



Document Title	Evolution Nose Gear Actuator Attachment Modification
Document Number	SB 016-0009
Date	October 14, 2011

Subject: Nose Gear Actuator Attachment Modification

Affected Aircraft: Lancair Evolution Aircraft Serial Numbers: EVO-001 - EVO-0035

Status: Mandatory Service Bulletin for all Lancair Evolution aircraft

Importance: High

Background: A service issue with Evolution nose gear installations has occurred on some Lancair Evolution aircraft. In these instances, the firewalls have exhibited delamination and some fracture type failures in proximity to the attachment of the nose gear actuator to the firewall.

Lancair has conducted engineering analysis and testing that has led to the conclusion that a tension member should be installed in the landing gear assembly to redistribute the nose wheel loads to the airframe. This affects all kits and aircraft with or without evidence of failure.

This design change is completely documented in this service bulletin. This change will not be noted in the latest revision to the Evolution Build Manual as the firewall will be revised to integrate the characteristics of this design modification.

Action: Disassemble the aircraft to expose the firewall in the area of the nose gear attachment, both from the inside and outside of the aircraft. Follow the service instructions contained in Engineering Work Order 2011-0004 to repair any damage to the composite structure and to complete the tension link installation. Each instruction step must be completed as described.

Call Lancair Customer Service at (866) 659-2376 to schedule your materials kit delivery and/or if you need assistance in performing this modification.


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Author:	J. Ruhl				Structures:		PC:		Q.A.		

Table 1: parts and Materials

<i>Material</i>	<i>Part Number</i>	<i>Quantity</i>
Nose Gear Tension Strap	207-0006-	1
Nose Gear Tension Strap Doubler Plate	208-0009-	1
Aluminum Angle Bracket	209-0153-	1
Carbon Laminate Firewall Doubler	284-0261-	1
Tension Strap Aluminum Spacers	112-0092-	2
Hysol EA 9394 Adhesive (50 gram EZ pack)	EA9394	2
1/8 inch diameter Rivets	AN470AD4-10	23
7/16 - 20 Bolt	AN7-33A	1
1/4 – 28 Bolts	AN4-12A	6
1/4 -28 Nuts	AN363-428	2
1/4 inch inside diameter Washer	AN970-4	6
7/16 inch inside diameter Washer	AN960-716	2
Alodine or equivalent aluminum corrosion protection	N/A	As Required
Acetone	N/A	As Required
80-Grit sand-paper	N/A	As Required




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Table 2: Inspection Requirements


Oper.	Description	Hrs.	Date	Oper	Insp
010	<p>As necessary for inspection of the outer face sheet area shown in the picture below, remove the nose gear actuator lug and firewall blanket, then visually inspect and tap test the laminate structure of all faces adjacent to this corner looking for any damage from heavy nose gear landing loads.</p>  <p>Note: It is possible that damage sites may be present several inches in any direction from this corner.</p>				

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020

As necessary for inspection of the inner face sheet area shown in the picture below, remove the interior, equipment and furnishings, then visually inspect and tap test the laminate structure of all faces adjacent to this corner looking for any damage from heavy nose gear landing loads.



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030	If no laminate damage is discovered, install the nose landing gear tension strap using the procedure defined in Table 4. Then reinstall the firewall blanket, interior, furnishings, and equipment.				
040	If laminate damage is discovered, it is necessary to conduct the composite repair defined in Table 3. Afterwards, install the nose landing gear tension strap using the procedure defined in Table 4. Lastly, reinstall the firewall blanket, interior, furnishings, and equipment.				



