

TELEDYNE CONTINENTAL ® AIRCRAFT ENGINE

SERVICE BULLETIN

Contains Important Information Pertaining to Your Aircraft Engine.
Compliance Will Enhance Safety

Category 3

SB10-1

Technical Portions FAA
Approved

SUBJECT: Exhaust and Turbocharger System Inspection

PURPOSE: Inspection criteria for installed systems

COMPLIANCE: Any engine that has had turbo and/or transition removed and reinstalled, must be inspected within 25 hours from date of this bulletin. All other affected models, must be inspected no later than next scheduled 50 hour maintenance event.

MODELS AFFECTED: TSIO-520-BE; TSIO-550-A, B, C, E, G

General:

This bulletin details inspection procedures to be utilized in service and troubleshooting of the Turbocharger and Exhaust systems for the engine models listed above.

These inspection procedures are included in Engine and Airframe Maintenance Manuals and are recommended at the following occurrences;

- 50 hour (Visual), 100 hour and/or Annual inspections (Complete)
- Anytime exhaust system leakage is suspected
- Anytime turbocharger system is inoperative, sluggish or erratic.

In most instances, the recommended inspection procedures do not require removal of system components. System components should only be removed when conditions require repair or replacement of components. Care must be taken at time of reinstallation to assure correct alignment of all components.

A list of current exhaust system assembly and component part numbers is included for information.


WARNING

Failure to complete these inspection procedures can cause leakage of Carbon Monoxide (CO) gases into the nacelle and cabin area of the aircraft. Any leaks found in these inspections must be repaired prior to further flight


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MO	DAY	YEAR	MO	DAY	YEAR		1 of 13 SB10-01	Original
01	28	2010						



Figure 1
Examples of transition components requiring replacement

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MO	DAY	YEAR	MO	DAY	YEAR		2 of 13	Original
01	28	2010					SB10-01	

Exhaust Component Original Part Number	Exhaust Component Current Part Number	Application
657013	657973	TSIO550-C5B, C7B, C9B, C10B, C11B, C12B, C13B, C17B, C18B
657143	657980 (Without Heater)	TSIO-550-G1B, G2B
654252	657975	TSIO-520-BE1A, BE1G, BE2G, BE3B TSIO-550-A1B, A2B TSIO-550-C1B, C3B, C6B, C14B TSIO-550-E4B, E9B, E19B, E21B
654254	657976	TSIO-550-B1B, B2B, C4B, C16B TSIO-550-E1B,E2B,E5B, E10B,E12B,E14B, E16B,E17B,E20B,E22B
657587	657981 (With Heater)	TSIO-550-G3B, G4B
656783	657977	TSIO-550-C8B, C19B
656823	657978	TSIO-550-E3B,E13B,E18B,E23B
656888	657979	TSIO-550-E11B, E15B
654326	657971	654252, 654254, 656783, 656823, 656888, 657977, 657979
654327	657683	654252, 654254, 656783, 656823, 656888,657977, 657979
657009	657972	657013, 657143, 657980, 657981
657010	657687	657013, 657143, 657980, 657981

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MO	DAY	YEAR	MO	DAY	YEAR		3 of 13 SB10-01	Original
01	28	2010						

Exhaust and Turbocharger System Inspection

Frequency

25 hour inspection: Initial inspection on systems with prior maintenance history (Table 1 Below)

50 hour visual inspection: Components, joints and attachment points. (Table 2 below)

100 hour/Annual inspection: (Table 3 and following)

On condition; at any time leakage of exhaust system is suspected or any time Turbocharger system is erratic, sluggish, inoperative or exhibits visible oil leaks.


ALLOW EXHAUST AND TURBOCHARGER COMPONENTS TO COOL PRIOR TO INSPECTION

Procedure

1. Remove airframe items that hinder visual inspection of the exhaust and turbocharger components.
2. Clean the exhaust system, removing oil and grease, by spraying the exhaust systems parts with Stoddard solvent. Allow the solvent to drain and wipe all parts with a clean cloth.
3. Inspect the exhaust system components according to the following Table 1.

