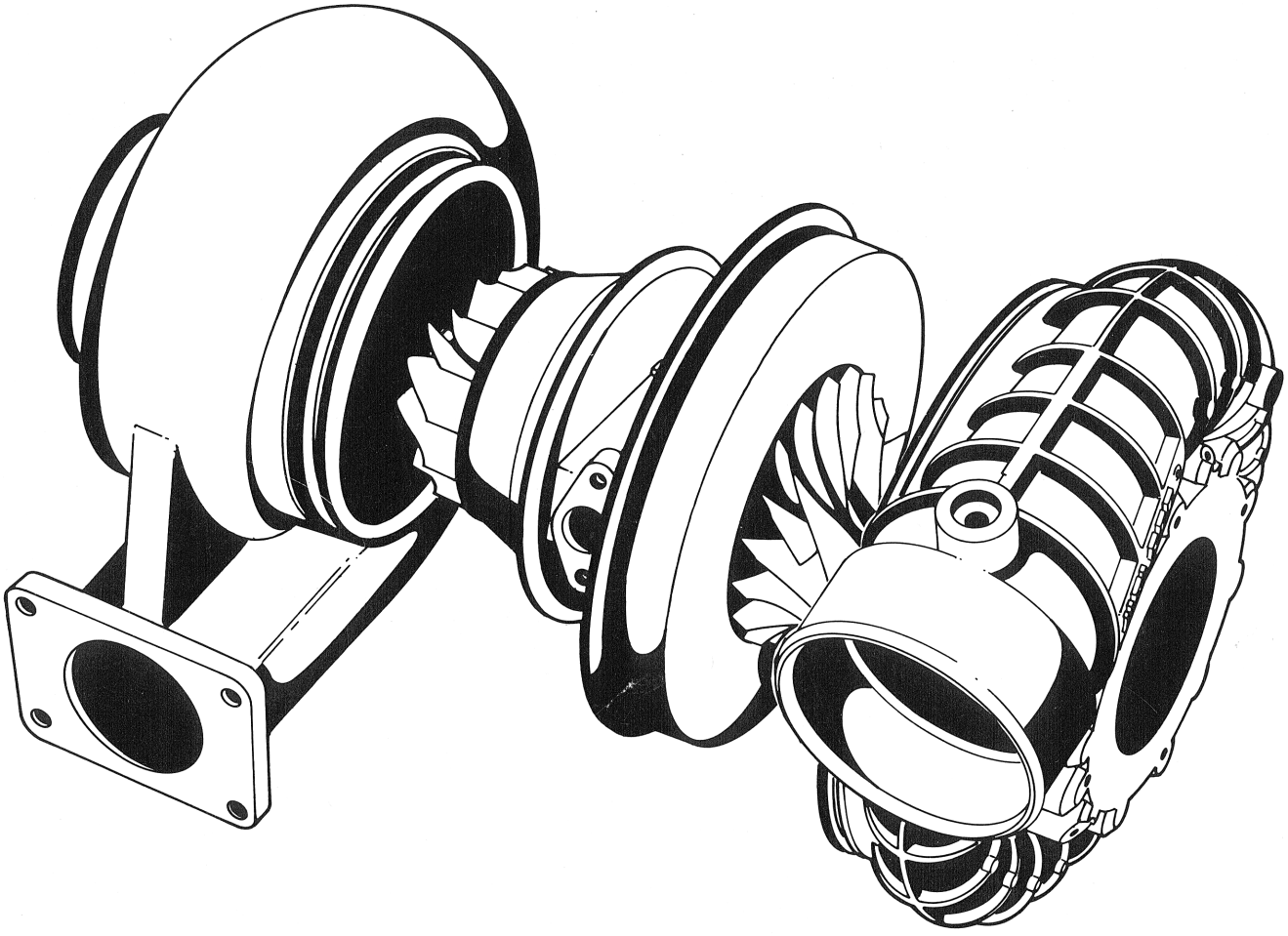
Shop Manual
HT 100 Series Turbocharger



Holset® HT100 Series Turbocharger

Table of Contents

Foreword

This publication was written to assist Field Personnel with rebuilding the Holset® HT100 turbocharger. This turbocharger uses **metric capscrews** and **threads**. Disassembly, Cleaning, Inspection, and Assembly instructions are included in this manual. A Specifications table is also provided.

Description

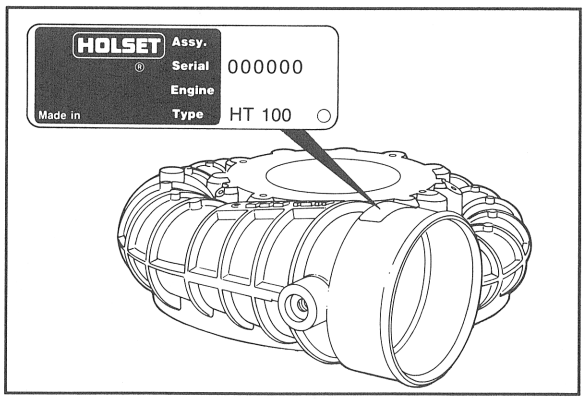
A turbocharger is a mechanical device which uses the engine's exhaust gases to force more air into the engine cylinders. A turbocharger uses energy from the engine to help increase its overall efficiency. Hot exhaust gas energy is used to turn a "shaft and wheel". At the other end of the shaft and wheel 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 cared for.

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.



