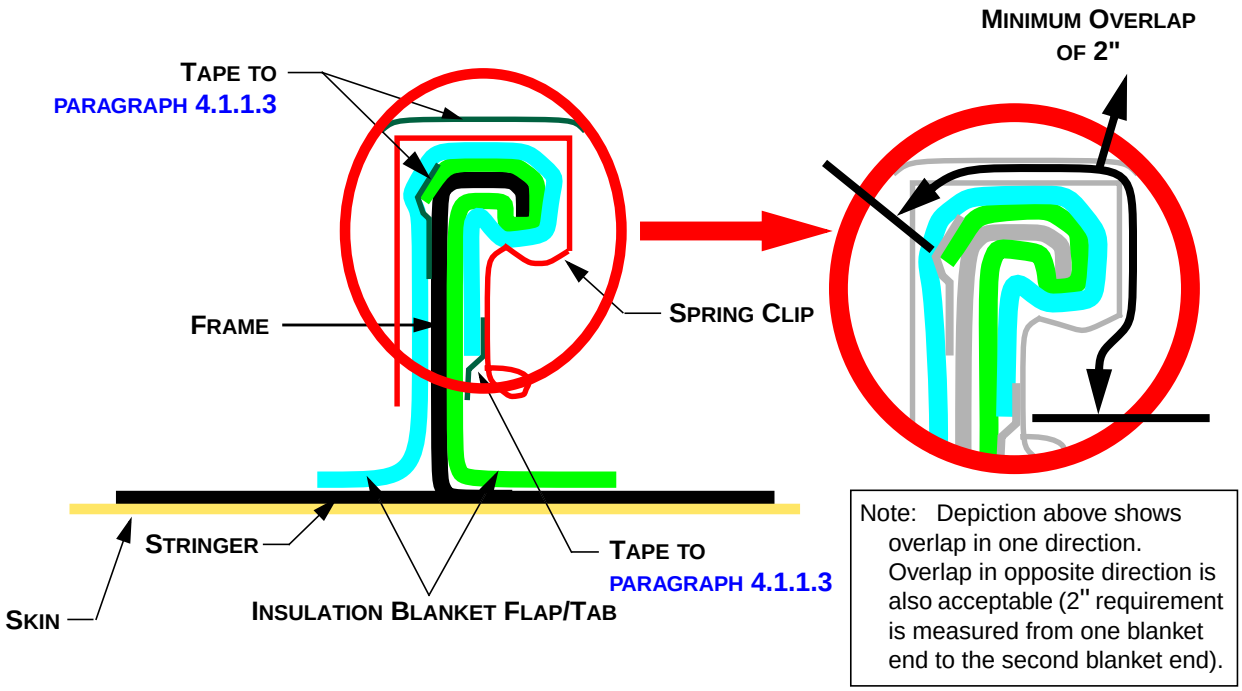


FIGURE 4 - MINIMUM OVERLAP AT FRAME

5.1.2.3 Joints between insulation blankets other than over frames should also be such that overlap of the blankets is a minimum of 6 inches unless otherwise specified on the engineering drawing. Additionally, to reduce potential for fire entry, if the installation considerations permit, blankets should be “shingled” so that the upper blanket overlaps the lower blanket in relation to the aircraft interior. Joints should be secured with tape or fasteners as specified on the engineering (see Figure 5).

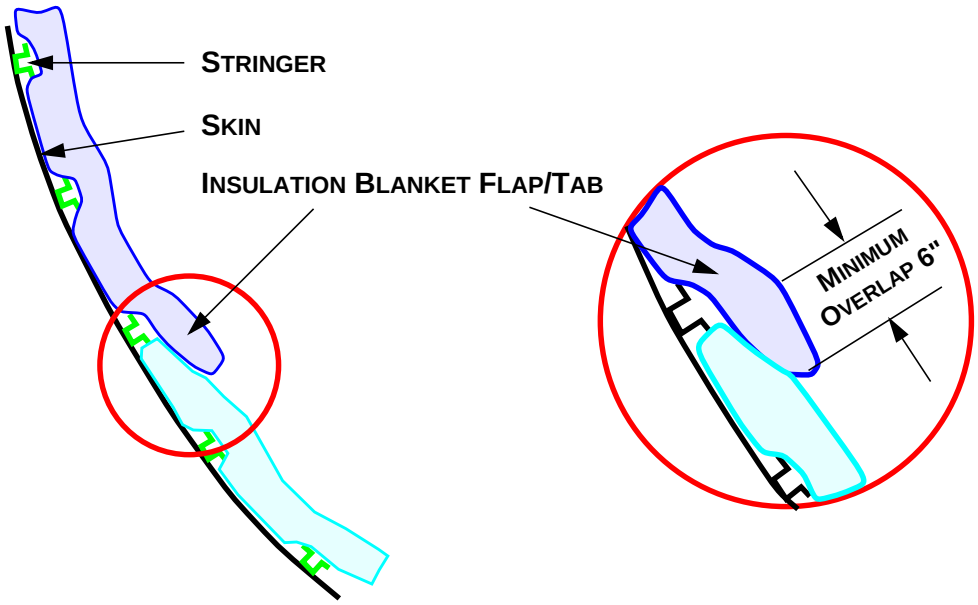


FIGURE 5 - METHOD OF OVERLAPPING

5.1.2.4 For above floor cabin blanket installation, when overlapping two blanket ends, ensure the blanket flap/tab that is continuous overlaps the blanket end that contains a slit or discontinuity (see Figure 6). Ensure all flaps/tabs are securely fastened by the spring clips.