Exhaust Inspection Criteria 25 hour	
Component	Inspection Action
Exhaust and Turbo system	Loosen the entire system. Inspect for possible damage or binding in prior reassembly paying special attention to tie rod installation on RH transition Tie rod must be allowed to move after installation Repair or replace any component discovered to be bent, cracked, leaking, deformed, bound or binding during reassembly
Stacks Risers Elbows Transitions	Visually check components for the following: <ul style="list-style-type: none"> • Burned areas • Cracks • Loose parts/hardware • Hardware and/or joints in tension (bind) • Pay particular attention to welded areas and seams while checking for cracks. • Replace parts that are cracked, leaking, burned, deformed or worn
Slip joints	Visually check for bulges, leaks, cracks, deformation or hot spots
Multi-segment V-band clamps	Inspect spot-weld (or rivet) areas for cracks and looseness. Verify 100% inner and outer band segment contact.
Crossover pipe/Heat exchanger	Inspect the heat exchanger seams, joints and transition slip joints for any evidence of leakage or cracks using a flashlight and mirror or a flexible borescope. Replace any heat exchanger that is suspect to be cracked or leaking.
Reassemble	Reassemble and tighten complete exhaust and turbo systems. IAW airframe manufacturers instructions, reinstall any airframe items removed to facilitate this inspection.

Table 1; 25 hour inspection

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MO	DAY	YEAR	MO	DAY	YEAR		4 of 13 SB10-01	Original
01	28	2010						

CAUTION: The exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (Item 10 page 11) is properly installed in the tie rod to allow expansion movement and all exhaust system components have adequate clearance from surrounding objects during and after installation


50 Hour Inspection

Procedure

1. Remove airframe items that hinder visual inspection of the exhaust and turbocharger components.
2. Clean the exhaust system, removing oil and grease, by spraying the exhaust systems parts with Stoddard solvent. Allow the solvent to drain and wipe all parts with a clean cloth.
3. Inspect the exhaust system components according to the following Table 2.

Exhaust Inspection Criteria 50 hour	
Component	Inspection Action
Stacks Risers Elbows Transitions	Visually inspect all components for the following: <ul style="list-style-type: none"> • Burned areas • Cracks, Leaks • Loose parts/hardware • Hardware and/or joints in tension (bind) • Pay particular attention to welded areas and seams while checking for cracks and leakage • Replace parts that are leaking, cracked, burned, deformed or worn
Slip joints	Check for leaks, bulges, cracks, deformation or hot spots
Multi-segment V-band clamps	<ul style="list-style-type: none"> • Inspect spot-weld (or rivet) areas for cracks and looseness. • Inspect the corner radii of clamp inner segments for cracks with a flashlight and mirror. • Inspect the clamp outer band for flatness, especially within 2 inches of spot-weld tabs that retain the T-bolt fastener – variance to flat must be less than 0.062 inches.
Crossover pipe/Heat exchanger	Inspect the heat exchanger seams, joints and transition slip joints for any evidence of leakage or cracks using a flashlight and mirror or a flexible borescope. Replace any heat exchanger that is suspect to be cracked or leaking.
Reassemble	IAW airframe manufacturers instructions, reassemble any airframe items removed to facilitate this inspection

Table 2 50 Hour Inspection

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MO	DAY	YEAR	MO	DAY	YEAR		5 of 13 SB10-01	Original
01	28	2010						

CAUTION: The exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (Item 10 page 11) is properly installed in the tie rod to allow expansion movement and all exhaust system components have adequate clearance from surrounding objects during and after installation


100 hour/Annual Inspection

Procedure

1. Remove airframe items that hinder visual inspection of the exhaust and turbocharger components.
2. Clean the exhaust system, removing oil and grease, by spraying the exhaust systems parts with Stoddard solvent. Allow the solvent to drain and wipe all parts with a clean cloth.
3. Inspect the exhaust system components according to the following Table 3 and following.