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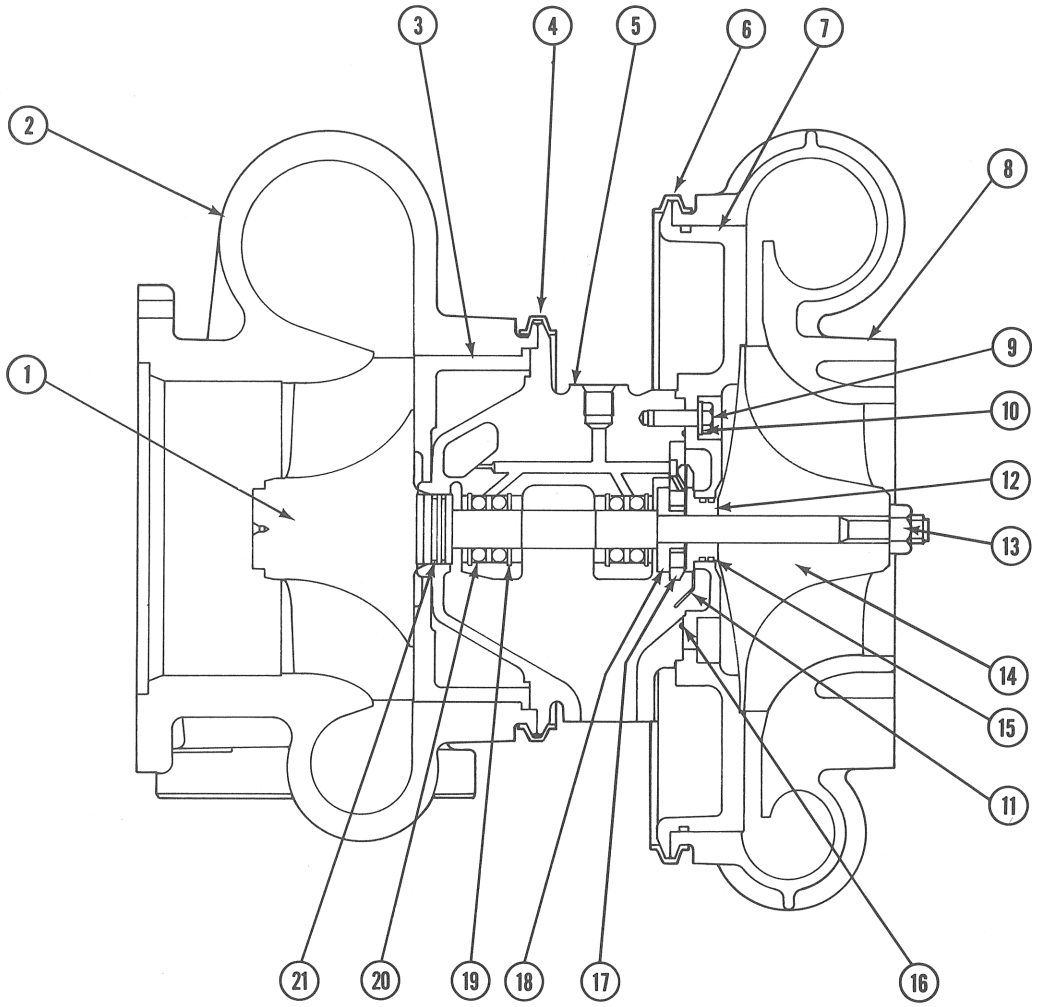
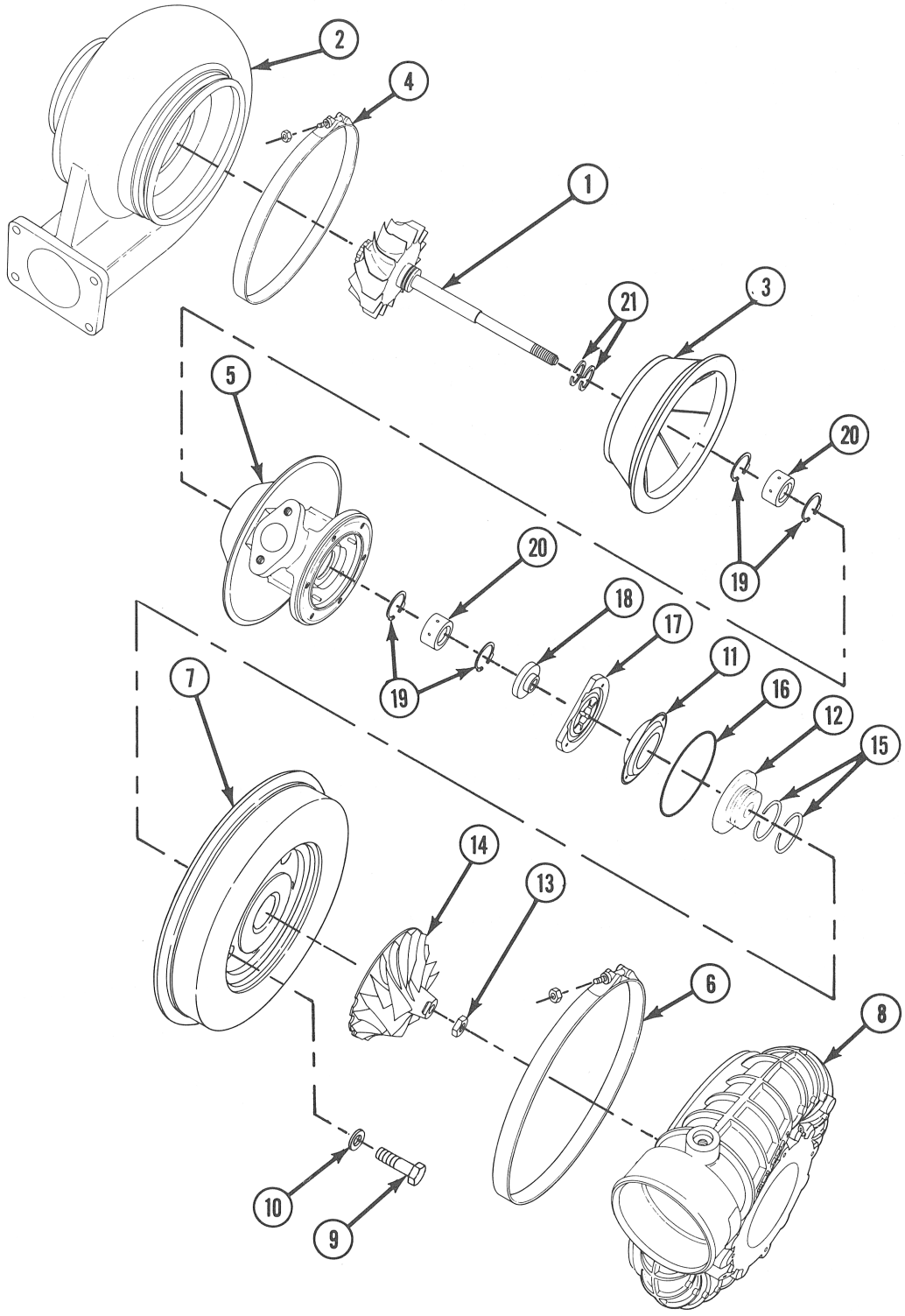


Ref. No.	Description	Qty.
1	Shaft and Wheel	1
2	Turbine Housing	1
3	Heat Shield	1
4	V-Band Clamp	1
5	Bearing Housing	1
6	V-Band Clamp	1
7	Diffuser	1
8	Compressor Housing	1
9	Hexagon Head Set Screw	6
10	Plain Washer	6
11	Oil Baffle	1

Ref. No.	Description	Qty.
12	Oil Slinger	1
13	Lock Nut	1
14	Compressor Impeller	1
15	Split Ring Seal	2
16	O-Ring Seal	1
17	Thrust Bearing	1
18	Thrust Collar	1
19	Retaining Ring	4
20	Bearing	2
21	Split Ring Seal	2



Exploded View of the HT100 Turbocharger

Symbols Used in This Manual

The following group of symbols are 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.

CAUTION - The component **WEIGHS** 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

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.

Simbolos Usados En Este Manual

Los símbolos siguientes son usados en este manual para clarificar el proceso de las instrucciones. Cuando aparece uno de estos símbolos, su significado se especifica en la parte inferior.

ADVERTENCIA - Serios daños personales o daño a la propiedad puede resultar si las instrucciones de Advertencia **no** se consideran.

PRECAUCION - Daños menores pueden resultar, o de piezas del conjunto o el motor puede averiarse si las instrucciones de Precaución **no** se siguen.

PRECAUCION - El componente pesa 23 kgs [50 lb] o mas. para evitar dano corporal empleen una cabria u obtengan ayuda para elevar el componente.

Indica un paso de **REMOCION** o **DESMONTAJE.**

Indica un paso de **INSTALACION** o **MONTAJE.**

Se requiere **INSPECCION.**

LIMPIESE la pieza o el montaje.

EJECUTESE una **MEDICION** mecánica o del tiempo.

LUBRIQUESE la pieza o el montaje.

Indica que se dará una **LLAVE DE TUERCAS** o el **TAMAÑO DE HERRAMIENTA.**

APRIETESE hasta un par torsor específico.

EJECUTESE una **MEDICION** eléctrica.

Para información adicional refiérase a otro emplazamiento de este manual o a otra publicación anterior.

Symbole

In diesem Handbuch werden die folgenden Symbole verwendet, die wesentliche Funktionen hervorheben. Die Symbole haben folgende Bedeutung:

WARNUNG - Wird die Warnung **nicht** beachtet, dann besteht erhöhte Unfall- und Beschädigungsgefahr.