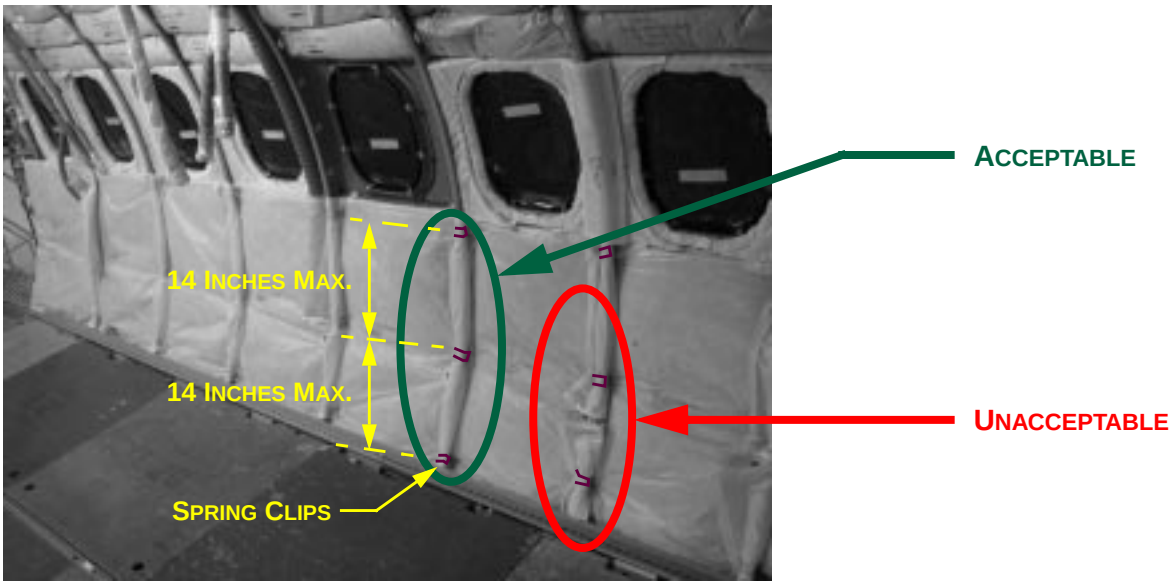
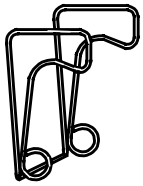
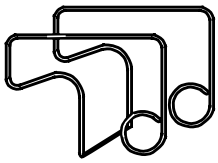
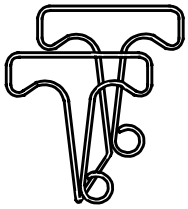
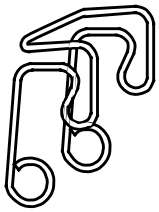
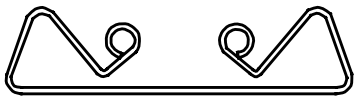
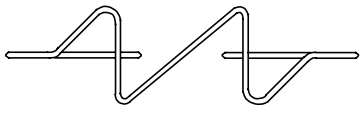


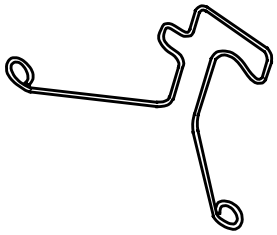
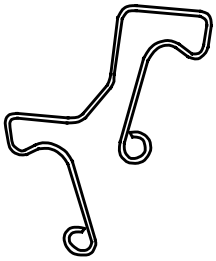
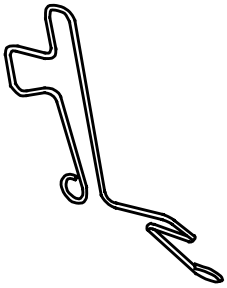
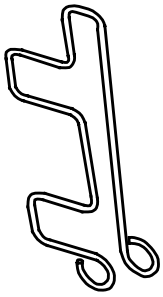
FIGURE 6 - ABOVE FLOOR CABIN INSTALLATION

TABLE I - HARDWARE FOR SECURING THERMAL/ACOUSTIC INSULATION BLANKETS (NOTE 1)

HARDWARE	ENGINEERING STANDARD/DRAWING (NOTE 2)	GENERAL DESCRIPTION
SPRING CLIPS		
	CSP 520-1-1 CSP 520-1-2 CSP 520-1-3 CSP 520-1-4	Clip, Insulation Retaining • Stainless Steel • See Figure 8
	CSP 520-2	Clip, Insulation Retaining • Stainless Steel
	CSP 520-3	Clip, Insulation Retaining • Stainless Steel • See Figure 9
	CSP 520-4-1 CSP 520-4-2	Clip, Insulation Retaining • Stainless Steel
 TOP VIEW  BACK VIEW	CSP 526-1 CSP 526-2 CSP 526-3 CSP 526-4	Clip, Insulation Retaining • Stainless Steel