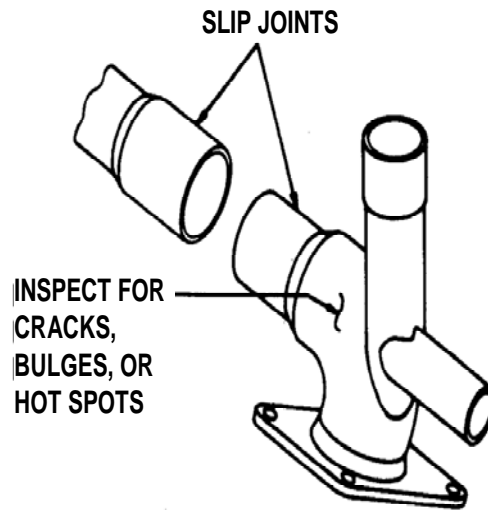
Exhaust Inspection Criteria 100 hour/Annual	
Component	Inspection Action
Stacks Risers Elbows Transitions	Visually inspect all components for the following: <ul style="list-style-type: none"> • Burned areas • Cracks • Loose parts/hardware • Hardware and/or joints in tension (bind) • Pay particular attention to welded areas and seams while checking for cracks. • Replace parts that are cracked, burned, deformed or worn
Slip joints	Check for bulges, cracks, deformation or hot spots
Multi-segment V-band clamps	<ul style="list-style-type: none"> • Inspect spot-weld (or rivet) areas for cracks and looseness. • Inspect the corner radii of clamp inner segments for cracks with a flashlight and mirror. • Inspect the clamp outer band for flatness, especially within 2 inches of spot-weld tabs that retain the T-bolt fastener – variance to flat must be less than 0.062 inches.
Crossover pipe/Heat exchanger	Inspect the heat exchanger seams, joints and transition slip joints for any evidence of leakage or cracks using a flashlight and mirror or a flexible borescope. Replace any heat exchanger that is suspect to be cracked or leaking.
Reassemble	IAW airframe manufacturers instructions reassemble any airframe items removed to facilitate this inspection

Table 3 100 hour/Annual Inspection

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MO	DAY	YEAR	MO	DAY	YEAR		6 of 13 SB10-01	Original
01	28	2010						

Connect a high volume, dust-free forced air source to the exhaust tailpipe outlet(s).

4. Apply approximately 5 psi of air pressure to the exhaust system.
5. Apply soap and water solution (ex; liquid dish washing soap and water solution with sufficient soap in water to produce bubbles in the solution when crack is located) to the entire exhaust system and check for air bubbling. If bubbling is found, examine components for cracks, security and overall condition. Check for any loose or leaking slip joints. Replace any cracked, worn, deformed or leaking exhaust components according to instructions that follow. Visually inspect the exhaust components and transition units for wear, leaks, cracks, or distortion. Replace any worn, leaking, cracked, or deformed exhaust system components. Inspect the exhaust riser connections at the cylinders to verify the condition of the exhaust flange, sealing of the gasket and exhaust manifold fastener security.




**Exhaust Slip Joint Inspection
Figure 1**

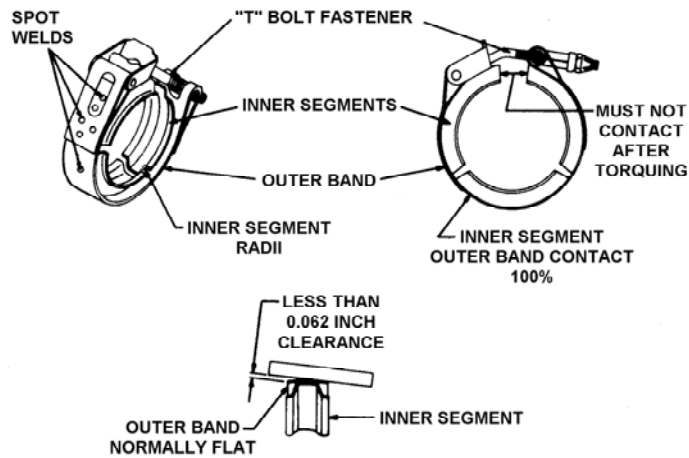
WARNING

Exhaust system weld repairs may only be performed by an FAA Approved repair facility certified to perform specific weld repairs

WARNING

Cracks in the exhaust system can release carbon monoxide into the nacelle or the cabin area; correct any exhaust leaks prior to further flight.

