



**INSTALLATION REQUIREMENTS
AND
INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
for
RAM AIRCRAFT
INDUCTION HOSES & CLAMPS
AND
EXHAUST SYSTEM CLAMPS & SEALS**

Drawing No. 2166

REV. K
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RECORD OF REVISIONS

Rev. No.	Change Description	ECN No.	By	Date
-	Initial release.	3713	S. Johnson	09/16/2002
A	Added RAM 2163-1 reference.	3741	S. Johnson	12/06/2002
B	Added RAM p/n's 2532-1 and 2570-1.	3779	T. Bowden	02/17/2003
C	Added RAM p/n's 2170-1, 2535-200, 2535-250, 2176-200N, 2176-300N, 2570-2, 2164-1, 2164-2, 2164-5, 2164-6, 2164-8, 2164-9	3814	T. Bowden	06/06/2003
D	Added 1125 series induction hoses and 1170 series induction hose clamps. Changed title to reflect addition of induction hoses and clamps. Added Section I, Sheet 8, Sheet 9, and Figure 1.	3819	T. Bowden	06/20/2003
E	Page 6: Section E2: Added note specifying dry-film lube or anti-seize on flange vee. Section E3: Removed the following sentence from note. "Lubricate threads with anti-seize... ..or clean SAE 50-wt oil."	3940	T. Bowden	07/12/2004
F	Added RAM p/n's 2177-100, 2177-150, 2177-200, 2177-250, 2177-300, 2178-225, 2179-200, 2179-225	4097	A. Jain	08/09/2005
G	Changed sentence from "Do not over tighten or allow spring to "bottom-out." to "Do not over tighten, allow clamp ends to touch, or allow spring to "bottom-out"." to CAUTION: on page 7.	4370	J. Pope	05/17/2007
H	Converted the document from Publisher to Microsoft Word. Added recommended torque value for the 2271-200 clamp on page 7.	4598	A. Jain	08/18/2008
J	Section 1.C. & Section 3 (Torque Table) – Added 2172-344 coupling. Section 3I - Clarify spring-loaded clamp as 1170-Series. Revised CAUTION in Section 3.I. to add "or heat shields on the turbocharged Cessna 200 Series." Sections 2, 3.E.(2) & 4.B. - Added caution about fluorine reaction with Inconel exhaust couplings.	4742	S. Espen	9/15/2009
K	Page 7: table removed -5 from second row and added 1170-5 to the ninth row. Section I3 removed "1170 series" from the first sentence.	5085	J. Stuck	11/10/2014



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1. INTRODUCTION

- A. **SCOPE:** Information in this document gives installation instructions, inspection, maintenance, and replacement information for RAM Aircraft FAA-PMA and STC induction system hoses & clamps and exhaust system band clamps, V-couplings, and seals. This information should be used in conjunction with the applicable basic Aircraft Maintenance/Service Manual.
- B. **PURPOSE:** This document is intended to satisfy the requirements of 14 CFR Part 23, Section 23.1529, Instructions for Continued Airworthiness, for RAM induction system hoses & clamps and exhaust system band clamps, V-couplings, and seals.
- C. **APPLICABILITY:** This document applies to the following RAM part number series:
Band Clamps 2265, 2266, 2267, 2268, 2270; Stamped clamp halves 2164; Multi-segment V-band couplings 2170, 2172, 2177, 2178, 2179, 2271, 2532; Exhaust gasket seals 2176, 2535, 2570; One-piece V-retainer couplings 2272, 2163-1, 2274; Induction hose 1125; and spring-loaded induction hose clamps 1170.
- D. **UPDATES:** Document updates will be made available upon request. Complete copies of Drawing 2166 can be obtained by contacting RAM's Customer Service Department.
- E. **CONTACT:** For copies of Drawing 2166, revisions, additional information, service difficulties, or replacement parts, contact RAM Aircraft, Limited Partnership at:

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2. DESCRIPTION

RAM Aircraft parts listed herein are FAA-PMA direct replacements for the specified PHA part and several are used in RAM Aircraft STC applications. Part eligibility is listed on the tag attached to the part and is available on the FAA approved PMA Supplement (on file at RAM Aircraft) or applicable STC Parts Manual Supplement.

RAM Aircraft band clamps and multi-segment V-band couplings are made of aircraft quality stainless steel, similar to the PAH part. RAM 2163-1 and 2274 one-piece V-retainer couplings are Inconel with stainless steel hardware, which is ideally suited for use in turbocharged aircraft exhaust systems. (**NOTE:** See Sections 3.E.(2) and 4.B. for precautions about exhaust couplings). RAM induction system hoses are made of composite silicone rubber impregnated fiberglass lay-up which is resistant to extreme heat. The spring-loaded induction hose clamps are made from high quality 300 series stainless steel.