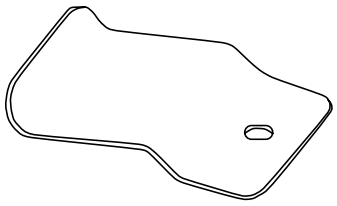
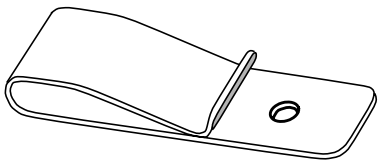
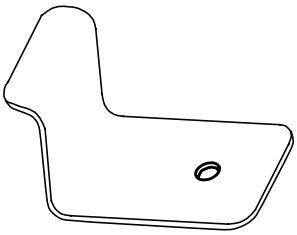
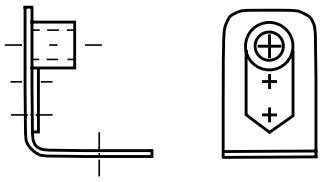
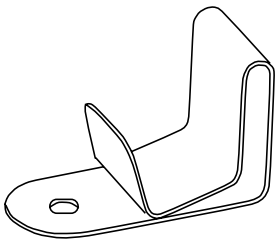
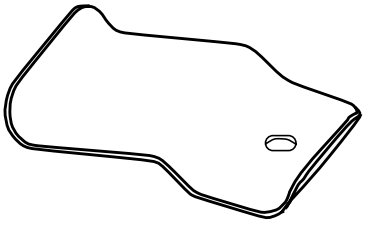
Note 1. Use the appropriate securing hardware as specified by the engineering drawing.
Note 2. If more than one engineering standard or drawing number is specified, see engineering standard or drawing for dimensional or design differences.

TABLE I - HARDWARE FOR SECURING THERMAL/ACOUSTIC INSULATION BLANKETS (NOTE 1)

HARDWARE	ENGINEERING STANDARD/DRAWING (NOTE 2)	GENERAL DESCRIPTION
	CSP 527	Clip, Insulation Retaining • Stainless Steel
	CSP 528	Clip, Insulation Retaining • Stainless Steel
	CSP 533	Clip, Insulation Retaining • Stainless Steel
	CSP 534-1 CSP 534-2	Clip, Insulation Retaining • Stainless Steel

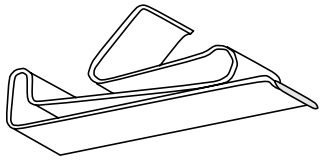
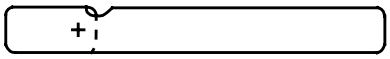
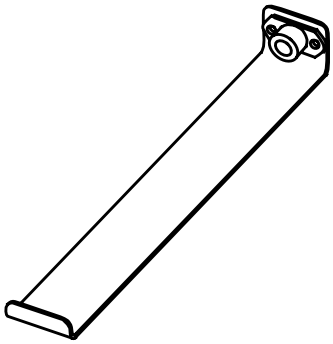
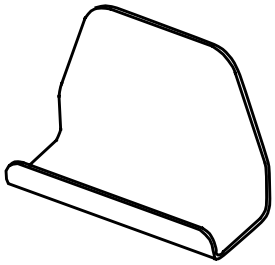
Note 1. Use the appropriate securing hardware as specified by the engineering drawing.
Note 2. If more than one engineering standard or drawing number is specified, see engineering standard or drawing for dimensional or design differences.

TABLE I - HARDWARE FOR SECURING THERMAL/ACOUSTIC INSULATION BLANKETS (NOTE 1)

HARDWARE	ENGINEERING STANDARD/DRAWING (NOTE 2)	GENERAL DESCRIPTION
RIVETED RETAINING CLIPS		
	CSP 519-1 CSP 519-2 CSP 519-3 CSP 519-4 CSP 519-5	Clip, Insulation Retaining • Aluminum • Riveted • See Figure 7 • Flaps/tabs may be folded under as shown in Figure 7 for a better fit
	CSP 522-1	Clip, Hanger Retainer • CRES • Riveted • See Figure 11
	CSP 523-1	Clip, Right Angled Retainer • CRES • Riveted • See Figure 11
	CSP 524-1	Bracket Assembly, Nut Plate Angle • CRES • Riveted
	CSP 525-1	Clip, Retaining • Riveted • See Figure 12
	85312703	Clip, Insulation Retaining • Aluminum • Riveted • See Figure 11

Note 1. Use the appropriate securing hardware as specified by the engineering drawing.
Note 2. If more than one engineering standard or drawing number is specified, see engineering standard or drawing for dimensional or design differences.

TABLE I - HARDWARE FOR SECURING THERMAL/ACOUSTIC INSULATION BLANKETS (NOTE 1)

HARDWARE	ENGINEERING STANDARD/DRAWING (NOTE 2)	GENERAL DESCRIPTION
MISCELLANEOUS		
	CSP 521-1	Double Clip • CRES
	85300102	Bracket Assembly, Retaining Clip
	85312711 85312713	Support Bracket • CRES
	85312702	Support Clip • Aluminum

Note 1. Use the appropriate securing hardware as specified by the engineering drawing.
Note 2. If more than one engineering standard or drawing number is specified, see engineering standard or drawing for dimensional or design differences.