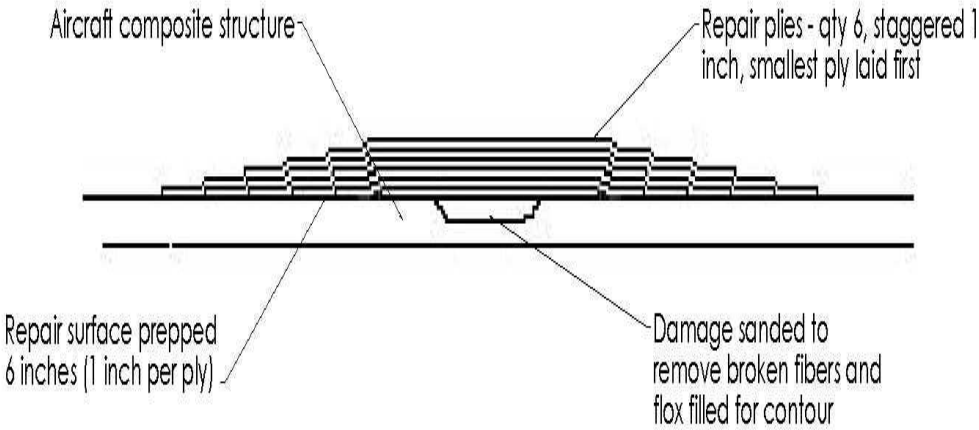

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Table 3: Composite Repair Requirements


Oper.	Description	Hrs.	Date	Oper	Insp
010	If there is damage to the inner surface of the composite firewall structure, continue with the repair below, or else continue at step 120.				
020	On the outer surface of the composite firewall structure, temporarily bond bracing to retain the contour of the stock firewall and achieve dimensional stability while the plies of the inner surface are repaired. For example use paint sticks temporarily bonded using Hysol to the outer surface extending beyond the repair area.				
030	On the inside surface of the firewall structure, clearly mark the extents of the damaged laminate structure.				
040	Sand all damaged plies away using a die-grinder with 80-grit sand paper.				
050	If there is exposed and/or core damage, remove the visible core through to the inner surface of the outer face sheet using a pencil grinder and additionally decore two core cells around the perimeter of the core damage between the face sheets.				
060	Paste fill any "de-cored" area with a mixture of epoxy resin and cotton floc and once cured sand to create a smooth and level repair surface.				
070	<p>Surface prep a minimum of 6.0** inches out from all edges of the repair area where the original laminate is fully intact. Surface prep by abrading the surface to which the repair plies will be bonded with 80-grit sandpaper, followed by a thorough cleaning with Acetone.</p> <p>Note:</p> <p>Great care must be taken during this step to avoid sanding through any of the fibers on the laminate surface.</p> <p>**Surface prep an area big enough to successfully complete the 6 ply repair with a minimum over lap of 1 inch per ply. For example if you stagger to accomplish the minimum of 1 inch per ply and actually stagger 1.25 inches per ply, the area to prep would be 7.5 inches.</p> <p>The damaged plies will be replaced with 150% of the</p>				

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	<p>constituent laminate. The inner face sheet of the firewall is constructed of the following ply-schedule: 45/0/0/45</p> <p>The damaged plies will be replaced with the following ply-schedule: 0/45/0/0/45/0</p>				
080	<p>Apply the smallest repair ply, which will be oriented at 0 degrees with respect to the plane of the horizon with the aircraft leveled, extending a minimum of 1.0 inch beyond the repair area in all directions.</p> <p>Note: The resulting repair will look similar to the figure shown below.</p> 				
90	<p>Apply the following five plies, extending a minimum of 1.0 inch per ply beyond the previous repair ply in the following orientation: 45/0/0/45/0.</p> <p>Application of peel-ply over the repair plies is optional.</p>				
100	Cure the repair as specified by the resin manufacturer's specification				
110	Once the inner face sheet repair plies are fully cured, the bracing applied in step 010 of Table 3 can be removed.				
120	On the outside surface of the firewall structure, clearly mark the extents of the damaged laminate structure. If there is no damage the composite repair is complete.				

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130	On the inner surface of the composite firewall structure, temporarily bond bracing, if needed, to retain the contour of the stock firewall and achieve dimensional stability while the plies of the outer surface are repaired.				
140	Sand all damaged plies away using a die-grinder with 80-grit sand paper.				
150	If there is exposed and/or core damage, remove the visible core through to the inner surface of the outer face sheet using a pencil grinder and additionally decore two core cells around the perimeter of the core damage between the face sheets.				
160	Paste fill any "de-cored" area with a mixture of epoxy resin and cotton flox and once cured sand to create a smooth and level repair surface.				
170	<p>Surface prep a minimum of 6.0** inches out from all edges of the repair area where the original laminate is fully intact. Surface prep by abrading the surface to which the repair plies will be bonded with 80-grit sandpaper, followed by a thorough cleaning with Acetone.</p> <p>Note:</p> <p>Great care must be taken during this step to avoid sanding through any of the fibers on the laminate surface.</p> <p>**Surface prep an area big enough to successfully complete the 6 ply repair with a minimum over lap of 1 inch per ply. For example if you stagger to accomplish the minimum of 1 inch per ply and actually stagger 1.25 inches per ply, the area to prep would be 7.5 inches.</p> <p>The damaged plies will be replaced with 150% of the constituent laminate. The inner face sheet of the firewall is constructed of the following ply-schedule: 45/0/0/45</p> <p>The damaged plies will be replaced with the following ply-schedule: 0/45/0/0/45/0.</p>				