ISSUED			REVISED			 CONTINENTAL MOTORS <small>A Teledyne Technologies Company</small> <small>P.O. BOX 90 MOBILE ALABAMA 36601 • 251-438-3411</small>	PAGE NO	REVISION
MO	DAY	YEAR	MO	DAY	YEAR		7 of 13 SB10-01	Original
01	28	2010						




**V-band Clamp Inspection
Figure 2**

6. Replace worn, leaking, cracked, or distorted parts according to the criteria in Tables 1-3 and appropriate Engine Maintenance Manual.
- 7... Remove and inspect the multi-segment V-band clamps:

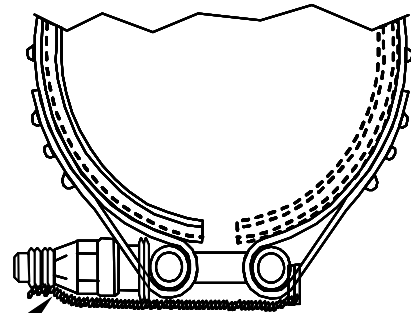
CAUTION: Stretching the V-band clamp excessively will cause undue stress on the outer band and lead to V-band clamp fracture or failure.

- a. Allow the engine (and exhaust system) to cool prior to commencing exhaust system removal to avoid burn injuries.
 - b. If the left tailpipe is to be removed, remove the four bolts, washers, and lock nuts connecting the tailpipe to the wastegate. Remove and discard the gasket and lock nuts.
 - c. Remove the safety wire and nut from the V-band clamp. Gently spread the V-band clamp and work the edges away from the turbocharger flange, onto the heater muff/tailpipe flange. Remove the heater muff/tailpipe.
 - d. Gently spread the V-band clamp over the removed exhaust flange.
 - e. Clean the outer band of the multi-segment V-band clamps with crocus cloth. Inspect the V-band clamps according to the instructions in Table 1. Replace the V-band clamp if it fails inspection criteria.
8. Inspect the turbocharger oil reservoirs, oil inlet and outlet fittings and surrounding area for signs of leakage. Torque fasteners or fittings to specifications contained in current revision of SB96-7 or replace leaking parts, as required to remedy leaking reservoirs or fittings.
 9. Remove the induction air supply from the turbocharger compressor according to the airframe manufacturer's instructions. Inspect the induction air supply duct for wear, deformation, cracks or other physical damage; replace, if necessary.

ISSUED			REVISED			 CONTINENTAL MOTORS <small>A Teledyne Technologies Company</small> <small>P.O. BOX 90 MOBILE ALABAMA 36601 • 251-438-3411</small>	PAGE NO	REVISION
MO	DAY	YEAR	MO	DAY	YEAR		8 of 13 SB10-01	Original
01	28	2010						


10. Reassemble the turbocharger and exhaust system.
 - a. Install the induction system air supply according to airframe manufacturer's instructions.
 - b. Connect the turbocharger compressor discharge to the aftercooler assembly with serviceable hose and induction tube clamps.
 - c. Spread a serviceable V-band clamp over the face of the turbocharger flange in a twisting motion.
 - d. Mate the exhaust tailpipe (or heater muff) and turbocharger flanges.
 - e. Gently spread the V-band clamp over the face of the tailpipe/heater muff flange in a twisting motion to center the V-band clamp evenly over the turbocharger and exhaust tailpipe flanges. Initially torque the clamp nut to half the amount specified in SB96-7.
 - f. Use a rawhide or plastic mallet to lightly tap the outer edge of the clamp to distribute the load. Align the flanges and torque the clamp to the final torque value of the clamp specified in SB96-7. Safety wire the V-band clamp from the T-bolt side of the clamp to the exposed t-bolt threads according to instructions.

