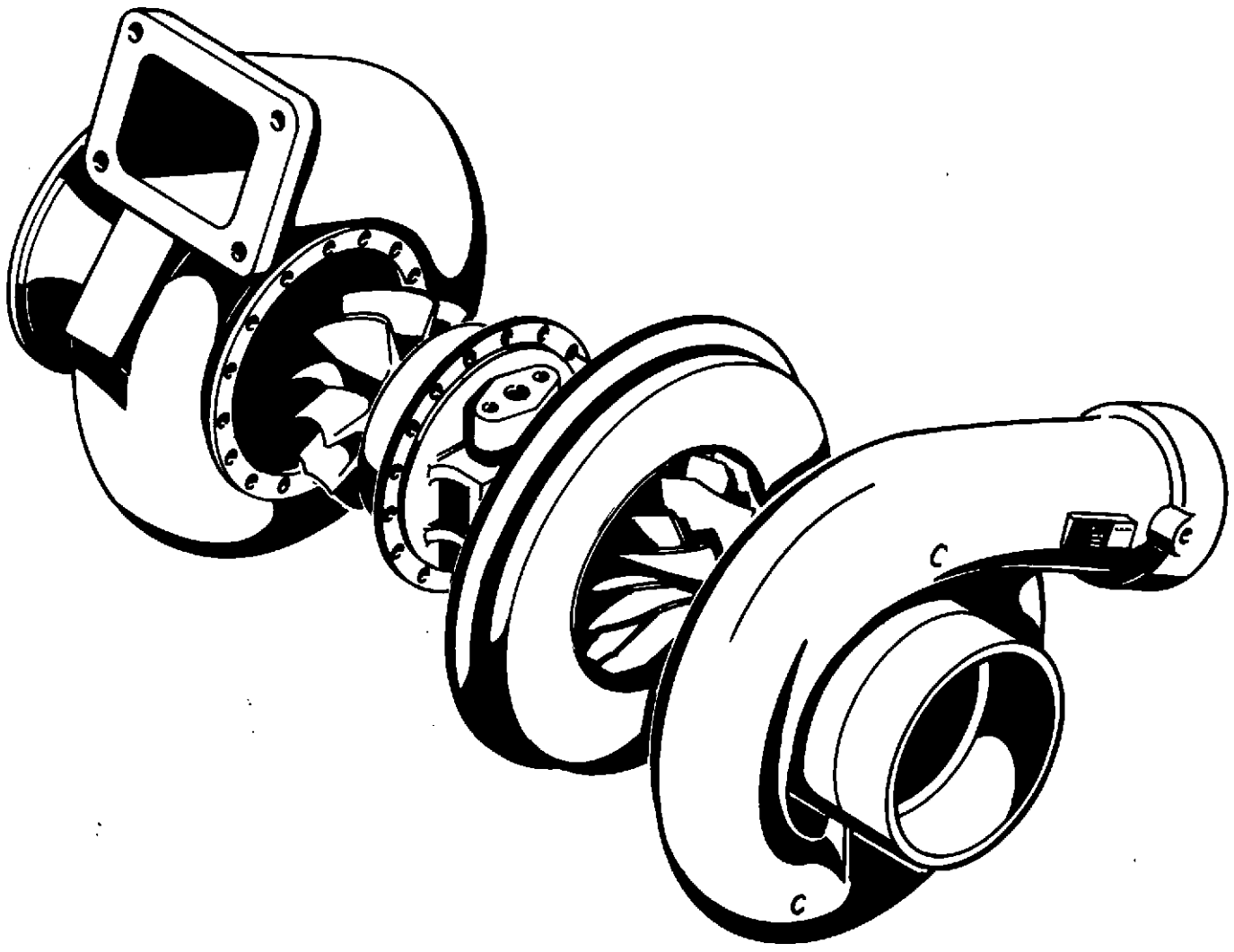
HC-5 Series Turbocharger Shop Manual



HC5 Series Turbochargers

Table of Contents

Foreword

This publication was written to assist Field Personnel with rebuilding the Holset HC5 turbocharger. This turbocharger uses U.S. Customary capscrews and threads. Disassembly, Cleaning, Inspection, and Assembly instructions are included in this manual. A Specifications table is also provided.

Description

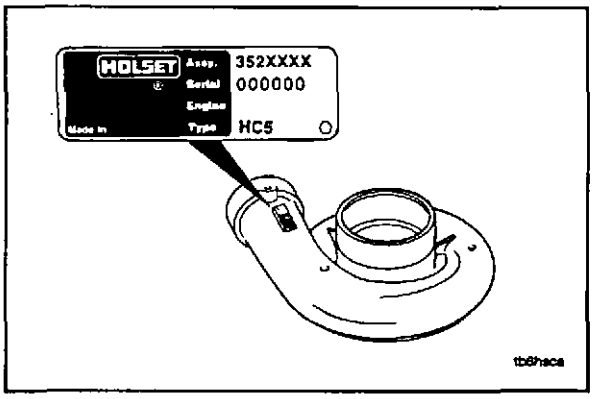
A turbocharger is a mechanical device which uses the engine's exhaust gases to force more air into the engine cylinders. A turbocharger uses energy from the engine to help increase its overall efficiency. Hot exhaust gas energy is used to turn a " shaft and wheel" . At the other end of the shaft and wheel is the " compressor impeller" (or compressor wheel), which draws in air and forces it into the engine cylinders.

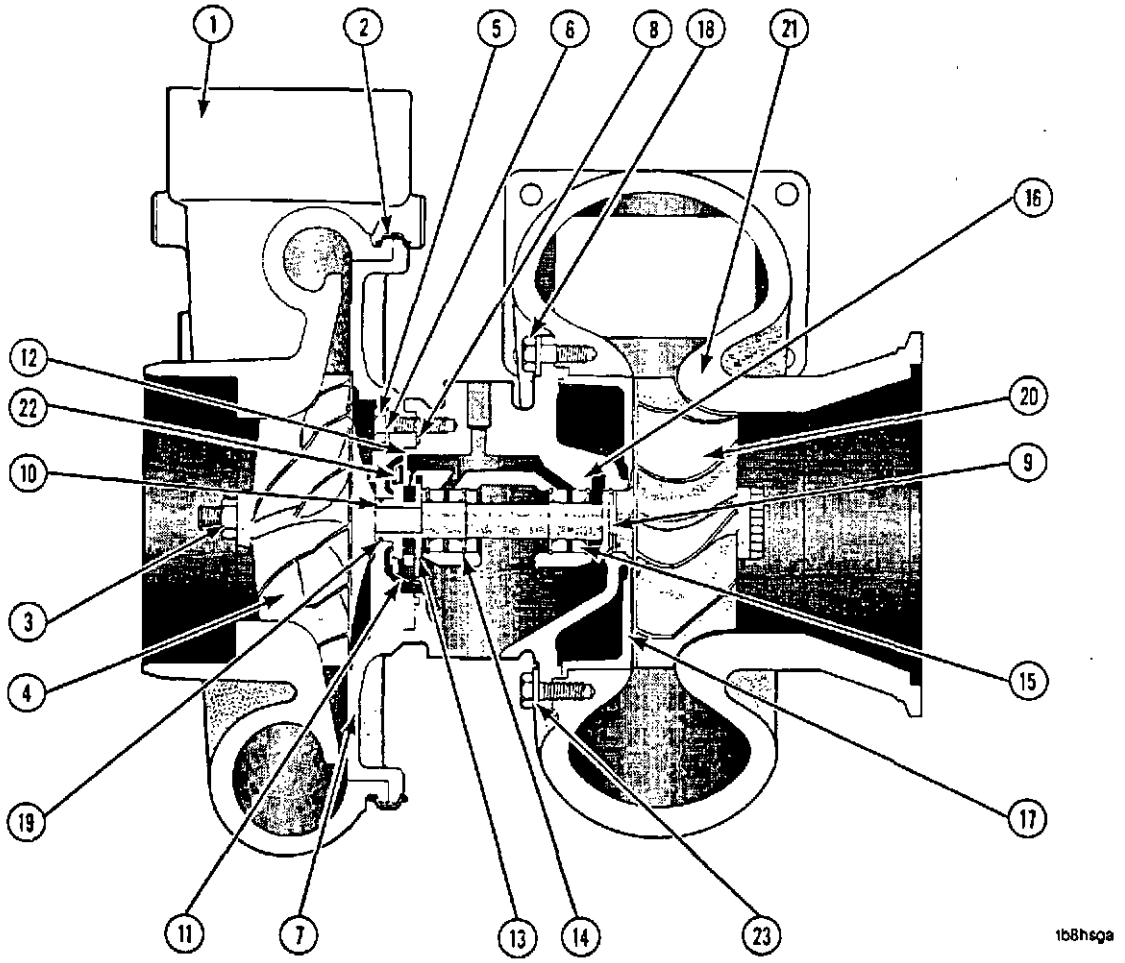
Supplying increased air mass flow to the engine provides improved engine performance, lower exhaust smoke density, improved operating economy, altitude compensation, and noise reduction. The turbocharger has proven to be one of the most beneficial devices for improving engine performance. It performs its job very well, as long as it is properly maintained.

Identification

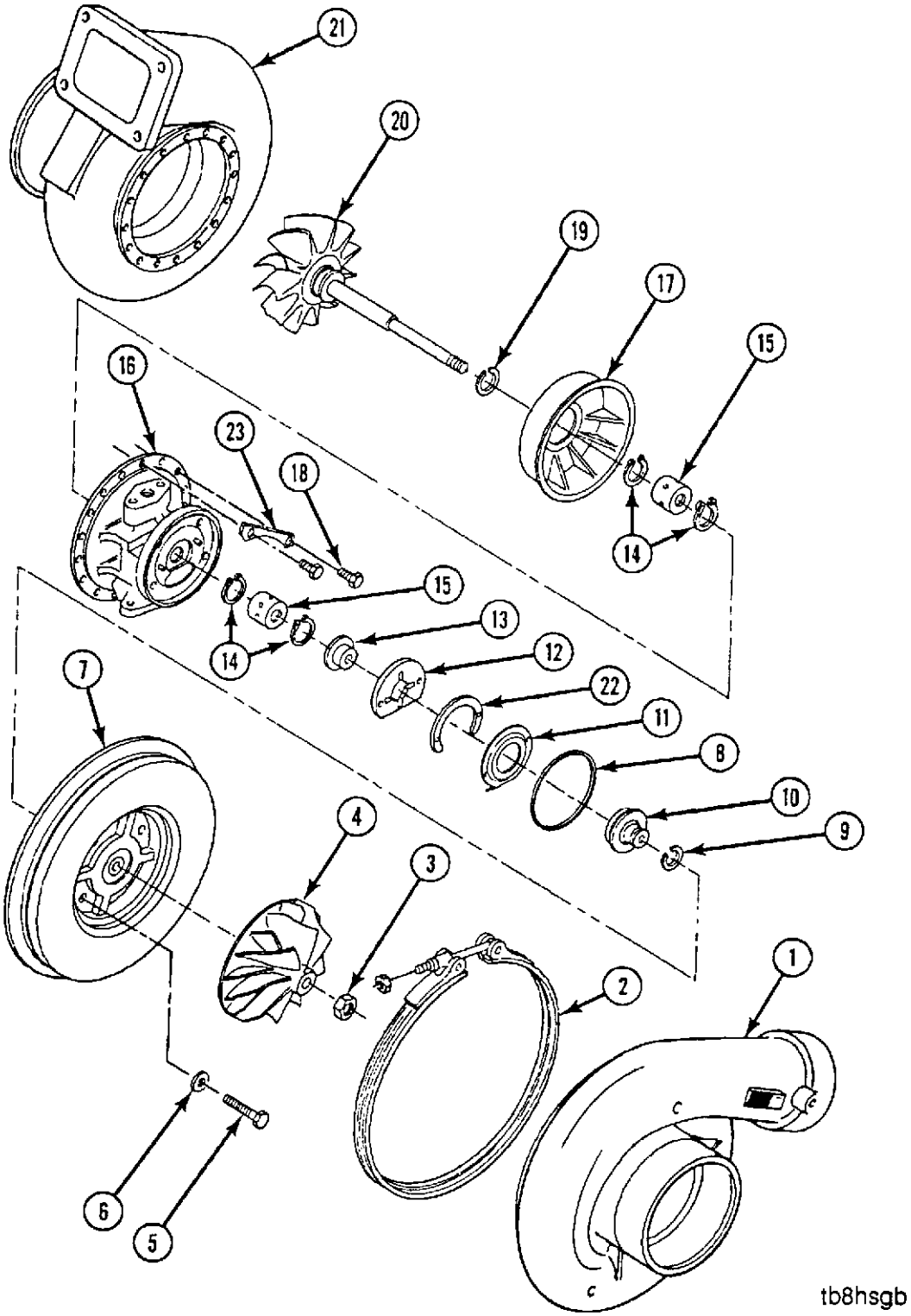
A Dataplate is located on the inlet side of the compressor housing. Always write the assembly number of the turbocharger, and turbocharger type on all orders for parts.

