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# Rolls-Royce

## P U B L I C A T I O N                      T R A N S M I T T A L

July 8, 2019

TO:                      Recipients of M250-C18, -C20, -C28, -C30, -C20R, -B15G, -B17, -B17F, -C40B, and -C47 Commercial Service Letters

SUBJECT:    MAINTENANCE WARNING - EXTERNAL LINES

This letter transmits Revision 2 to the subject commercial service letters:

<u>Model</u>	<u>Letter Number</u>
M250-C18 Series	CSL A-169
M250-C20 Series	CSL A-1166
M250-C28 Series	CSL A-2113
M250-C30 Series	CSL A-3117
M250-C20R Series	CSL A-4036
M250-B15G	TPCSL A-101
M250-B17 Series	TPCSL A-1121
M250-B17F Series	TPCSL A-2019
M250-C40B	CSL A-5153
M250-C47 Series	CSL A-6162

This is a complete revision. Replace the Revision 1 issue with this Revision 2.

Revision 2 makes editorial changes to the recommendations.

The following list includes the original issue date and current revision to this letter:

Original issue	November 15, 1990
Revision 1	February 5, 2007
Revision 2	July 8, 2019

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## MAINTENANCE WARNING - EXTERNAL LINES

1. Background

Rolls-Royce continues to be involved in investigations of aircraft accidents and incidents which are attributed to improper alignment, clamping, and torquing of engine tubing during installation. Instances of twisted lines, kinked lines, and split flares have resulted from installation practices contrary to those specified in the Operation and Maintenance Manual. Compliance with the manual procedures is critical to safety of flight. In most cases, the failure of the tube assemblies can be traced to one or any combination of the following causes:

- A. Bent tubes which induce misalignment at the flare and result in cracked flares or fretting of the tube at the end of the ferrule.
- B. Tube to fitting misalignment caused by poorly aligned fittings, which result in cracked flares or fretting of the tube at the end of the ferrule.
- C. Clamps of the improper size that cause fretting wear and failure at the clamp due to stress concentration at the wear step.
- D. Incorrect clamps with cushion material that causes corrosion and eventual stress corrosion failure of the tube.
- E. Installation of chafe wrapping to correct a loose clamp. This chafe wrapping then causes corrosion and eventual stress corrosion failure of the tube.
- F. Incorrect clamp locations that do not properly dampen tube vibrations. The vibrations then lead to fatigue failure of the tube.
- G. Unauthorized clamping of other hardware to the engine tube assemblies, which induce vibratory stress that results in the tube failure.
- H. Failure to properly torque tube coupling nuts can cause leakage if under torqued, which can result in fuel or oil leaks or engine power loss. Overtorqued B-nuts result in deformed and cracked flares.

Example 1

The tube assembly P/N 6890581 failed forcing the aircraft to make a hard landing. Photographs were taken of the tube assembly and are depicted in Figures 1-3. The following discrepancies were noted during the examination of the tube:

- A. The tube is bent in an area that is not a principal bend, a region that should be straight. See Figure 1.
- B. Severe fretting was found under the ferrule sleeve caused by misalignment of the tube to fitting joint. See Figure 2.
- C. The flared tube was found cracked 270° circumferentially in the area of ferrule fretting. The crack and fretting were likely caused by misalignment of the tube to fitting joint. See Figure 3.

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Example 2

P/N 23033896 tube assembly was removed from a Model C20R Series engine. Photographs were taken of the deformations in the tube assembly and are indicated in Figure 4. The following discrepancies were noted during the examination of the tube assembly:

- A. The deformations were caused by attempting to use Model C20R Series single engine designated clamping on a multi-engine configuration tube.
- B. The previously mentioned clamp hid the large dent. Only removal of the tube assembly allowed discovery of the extent of damage to the tube.

2. Recommendations

In the interest of flight safety, Rolls-Royce recommends the following maintenance practices when handling any pneumatic control system, lubrication system, or fuel system tube assemblies on the Model 250 engine.