VORSICHT - Werden die Vorsichtsmassnahmen **nicht** beachtet, dann besteht Unfall- und Beschädigungsgefahr.

VORSICHT - Das teil weigt 23 kg [50 lb] oder mehr. Zur vermeidung von koerperverletzung winde benutzen oder hilfe beim heben des teils in anspruch nehmen.

AUSBAU bzw. **ZERLEGEN.**

EINBAU bzw. **ZUSAMMENBAU.**

INSPEKTION erforderlich.

Teil oder Baugruppe **REINIGEN.**

DIMENSION - oder **ZEITMESSUNG.**

Teil oder Baugruppe **ÖLEN.**

WERKZEUGGRÖSSE wird angegeben.

ANZUG auf vorgeschriebenes Drehmoment erforderlich.

Elektrische **MESSUNG DURCHFÜHREN.**

Weitere Informationen an anderer Stelle bzw. in anderen Handbüchern.

Symboles Utilises Dans Ce Manuel

Les symboles suivants sont utilisés dans ce manuel pour aider à communiquer le but des instructions. Quand l'un de ces symboles apparaît, il évoque le sens défini ci-dessous:

AVERTISSEMENT - De graves lésions corporelles ou des dommages matériels considérables peuvent survenir si les instructions données sous les rubriques " Avertissement" **ne** sont **pas** suivies.

ATTENTION - De petites lésions corporelles peuvent survenir, ou bien une pièce, un ensemble ou le moteur peuvent être endommagés si les instructions données sous les rubriques " Attention" **ne** sont **pas** suivies.

ATTENTION - Le composant pese 23 kg [50 lb] ou davantage. Pour eviter toute blessure, employer un appariel de levage ou demander de l'aide pur le soulever.

Indique une opération de **DEPOSE.**

Indique une opération de **MONTAGE.**

L'INSPECTION est nécessaire.

NETTOYER la pièce ou l'ensemble.

EFFECTUER une **MESURE** mécanique ou de temps.

GRAISSER la pièce ou l'ensemble.

Indique qu'une **DIMENSION DE CLE** ou **D'OUTIL** sera donnée.

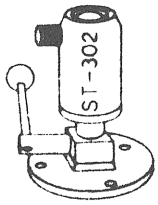
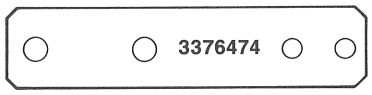
SERRER à un couple spécifique.

EFFECTUER une **MESURE** électrique.

Se reporter à un autre endroit dans ce manuel ou à une autre publication pour obtenir des informations plus complètes.

Required Service Tools

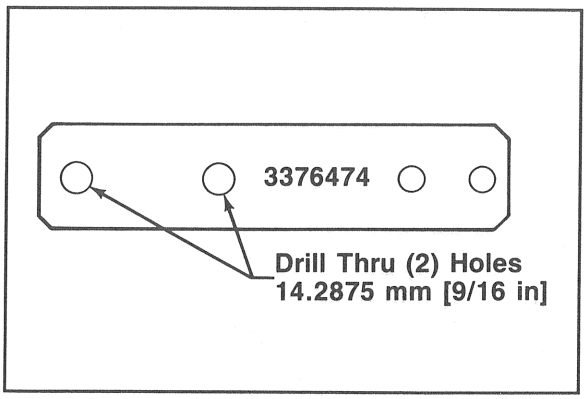
The following special tools are recommended to perform procedures in this manual. The use of these tools is shown in the appropriate procedure. These tools can be purchased from your local Cummins Authorized Repair Location.

Tool No.	Tool Description	Tool Illustration
ST-302	**Ball Joint Vice** Used to hold any Cummins PT fuel pump, turbocharger or air compressor for disassembly or assembly.	
3376474	**Adapter Plate** Part of H2B Turbocharger Rebuild Kit, Part No. 3375543. Use with Part No. ST-302, Ball Joint Vice, to mount the turbocharger for disassembly and assembly.	
Common Tools	**11mm, 13mm, 22mm** Box End Small Screwdriver Snap Ring Pliers Punch Hammer Plastic Hammer **N•m [in-lb]** Torque Wrench	

Disassembly

14.2875 mm 9/16 inch drill bit

Enlarge the two mounting holes in the adapter plate, Part No. 3376474 as shown.



Caution: The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

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

Compressor housing (8)

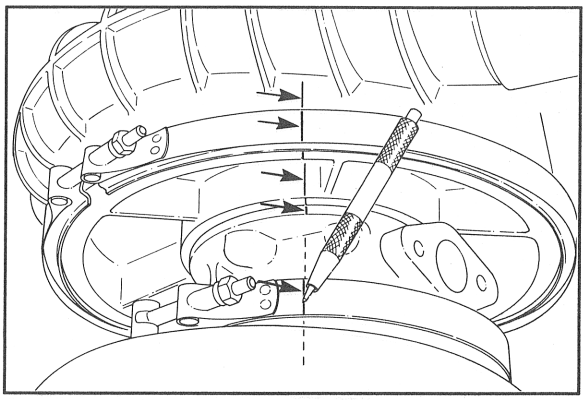
V-band clamp (4)

Diffuser (7)

Bearing housing (5)

Turbine housing (2)

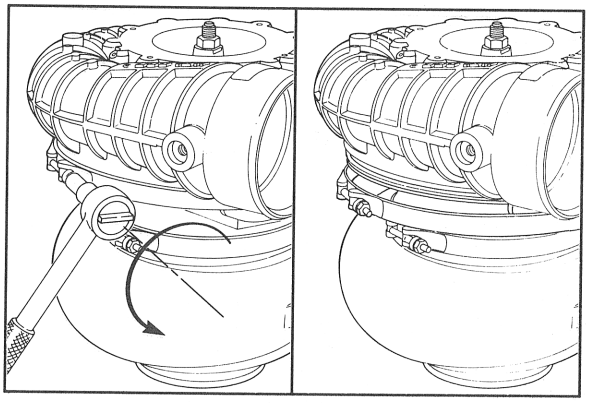
V-band clamp (6)



11 mm

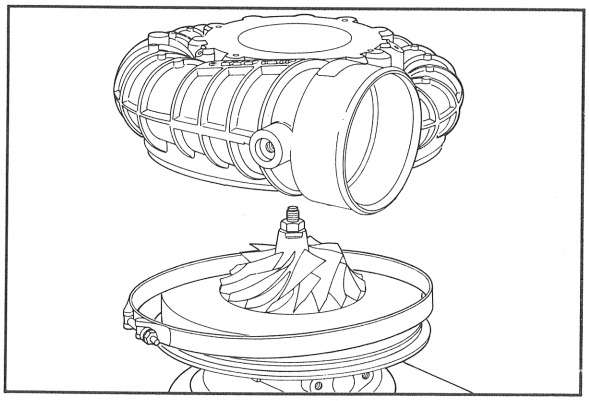
Loosen the V-band clamp (6) regular hexagon nut.

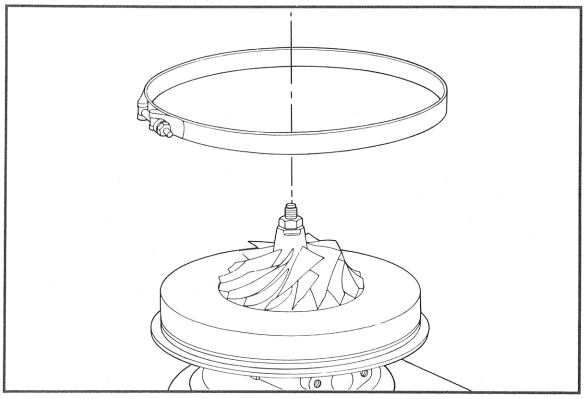
Move the clamp onto the bearing housing.