NOTE: The turbocharger Dataplate must not be changed unless approved by Cummins Engine Co., Inc.





REF. NO.	DESCRIPTION	QUANTITY	REF. NO.	DESCRIPTION	QUANTITY
1	Compressor Housing	1	12	Thrust Bearing	1
2	V-Band Clamp	1	13	Thrust Collar	1
3	Impeller Nut	1	14	Retaining Ring	4
4	Compressor Impeller	1	15	Bearing	2
5	Hexagon Head Capscrew	4	16	Bearing Housing	1
6	Plain Washer	4	17	Heat Shield	1
7	Turbocharger Diffuser	1	18	Hexagon Head Capscrew	8
8	O-Ring Seal	1	19	Split Ring Seal	1
9	Split Ring Seal	1	20	Shaft and Wheel	1
10	Oil Slinger	1	21	Turbine Housing	1
11	Oil Baffle	1	22	Shim	1
			23	Lockplate	4



Exploded View of the HC5 Turbocharger

Generic Symbols

The following group of symbols have been used in this manual to help communicate the intent of the instructions. When one of the symbols appears, it conveys the meaning defined below.

WARNING - Serious personal injury or extensive property damage can result if the warning instructions are not followed.

CAUTION - Minor personal injury can result or a part, an assembly or the engine can be damaged if the caution instructions are not followed.

Indicates a REMOVAL or DISASSEMBLY step.

Indicates an INSTALLATION or ASSEMBLY step.

INSPECTION is required.

CLEAN the part or assembly.

PERFORM a mechanical or time MEASUREMENT.

LUBRICATE the part or assembly.

Indicates that a WRENCH or TOOL SIZE will be given.

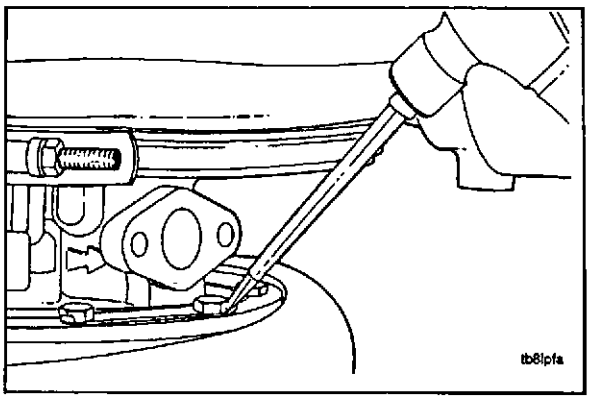
TIGHTEN to a specific torque.

PERFORM an electrical MEASUREMENT.

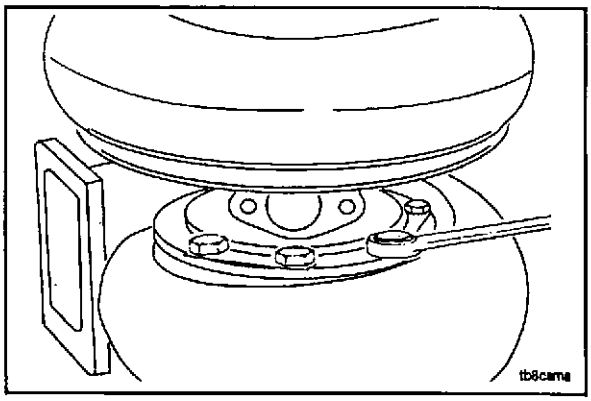
Refer to another location in this manual or another publication for additional information.

Disassembly

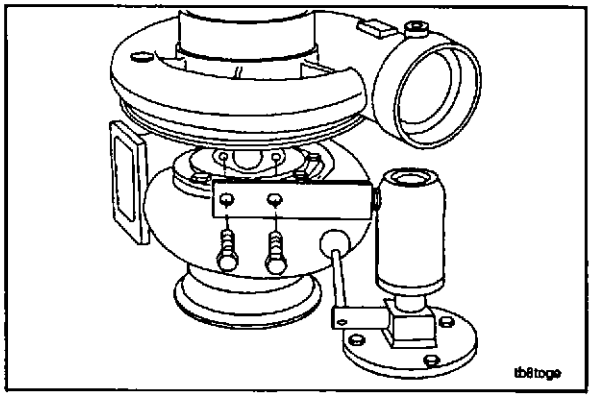
Use a hammer and a chisel to move the lockplate (23) tangs away from the hexagon head capscrews (18).



Remove three hexagon head capscrews (18) from the turbine housing (21) next to the oil outlet flange.

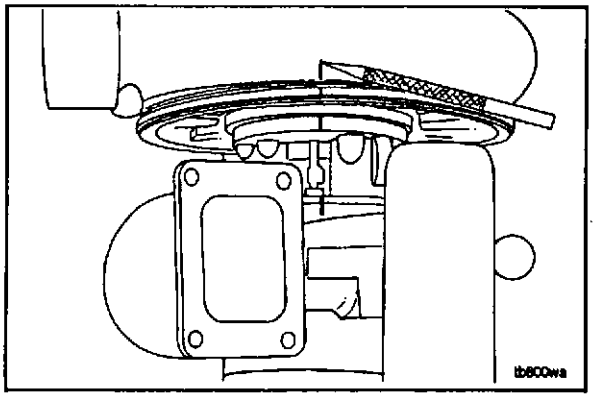


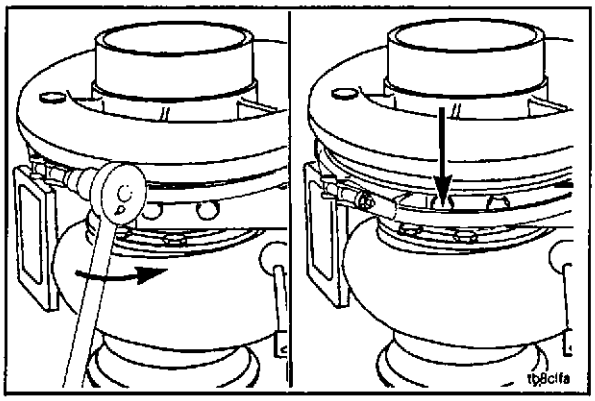
Install the turbocharger on a Part No. 3375527 Mounting Plate which is used with a Part No. ST-302 Ball Joint Vise.



Before disassembling the turbocharger, scribe the parts listed below to help in alignment during assembly.

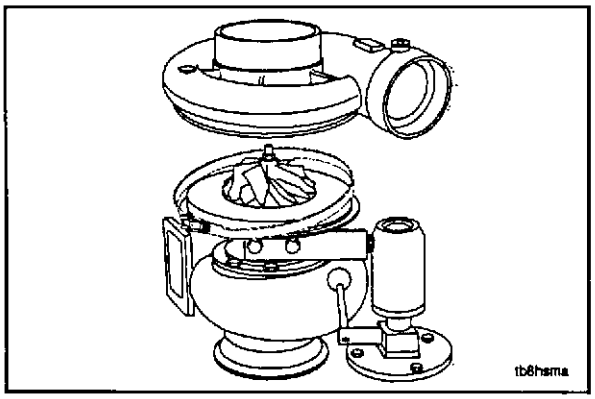
Compressor housing (1).
V-band clamp (2).
Bearing housing (16).
Turbine housing (21).





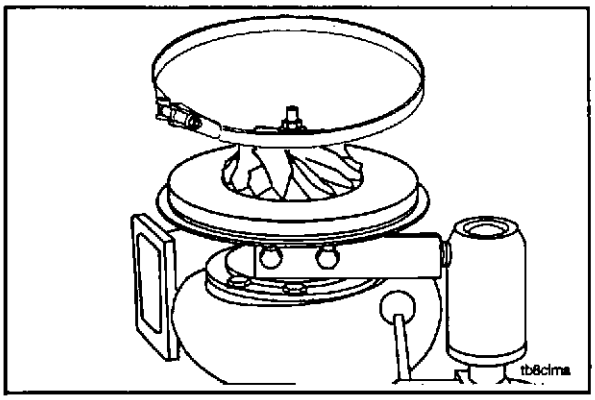
Loosen the V-band clamp (2) regular hexagon nut.

Move the V-band clamp (2) onto the bearing housing (16).

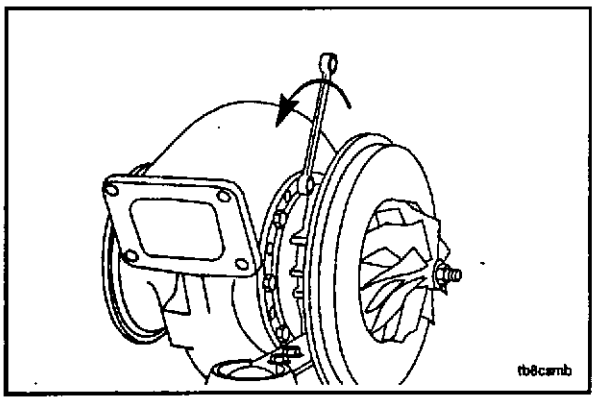


Caution: The compressor impeller blades can be easily damaged when the compressor housing (1) is removed.

Hold the compressor housing with both hands. Carefully remove the compressor housing from the bearing housing.



Remove the V-band clamp (2).

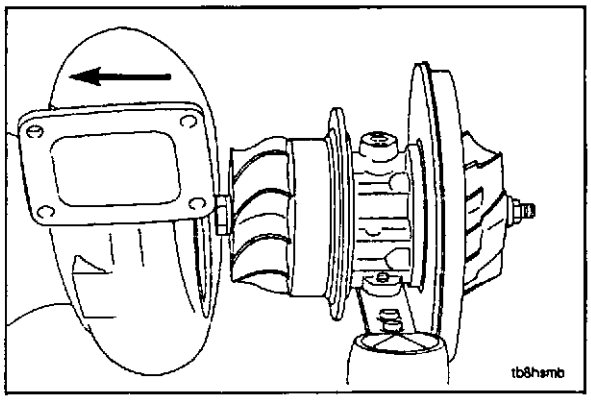


Remove the remaining hexagon head capscrews (18) from the turbine housing (21).

Remove and discard the lockplates (23).

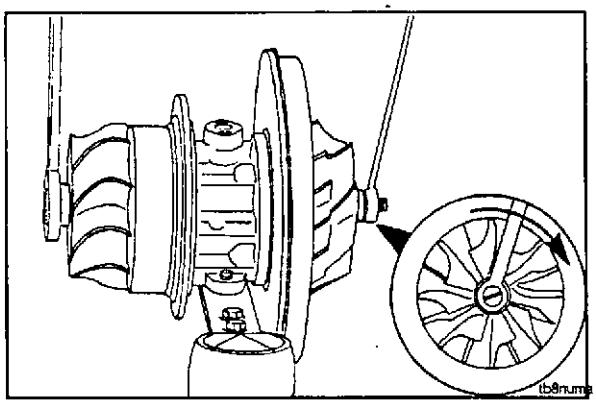
Caution: The turbine blades can be easily damaged when the turbine housing (21) is removed.

Hold the turbine housing with both hands. Carefully remove the turbine housing fom the bearing housing.