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180	<p>Apply the smallest repair ply, which will be oriented at 0 degrees with respect to the plane of the horizon with the aircraft leveled, extending a minimum of 1.0 inch beyond the repair area in all directions.</p> <p>Note: The resulting repair will look similar to the figure on the page 7.</p>				
190	<p>Apply the following five plies, extending a minimum of 1.0 inch per ply beyond the previous repair ply in the following orientation: 45/0/0/45/0</p> <p>Application of peel-ply over the repair plies is optional.</p>				
200	<p>Cure the repair as specified by the resin manufacturer's specification.</p>				


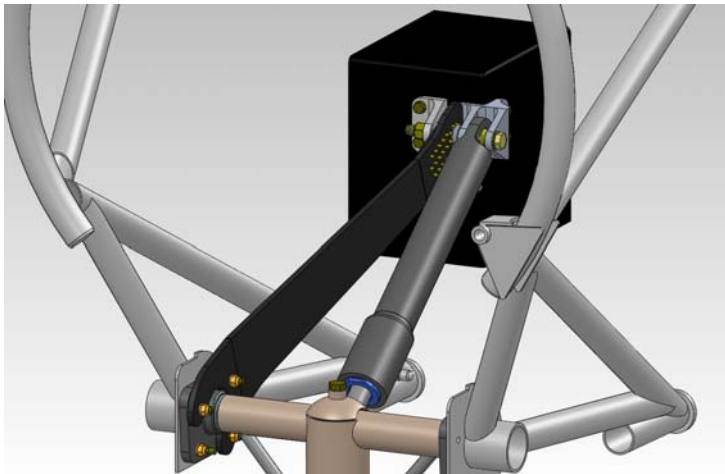

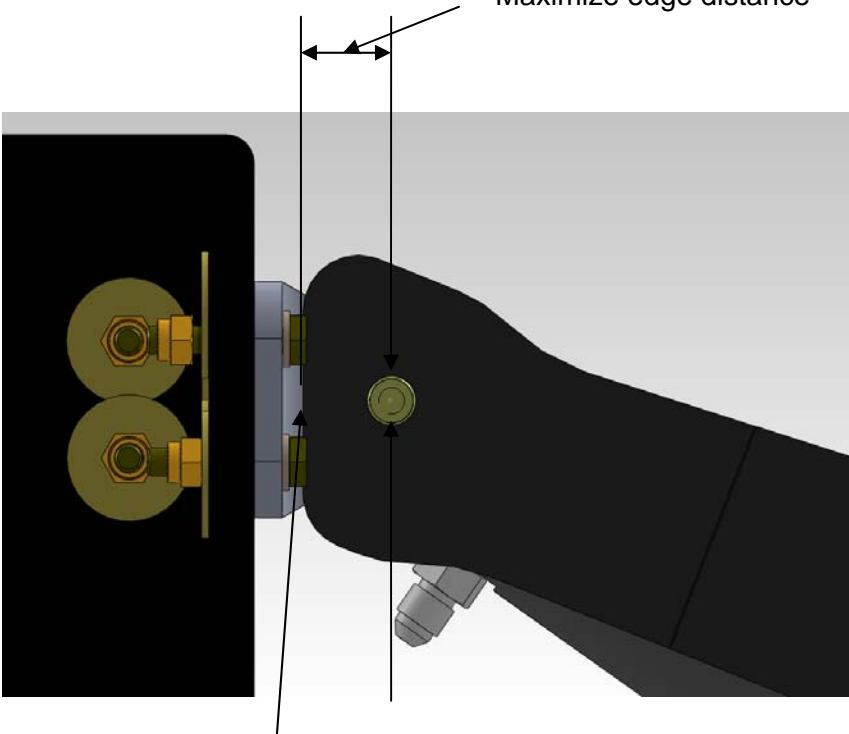

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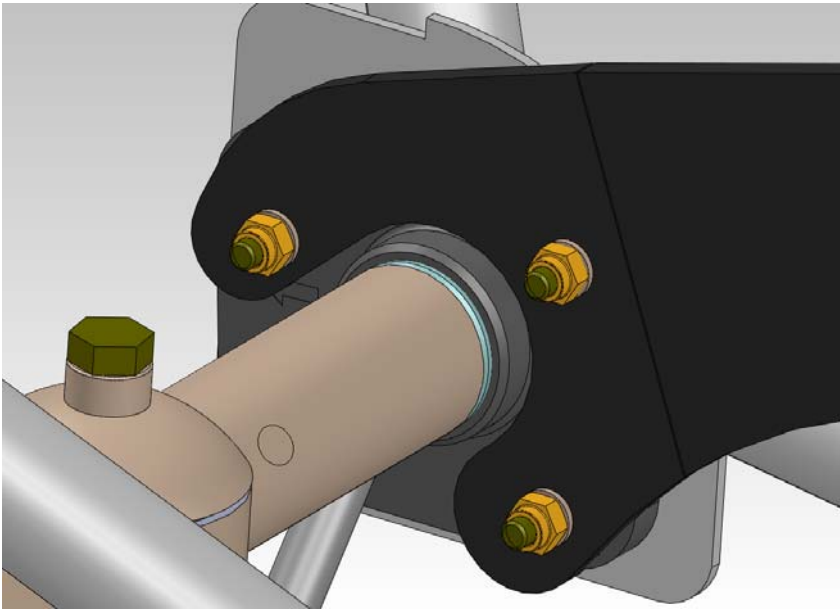
Table 4: Nose Landing Gear Tension Strap Installation


Oper.	Description	Hrs.	Date	Oper	Insp
	<p>The tension strap is to be installed between the hydraulic actuator attach bracket at the firewall and the nose gear pivot at the bearing block, as shown in the illustration below.</p>  <p>It is fastened at the attach bracket using the actuator attachment bolt. It is fastened at the right side bearing block using three of the four bearing block attachment bolts.</p>				
010	Remove the two upper and one lower nose gear trunion attachment block bolts on the right side.				