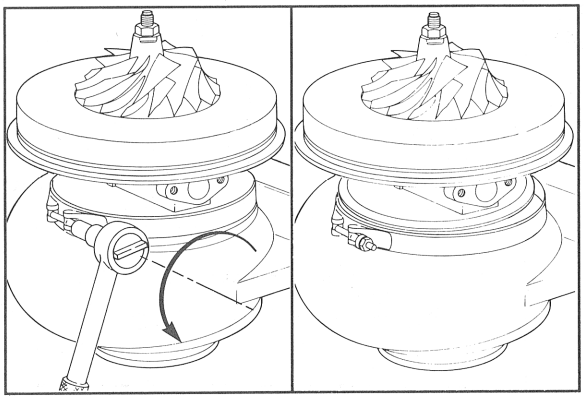
Caution: The compressor impeller blades can be easily damaged when the compressor housing (8) is removed.

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





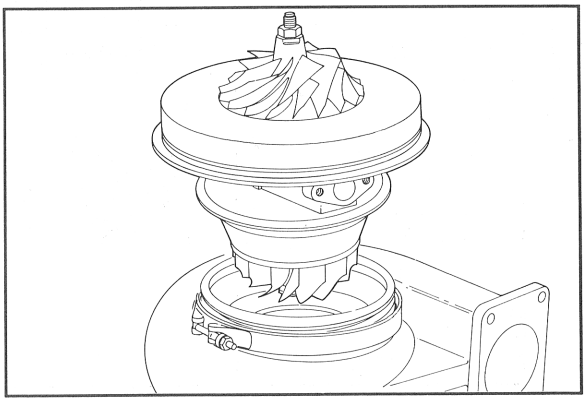
Remove the clamp.



11 mm

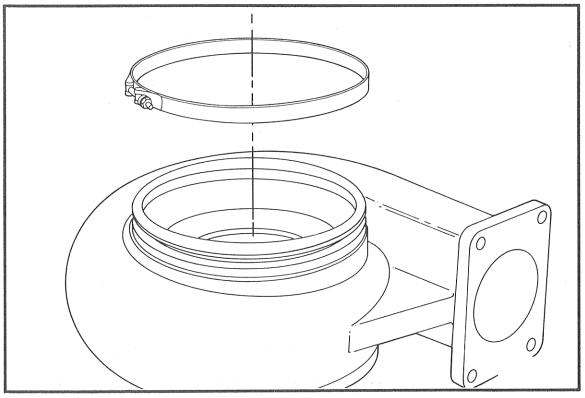
Loosen the V-band clamp (4) regular hexagon nut.

Move the clamp onto the bearing housing (5).



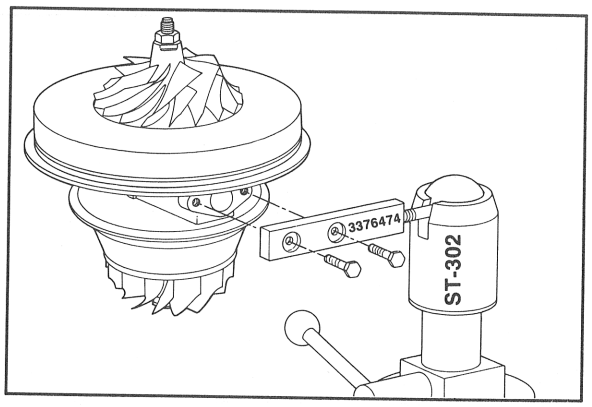
Caution: The turbine blades can be easily damaged when the bearing housing assembly is removed from the turbine housing (2).

Hold the bearing housing assembly with both hands and carefully remove it from the turbine housing (2).



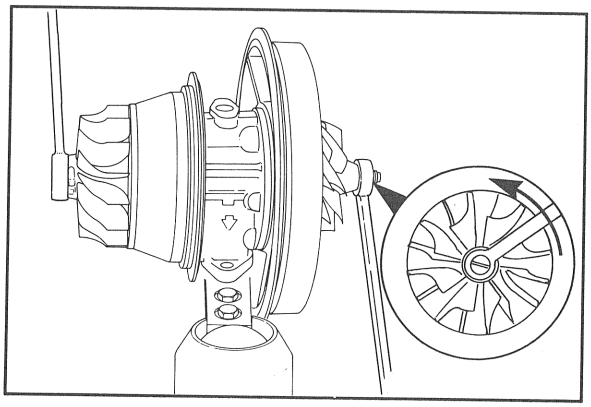
Remove the clamp.

Install the assembly to the adapter plate, Part No. 3376474, which is used with the ball joint vise, Part No. ST-302.

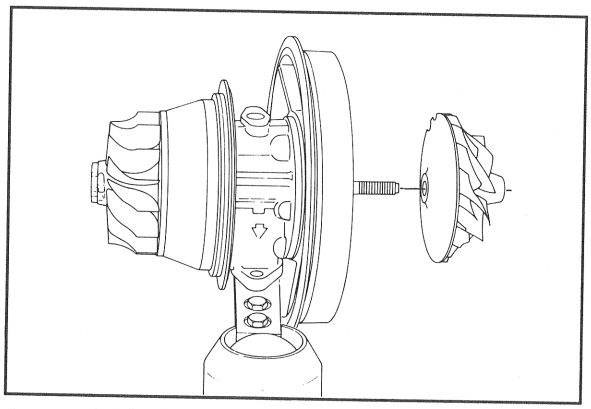


22 mm

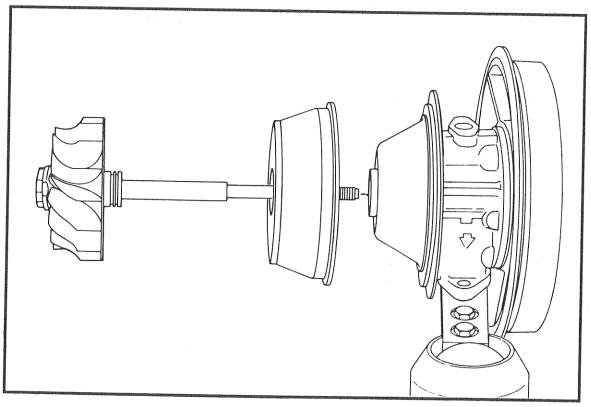
Remove the impeller nut (13).

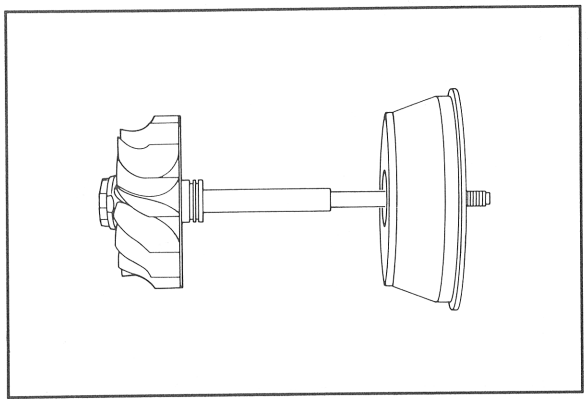


Remove the compressor impeller (14).