- A. Use only genuine Rolls-Royce tube assemblies of the correct part number.
- B. Consult the appropriate engine Operation and Maintenance Manual for tube to fitting alignment procedures, correct torque values, and installation/tightening recommendations.
- C. Always use a torque reaction wrench when tightening tube assembly B-nuts.
- D. Tube assemblies must fit and be aligned with the mating flare tube fittings to the degree that at both ends of the assembly, the flares shall be uniformly seated in a free state on the cones of the mating fittings. The fitting shall be without distortions or stretching of the tube assembly, and to the degree that the nuts can be fully engaged up to the final one-half turn with light finger pressure. See Figures 5 and 6.
- E. In the event that a tube does not align with the mating fittings, re-position the mating fittings to the degree that proper alignment may be attained. Final tightening of these fitting lock nuts must be accomplished before the tube assembly is torqued.

**CAUTION:** THE PRACTICE OF TIGHTENING FITTING LOCK NUTS WITH TUBE ASSEMBLIES INSTALLED CAN RESULT IN DAMAGE TO THE TUBE, WITH POSSIBLE FAILURE OF THE TUBE AND ENGINE.

- F. If proper alignment cannot be attained by re-positioning the mating flare tube fittings, bend the tube to provide alignment in the free state as specified. Accomplish all bending with the tube removed from the engine. Adjustment of the fit may be accomplished by bending by hand at principal bends.

**WARNING:** TO PREVENT FLATTENING OF TUBE AT THE BEND RADIUS, EXTREME CAUTION MUST BE OBSERVED WHILE HAND BENDING PREVIOUSLY FORMED TUBES.

- G. In the event that the tube cannot be bent by hand, the tube must be clamped in a fixture or device which will not scratch, indent, crimp or mark the surface of the tube during the bending operation. The flattened effect of the cross section of the tube, as a result of the reforming operation, must not exceed fifteen percent of the tube OD.
- H. When proper free-state alignment is attained, complete the tubing installation by simultaneously securing the coupling nuts.
- I. After properly torquing the B-nut, a slippage mark of a contrasting color shall be applied by a continuous stripe approximately 0.0625 in. (1.588 mm) wide, minimum, that extends down the side of the B-nut and onto the fitting.
- J. The B-nuts shall be inspected for indications of slippage at regular 100 hour maintenance intervals.
- K. Old slippage marks (torque paint) must be completely removed and renewed each time the B-nut is retorqued. Reference applicable Operations and Maintenance Manual for proper removal procedures and slippage mark remover solvent.

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- L. Clamp the tube assemblies as shown in the appropriate Illustrated Parts Catalogs and/or Commercial Engine Bulletins.
- M. Do not install unauthorized clamps, hardware, fittings, chafe material, etc., on the engine tube assemblies. See Figure 7 for a correct cushion material example.
- N. Visually inspect tube assemblies before each installation for the following items: cracked flares, nicks, dents, severe fretting in the area of clamps and end ferrules, **corrosion**, bent or malformed tubing, correct part number, and proper clamping. Failure to meet acceptable criteria is cause for rejection of the tube assembly.
- O. Perform detailed visual inspection of the tube assemblies each time the tubes are removed in the completion of maintenance procedures. For example, if the fuel control unit is removed from the engine, all tube assemblies connected to the fuel control unit should be visually inspected.
- P. Assure that the tube to fitting alignment is acceptable per the appropriate Operation and Maintenance Manual. It will be the maintenance facility's responsibility to assure conformance with the proper alignment and torquing of the tubing.
- Q. Maintain installation of warning placards for fuel, oil, and air tubes. Consult the Airframe Manufactures installation instructions for placard installation details. Should replacement placards P/N 23052363 be required, they can be procured from a Rolls-Royce Model 250 distributor. See Figure 8.

3. Summary

Failure of a pneumatic, lubrication, or fuel system tube assembly can cause the engine to cease operation, resulting in an in-flight shutdown or a forced landing. Properly maintained engine tubing will greatly lessen the possibility of an in-flight shutdown or forced landing.