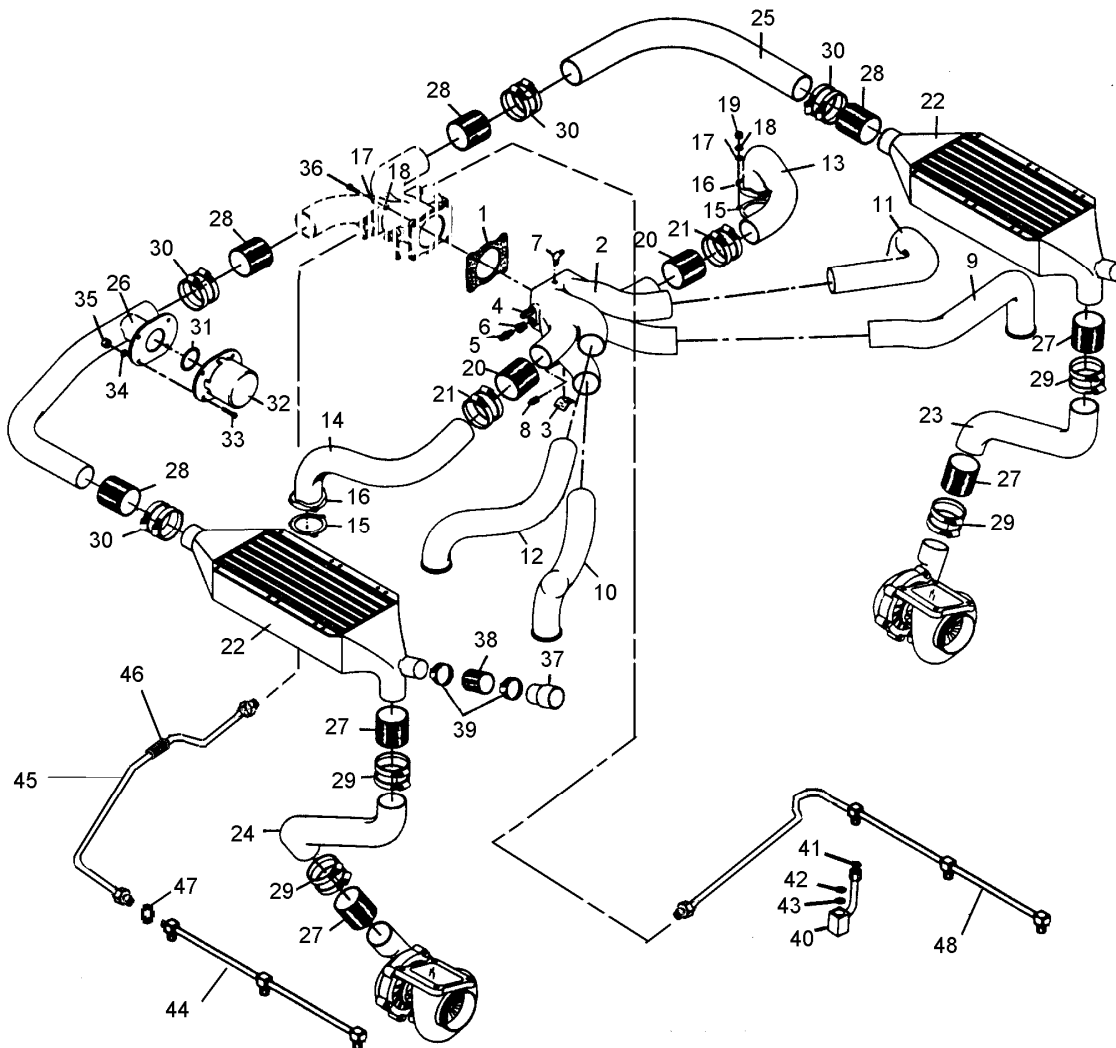
NOTE: TSIO-550-G V-band clamps are riveted instead of welded.



Torque nut to specification plus nut running torque and secure V-Band clamp fastener with Ø .032 safety wire.


