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2002159E Lightband Compression Tool Operating Procedure

Organization Name	
MLB Diameter	
MLB Assembly Number	
MLB Assembly Revision	
MLB Serial Number	

Instructions:

IF LCTS ARE NOT YET INSTALLED ON LIGHTBAND:

Read Sections 2 and 3, and proceed to Section 4 of this procedure.

IF LCTS ARE ALREADY INSTALLED ON LIGHTBAND:

Read Sections 2 and 3, and proceed to Section 5 of this procedure.

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1. Revision History

Revision	Issued	Written By	Released By	Change Description
-	N/A	SS	N/A	Initial document.
A	27-Nov-12	SS	WH	Format changed to match current PSC templates, procedure updated.
B	28-Nov-12	SS	RW	Added figure 3-1 for clarification, reordered steps in compression procedure, removed draft remnants.
C	20-Aug-13	SS	AZ	Added alternate equipment, simplified procedure.
D	11-Sep-13	AZ	RW	Modified format, added required equipment table, clarified procedure.
E	5-May-16	HM	AZ	<ol style="list-style-type: none"> 1. Section 4 & 5: Updated procedure. 2. Section 4 & 5: Removed use of staking, added use of locking patch screws. 3. Section 6: New. 4. Figure 3-1: Updated. 5. Removed inventory table.

2. Introduction

This document describes the materials and procedure required to prepare the MkII Motorized Lightband (MLB) for stowing using PSC part number 4000637 Lightband Compression Tools (LCT). The LCTs are instruments used to properly compress the Lightband so that the Motors may be used to stow. LCTs are ideal for situations in which the Lightband must be stowed horizontally or when the required compressive weight cannot be applied to the Upper Ring payload in a vertical configuration.

The following procedure should be used in conjunction with the latest revision of PSC document 2000781 MKII *MLB Operating Procedure*.

Terminology note: One Lightband Compression Tool Assembly consists of an aluminum mount, a bearing, and mounting hardware. For each Assembly installed on either Lightband Ring, an identical Assembly must be installed on the opposite Ring. In this way, the LCTs are often referred to in pairs as two are required at every Separation Spring Location.

2.1 Warnings

Violating any of the below shall void PSC Document 1001015 MLB Warranty.

1. ALL technicians completing this procedure shall be trained directly by PSC and given authority to operate their specific Lightband(s) via PSC Document 2000750 Lightband Training Record.
2. The Lightband shall only be operated using this procedure. This procedure shall be filled out for every operation of the Lightband. Steps shall not be skipped or modified.
3. If a Lightband ever fails to operate correctly, PSC shall be contacted immediately for recommendations and troubleshooting techniques. Another operation shall not be attempted without first understanding the cause of the initial failure.
4. ALL bolts shall be used when attaching the Lightband to adjoining structures. Bolts shall not be omitted from any bolt hole in the Lightband.
5. With the Upper Ring not present, the Lightband shall never be powered in the stow direction. This would cause damage by repeatedly slamming the ball nut against a hard stop at high speed and force.
6. During operations, objects shall not be placed and left in-between the Lightband flanges which may inhibit the Lightband from properly stowing. The tolerance on the pre-stowed Lightband height is NOT the same as the stowed tolerance. Common potential objects include wiring harnesses and height gages.
7. The Upper Ring shall be physically separated from the Lower Ring after every deployment. A stow operation shall not be attempted without first inspecting the Lightband.
8. BOTH motors shall always be powered when operating the Lightband.
9. The Lightband shall only be stowed within the temperature range of 10-32°C (50-90°F)

3. Required Equipment

Qty.	Item	Make and Model Typically Used by PSC
1	Lightband attached to adjoining structures IAW 2000781	-
AR	4000637 Lightband Compression Tool	-
AR	Nylon Cable Tie (must have minimum 50 lb; tensile force limit)	MS 3367-1-0 7"
1	Cable Tie Tool (must have adjustable force)	Ty-Rap ERG 50
1	Calipers with inside jaws	Mitutoyo 500-196-30
1	Torque Wrench (capable of measuring min 8 in*lb)	Precision Instruments 1050
1	¼ inch Open-Ended Wrench	-
OPTIONAL IF LIGHTBAND FLANGES CANNOT BE ACCESSED WITH CALIPERS		
1	Bore gage or parallel (both with 1.2 to 2.1 inch range)	