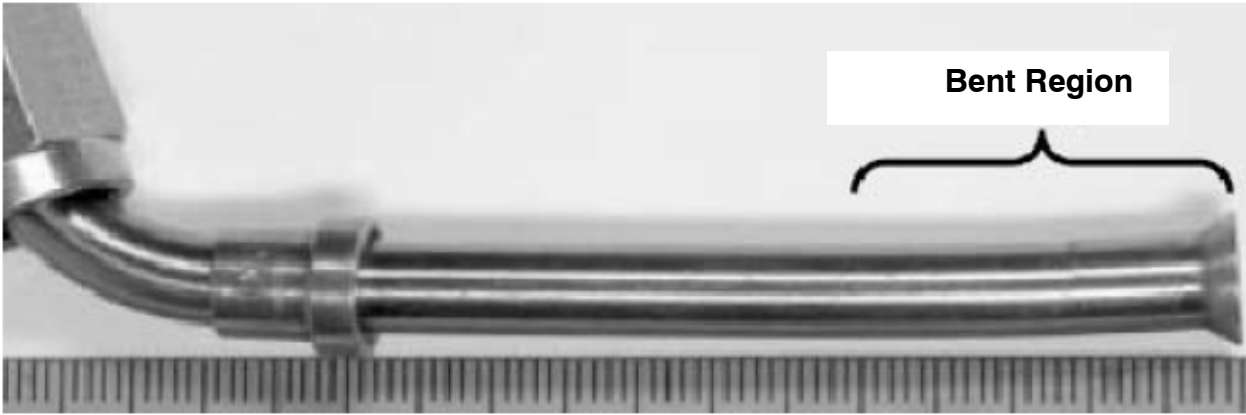
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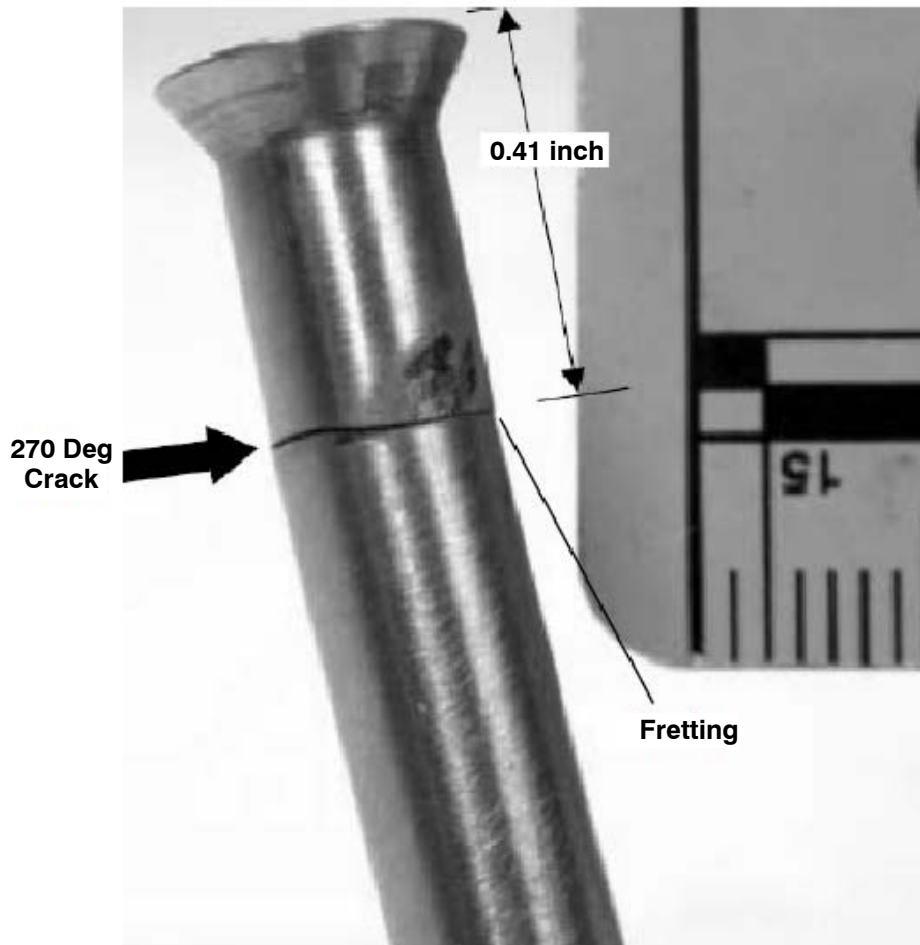