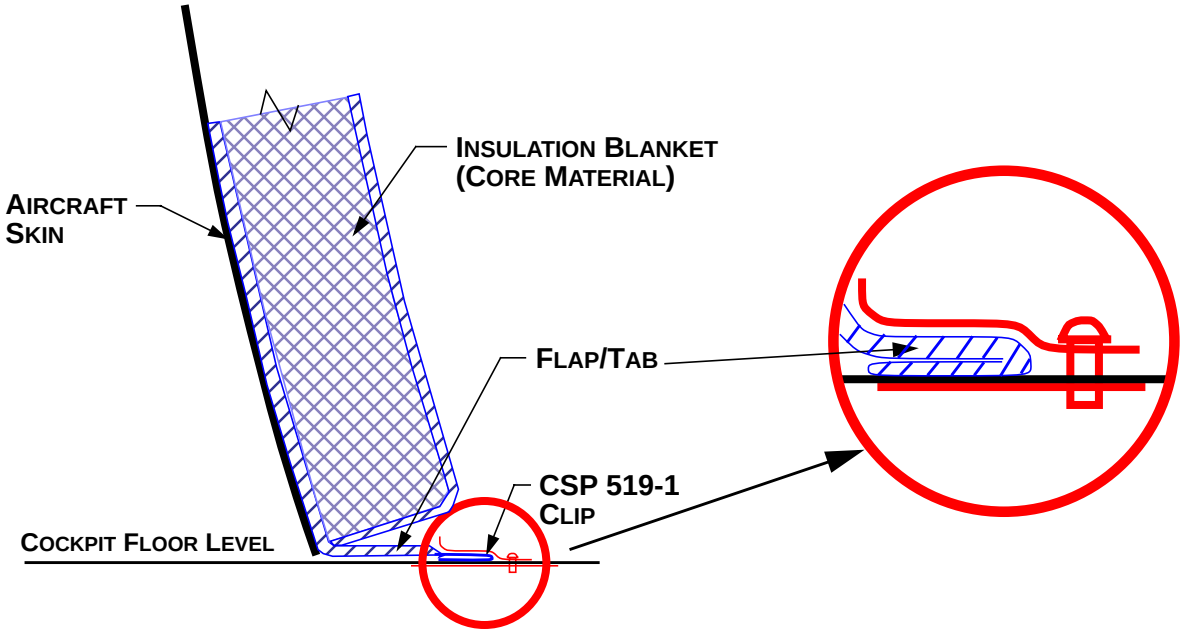


FIGURE 7 - CSP 519-1 RETAINING CLIPS INSTALLATION

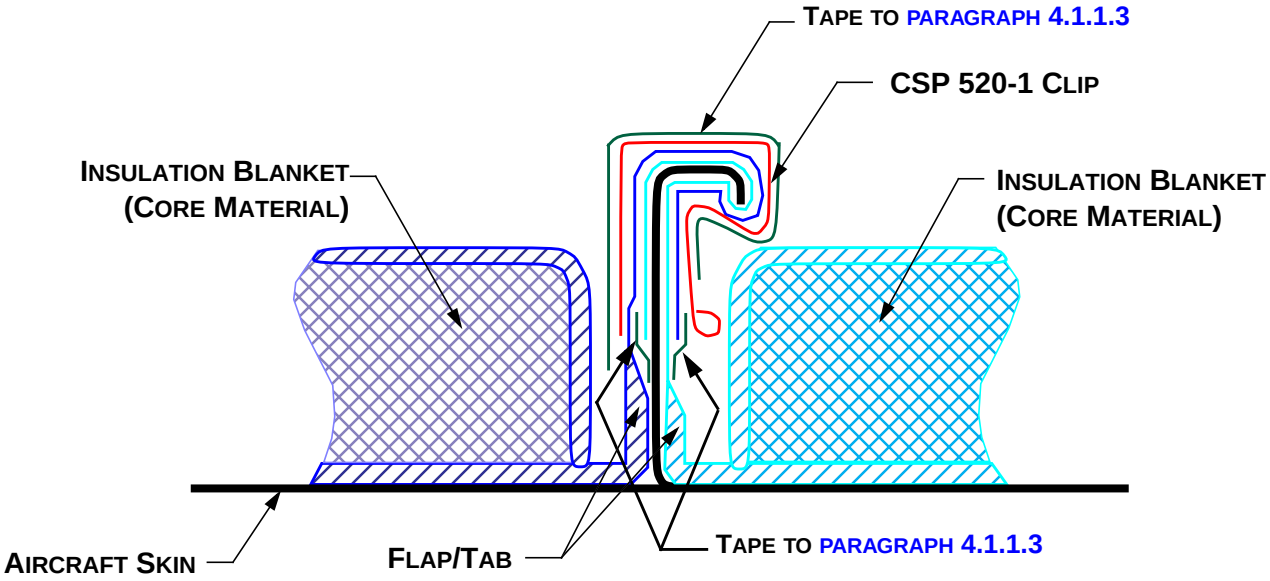


FIGURE 8 - CSP 520-1 SPRING CLIP INSTALLATION