V-Band Clamp Safety Wire

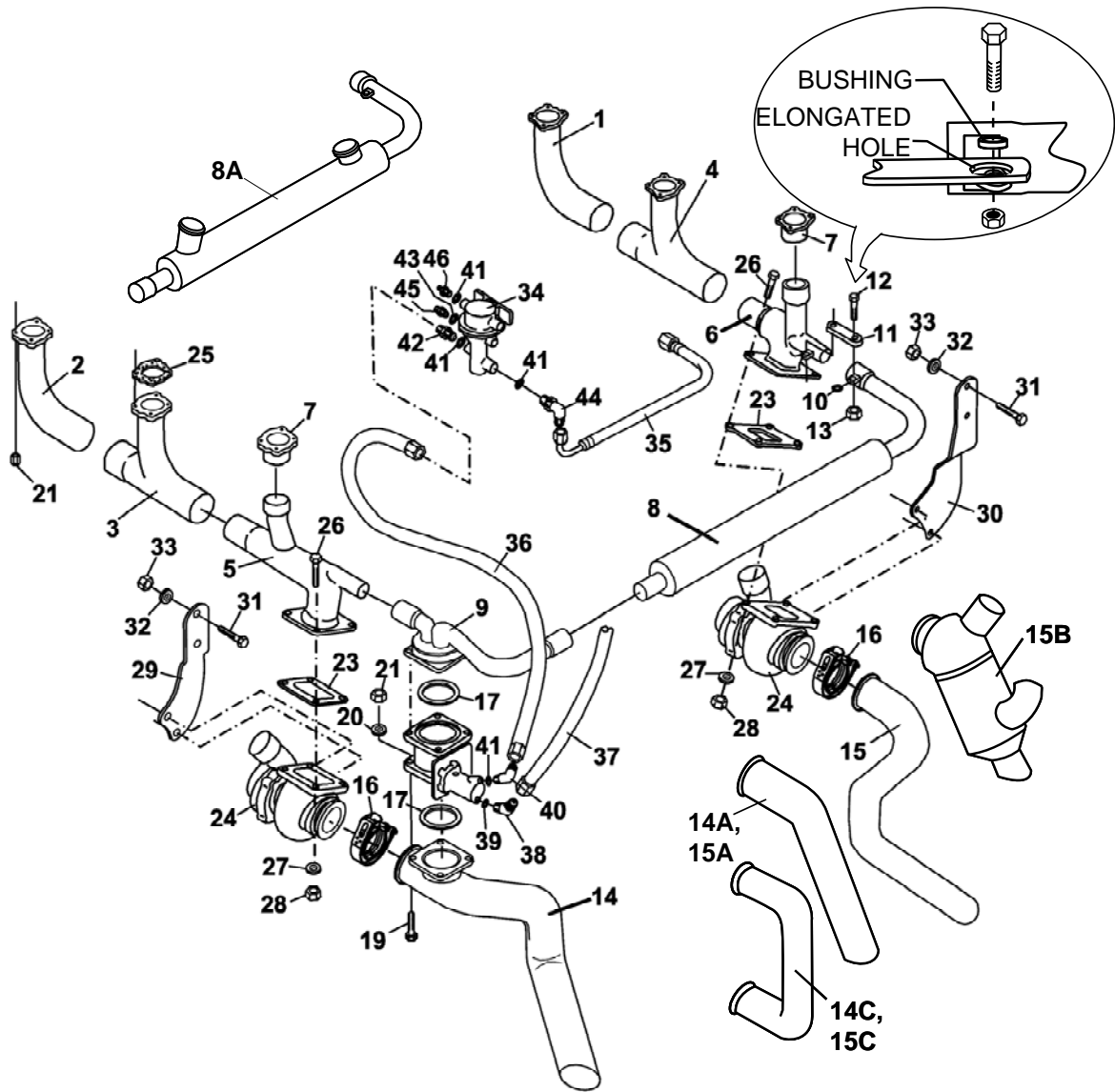
ISSUED			REVISED			 CONTINENTAL MOTORS <small>A Teledyne Technologies Company</small> P.O. BOX 90 MOBILE ALABAMA 36601 • 251-438-3411	PAGE NO	REVISION
MO	DAY	YEAR	MO	DAY	YEAR		9 of 13 SB10-01	Original
01	28	2010						