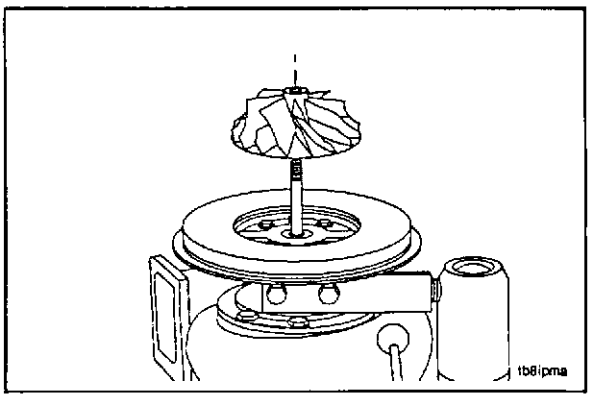


Caution: The impeller nut (3) has LEFT HAND threads.

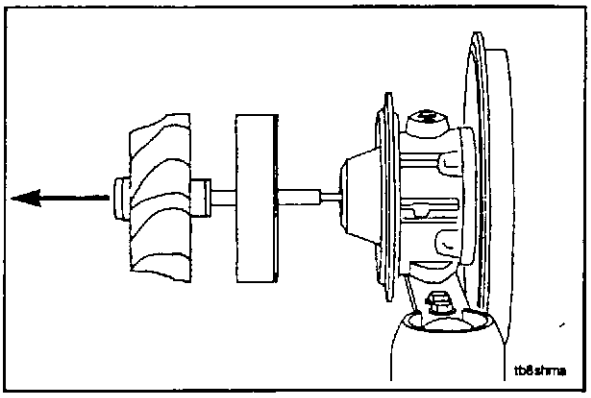
Remove the impeller nut.

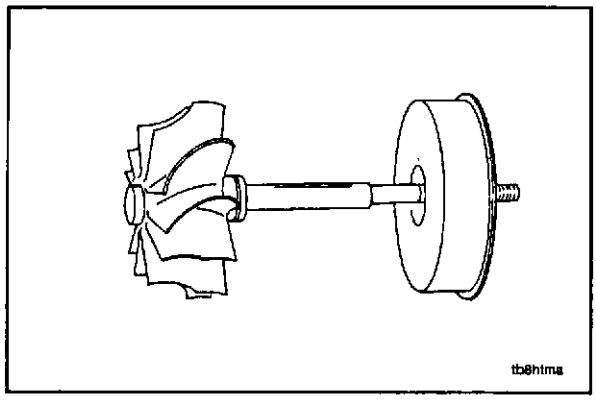


Remove the compressor impeller (4).

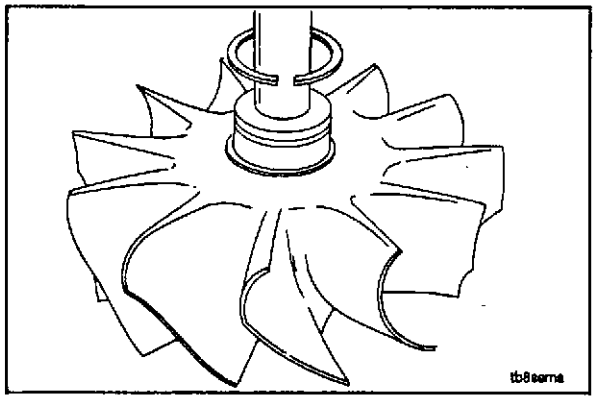


Remove the shaft and wheel (20).

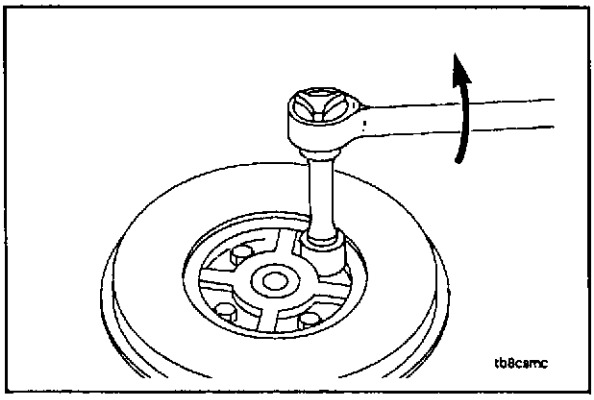




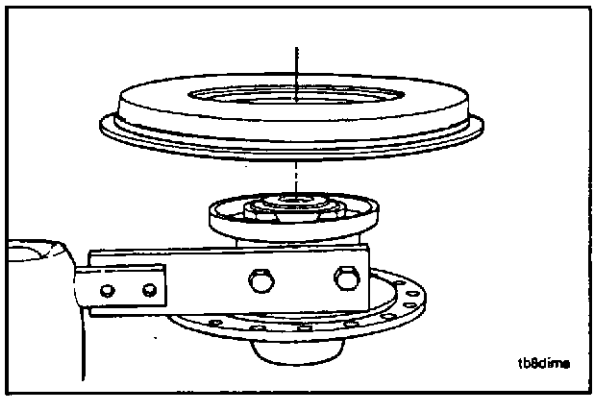
Remove the heat shield (17).



Remove and discard the split ring seal (19).

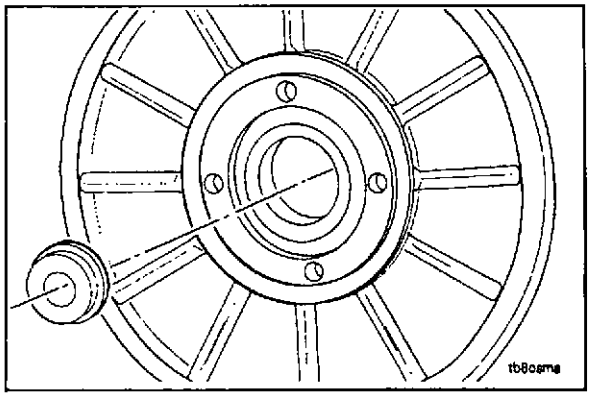


Remove and discard the four hexagon head capscrews (5) and the four plain washers (6).

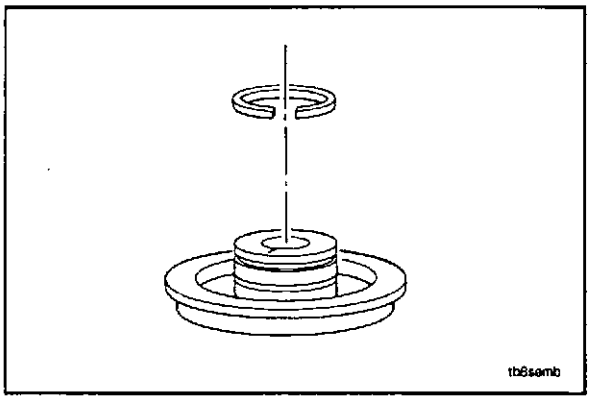


Remove the turbocharger diffuser (7).

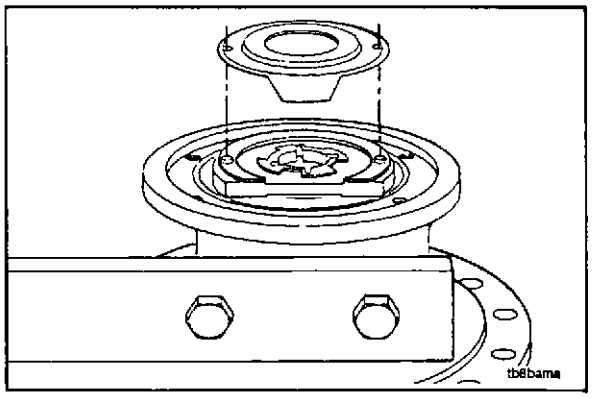
Remove the oil slinger (10).



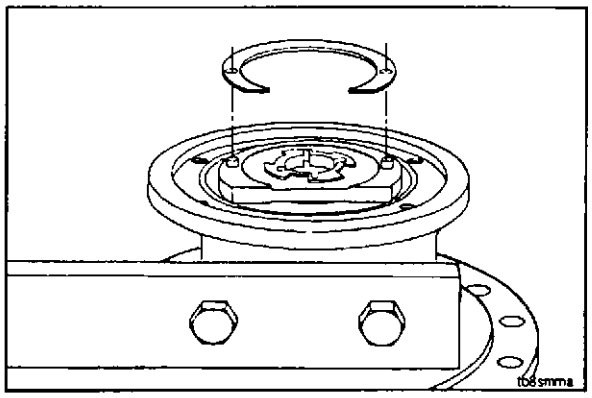
Remove and discard the split ring seal (9).

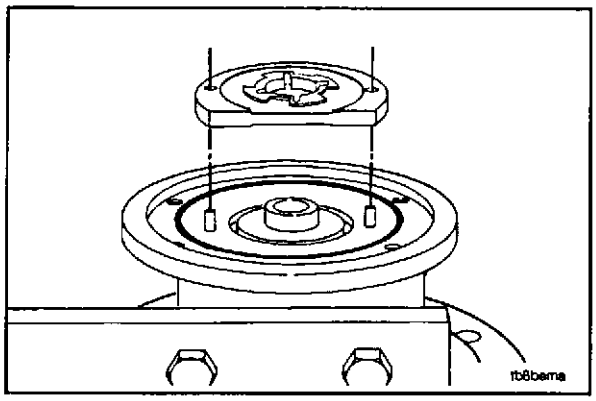


Remove and discard the oil baffle (11).

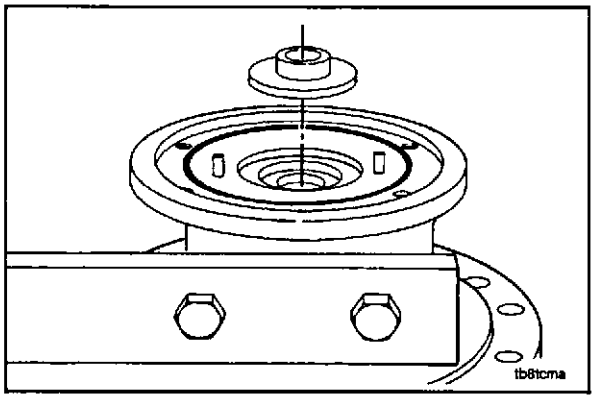


Remove and discard the shim (22).

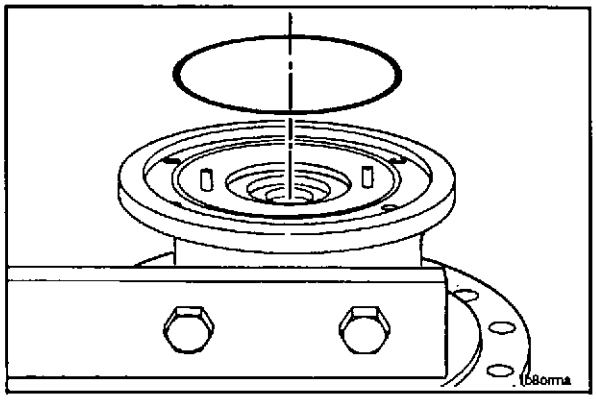




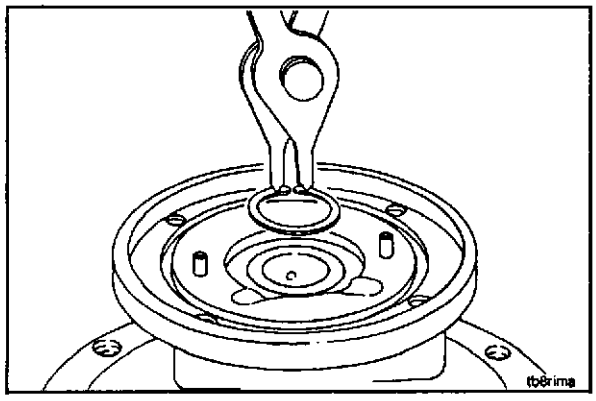
Remove the thrust bearing (12).



Remove the thrust collar (13).