M250-C18 Series	CSL A-169	M250-B15G	TP CSL A-101
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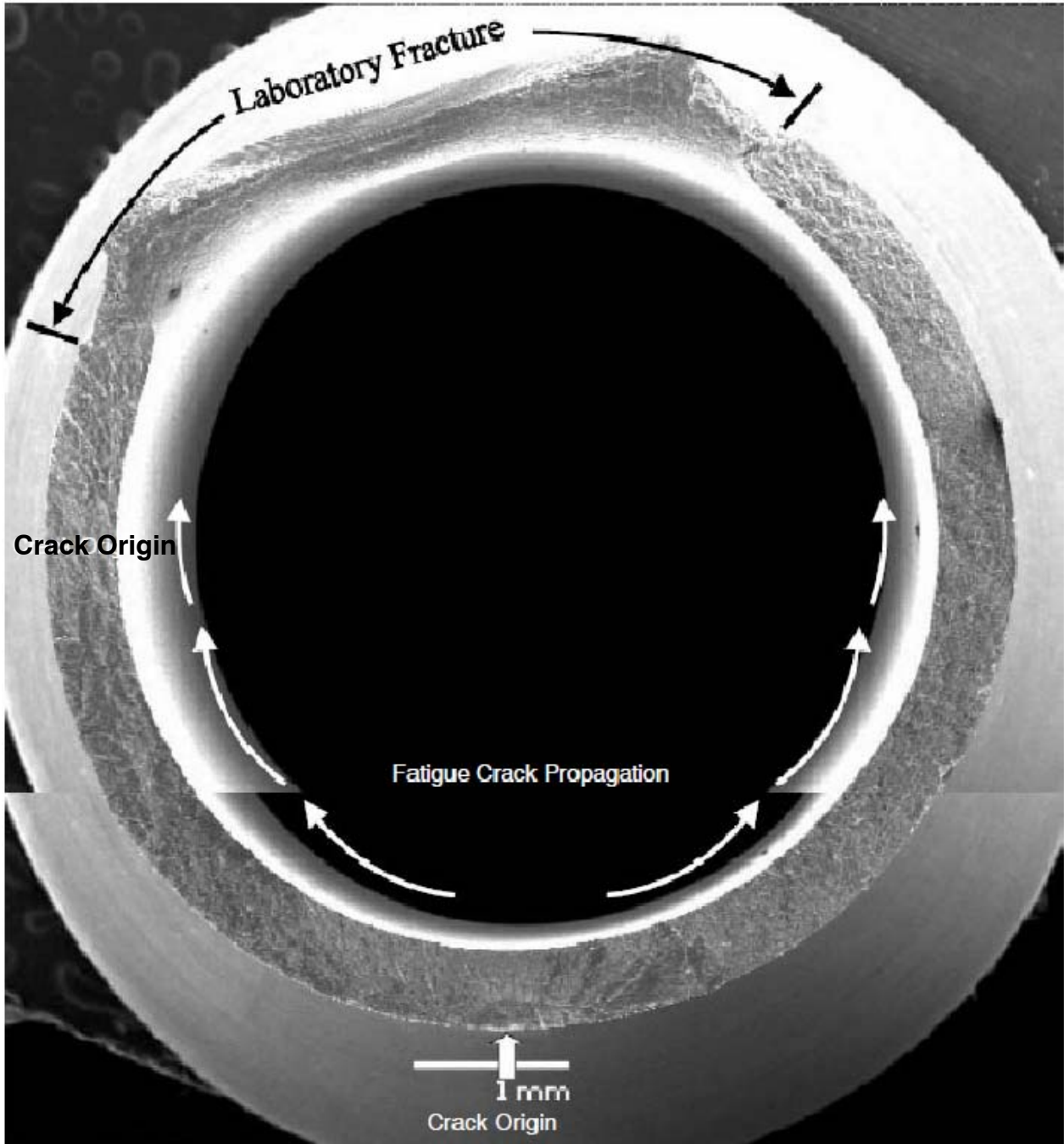