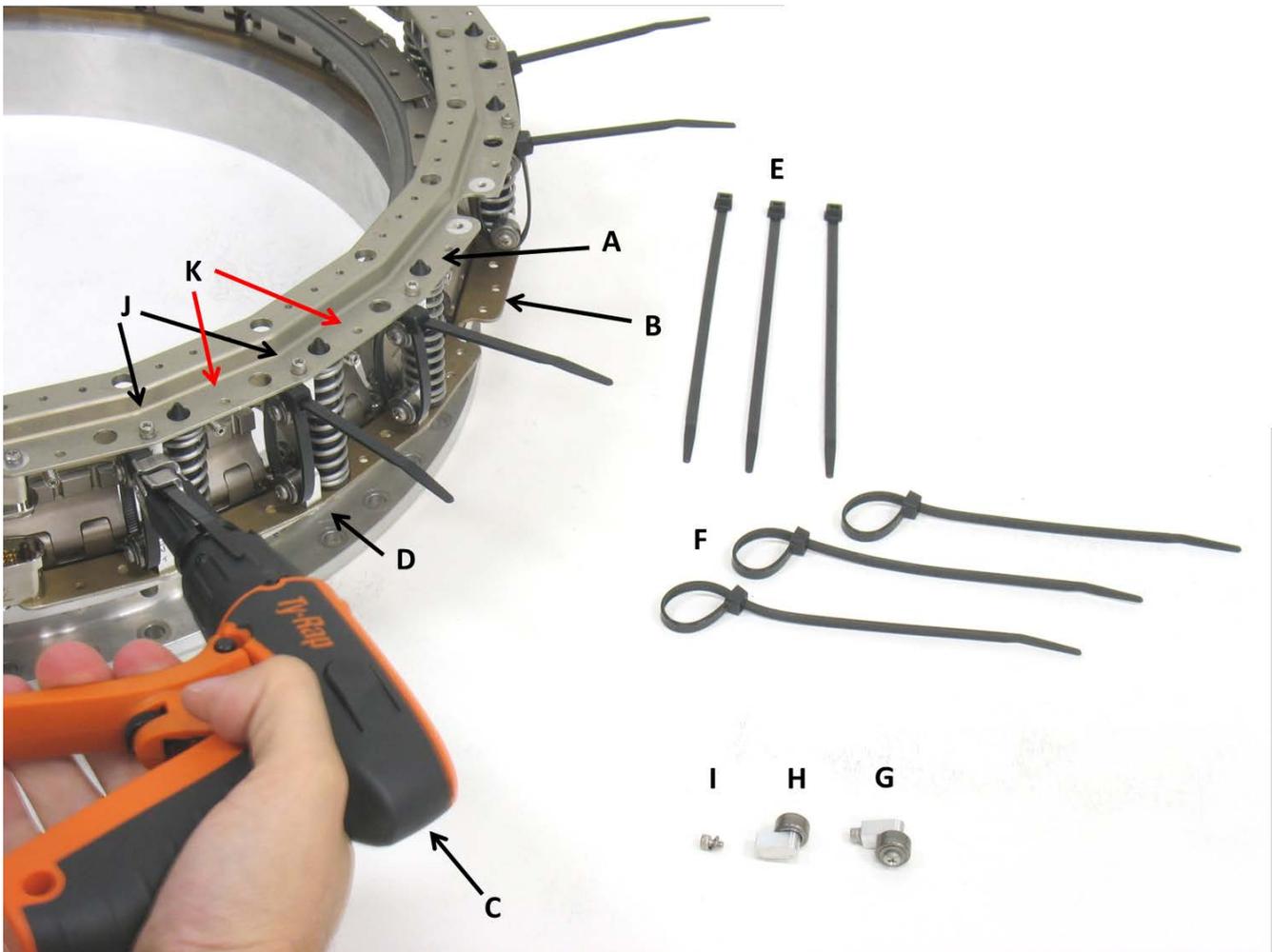


Figure 3-1: A: Lightband Upper Ring Flange, B: Lightband Lower Ring Flange, C: Ty-Rap ERG 50 Cable Tie Tool, D: LCT Pair with Cable Tie Installed, E: MS 3367-1-0 7" Nylon Cable Ties (Before Installation), F: Cable Ties (Removed After Stowing), G: Single LCT Assembly, H: Lower Assembly of LCT, I: Attachment Screw and Washer of LCT, J: Correct LCT attachment points, K: Incorrect LCT Attachment Points

3.1 Referenced Documents

Name	Document No.	Note
Lightband Operating Procedure	2000781	To operate Lightband
PSC Standards	3000100	For fastener torque values
Lightband Compression Tool Assembly	4000637	Production drawing for reference

4. LCT Installation and Compression Procedure

This procedure shall be followed if LCTs **ARE NOT** yet installed on the Lightband.