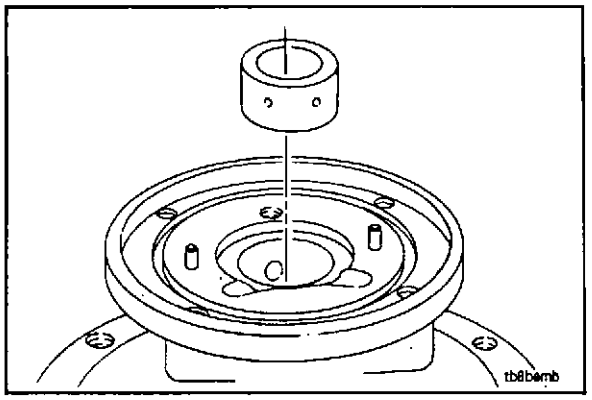


Remove and discard the O-ring seal (8).

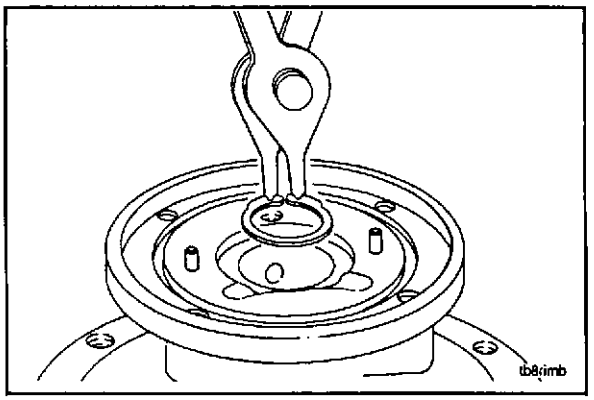


Remove the outer retaining ring (14).

Remove the bearing (15).

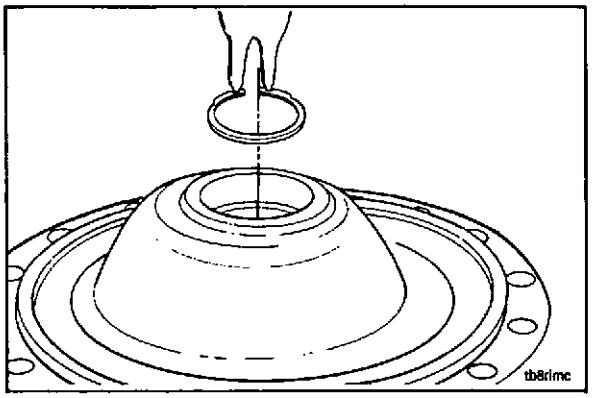


Remove the inner retaining ring (14).

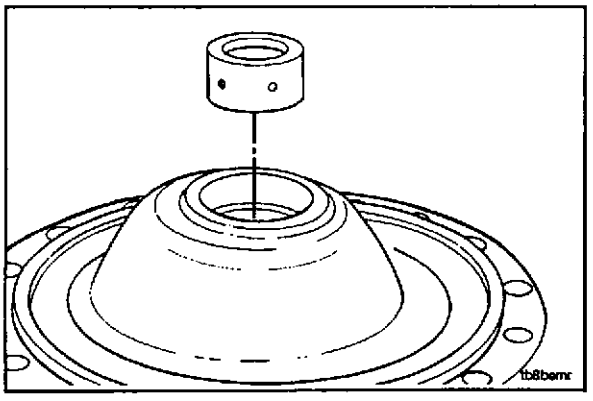


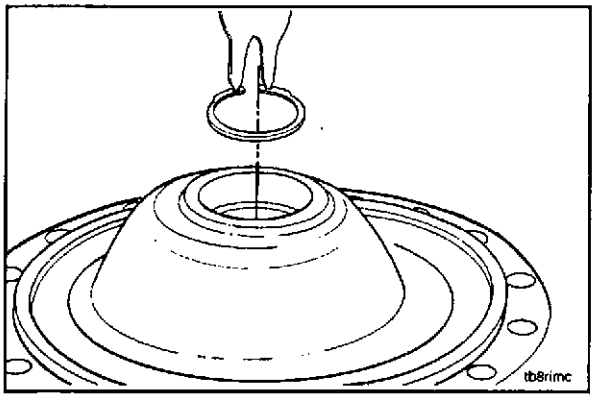
Turn the bearing housing so the turbine end is facing up.

Remove the outer retaining ring (14).

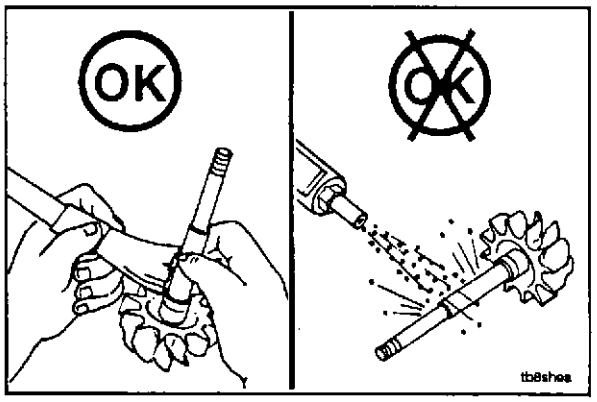


Remove the bearing (15).





Remove the inner retaining ring (14).

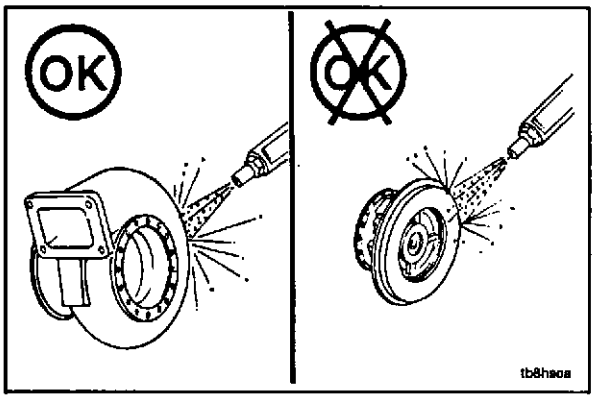


Cleaning

Warning: When using solvents, acids, or alkaline materials for cleaning follow the manufacturers recommendations for use. Wear goggles and protective clothing. Wash all parts in cleaning solvent.

Caution: Do not bead blast the shaft and wheel. Critical machined areas and balance will be affected.

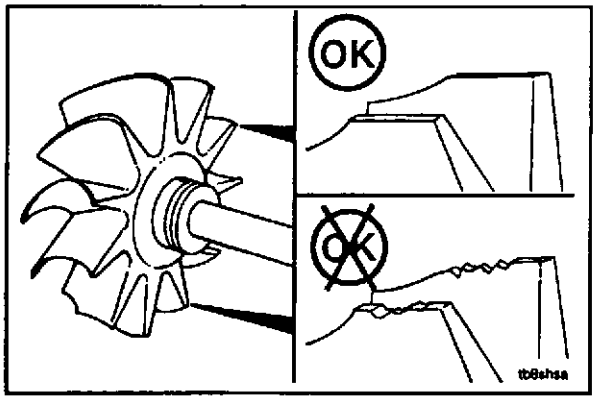
Use 600 grit emery paper to clean the split ring seal groove.



Caution: Do not bead blast the bearing housing or the compressor housing.

Critical machined area's will be damaged.

Bead blast can be used to clean the turbine housing.



Inspection

Shaft and Wheel

Caution: Do not attempt to straighten bent or damaged blades.

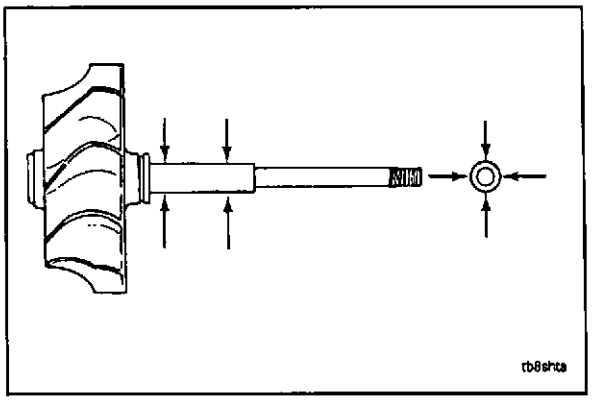
Critical balance will be affected.

Carefully inspect for cracks, bent or damaged blades.

Replace if any damage has occurred.

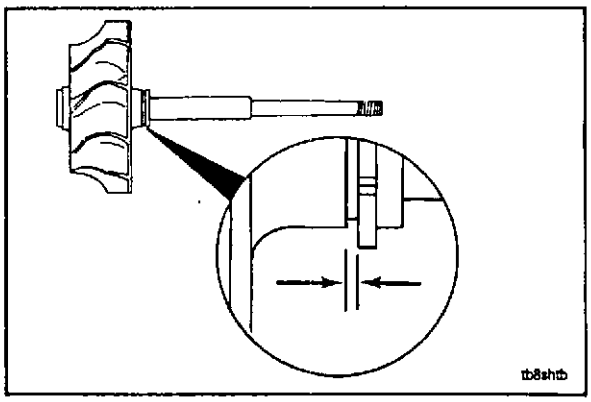
Measure the bearing journals.

Shaft and Wheel Journals		
mm		in
15.961	MIN	0.6284
15.976	MAX	0.6289



Measure the split ring seal side clearance with new split ring seal installed.

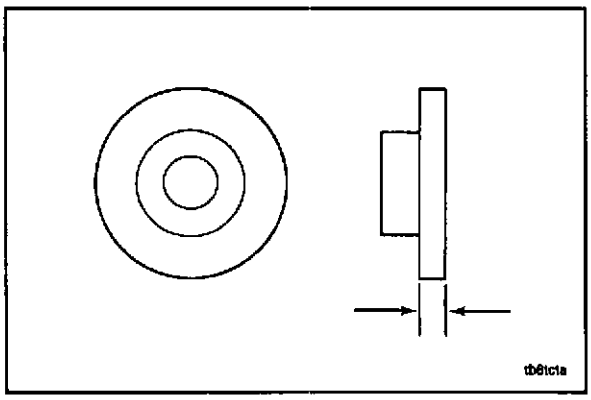
Side Clearance		
mm		in
0.038	MIN	0.0015
0.13	MAX	0.005



Thrust Collar

Measure the thrust collar thickness.

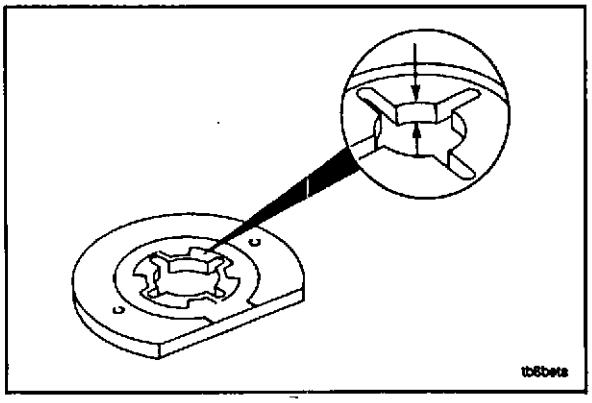
Thrust Collar		
mm		in
3.00	MIN	0.118
3.07	MAX	0.121

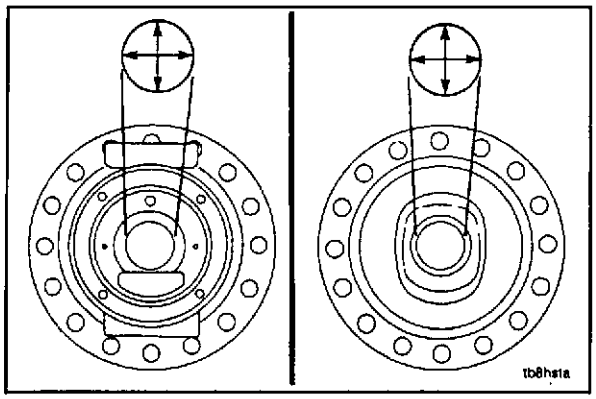


Thrust Bearing

Measure the thrust bearing on the high side next to any of the oil grooves.