Typical Turbocharger and Induction System


- | | | | | | | | |
|----|--------------------|----|-------------|----|-----------------|----|--------------------------|
| 1 | Gasket | 13 | Tube | 25 | Tube | 37 | Nozzle |
| 2 | Induction Manifold | 14 | Tube | 26 | Tube | 38 | Hose |
| 3 | Rubber Bumper | 15 | Gasket | 27 | Hose | 39 | Clamp |
| 4 | Adapter | 16 | Flange | 28 | Hose | 40 | Sleeve Assembly |
| 5 | Fitting | 17 | Washer | 29 | Clamp | 41 | Seal |
| 6 | Elbow Fitting | 18 | Lock Washer | 30 | Clamp | 42 | Washer |
| 7 | Elbow, Primer | 19 | Nut | 31 | O-ring | 43 | Washer |
| 8 | Plug | 20 | Hose | 32 | Overboost Valve | 44 | Tube Assembly |
| 9 | Tube | 21 | Clamp | 33 | Bolt | 45 | LH Air Ref Tube Assembly |
| 10 | Tube | 22 | Aftercooler | 34 | Washer | 46 | Hose |
| 11 | Tube | 23 | Tube | 35 | Lock Nut | 47 | Seal |
| 12 | Tube | 24 | Tube | 36 | Screw | 48 | RH Air Ref Tube Assembly |

ISSUED			REVISED			 CONTINENTAL MOTORS <small>A Teledyne Technologies Company</small> <small>P.O. BOX 90 MOBILE ALABAMA 36601 • 251-438-3411</small>	PAGE NO	REVISION
MO	DAY	YEAR	MO	DAY	YEAR		10 of 13 SB10-01	Original
01	28	2010						



Typical Turbocharger and Exhaust System


1	Elbow	13	Nut	22	Plug	35	Hose
2	Elbow	14	Contoured Tailpipe	23	Gasket	36	Hose
3	Tee	14A	Inverse Tailpipe Option	24	Turbocharger	37	Hose
4	Tee	15	Contoured Tailpipe	25	Gasket	38	Elbow Fitting
5	Transition	15A	Straight Tailpipe Option	26	Bolt	39	O-ring
6	Transition	15B	Heater Muff	27	Washer	40	Elbow Fitting
7	Riser	15C	Inverse Tailpipe Option	28	Lock Nut	41	O-ring
8	Crossover	16	V-band clamp	29	Support Bracket	42	Adapter
8A	Crossover w/Heater Option	17	Gasket	30	Support Bracket	43	O-ring
9	Transition	18	Wastegate	31	Screw	44	Elbow Fitting
10	Bushing	19	Bolt	32	Washer	45	Adapter
11	Tie Rod	20	Washer	33	Lock Nut	46	Reducer
12	Bolt	21	Lock Nut	34	Controller		

ISSUED			REVISED			 CONTINENTAL MOTORS <small>A Teledyne Technologies Company</small> <small>P.O. BOX 90 MOBILE ALABAMA 36601 • 251-438-3411</small>	PAGE NO	REVISION
MO	DAY	YEAR	MO	DAY	YEAR		11 of 13	Original
01	28	2010				SB10-01		