020	Verify that all installed components are free from interference with the tension strap path. If there is interference, reposition components such that there is no longer interference. In some instances this may mean relocating the fuel flow meter.				
030	Position Lancair P/N 207-0006, tension strap, nose gear, Evolution, so that the semicircular edge of the large open end is concentric with the axis of rotation of the landing gear trunion.				

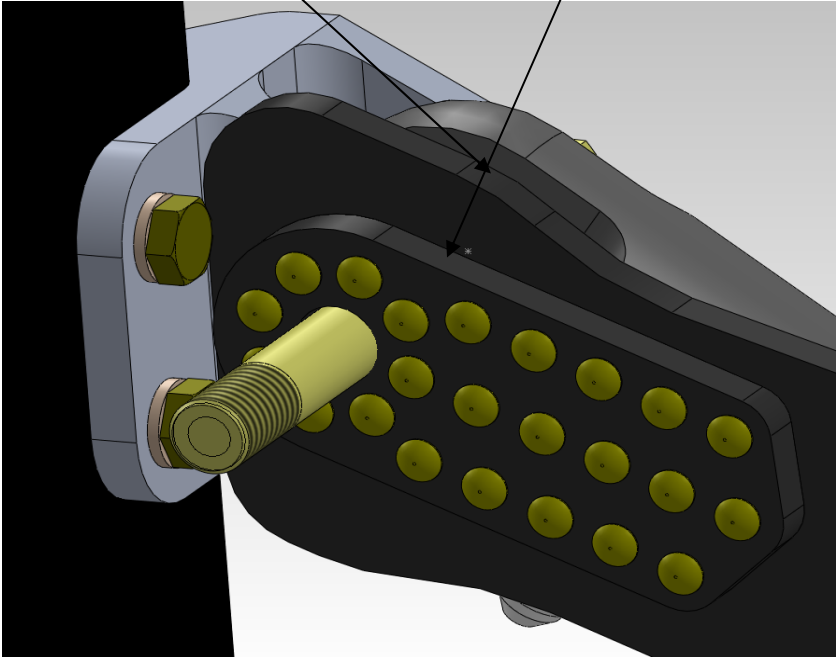
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040	<p>Mark the actuator attachment end of the tension strap for trimming so that the tightest fit and greatest edge-distance from the upper 0.4375 in diameter bolt hole is maintained with the bolt passing through the thin end as close to centered about its width as is practicable, as shown in the illustration below.</p>  <p>Trim line to be marked during this step</p>				
050	<p>Trim the upper end of the tension strap to retain the most material possible around the bolt hole, while eliminating any contact or interference with the actuator attachment bracket, hardware or other components of the installation.</p> <p>Note:</p> <p>Take great care to ensure that the tension strap is trimmed to maintain the most material from the edge of the upper attach hole. Excessive material removal can be avoided by first trimming it undersized, and then removing small amounts of material until the very best fit is achieved with minimal material removal.</p>				