Thrust Bearing		
mm		in
5.31	MIN	0.209
5.38	MAX	0.212

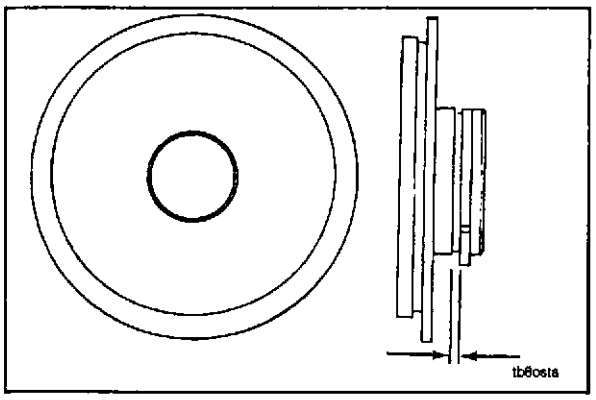




Bearing Housing

Measure the bearing housing bores.

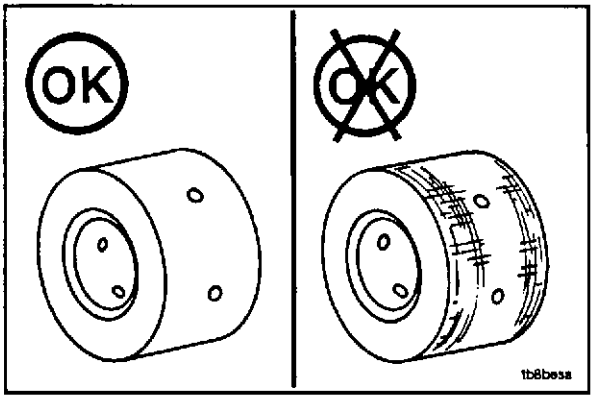
Bearing Housing Bores		
mm		in
28.00	MIN	1.1023
28.023	MAX	1.1032



Oil Slinger

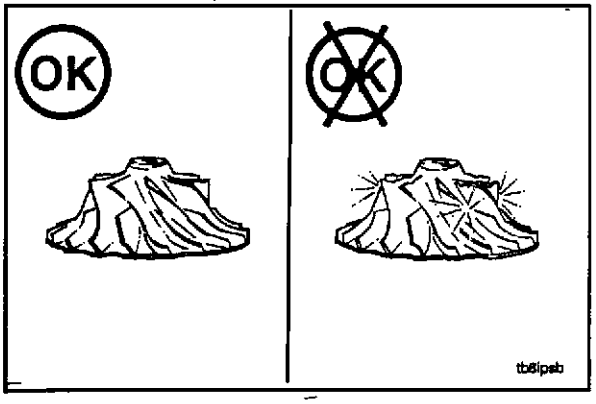
Measure the split ring seal side clearance with new split ring seal installed.

Side Clearance		
mm		in
0.038	MIN	0.0015
0.13	MAX	0.005



Bearings

Replace if any bronze material is visible.



Compressor Impeller

Caution: Do not attempt to straighten bent or damaged blades.

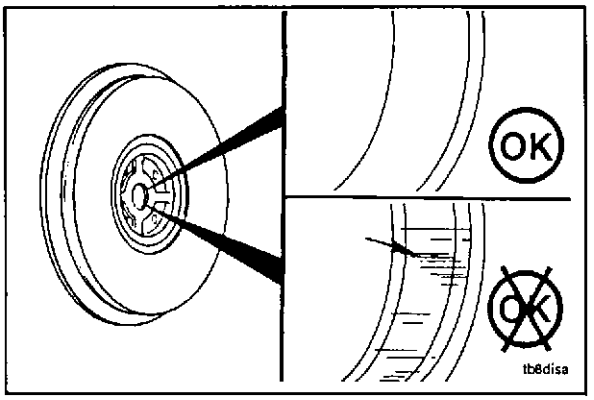
Critical balance will be affected.

Carefully inspect for cracked, bent or damaged blades.

Replace if any damage has occurred.

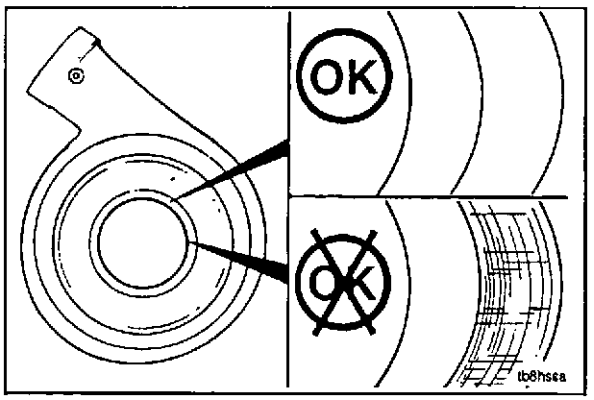
Turbocharger Diffuser

Inspect and replace if the seal bore is scratched or damaged.



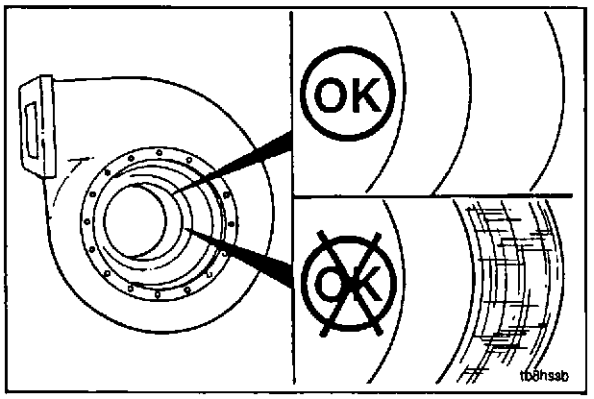
Compressor Housing

Inspect and replace if scratched or damaged by the compressor impeller.

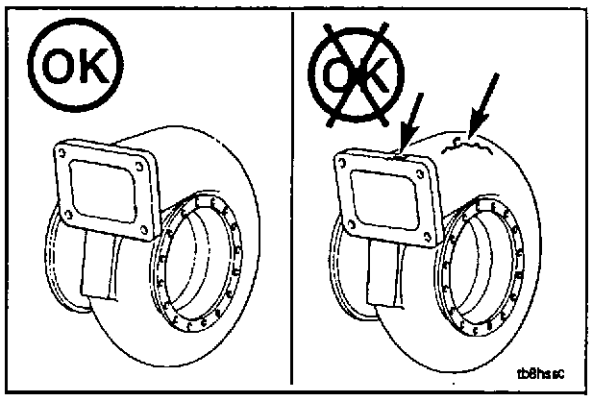


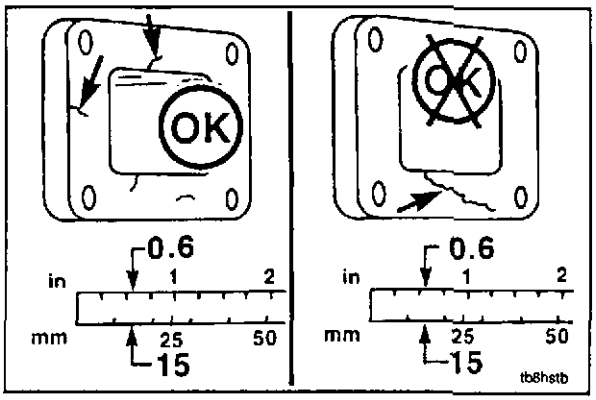
Turbine Housing

Inspect and replace if scratched or damaged by the shaft and wheel.

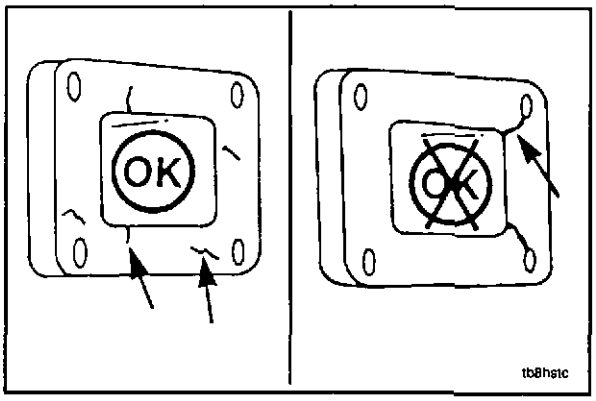


Inspect and replace if through cracks are found in the outer walls.

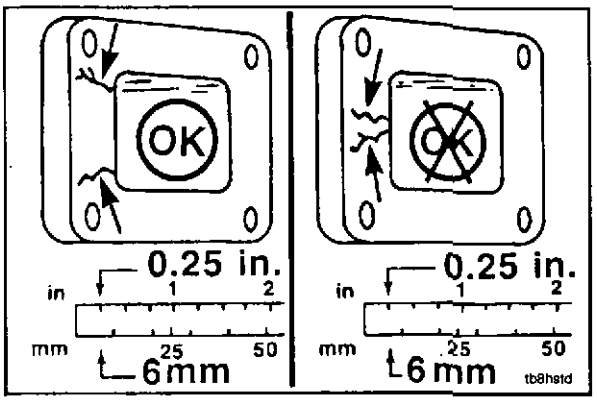




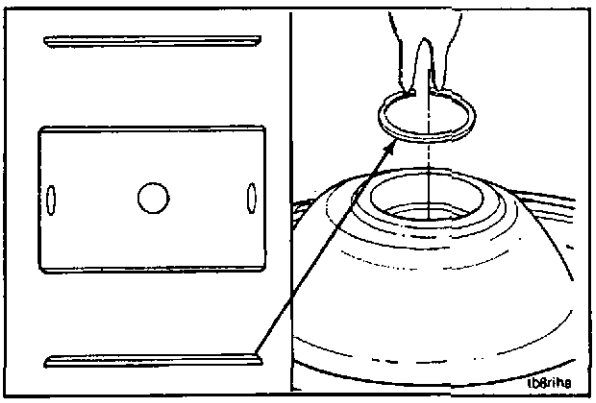
Cracks on the mounting flange longer than 15 mm [0.6 inch] are not acceptable.



Cracks must not reach the mounting holes.



Two cracks must be separated by 6.4 mm [0.25 inch].



Assembly

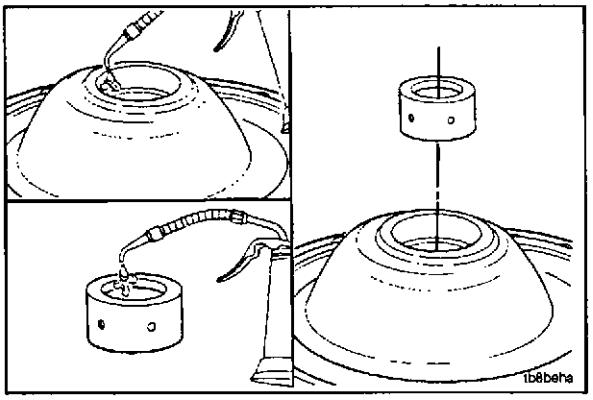
Caution: The retaining rings (14) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear can result if the retaining rings are installed backwards.

Position the housing so that the turbine end is facing up.

Install the inner retaining ring.

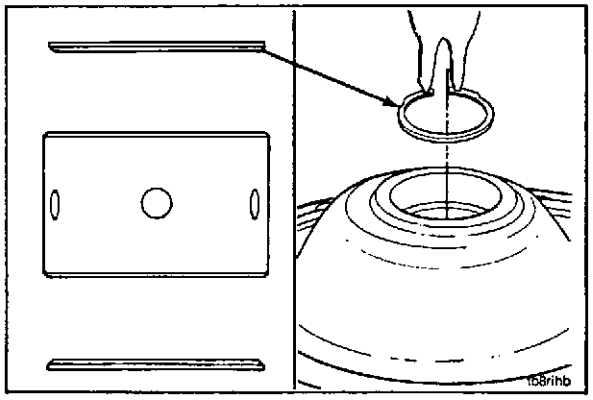
Use clean engine oil to lubricate the bearing housing (16) bore and the bearing (15).

Install the bearing.



Caution: The retaining ring (14) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear may result if the retaining rings are installed backwards.

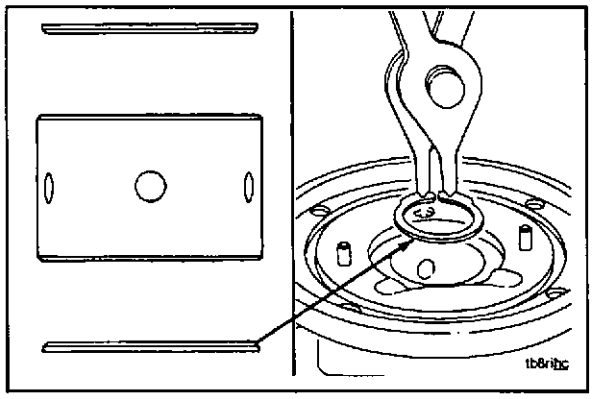
Install the outer retaining ring.