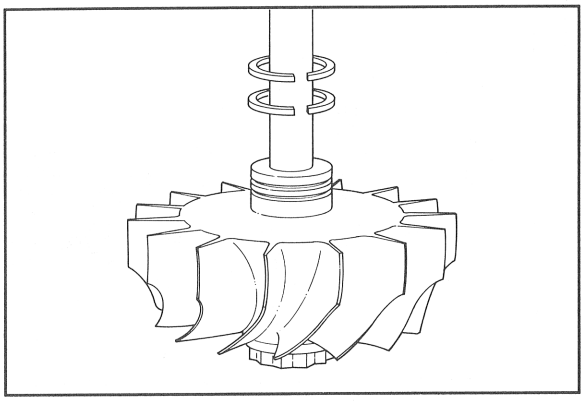


Remove the shaft and wheel (1).

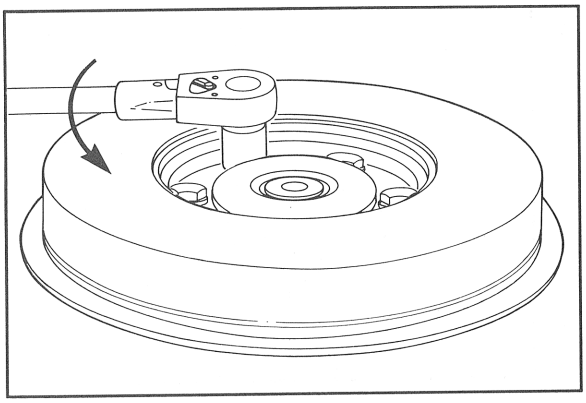




Remove the heat shield (3).



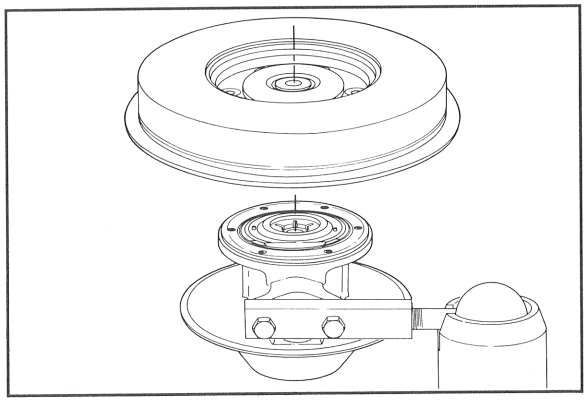
Remove and discard the two split ring seals (21).



13 mm

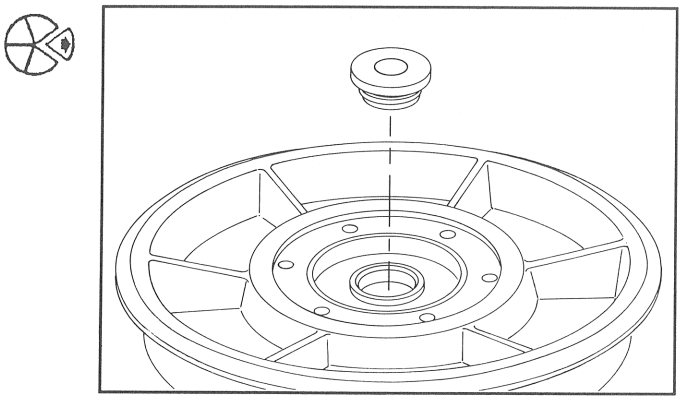
Turn the assembly so the turbocharger diffuser (7) is facing up.

Remove and discard the six hexagon head capscrews (9) and the six plain washers (10).

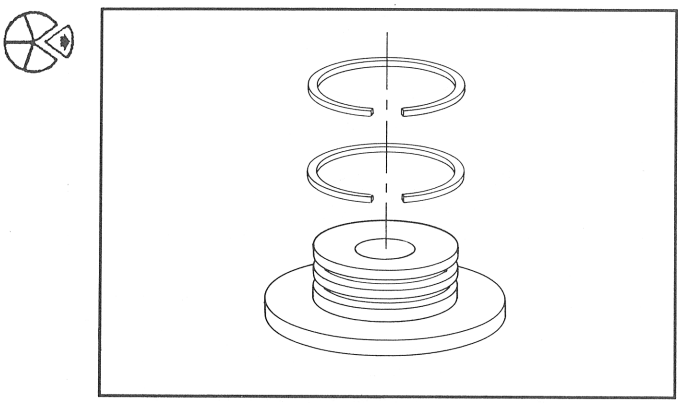


Remove the diffuser.

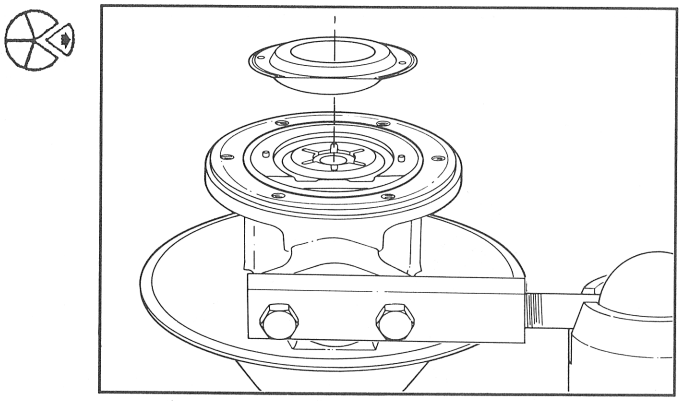
Remove the oil slinger (12).



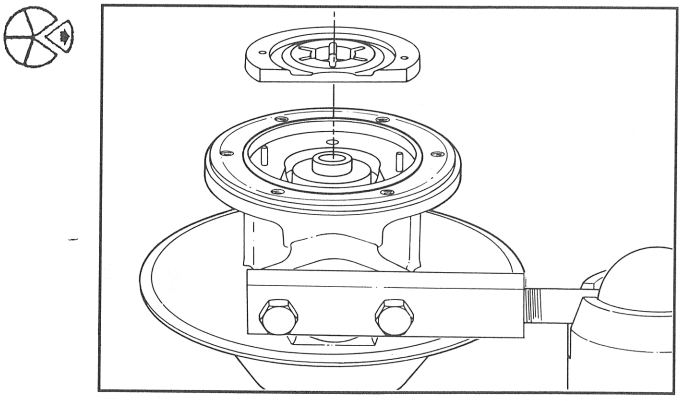
Remove and discard the two split ring seals (15).

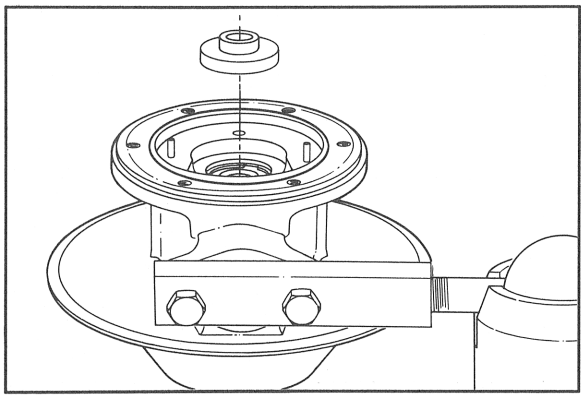


Remove the oil baffle (11).

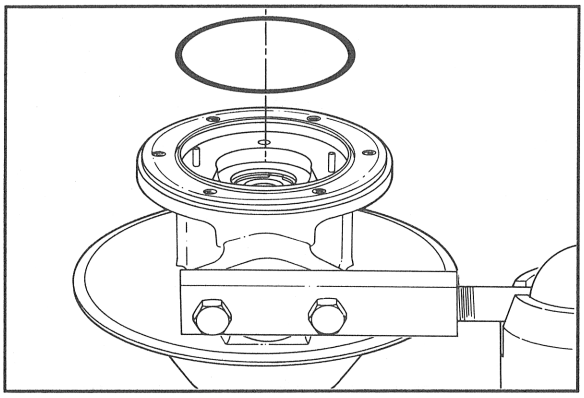


Remove the thrust bearing (17).