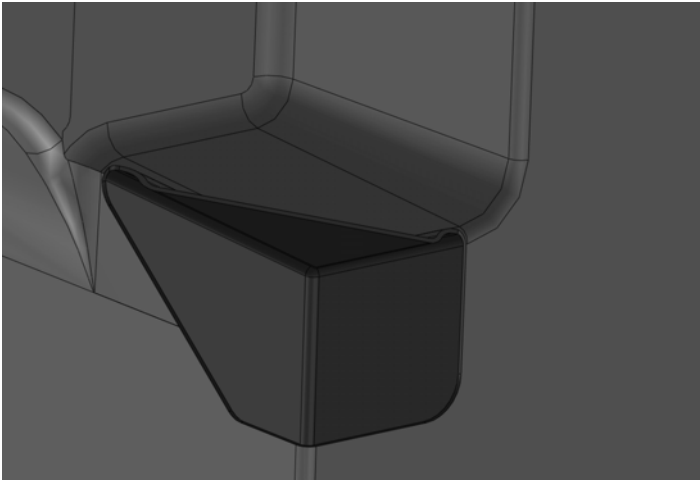
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060	<p>Once fit is established, position the tension strap in the proper orientation for the installed position. Clamp where possible. Match drill the large open end of the tension strap to the two upper and one lower bearing block bolts on the right-side of the nose gear trunion so that the angle of the tension strap positions the small actuator end for best fit. It will be bolted as illustrated below:</p> 				
070	<p>Once the two upper and single lower holes are located, scribe a line between the single bolt hole at the actuator attachment bracket and the pivot center for the trunion.</p>				

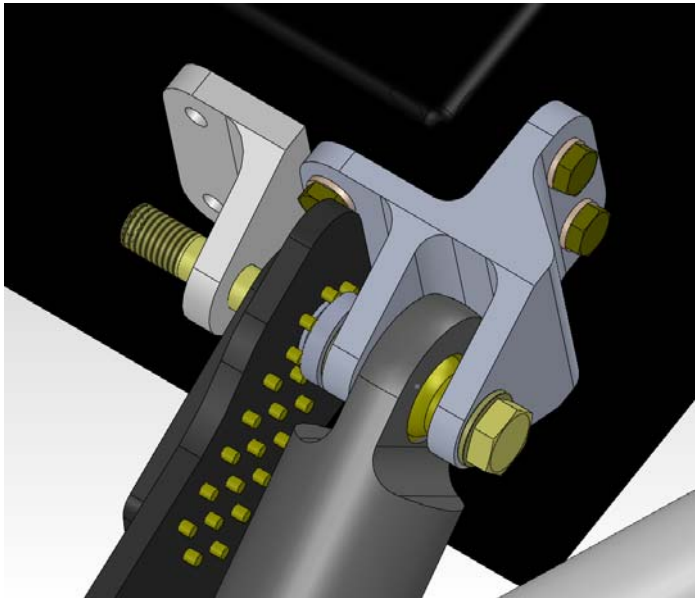
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080	<p>Insert an AN-7 bolt through the upper hole in the tension strap and the doubler plate, 208-0009, so that it can be riveted as shown in the illustration below. Align the center rivet row of the doubler with the line scribed in step 080, and match drill the tension strap to the doubler plate with the doubler located on the outboard face of the tension strap.</p> <p>Tension Strap</p> <p>Doubler</p> 				
090	Using standard aircraft practices, rivet the doubler to the tension strap using the 23 rivets provided with the tension strap install kit.				