Caution: The retaining ring (14) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear may result if the retaining rings are installed backwards.

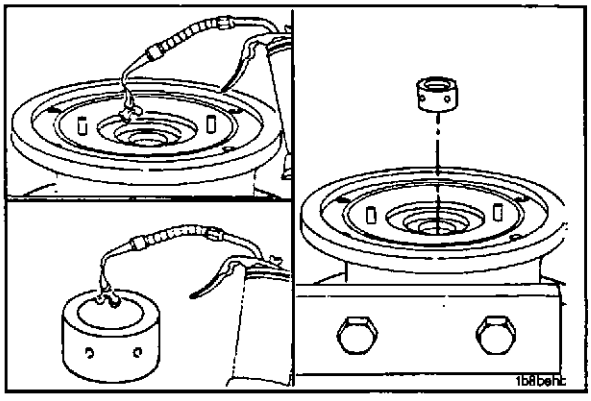
Turn the bearing housing (16) so that the compressor end is facing up.

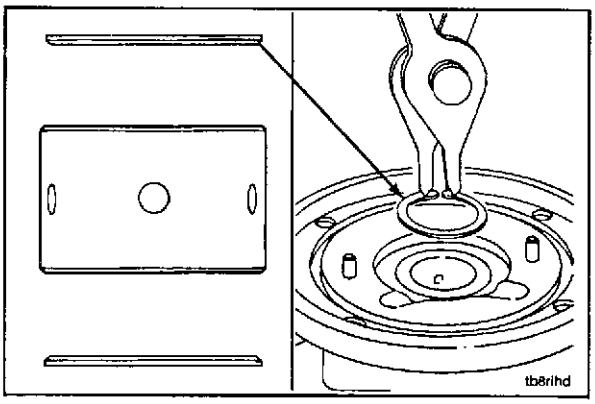
Install the inner retaining ring.



Use clean engine oil to lubricate the bearing housing (16) bore and the bearing (15).

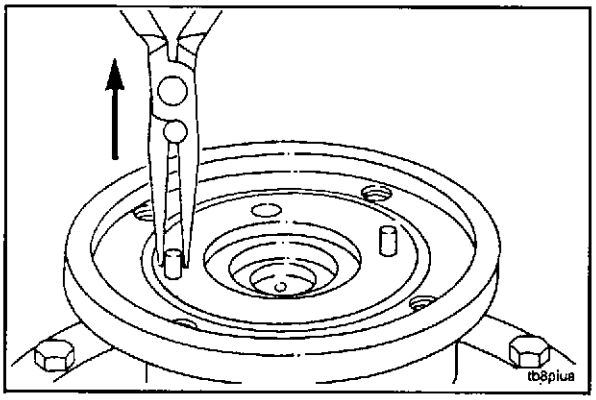
Install the bearing.





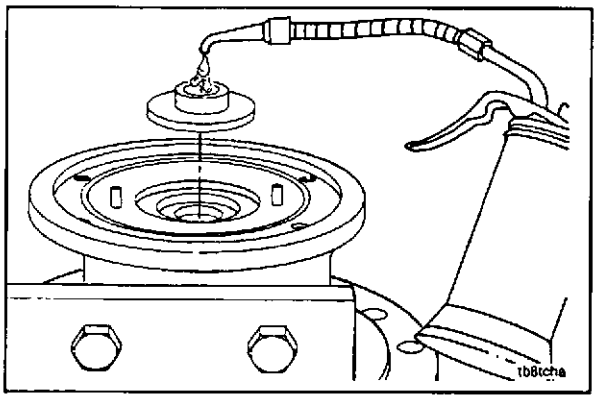
Caution: The retaining ring (14) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear may result if the retaining rings are installed backwards.

Install the outer retaining ring.



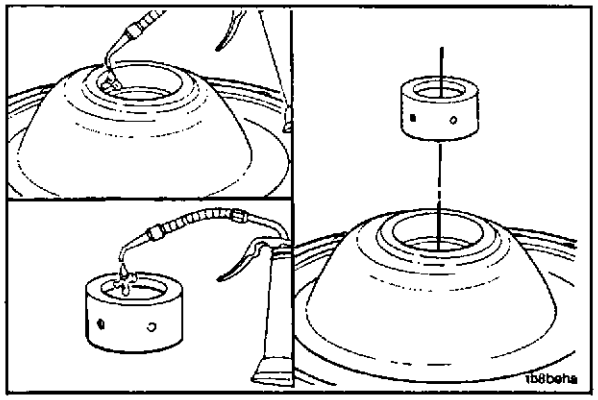
Use pliers to pull the two roll pins out 3mm [1/10 inch] approximately.

NOTE: Do not use excessive squeezing force on the pliers as the roll pins can collapse. If the roll pins collapse they must be replaced.



Use clean engine oil to lubricate the thrust collar (13).

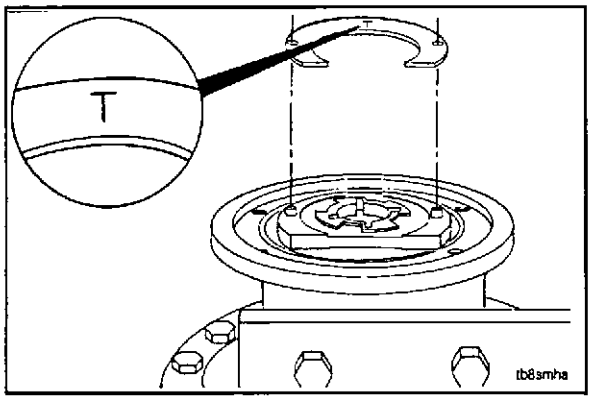
Install the thrust collar.



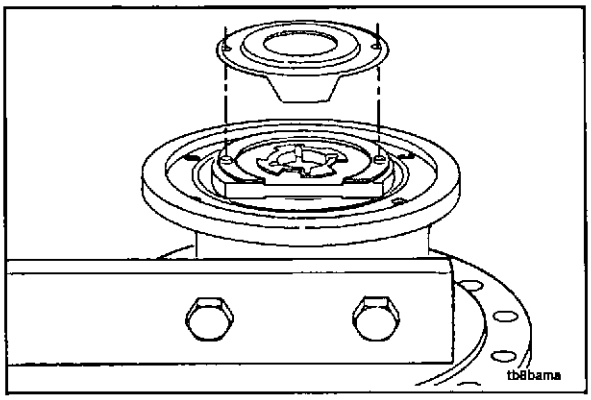
Use clean engine oil to lubricate the thrust bearing (12).

Install the thrust bearing.

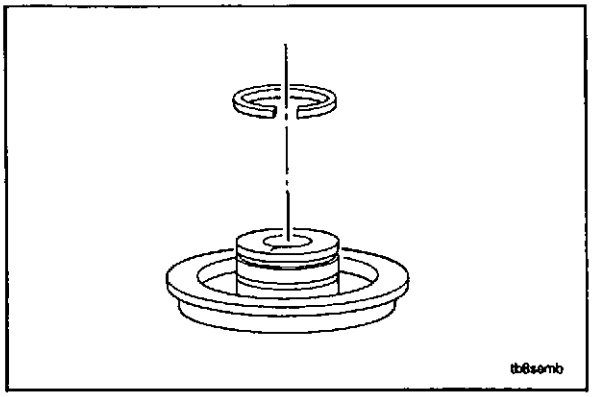
Install a new shim (22) so that the letter " T" is facing away from the thrust bearing.



Install a new oil baffle (11).

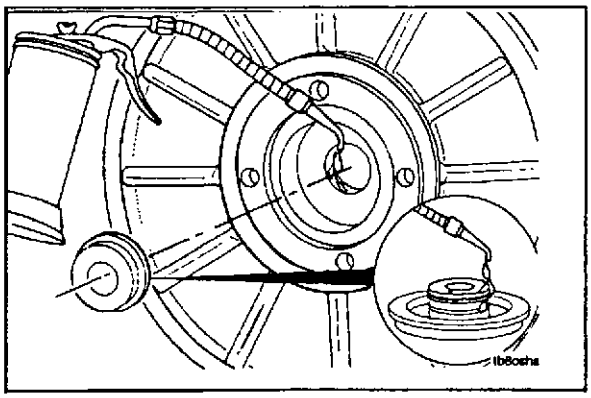


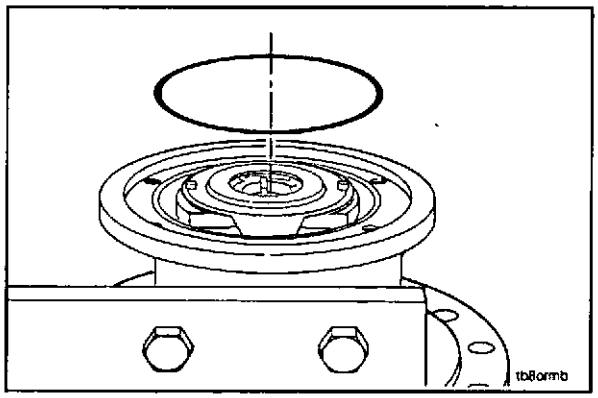
Install a new split ring seal (9) on the oil slinger (10).



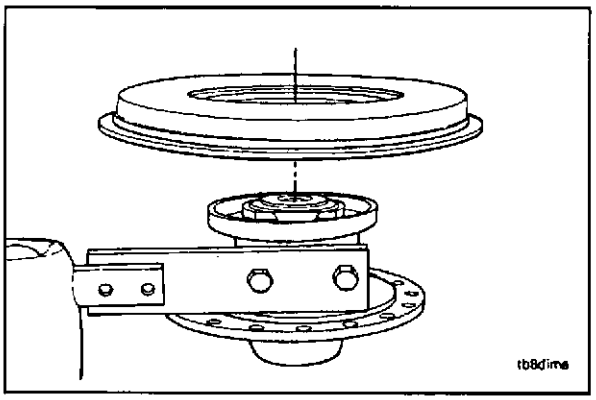
Use clean engine oil to lubricate the turbocharger diffuser (7) bore and the split ring seal (9).

Install the oil slinger (10) into the turbocharger diffuser (7) bore.

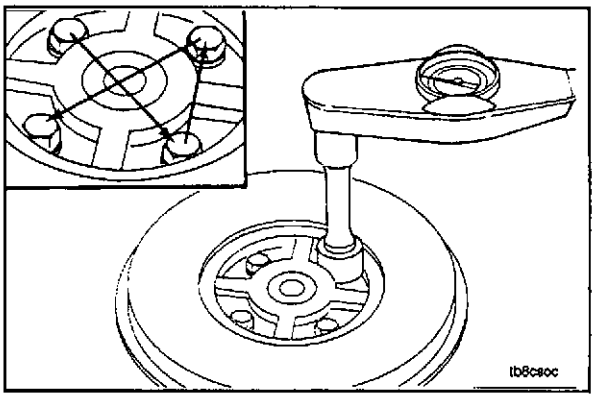




Install a new o-ring seal (8).



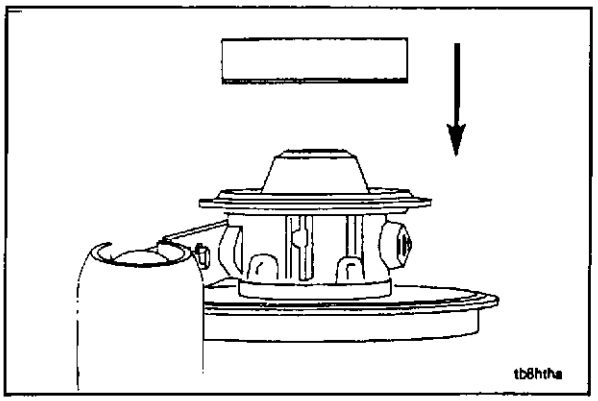
Install the turbocharger diffuser (7) on the bearing housing (16).