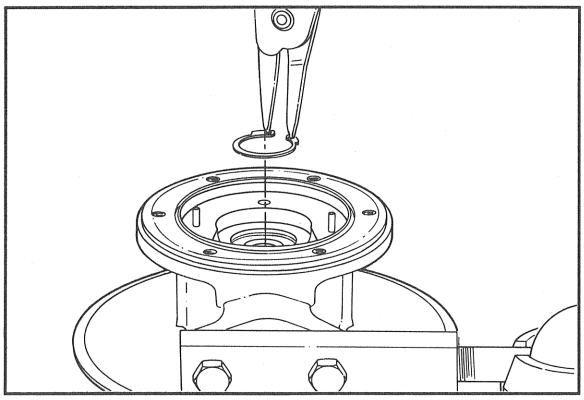




Remove the thrust collar (18).

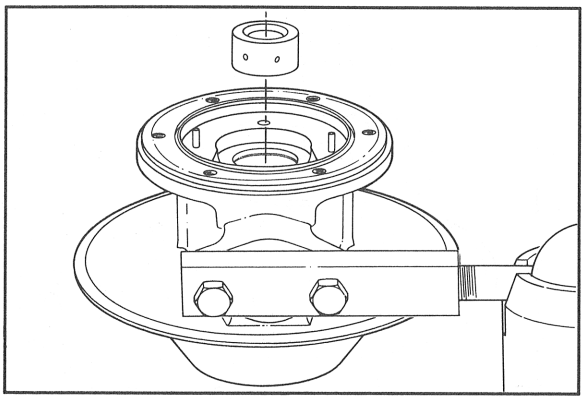


Remove and discard the o-ring seal (16).



Snap ring pliers

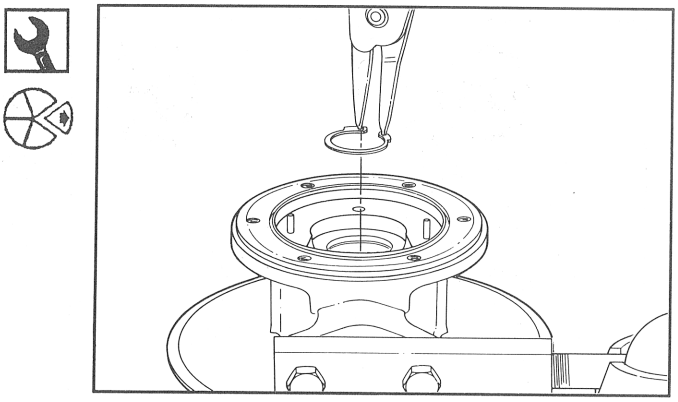
Remove the outer retaining ring (19).



Remove the bearing (20).

Snap Ring Pliers

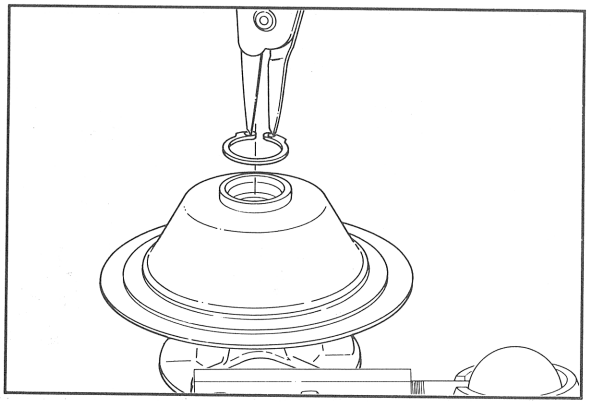
Remove the inner retaining ring (19).



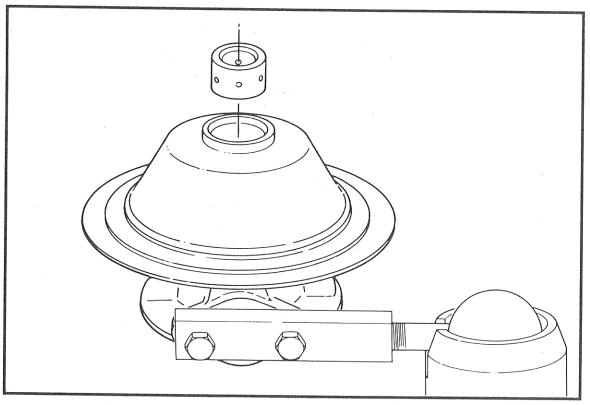
Turn the bearing housing so the turbine end is facing up.

Snap Ring Pliers

Remove the outer retaining ring (19).

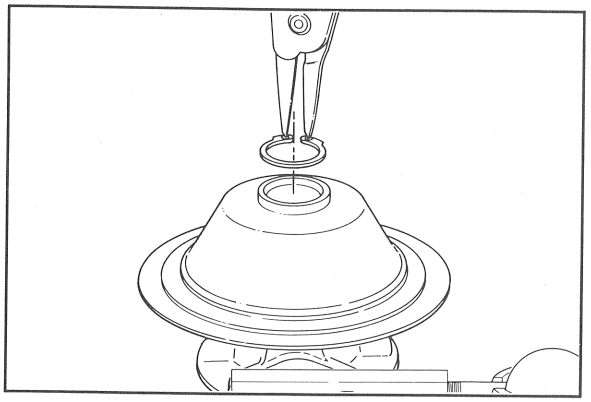


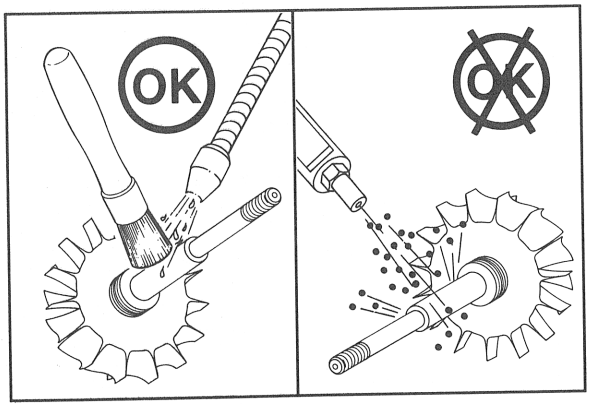
Remove the bearing (20).



Snap Ring Pliers

Remove the inner retaining ring (19).



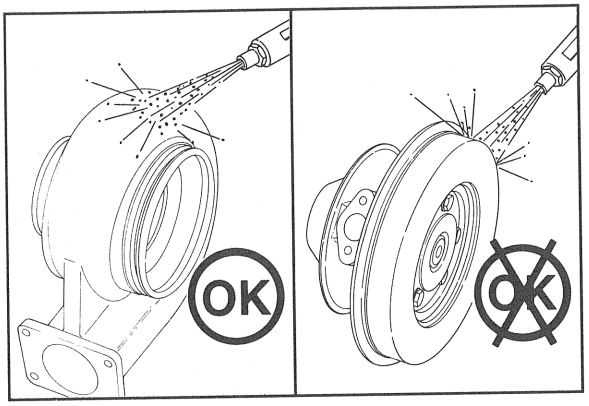


Cleaning

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.