RAM PMA clamps, hoses, and seals function the same as and are interchangeable with the OEM clamps. Therefore, inspection and installation instructions from the applicable aircraft service manual shall apply to RAM PMA clamps. Refer to the appropriate STC installation and service instructions, if applicable. The installation instructions and service information presented in this drawing are intended to compliment the aircraft service manual.

Please note that several RAM exhaust system clamps are subject to inspection and replacement requirements specified by FAA Airworthiness Directive (AD) 2000-01-16. A copy of AD 2000-01-16 is available from RAM Aircraft or the FAA and can be downloaded from the FAA website. The requirements of AD 2000-01-16 must be followed when using RAM Aircraft replacement parts.

Also, please note that clamps, hoses, and seals certified to replace TCM engine parts are subject to mandatory replacement at the time of engine overhaul as specified by TCM service bulletin SB97-6. Likewise, induction hoses and v-band couplings certified to replace Lycoming engine parts are subject to mandatory replacement at the time of engine overhaul as specified by Lycoming service bulletin SB240-S.

3. INSTALLATION INSTRUCTIONS

The installation instructions provided below for RAM Aircraft induction hoses, band clamps, gasket seals, and V-couplings are general recommended practices for clamp installation. These instructions are based on procedures outlined in SAE Aerospace Information Report AIR869, "V-Couplings, Application of" (SAE, Inc., Warrendale, PA, 1992). Aircraft specific installation instructions for each clamp are found in the applicable aircraft service manual. In addition, nut tightening torque values are specified in the applicable aircraft service manual.

A. Prior to installation, examine clamp or coupling for defects.

- (1) Band or V-retainer is free of kinks or permanent twist. V-band free from crowning or bending over the apex of retainer from over-torque.
- (2) Spot welds per MIL-W-6858 class B or AMS-W-6858 class B or class A for critical applications.
- (3) No evidence of permanent deformation, such as an overspread V-angle (no more than 4° over specified angle permitted).
- (4) Inside radii free from tool marks or cracks.
- (5) Bolts not deformed and have clean, undamaged threads (some clamps have curved T-bolt by design).
- (6) Trunnion and latch parts should move freely and show no evidence of overloading or binding with the strap.
- (7) Use only specified nuts; locknut typically used. Nuts should be clean and free of chips, burrs with no damaged or galled threads.

NOTE: Locknuts have limited number of installations and removal cycles before thread galling and seizure occurs. Locknut and bolt threads should be clean and free of dirt, burrs, and damaged threads. Nuts should be silver plated or dry film lubricated to help prevent thread galling and seizure.



- B. Exhaust (or induction) system component flange should have required finish and should be clean and free from scratches, dirt, or grease. Machined inner corners of flange should be free from cracks or tool marks. Weld between flange and tube should be examined for cracks.
- C. If seals are used in conjunction with V-coupling and joint, make sure seal is clean and unused and is properly oriented with respect to flange upon installation.
- D. Flanges of connecting components must be aligned before installation of V-coupling. To eliminate misalignment, all adjacent support clamps or brackets should remain loose until installation of the V-coupling has been completed. Correct alignment of flanges prior to coupling installation is essential in achieving good joint performance.

CAUTION: V-couplings should NOT be used to pull flanges into alignment.

- E. To install V-couplings,
 - (1) Slip V-coupling over flanged tube end being careful to not overspread band.
 - (2) Install seal, if required, and mate flanges.

NOTE: Some couplings have dry film lubricant on interior surface to aid seating process. If not, lubricate external surfaces of flange vee with anti-seize compound, such as Fel-Pro C-5 high temperature compound (Felt Products Manufacturing Co., Chicago, IL).
Do NOT use anti-seize compounds which contain Teflon®.
 - (3) Place V-coupling on mated flanges and tighten nut.

NOTE: Do not exceed 2 rev/sec (120 rpm) when installing locknut; use hand torque wrench. Excessive nut rotation speed promotes thread galling.
 - (4) Tighten nut to 70% of required torque and check to see that V-coupling has seated over flanges equally around periphery and look between retainer gaps to see that flanges are properly aligned.
 - (5) LIGHTLY TAP around circumference of coupling with plastic or non-metallic hammer in order to distribute clamp tension.
 - (6) Continue to tighten nut to 100% of the required torque.
 - (7) After 100% of specified torque is reached, lightly tap around clamp again and re-torque once more to final value. No additional tightening should be required.

CAUTION: Further tapping and tightening will cause V-coupling retainer to overspread and eventually fail. Use a torque wrench to prevent over-torque.