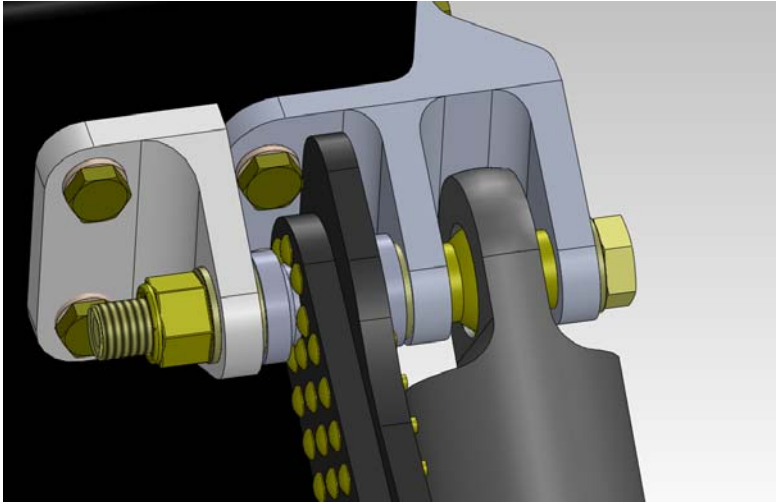
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100	<p>Remove the nose gear actuator attach bracket from the firewall and any other furnishings or equipment that will interfere with the installation of the firewall doubler, 284-0261, that is provided with the tension strap installation kit. The doubler is installed on the interior, cabin side of the firewall as shown in the illustration below. It is critical that the forward and inboard faces of the doubler extend a minimum of ½ in beyond the area washers attaching the actuator attachment brackets to the firewall in all directions. The horizontal surface of the doubler is not critical, and can be trimmed away to the edge of the radius if necessary for fitment.</p> 				
110	Using Hysol EA9394 adhesive and standard aircraft composite structural bonding procedures, bond the carbon gusset to the right side corner where the firewall actuator bracket is bolted.				
120	<p>Once cured, match drill the bracket bolt holes through the gusset using the existing holes as guides then replace the firewall actuator bracket.</p> <p>Note: If there is interference with the bolt shanks in the corner, two of the bolts can be inserted through the holes with the head on the inner surface of the firewall.</p>				

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130	<p>Using the long AN-7 bolt that was included in the tension strap installation kit, align the aluminum angle bracket, 209-0153, so that the base is seated against the firewall surface with the base plate oriented in the outboard direction as shown in the illustration below:</p>  <p>Note: Shims may be required to maintain alignment beneath the base of 209-0153- "Aluminum Angle Bracket.</p>				
140	<p>Once the angle bracket is positioned properly, match drill the two ¼ inch bolt holes through the laminate firewall and gusset structures.</p> <p>Note: Typically the hard point extends in the outboard direction beyond the foot-print of 209-0159. In the case that it does not, it will be necessary to decoke this area and fill with a mixture of 1304 resin and cotton flock.</p>				
150	<p>Install the angle bracket to the firewall using the AN-4 bolts and hardware provided in the kit. Use the area washers on the inner surface of the gusset, and take great care not to over-torque the bolts, as this could crush core and damage the firewall laminate structure.</p>				

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160	Using standard aircraft methods, apply corrosion protection at all cut-edges of all aluminum parts prior to final installation on the aircraft.				
170	Install the tension strap and insert the long AN-7 bolt through the inboard lug, the firewall end of the actuator, the second lug, one supplied aluminum spacer, the tension strap and doubler, the second supplied aluminum spacer, 112-0092, and the outboard lug of the angle bracket. Use washers to fill any extra width between the lugs and beneath the bolt and nut heads.				
180	Use the existing nut and washers to complete the installation of the firewall end of the tension strap.				
190	<p>The existing ¼ inch bolts used to install the trunion bearing blocks will need to be replaced with ¼ inch longer bolts to reach through the engine mount bearing block attach plate, the bearing block, and tension strap. These bolts are supplied with the modification kit.</p> <p>The typical firewall end of the tension strap installation should appear as shown in the illustration below:</p> 				
200	Thoroughly inspect all work, and contact Customer Service at Lancair if there are any matters requiring clarification for this installation.				