LCT Assemblies are installed in pairs as close as possible to Separation Springs.

This procedure assumes the use of the materials shown in Figure 3-1. Consult PSC before substituting any tools.

This procedure is to be performed only by individuals who have been formally trained on the use of LCTs by a PSC engineer. Contact PSC to setup training.

Step	Procedure	Technician Date & Initials	QA Date & Initials
LCT Installation			
1.1	Ensure the SN on the Upper Ring corresponds to the SN on the Lower Ring. Record all MLB info on the cover page. (This can be found on both the Upper and Lower Ring, typically adjacent to the Motor Bracket Assembly.)		
1.2	Complete the stowing procedure of PSC Document 2000781 up to the point where force is applied to compress the Lightband.		
1.3	Calculate the number of LCT pairs required using the equation below rounding up to the nearest integer: Minimum number of LCT pairs: N_{min} Maximum number of LCT pairs: N_{max} Number of Separation Springs installed on Lightband: $N_{springs}$ Stack weight above Lightband in lb: W (Note: $W = 0$ if in horizontal configuration) $N_{springs} = \underline{\hspace{2cm}}$ $W = \underline{\hspace{2cm}}$ $N_{min} = N_{springs} - \frac{W}{20lb_f} = \underline{\hspace{2cm}}$ $N_{max} = N_{min} \times 1.5 = \underline{\hspace{2cm}}$		
1.4	Attach half of the LCTs onto the corners of the Lightband Upper Ring flange. Orient each LCT as shown in Figure 3-1 and ensure LCTs are placed as close to a Separation Spring as possible. Torque attachment screws 5-6 in*lb above running torque (8 in*lb max).		
1.5	Attach the remaining half of the LCTs onto the corners of the Lightband Lower Ring flange. Orient each LCT as shown in Figure 3-1 and ensure LCTs are placed directly below an LCT on the Upper Ring. Ensure that the pairs of LCTs are visually aligned with each other to allow rotation of the cable ties over the bearings. Torque attachment screws 5-6 in*lb above running torque (8 in*lb max).		

Lightband Compression and Stow			
2.1	If not already performed, bring the Upper and Lower Rings together and verify alignment via the following: <ol style="list-style-type: none"> 1. Cutout in the Upper Ring lines up over the Motor Bracket on the Lower Ring. 2. ALL Separation Connector/Switch cutouts align. 3. ALL Separation Spring tips protrude through appropriate holes in the Upper Ring. 		
2.2	Place one cable tie around each LCT Pair and pull until hand-tight. Do not allow the Lightband to compress yet.		
2.3	If applicable, disable the cut-off feature of the Cable Tie Tool.		
2.4	Ensure that the force setting on the Cable Tie Tool does not exceed the tensile strength of the cable ties. If using the PSC-recommended hardware, the Ty-Rap Erg 50 Cable Tie Tool should be set at "8."		
2.5	Measure the distance between Upper and Lower Ring flanges next to each LCT. Ensure distance between flanges is uniform to within 0.020 inches at each location. It is often helpful to record measurements in a table as it may require multiple measurement iterations; see Section 6. Use the minimum measured distance as a reference and tighten the remaining cable ties with the Cable Tie Tool until all are within 0.020 inches of the minimum. Note: Failure to evenly compress Lightband increases chance of breaking cable ties.		
2.6	Tighten the cable tie nearest to the Motor Bracket using the Cable Tie Tool by 5 to 6 notches of the cable tie or until the safety mechanism of the Cable Tie Tool releases the cable tie. Do this for all cable ties, working in a circle. Stop once all cable ties have been tightened once.		
2.7	Measure the distance between Upper and Lower Ring flanges next to each LCT. Ensure distance between flanges is uniform to within 0.020 inches at each location. Use the minimum measured distance as a reference and tighten the remaining cable ties with the Cable Tie Tool until all are within 0.020 inches of the minimum. If the distance between the flanges is IAW the stowing procedure directed in PSC Document 2000781 proceed to step 2.8, otherwise repeat steps 2.5 through 2.7 always working around the Lightband in the same direction. Note: If a cable tie is over-tightened or broken, remove cable tie from LCT, place new cable tie around LCT and follow steps 2.5 – 2.7 until the distance between the Upper and Lower Ring flange is uniform within 0.020 inches.		
2.8	Stow the Lightband IAW with PSC Document 2000781 within 10 minutes of final flange distance measurement as cable ties will creep if kept under stress. If more than 10 minutes pass before stowing, re-verify that the distance between flanges is IAW the requirement defined in PSC Document 2000781 before stowing.		
Post-Stow			
3.1	Remove the cable ties by cutting or manually sliding each one outward over the bearings.		
3.2	Return to the PSC Document 2000781 and continue with the Set-For-Flight portion of the procedure.		