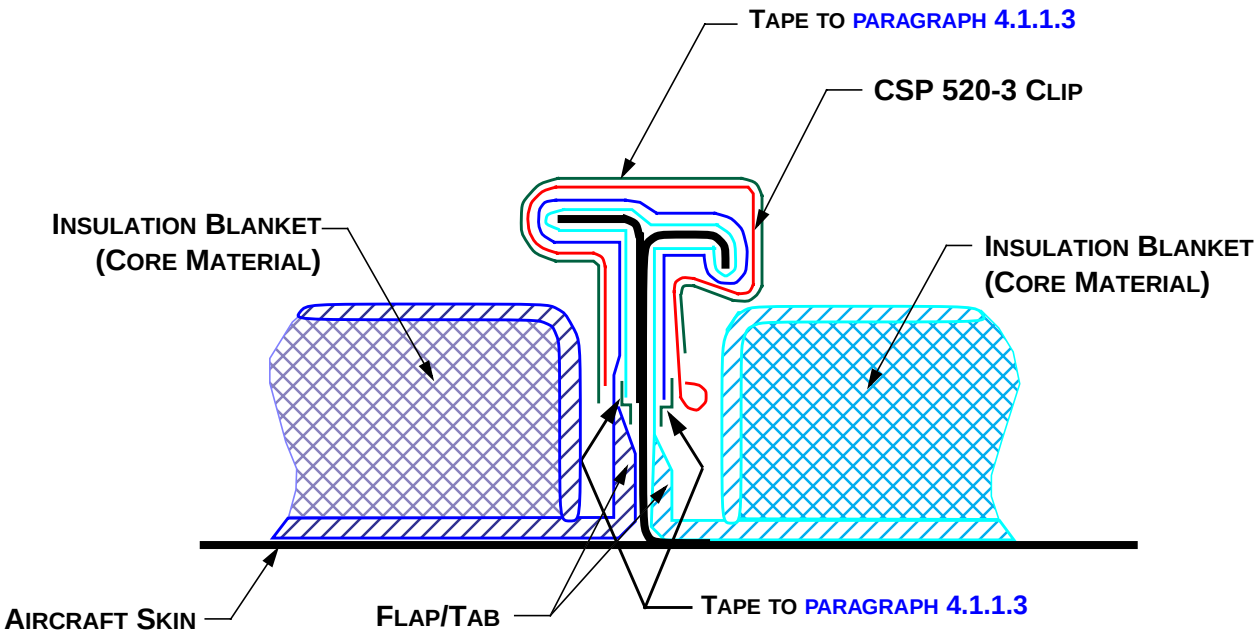


FIGURE 9 - CSP 520-3 SPRING CLIP INSTALLATION (BELOW COCKPIT FLOOR)

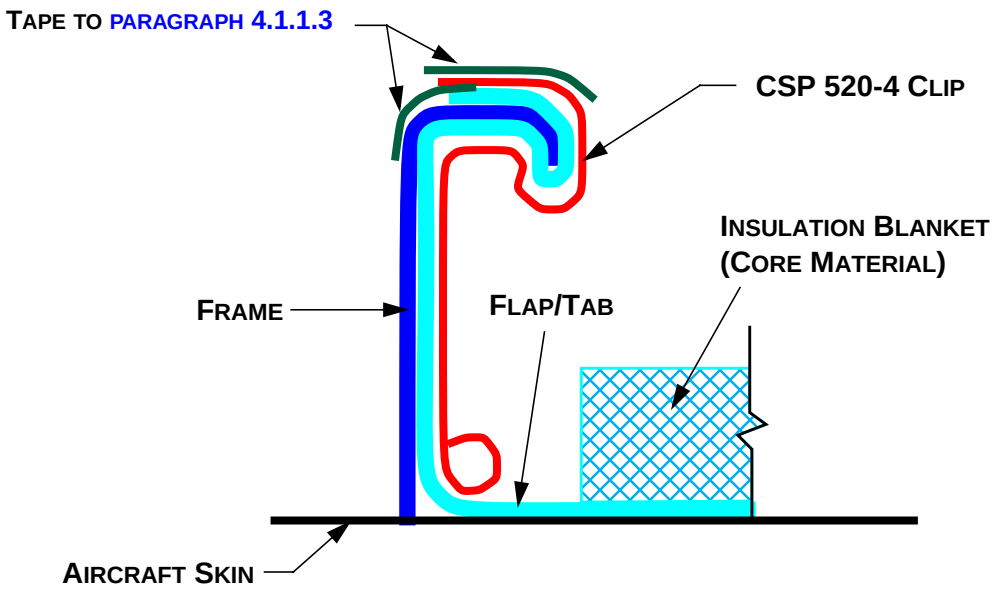
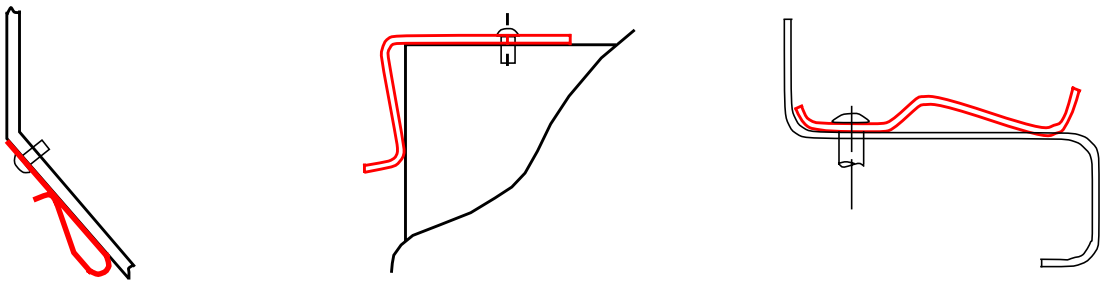