Tube Assembly, P/N 6890581  
 FIG. 1



Tube Assembly, P/N 6890581  
 FIG. 2

November 15, 1990 Revision 2 July 8, 2019	M250-C18 Series	CSL A-169	M250-B15G	TP CSL A-101
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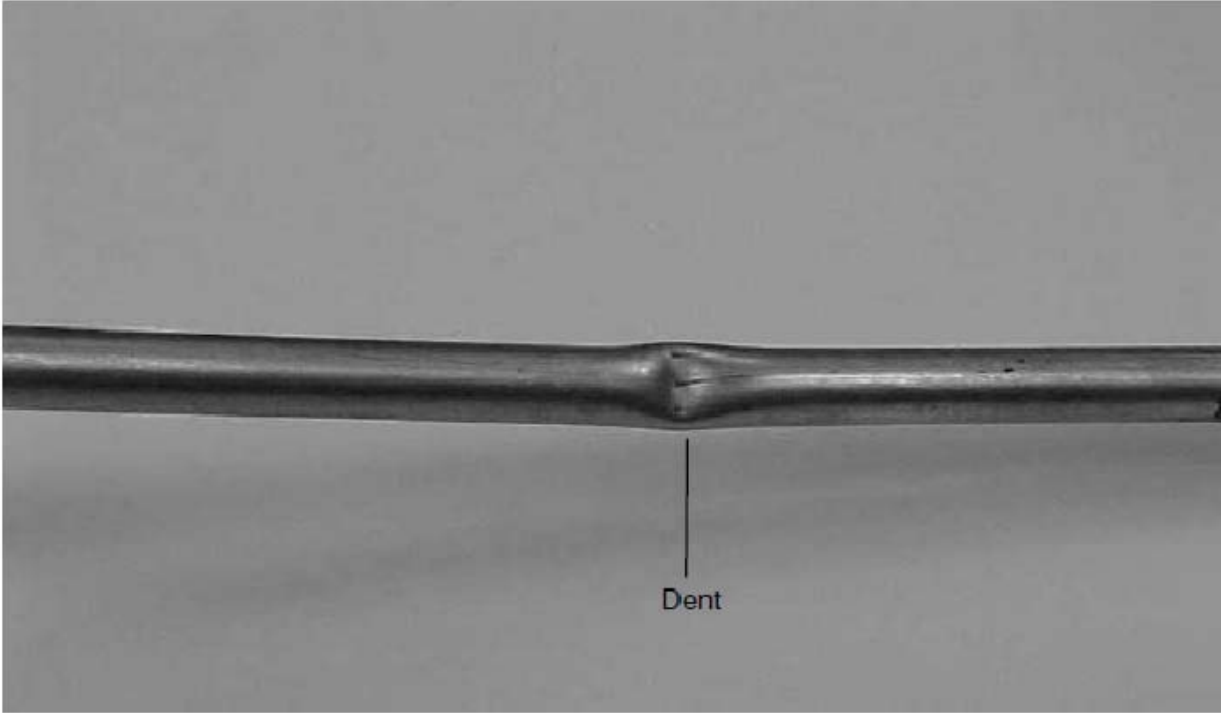
Tube Assembly, P/N 6890581 Surface of Fracture  
FIG. 3

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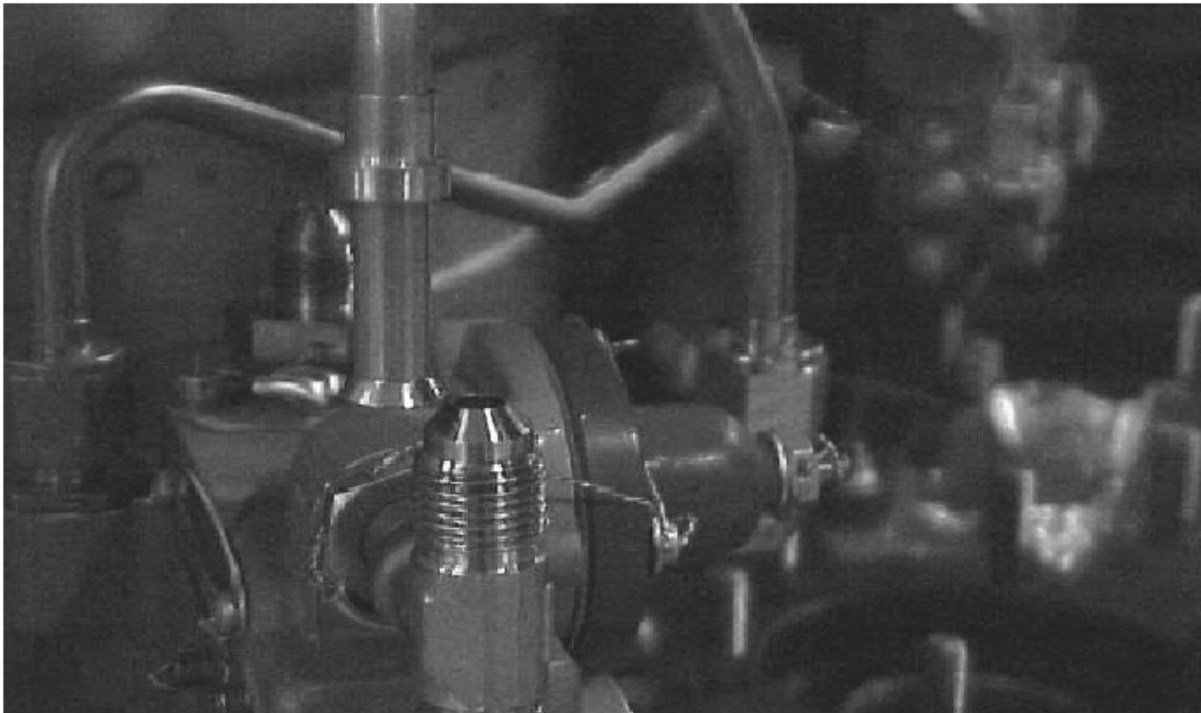
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Tube Assembly, P/N 23033896  
 FIG. 4