Install the four new plain washers (6) and the four new hexhead capscrews (5).

Tighten the capscrews in a diagonal pattern to 27 N•m[230 in-lb] torque.

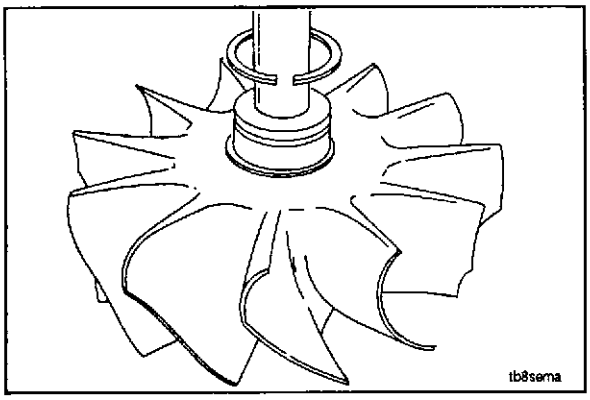
NOTE: Torque the capscrews twice to ensure that all four are tightened equally.



Turn the bearing housing (16) so that the turbine end is facing up.

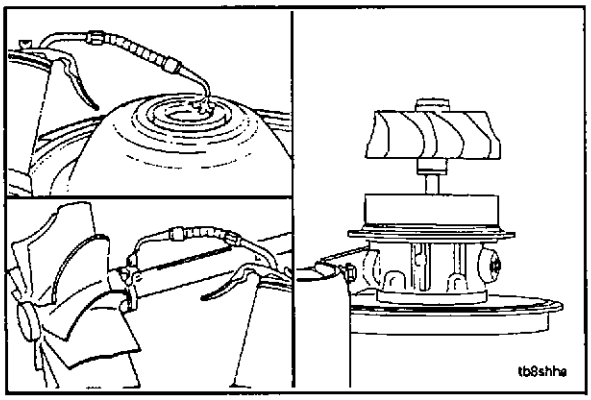
Install the heat shield (17).

Install a new split ring seal (19) on the shaft and wheel (20).



Use clean engine oil to lubricate the bearing housing (16) bore the split ring seal (19) and the shaft and wheel journals (20).

Install the shaft and wheel.

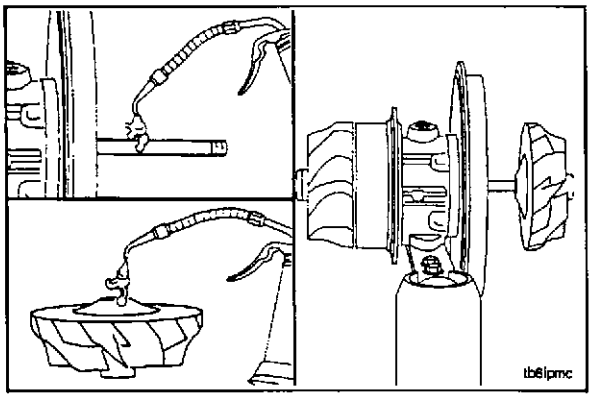


Turn the bearing housing (16) to the horizontal position.

Use clean engine oil to lubricate the shaft and wheel (20) journal.

Install the compressor impeller (4).

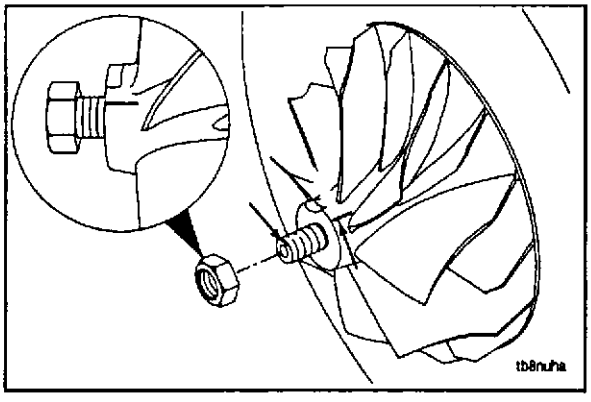
NOTE: If the end of the shaft and nose of the impeller have alignment marks align the marks.

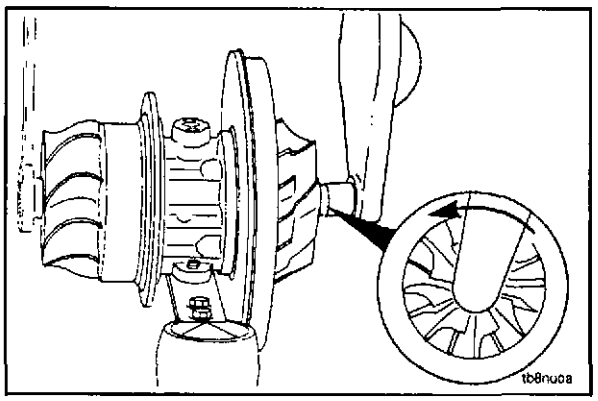


Caution: The impeller nut (3) has Left Hand threads.

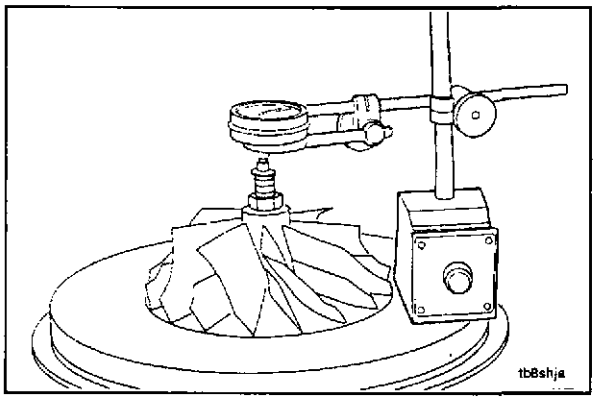
The impeller nut must be installed with the flat side towards the compressor impeller (4). Improper installation will cause compressor impeller damage

Install the impeller nut.

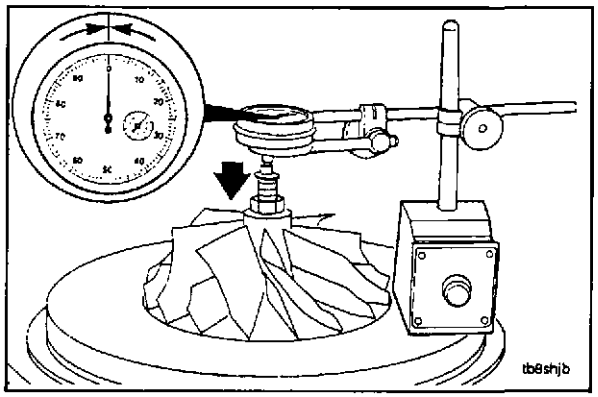




Tighten the impeller nut to 45 N•m [33 ft-lb] torque.

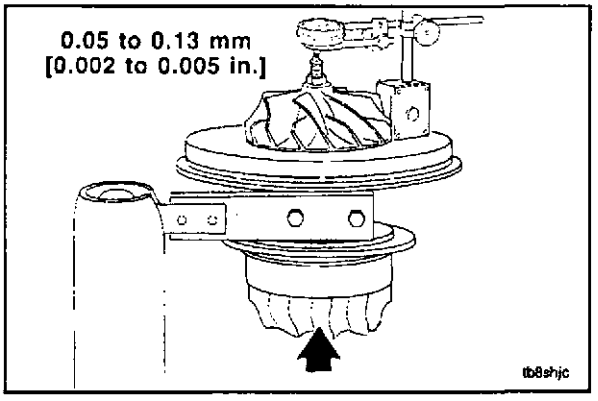


Use a magnetic base dial indicator to check the axial motion.



Push the rotor assembly away from the gauge.

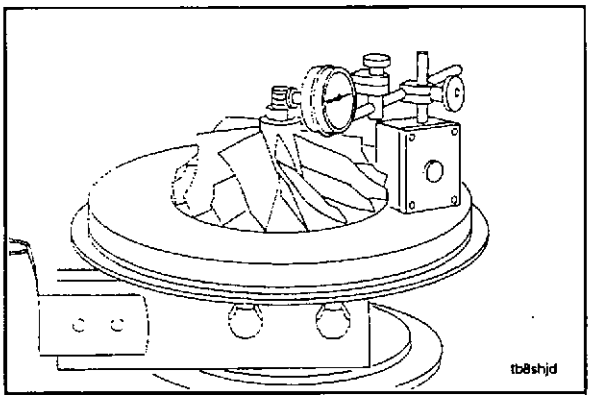
Set the gauge on "0".



Push the rotor assembly toward the gauge.

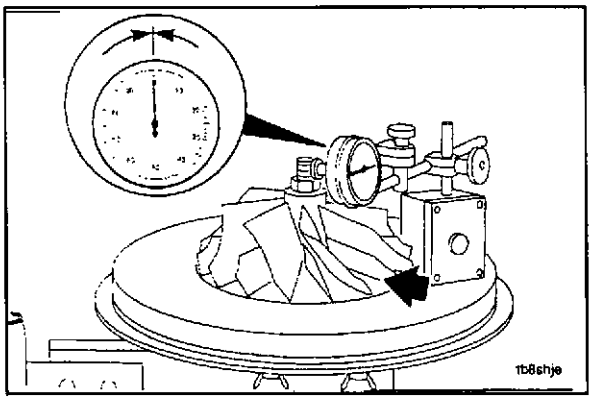
Total gauge reading must be between 0.05 mm [0.002 inch] and 0.13 mm [0.005 inch].

Use a magnetic base dial indicator to check the radial motion.



Push the rotor assembly away from the gauge.

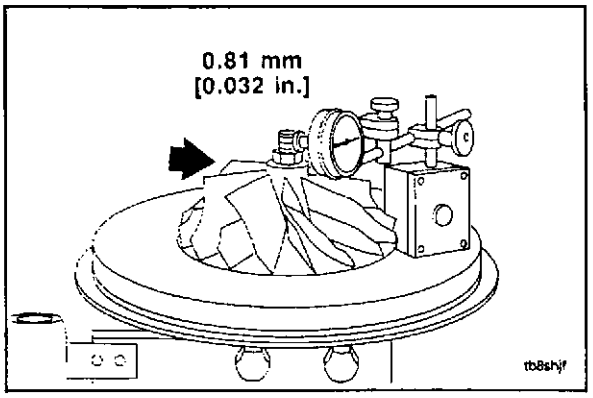
Set the gauge on " 0" .



Push the rotor assembly toward the gauge.

Measure the clearance in three places.

The maximum acceptable radial motion is 0.81 mm [0.032 inch].

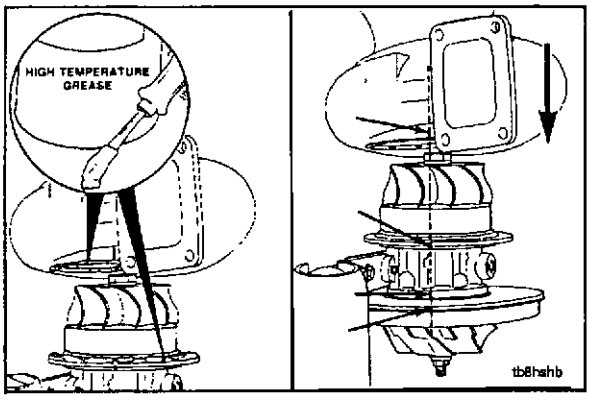


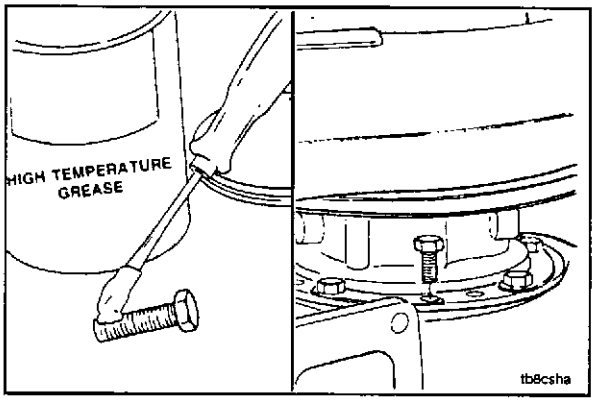
Use a high temperature grease to coat the turbine housing (21) and the bearing housing (16) mating surfaces.