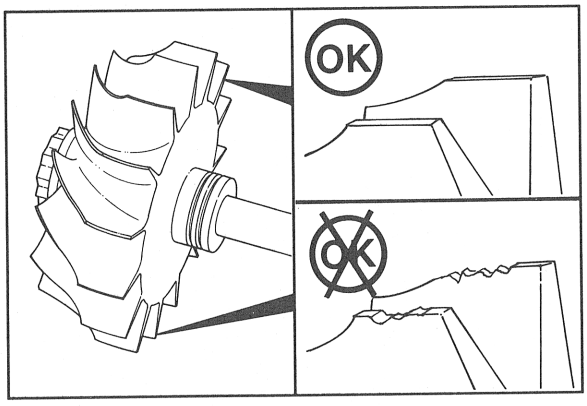
Caution: Do not bead blast the shaft and wheel. Critical machined areas and balance will be affected.

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



Caution: Do not bead blast the bearing housing, compressor housing or the diffuser. Critical machined areas will be damaged.

Bead blast can be used to clean the turbine housing.



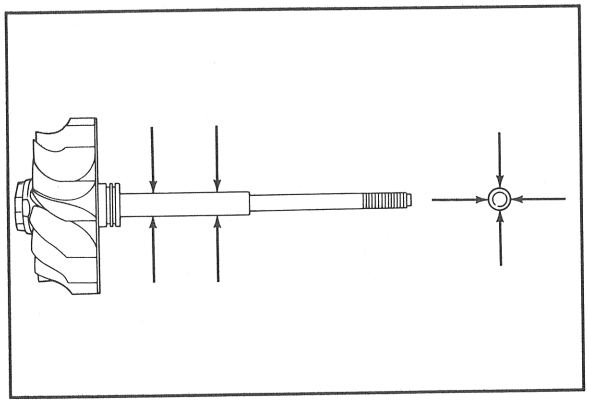
Inspection

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.

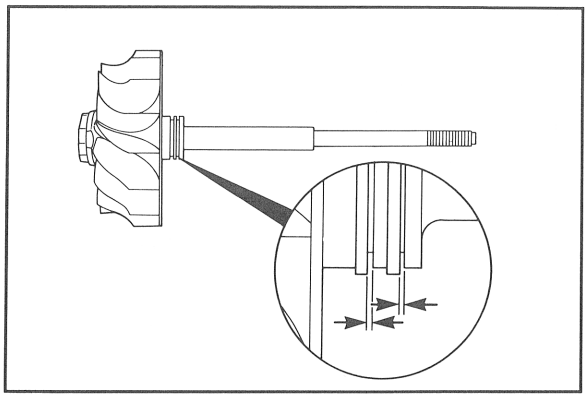


Measure the bearing journals.

Shaft and Wheel Journals		
mm		in
19.936	MIN	0.7849
19.950	MAX	0.7854

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

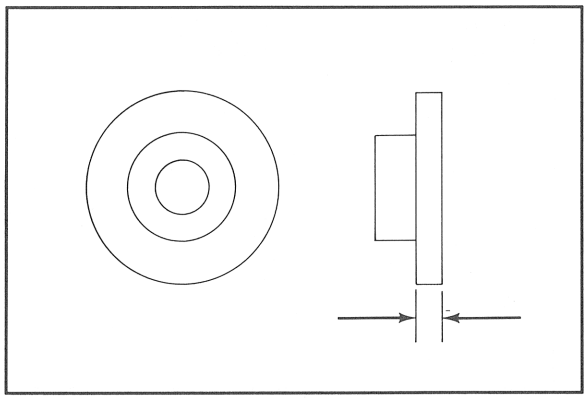
Side Clearance		
mm		in
0.0762	MIN	0.003
0.1524	MAX	0.006



Thrust Collar

Measure the thrust collar thickness.

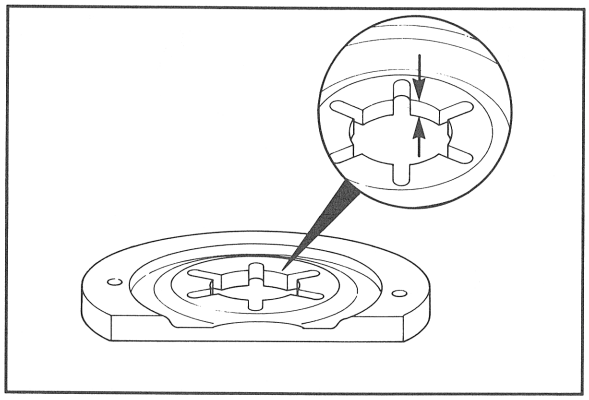
Thrust Collar		
mm		in
6.31	MIN	0.2484
6.39	MAX	0.2516



Thrust Bearing

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

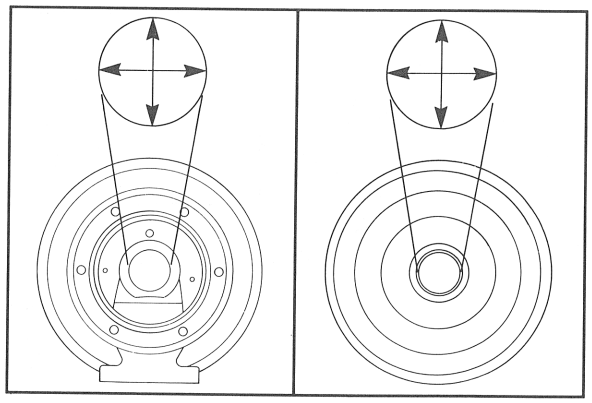
Thrust Bearing		
mm		in
7.400	MIN	0.2941
7.470	MAX	0.294

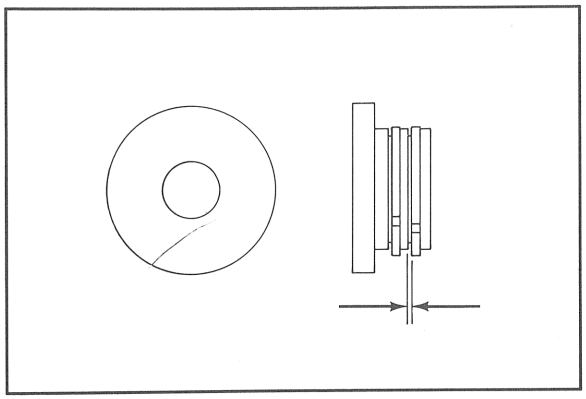


Bearing Housing

Measure the bearing housing bores.

Bearing Housing Bores		
mm		in
35.000	MIN	1.3786
35.033	MAX	1.3793

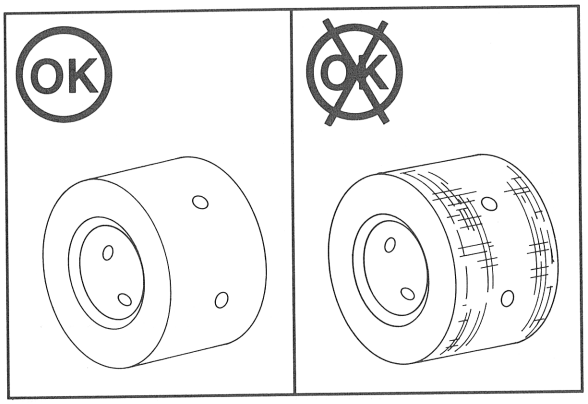




Oil Slinger

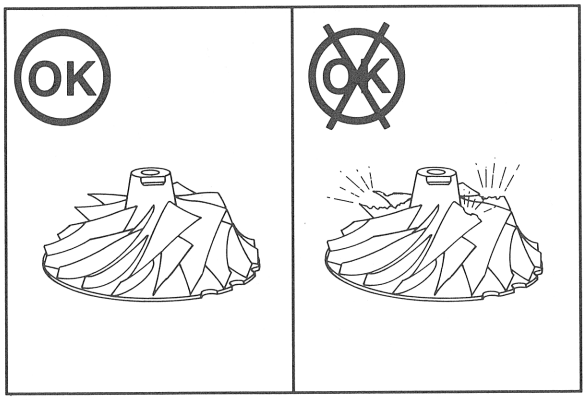
Measure the split ring seal side clearance with new split ring seals installed.