FIGURE 10 - CSP 520-4 SPRING CLIP INSTALLATION (ACCESS DOOR SURROUND)



CSP 522 HANGER RETAINER | CSP 523 RIGHT ANGLE RETAINER | 85312703 RETAINING CLIP

FIGURE 11 - RETAINING CLIP INSTALLATION

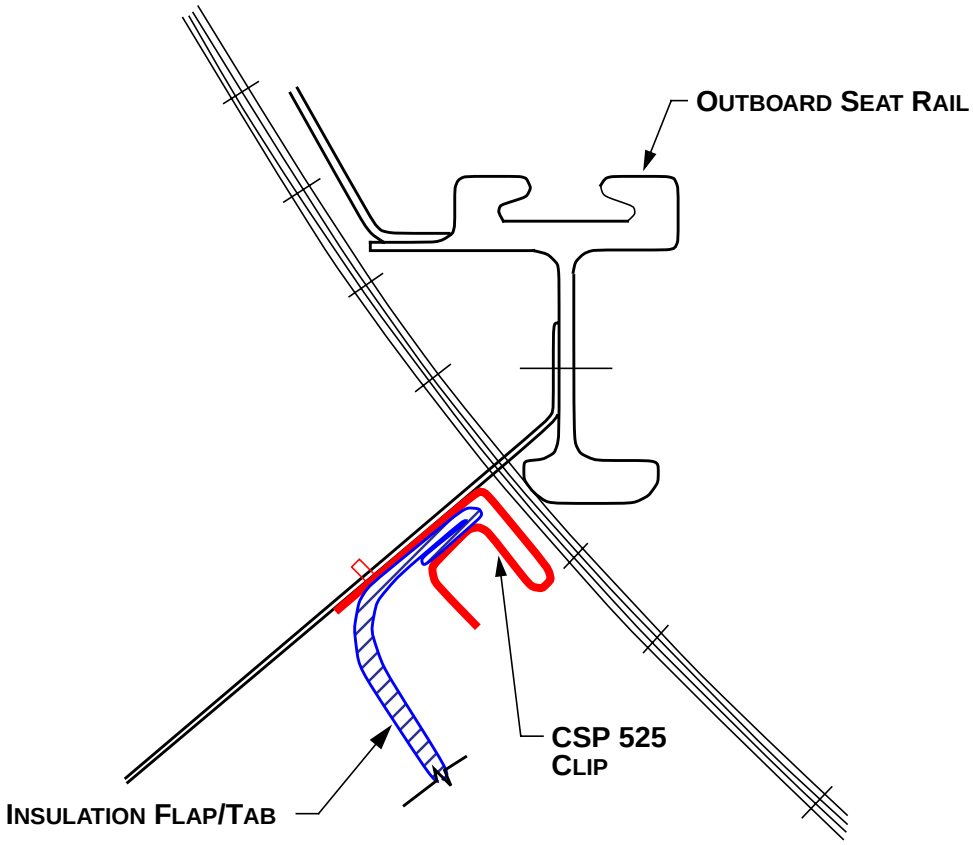


FIGURE 12 - CSP 525-1 RETAINING CLIP INSTALLATION (UNDERFLOOR STRUCTURE)

5.2 Fitting Wrap-Around Type Heating Blankets

5.2.1 This section applies to heating blankets installed onto DASH 8 Series 100, 200 and 300 aircraft wing only. The procedure specified in this section does not apply to blankets that shall meet FAR 25.856 burnthrough protection requirements. For such blankets, install according to section 5.1.

5.2.2 Fit wrap-around type heating blankets as follows:

Step 1. Wrap the blanket around the part in such a manner that it forms naturally to the shape of the part without buckling. Wrap the blanket in such a manner so that the thicker part of the blanket overlaps the thinner part.

Step 2. Check that the lacing posts are parallel and adjacent to each other.

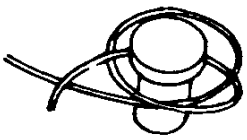
Step 3. Ensure the overlapped portion of the blanket does not contact the posts of the opposite side.

Step 4. Secure the blanket to the part according to section 5.2.3, using the lacing material specified on the engineering drawing.

5.2.3 Lacing

5.2.3.1 Lace blankets with posts as follows:

Step 1. For wire lacing, secure one end of the appropriate lacing material to a post on one end of the blanket by wrapping one complete turn around the post.
For nylon lacing, secure one end of the appropriate lacing material to a post on one end of the blanket using a single overhand knot (see Figure 13-A).