RAM P/N	Recommended Torque, Maximum, unless Range Specified (inch-pounds)
1170-1, -2, -3,	See Fig. 1
2163-1, 2265 (all)	40
2170-1	120
2172-344	35-40
2177-100, -150, -200, -250	30-40
2177-300	35-45
2178-225	80-90
2179-200 and 2179-225	80-90
2266C050-240-M, 2266C062-262-M; 2267-262, -400, -450; 2268-62-230; 2270C500-SS, 1170-5	Per Applicable Service Manual
2271-200	90-100
2274-20, -30, -40, -50, -60, -70	Per Tag
2532-1	70

NOTE: Torque values specified in applicable aircraft service manual.

- (8) Check V-coupling to be sure no contact exists between V-band strap loops or between V-retainer lugs in bolt/latch area.

F. To install band clamps,

- (1) Place clamp over induction or exhaust system tube.
- (2) Position support bracket, heat shield, flexible duct, or other on tube and slide band clamp into place.
- (3) Torque nut to 100% of required torque (per applicable aircraft service manual).
- (4) Make sure components stay in proper position while securing clamp. In case of support attachments, be sure tightening clamp does not cause system misalignment that will result in undue stress on the system. In case of flexible ducts, make sure band clamps do not inadvertently cut into material.

G. Perform final check of installation: adjust and tighten any supports that were loosened being careful not to introduce bending loads due to misaligned supports.

H. Perform leak check of system. Do not over-torque clamp to prevent leakage. If leak is found, check for incorrect assembly, incorrect torque, or damage to flanges or seal.



- I. To install spring-loaded induction hose clamps (RAM p/n 1170-Series) and induction system hoses, refer to RAM drawing 1171, and:
- (1) If necessary to install hose over flange, it is acceptable to lubricate the inside surfaces of the 1125 series hose with a very light film of Dow-Corning #4 or equivalent.
 - (2) Place clamp over hose and ensure that three latch tabs are visible through three slots in the clamp band.
 - (3) Position the clamp over the induction hose, making sure it is located between the hose end and the beaded area of the flange. Orient the clamp trunion/screw so that it will not rub or interfere with other parts of the structure or the engine.
 - (4) Tighten screw until spring compression length is within the limits shown in figure 1.
 - (5) Visually inspect clamp to ensure proper placement per step I.3.

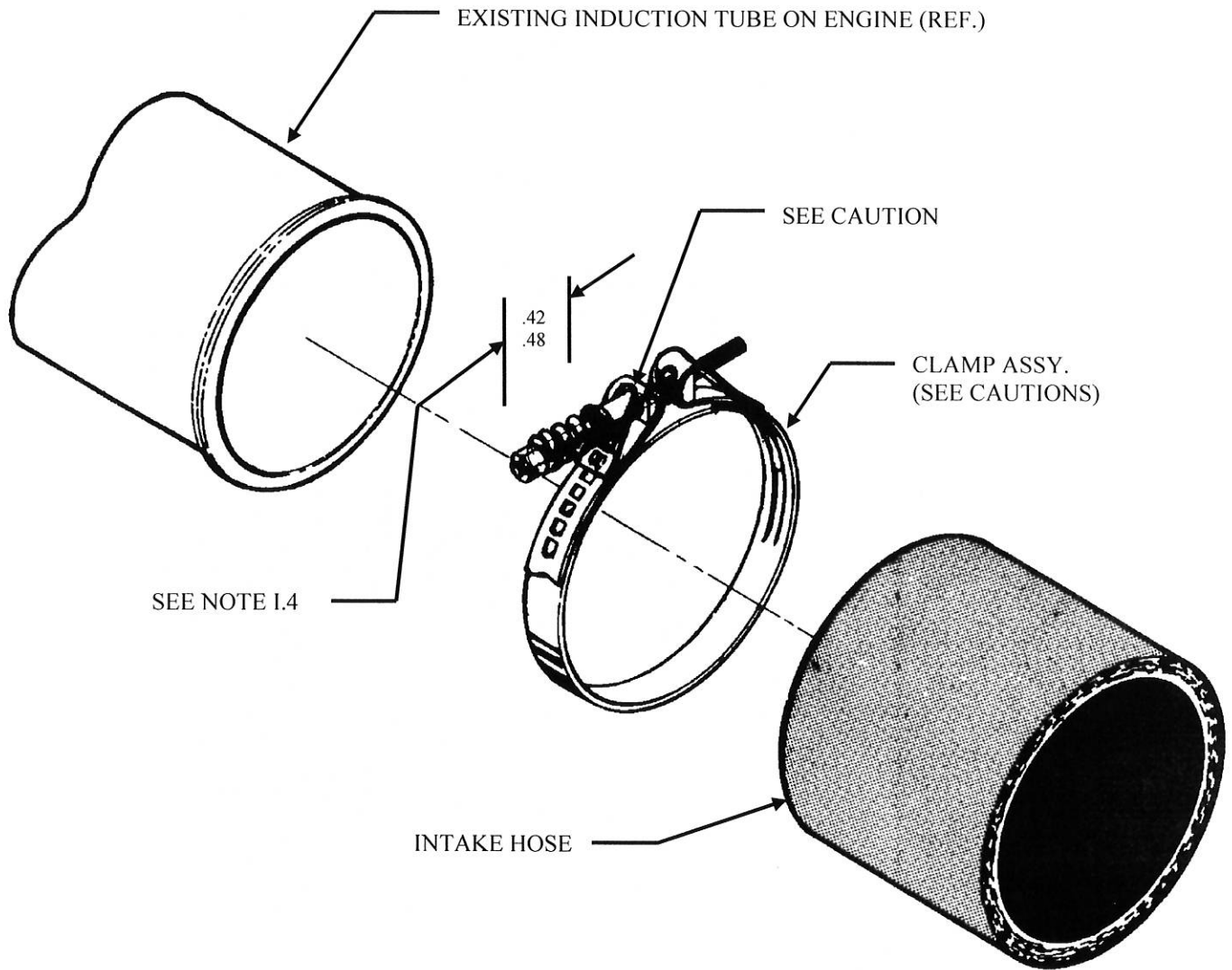
CAUTION: DO NOT over tighten, allow clamp ends to touch, or allow spring to “bottom-out”. This can cause damage or premature failure of the induction hose.