5. LCT Compression Procedure

This procedure shall be followed if LCTs **ARE** installed on the Lightband.

This procedure assumes the use of the materials shown in Figure 3-1. Consult PSC before substituting any tools.

This procedure is to be performed only by individuals who have been formally trained on the use of LCTs by a PSC engineer. Contact PSC to setup training.

Step	Procedure	Technician Date & Initials	QA Date & Initials
Lightband Compression and Stow			
1.1	<p>Ensure the SN on the Upper Ring corresponds to the SN on the Lower Ring. Record all MLB info on the cover page.</p> <p>(This can be found on both the Upper and Lower Rings, typically adjacent to the Motor Bracket Assembly.)</p>		
1.2	Complete the stowing procedure of PSC Document 2000781 up to the point where force is applied to compress the Lightband.		
1.3	<p>If not already performed, bring the Upper and Lower Rings together and verify alignment via the following:</p> <ol style="list-style-type: none"> 1. Cutout in the Upper Ring lines up over the Motor Bracket on the Lower Ring. 2. ALL Separation Connector/Switch cutouts align. 3. ALL Separation Spring tips protrude through appropriate holes in the Upper Ring. 		
1.4	Place one cable tie around each LCT Pair and pull until hand-tight. Do not allow the Lightband to compress yet.		
1.5	If applicable, disable the cut-off feature of the Cable Tie Tool.		
1.6	<p>Ensure that the force setting on the Cable Tie Tool does not exceed the tensile strength of the cable ties.</p> <p>If using the PSC-recommended hardware, the Ty-Rap Erg 50 Cable Tie Tool should be set at "8."</p>		
1.7	<p>Measure the distance between Upper and Lower Ring flanges next to each LCT. Ensure distance between flanges is uniform to within 0.020 inches at each location. It is often helpful to record measurements in a table as it may require multiple measurement iterations; see Section 6. Use the minimum measured distance as a reference and tighten the remaining cable ties with the Cable Tie Tool until all are within 0.020 inches of the minimum.</p> <p>Note: Failure to evenly compress Lightband increases chance of breaking cable ties.</p>		
1.8	Tighten the cable tie nearest to the Motor Bracket using the Cable Tie Tool by 5 to 6 notches of the cable tie or until the safety mechanism of the Cable Tie Tool releases the cable tie. Do this for all cable ties, working in a circle. Stop once all cable ties have been tightened once.		
1.9	Measure the distance between Upper and Lower Ring flanges next to each LCT. Ensure distance between flanges is uniform to within 0.020 inches at each location. Use the minimum measured distance as a reference and tighten the remaining cable ties with the Cable Tie Tool until all are within 0.020 inches of the minimum. If the distance between the flanges is IAW the stowing procedure directed in PSC Document 2000781 proceed to step 2.8, otherwise repeat steps 2.5 through 2.7 always working around the Lightband in the same direction.		

	Note: If a cable tie is over tightened or broken, remove cable tie from LCT, place new cable tie around LCT and follow steps 2.5 – 2.7 until the distance between the Upper and Lower Ring flange is uniform within 0.020 inches.		
1.10	Stow the Lightband IAW with PSC Document 2000781 within 10 minutes of final flange distance measurement as cable ties will creep if kept under stress. If more than 10 minutes pass before stowing, re-verify that the distance between flanges is IAW the requirement defined in PSC Document 2000781 before stowing.		
Post-Stow			
2.1	Remove the cable ties by cutting or manually sliding each one outward over the bearings.		
2.2	Return to the PSC Document 2000781 and continue with the Set-For-Flight portion of the procedure.		

6. Reference LCT Measurement Table Template

The following table template shall be used as a reference when gradually compressing the cable ties on the LCTs and measuring the distance between flanges at corresponding locations. The table may have to be expanded depending on actual quantity of LCTs installed.

Measurement No.	Distance Between Upper and Lower Ring Flanges [in]								
	LCT 1	LCT 2	LCT 3	LCT 4	LCT 5	LCT 6	LCT 7	LCT 8	...
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
...									