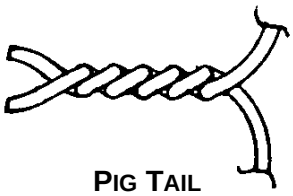


OVERHAND KNOT

Figure 13-A

REEF KNOT

Figure 13-B

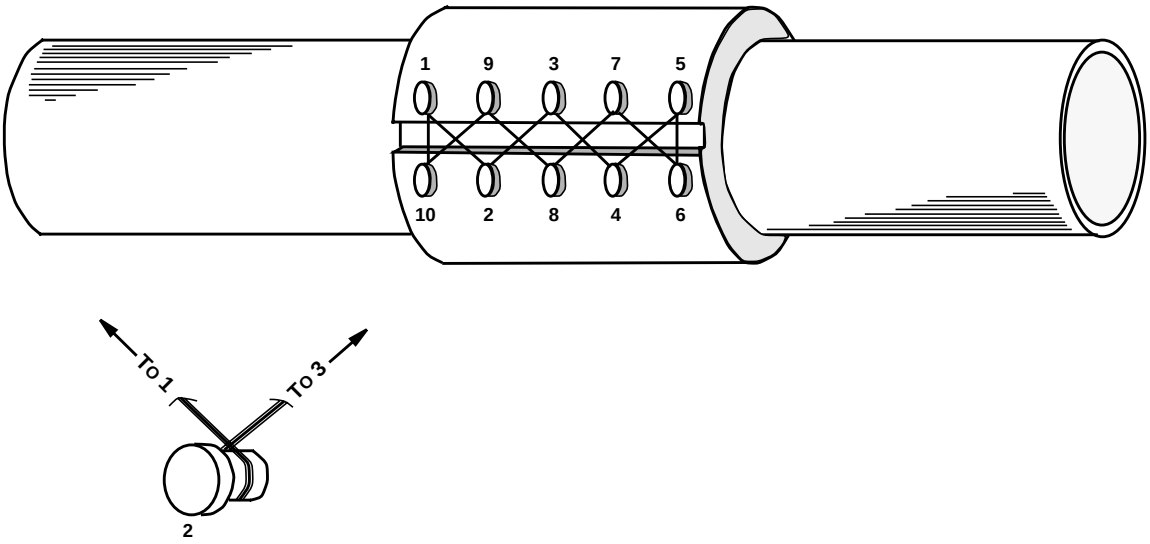


PIG TAIL

Figure 13-C

FIGURE 13 - SECURING METHODS

Step 2. Following the pattern shown below, wrap the lacing around each post one full turn.



Step 3. Pull the lacing taut so that the flange on moulded blankets or the overlap on wrap-around blankets, as applicable, overlaps a minimum of 75% of the flange or overlap width (see Figure 14).

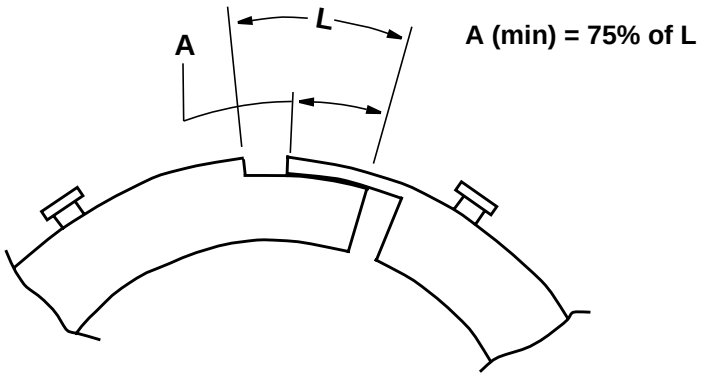
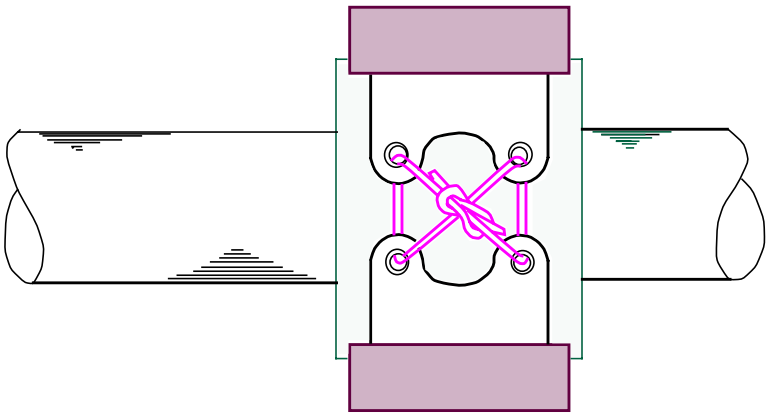


FIGURE 14 - FLANGE OVERLAP

Step 4. Terminate nylon lacing at the starting post by wrapping the lacing one full turn around the last post in a direction opposite to the first turn and securely tie using a single reef knot according to Figure 13-B.
Terminate wire lacing at the starting post by wrapping the wire around the last post one full turn in a direction opposite to the first turn on the post and twisting the two ends of the wire into a pigtail using wire twister pliers (see Figure 13-C). Cut the pigtail to approximately 3/4" and bend in to prevent injury to personnel or damage to the blanket.