Caution: The turbine blades can be easily damaged when the turbine housing (21) is installed.

Hold the turbine housing with both hands. Carefully install the turbine housing on the bearing housing.

Align the scribe marks on the turbine housing and bearing housing.

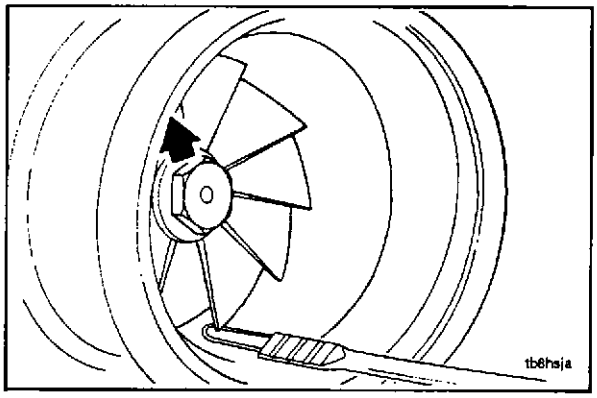




Use a high temperature grease to coat the hexagon head capscrew (18) threads.

Install two new lockplates and four of the capscrews.

Tighten the capscrews to 14 N•m [120 in-lb] torque.

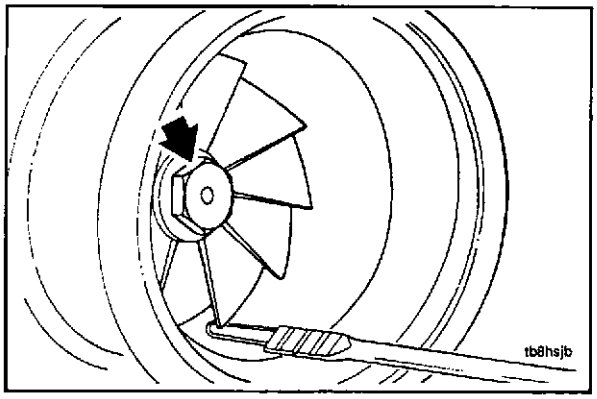


Caution: Insufficient turbine wheel to turbine housing clearance will cause serious engine damage.

If a problem is found disassemble the turbocharger and measure the parts with critical dimensions again to be sure the dimensions meet the specifications.

Use a tapered or wire type feeler gauge to measure the clearance.

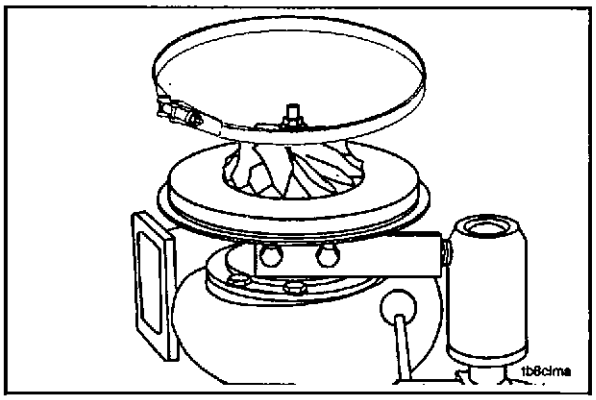
Push the turbine wheel away from the turbine housing.



Insert the gauge between the turbine wheel and the turbine housing.

Push the turbine wheel toward the turbine housing.

The minimum acceptable clearance is 0.20 mm [0.008 inch].

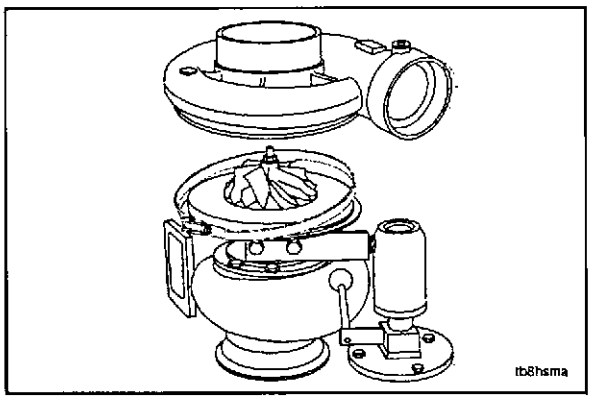


Turn the bearing housing (16) so that the compressor end is facing up.

Put the V-band clamp (2) on the bearing housing (16).

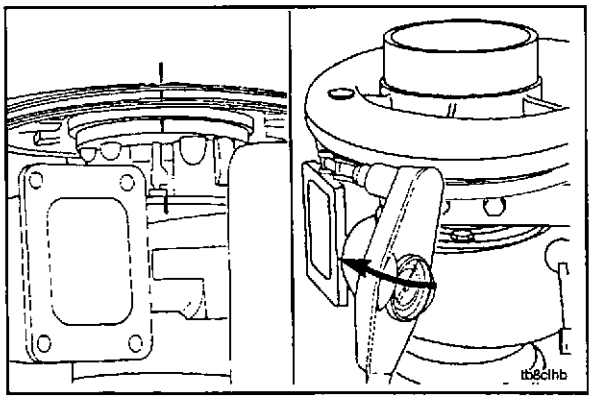
Caution: The compressor impeller (4) blades can be easily damaged when the compressor housing (1) is installed.

Hold the compressor housing with both hands. Carefully install the compressor housing on the bearing housing. Position the V-band (2) over the flanges.



Align the scribe marks on the bearing housing (16) compressor housing (1) and the V-band clamp (2).

Tighten the V-band clamp (2) regular hexagon nut to 14 N•m [120 in-lb] torque.

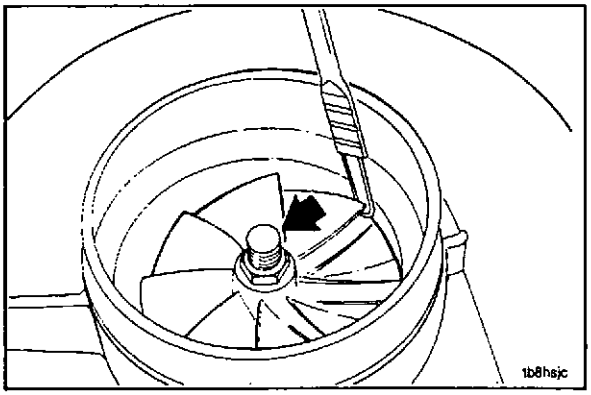


Caution: Insufficient compressor wheel to compressor housing clearance will cause serious engine damage.

If a problem is found disassemble the turbocharger and measure the parts with critical dimensions again to be sure the dimensions meet the specifications.

Use a tapered or wire type feeler gauge to check the clearance.

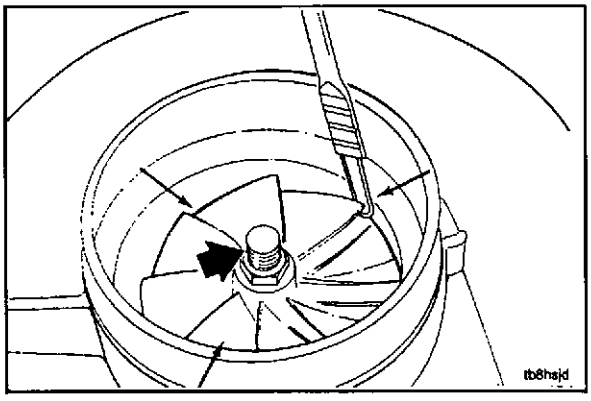
Push the compressor wheel away from the compressor housing.

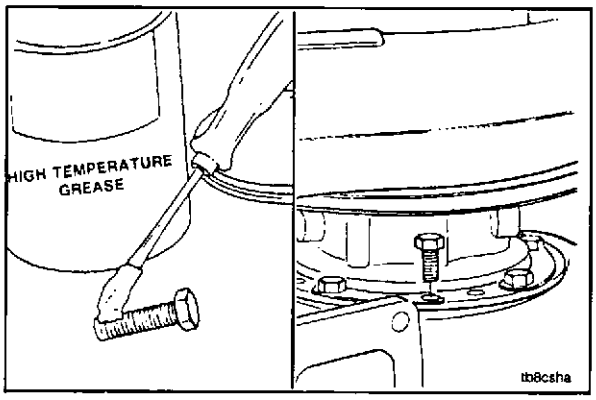


Insert the gauge between the compressor wheel and the compressor housing.

Push the compressor wheel toward the compressor housing.

The minimum acceptable radial clearance is 0.15 mm [0.006 inch].

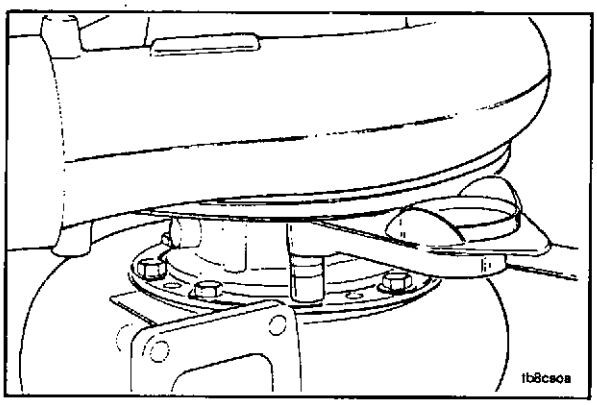




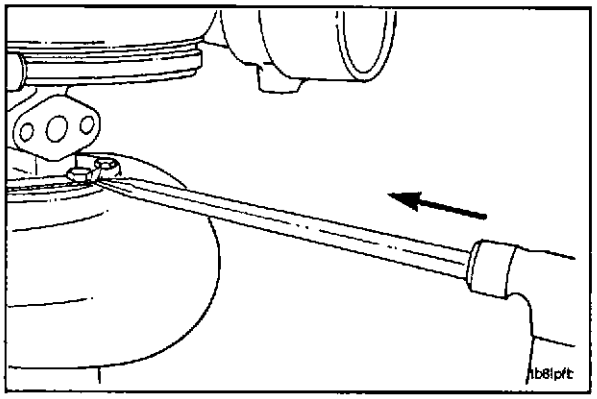
Remove the turbocharger from the Part No. 3375527 Mounting Plate which is used with the Part No. ST-302 Ball Joint Vise.

Use a high temperature grease to coat the remaining hexagon head capscrew (18) threads.

Install new lockplates and the remaining capscrews.



Tighten the capscrews (18) to 14 N•m [120 in-lb]torque.



Use a chisel and a hammer to bend the lockplate tangs against the capscrew heads.

Dimensions And Specifications

Part or Location	Min. mm	[In.]	Max. mm	[In.]	
Compressor Impeller Radial Clearance	0.15	[0.006]	0.46	[0.018]	
Turbine Wheel Radial Clearance	0.20	[0.008]	0.53	[0.021]	
Axial Motion	0.05	[0.002]	0.13	[0.005]	
Thrust Bearing Width at Bore	5.31	[0.209]	5.38	[0.212]	
Bearing Outside Diameter	27.873	[1.0973]	27.89	[1.098]	Replace if any bronze material is visible.
Bearing Inside Diameter	16.000	[0.6299]	16.013	[0.6304]	Replace if any bronze material is visible.
Shaft Bearing Journal Diameter	15.961	[0.6284]	15.976	[0.6289]	
Bearing Housing Bore at Bearing	28.000	[1.1023]	28.023	[1.1032]	
Thrust Collar Thickness	3.00	[0.118]	3.07	[0.121]	
Shaft and Wheel Split Ring Seal to Groove Clearance	0.038	[0.0015]	0.13	[0.005]	
Oil Slinger Split Ring Seal to Groove Clearance	0.038	[0.0015]	0.13	[0.005]	

Assembly Torque Specifications

V-Band Clamp Nut Compressor	14 N•m	120 in-lb
Impeller Nut	45 N•m	33 ft-lb
Turbine Housing Hexhead Capscrews	14 N•m	120 in-lb
Turbocharger Diffuser Hexhead Capscrews	27 N•m	230 in-lb

Notes:

Cummins Engine Company, Inc.
Box 3005
Columbus, Indiana 47202-3005

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