Turbocharger and Exhaust System Installation

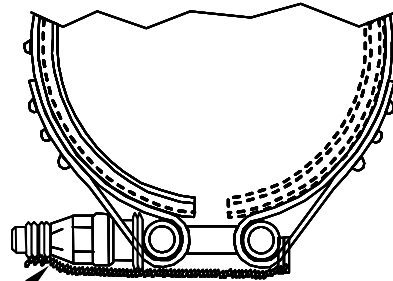
Procedure

1. Install risers (7) on the exhaust transitions (5 and 6). Apply 646943 anti seize compound on all slip joints.
2. Slide the riser, tee, transition and flange assemblies (2, 3, 5, and 7) together to make up the 2-4-6 side collector assembly.
3. Slide the riser, tee, transition and flange assemblies (1, 4, 6 and 7) together to make up the 1-3-5 side collector assembly.
4. Install a new exhaust flange gasket (25) on each cylinder.
5. Carefully install the left and right side collectors on the cylinder exhaust ports; position the collector so the flanges mate with the risers and seat squarely on the ports; lubricate and install new lock nuts (21) on each cylinder flange- do not torque.
6. Install the turbochargers (24), mounted on the support brackets (29 and 30) on the turbo mount brackets (not shown); loosely install the mounting hardware with new lock nuts (33). This hardware will be torqued later in this procedure.
7. Install a new gasket (23) between the transitions (5 and 6) and the turbochargers (22 and 23). Hand-tighten the bolts and washers (26 and 27) with new lock nuts (28). This hardware will be torqued later in this procedure.
8. Loosely install the wastegate (18) between the tailpipe (14) and bypass transition assembly (9) positioned between two new gaskets (15) one gasket on top of the wastegate and one on the tailpipe mounting flange, using eight sets of fastening hardware (17 and 18) with new lock nuts (19). Fit this bypass transition assembly to the 2-4-6 side collector, transition and turbo. All this hardware will be torqued later in this procedure.
9. Slide the crossover (8) (or with heater if so equipped 8A) onto the slip joints of the 2-4-6 side bypass transition (9) and the 1-3-5 side transition (6). Check to assure that the crossover does NOT fit in a bind and slides smoothly onto the two slip joints (6 and 9).
10. Install the 1-3-5 side crossover to transition tie rod (11) with elongated hole matched with the transition and bushing. Install loosely to allow free movement of the tie rod and securing hardware (10, 12 and 13).
11. Place an exhaust flange v-band clamp (16) halfway onto each turbocharger exhaust flange.
12. Install the tailpipe (14) flange inside the clamp (16) mounted on the left side turbine exhaust flange.
13. Install the tailpipe flange (15) or heat exchanger flange (15A), if so equipped, inside the clamp (16) mounted on the right side turbine exhaust flange.
14. Assure that all components of the exhaust and turbocharger systems are correctly installed. Assure that 646943 anti-seize compound has been applied to all slip joints. Assure a loose fit to all components. Confirm that systems are installed with no misfit or bind in the completed installation. Any system misfit or binding must be corrected prior to final torquing of components.

ISSUED			REVISED			 CONTINENTAL MOTORS <small>A Teledyne Technologies Company</small> <small>P.O. BOX 90 MOBILE ALABAMA 36601 • 251-438-3411</small>	PAGE NO	REVISION
MO	DAY	YEAR	MO	DAY	YEAR		12 of 13 SB10-01	Original
01	28	2010						

15. Torque the support bracket screws (31) and nuts (33) to current rev SB96-7 specifications.
16. Torque the turbocharger riser bolts (26) and lock nuts (28) to current rev SB96-7 specifications.
17. Torque the exhaust flange nuts (21) to current rev SB96-7 specifications.
18. Secure the crossover assembly (8) on the transition (6) using the tie rod (11), bushing (10), nut (13) and bolt (12). Torque to current rev SB96-7 specifications. Check the installed assembly for freedom of movement and lack of binding.


CAUTION: The exhaust system requires freedom of movement for proper operation after installation. Ensure the bushing (10) is properly installed in the tie rod to allow expansion movement and all exhaust system components have adequate clearance from surrounding objects after installation



Torque nut to specification plus nut running torque and secure V-Band clamp fastener with Ø .032 safety wire.

V-Band Clamp Safety Wire Detail.

19. Reinstall airframe items, baffle pieces, electrical, sensors and cowling.
20. Run for test of exhaust and turbocharging systems.
21. After inspection is complete, make an appropriate log book entry for completion of this Service Bulletin, note time for next inspection and return aircraft to service.

ISSUED			REVISED			 CONTINENTAL MOTORS <small>A Teledyne Technologies Company</small> <small>P.O. BOX 90 MOBILE ALABAMA 36601 • 251-438-3411</small>	PAGE NO	REVISION
MO	DAY	YEAR	MO	DAY	YEAR		13 of 13 SB10-01	Original
01	28	2010						