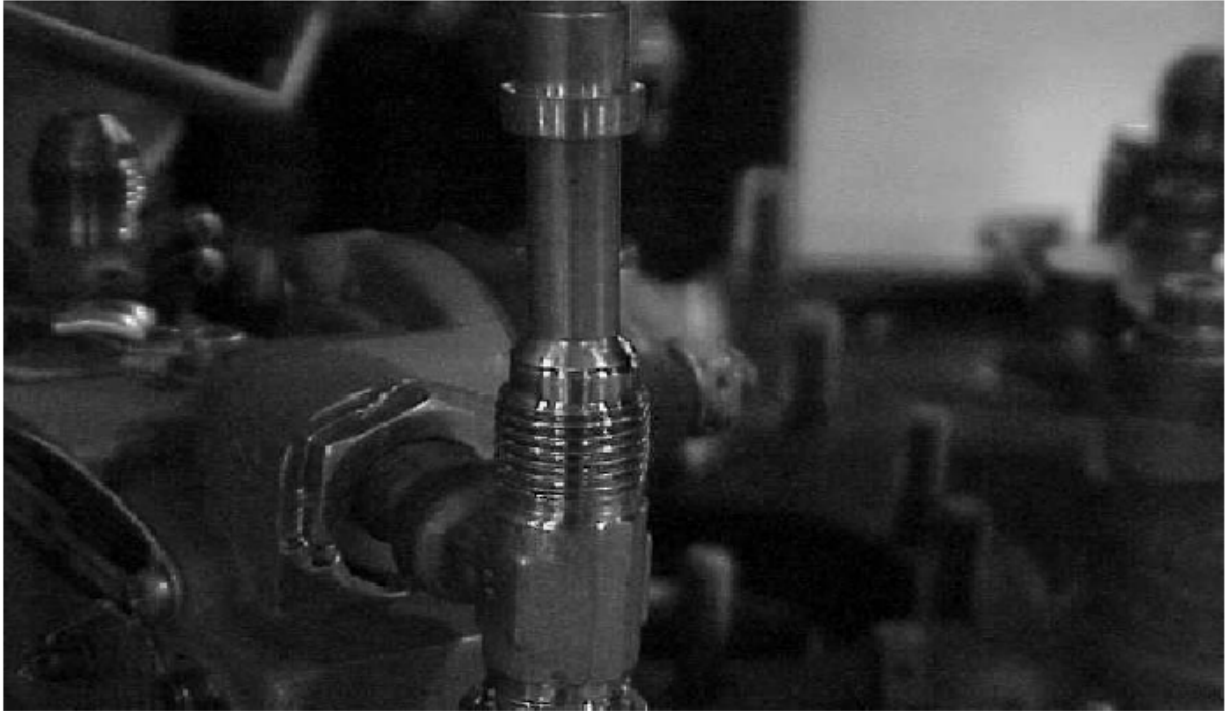


Misaligned Tube  
 FIG. 5

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Properly Aligned Tube  
FIG. 6



Correct Cushion Material  
FIG. 7

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"B" Nut Warning Placard P/N 23052363  
FIG. 8

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M250-C18 Series  
M250-C20 Series  
M250-C28 Series  
M250-C30 Series  
M250-C20R Series

CSL A-169  
CSL A-1166  
CSL A-2113  
CSL A-3117  
CSL A-4036

M250-B15G  
M250-B17 Series  
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CSL A-5153  
CSL A-6162