5.2.3.2 Lace blankets with eyelets as follows:

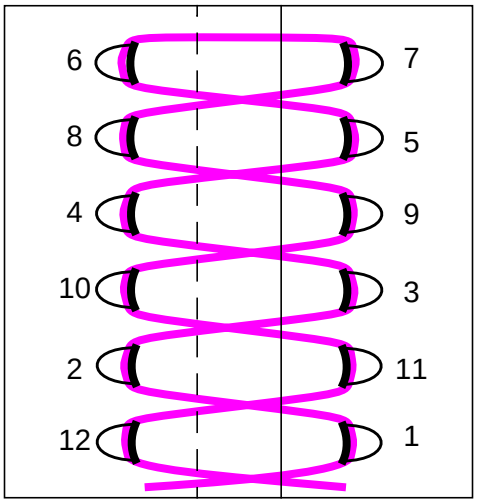
Step 1. Lace as shown below.



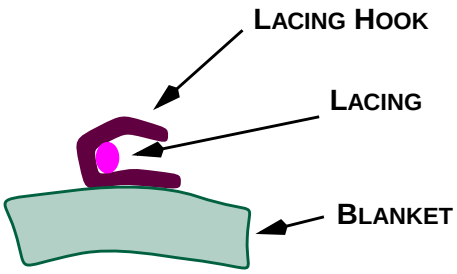
Step 2. Terminate nylon lacing by securely tying using a single reef knot according to Figure 13-B.

5.2.3.3 Lace blankets with speed lacing hooks as follows:

Step 1. Following the pattern shown below, run the lacing through each hook.



TOP VIEW



CROSS SECTION VIEW

Step 2. Pull the lacing taut so that the flange on moulded blankets or the overlap on wrap-around blankets, as applicable, overlaps a minimum of 75% of the flange or overlap width (see Figure 14).

Step 3. Terminate the lacing securely using a single reef knot as shown in Figure 13-B.

6 REQUIREMENTS

6.1 Secondary, Inboard "Top Cover" Thermal/Acoustic Insulation for Burnthrough Protection

6.1.1 Inspect installed blankets for defects as specified in paragraph 5.1.1.1. Should any defect be found as outlined in paragraph 5.1.1.1, the insulating blankets shall be discarded and replaced.

6.1.2 For blankets that are supplied with discontinuity on the flap/tab or where trimming was required on the flab/tab for proper fit (e.g., to avoid protrusions), ensure additional clips were installed on either side of the discontinuity (i.e., blanket ends). Except for "above floor" door surrounds, ensure blanket ends are secured with at least one appropriate spring clip, no more than one inch from the blanket end. For "above floor" door surrounds, ensure clips are installed in the locations as specified by the blanket manufacturer's drawing and blanket markings. If blankets are supplied without such markings, ensure installed clips meet the requirements specified in paragraph 5.1.1.4.1.

6.1.3 Inspect insulation blankets terminating at "above floor" door surrounds to ensure the blanket end terminates and overlaps the door frame a minimum of 90% of the door frame width (see paragraph 5.1.1.5).

6.1.4 Inspect to ensure the maximum distance between two adjacent securing hardware does not exceed the requirements specified in paragraph 5.1.1.6.

6.1.5 Inspect to ensure that the blanket overlap requirements specified in section 5.1.2 are met.

6.1.6 Inspect the installed insulation blanket flaps/tabs to ensure that they are suitably secured by the retaining clips. There should be no, or minimal, movement of installed clips. Where necessary, ensure tape to paragraph 4.1.1.3 is used to reinforce the clip to the blanket, especially where flight control cables are in close proximity to the installed clips.

6.1.7 Insulating blankets shall fit in their assigned location without excessive gaps and shall be free of wrinkles.

6.2 Wrap-Around Type Heating Blankets

6.2.1 Blankets showing evidence of cuts or other damage are not acceptable.

6.2.2 Wrap-around type blankets shall fit snugly on the part with no evidence of buckling.

6.2.3 The overlap on wrap around blankets and the flange on moulded blankets shall be at least 75% of the flange or overlap width according to Figure 14. The overlapping portion of the wrap-around type blankets shall not be in contact with the securing posts on the opposite side of the blanket.

6.2.4 The lacing type and size shall be as specified on the engineering drawing.

6.2.5 The lacing pattern and termination shall be as specified in section 5.2.3.

7 SAFETY PRECAUTIONS

7.1 The materials and procedures specified herein present no specific health or safety hazard when used for the intended purpose.

7.2 Observe general shop safety precautions when performing the procedure specified herein.

8 PERSONNEL REQUIREMENTS

8.1 Personnel responsible for fitting and lacing heating and insulating blankets shall have a good working knowledge of the applicable procedure and requirements as specified herein and shall have exhibited their competency to their supervisor.

9 STORAGE OF WRAP AROUND TYPE HEATING BLANKETS

9.1 Wrap-around type heating blankets may be interlaced with strong cardboard for storage purposes.