CAUTION: DO NOT use RAM p/n 1170-Series spring-loaded clamps to support propeller governor cable brackets as used on Cessna twin engine aircraft.

DO NOT use RAM p/n 1170-Series spring-loaded clamps to support heat shields on turbocharged Cessna 200 Series aircraft.

Retain original clamps for these applications.

FIGURE 1



INTAKE HOSE & CLAMP INST'L

SEE NOTES, SECTION I
SCALE: NONE



4. MAINTENANCE INSTRUCTIONS

The RAM Aircraft band clamps and V-couplings must be periodically inspected to ensure their continued airworthiness. The inspection interval should follow the applicable aircraft powerplant induction system and exhaust system inspection interval specified in the aircraft service manual. In addition, the requirements of FAA AD 2000-01-16 must be followed for applicable exhaust system V-couplings.

- A INSPECTION INTERVAL: Unless more frequent inspections are required by the FAA or aircraft service instruction, inspect band clamps and V-couplings Every 100 HRS or 1 YEAR, whichever comes first.
- B CLEANING: Prior to inspection, clean installed clamp with mineral spirits and crocus cloth.

NOTE: Do not remove clamp unless required for inspection or part replacement is necessary. Unnecessary, frequent removal and installation can damage threads.

NOTE: Some commercial wash agents, wheel cleaners and aluminum deoxidizers contain fluorine, as hydrofluoric acid (HF) or ammonium bifluoride (ABF), to aid to loosen grime, remove oxidation and leave a streak-free finish. At elevated temperatures, fluorine ions can react with nickel alloys (Inconel is approximately 50% nickel) to induce stress corrosion cracking (SCC). These types of cleaners should not be used in or near engine compartments.

- C INSPECTION: Inspect clamps, hoses, and seals for security and condition. Be sure to check for cracks on V-retainer couplings at V-apex and at intersection of bolt towers and V-apex. Check multi-segment V-band couplings for cracks at spot weld areas and corner radii. Also check V-band couplings for flatness of outer band (no greater than .062 in curvature permitted).
- D REPLACEMENT INTERVAL: Replace multi-segment, V-band couplings on Cessna 300/400 series aircraft exhaust system Every 500 HRS TIS. Replace multi-segment V-band couplings, and wastegate gasket seals on TCM TSIO-520/550 series engine exhaust system at every overhaul. Replace induction hoses on condition of rubs, tears, deterioration, leaks, and at every overhaul.



5. AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is FAA approved and specifies maintenance required under Parts 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

According to the FAA AD 2000-01-16, V-band couplings on Cessna 300/400 series aircraft exhaust system must be replaced every 500 hours. This implies that RAM part number 2170-1, 2177-100 thru -300, and 2271-200 V-band couplings must be replaced every 500 hours if they are eligible to be installed on Cessna 300/400 series aircraft. RAM part numbers 2178-225, and 2179-200 and 2179-225 must be replaced at time of engine overhaul in accordance with Lycoming service bulletin SB240-S. RAM part number 1125 series induction hoses, 2532-1 V-band coupling, and part number 2570-1 gasket must be replaced at the time of engine overhaul in accordance with TCM service Bulletin SB97-6 and/or Lycoming service bulletin SB240-S. There are no additional airworthiness limitations for RAM Aircraft band clamps, gasket seals, or V-band couplings. Any changes to Airworthiness Limitations will be published in FAA Airworthiness Directives (AD).