Side Clearance		
mm		in
0.0762	MIN	0.003
0.1524	MAX	0.006



Bearings

Replace if any bronze material is visible through the tin plating.

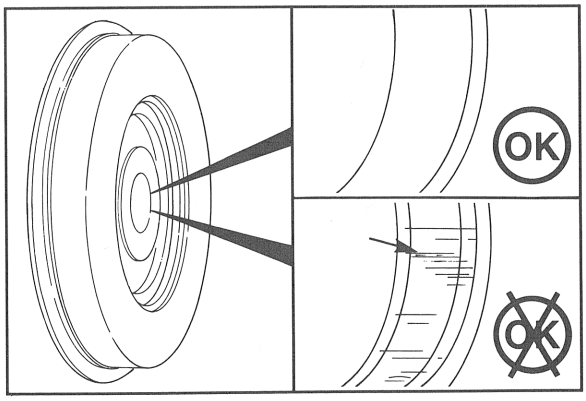


Compressor Impeller

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.

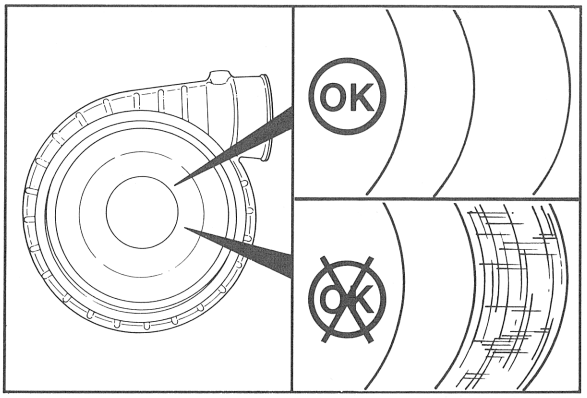


Turbocharger Diffuser

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

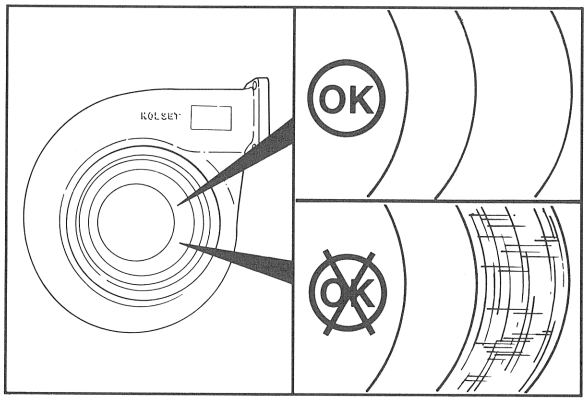
Compressor Housing

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

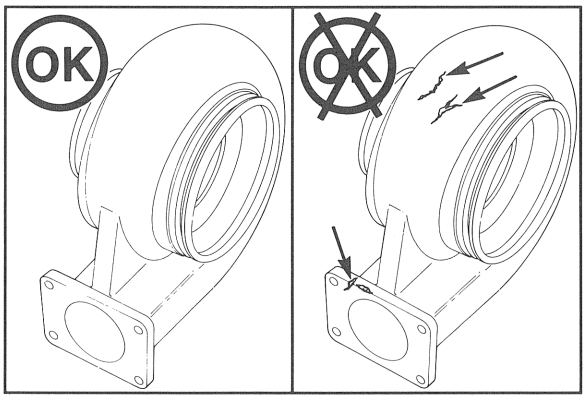


Turbine Housing

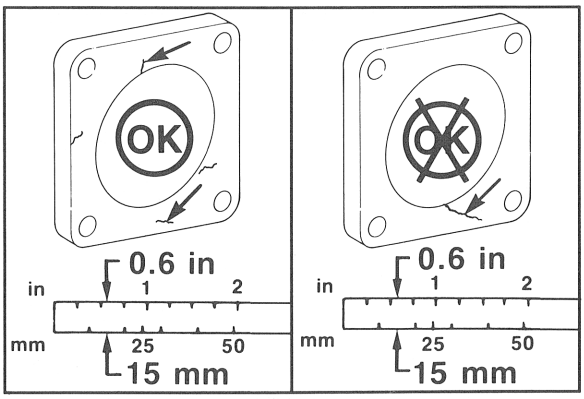
Inspect and replace if scratched or damaged by the shaft and wheel.

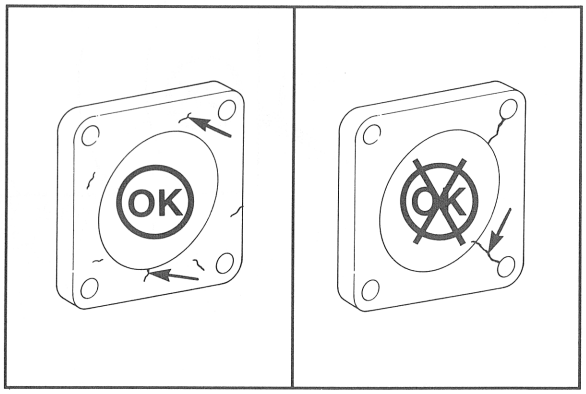


Inspect and replace if through cracks are found in the outer walls.

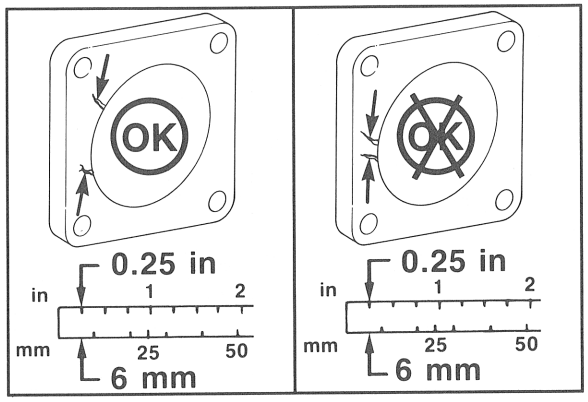


Cracks on the mounting flange longer than 15 mm [0.6 inch] are **not** acceptable.

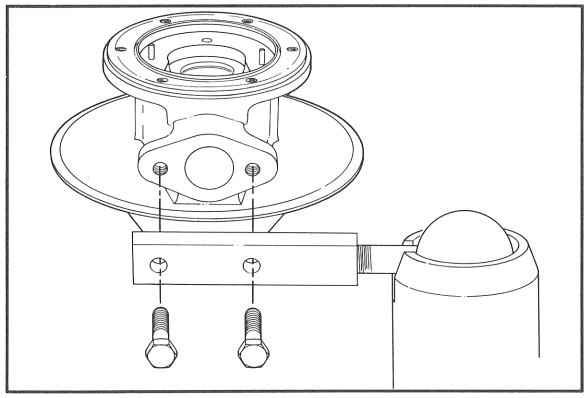




Cracks must **not** reach the mounting holes.

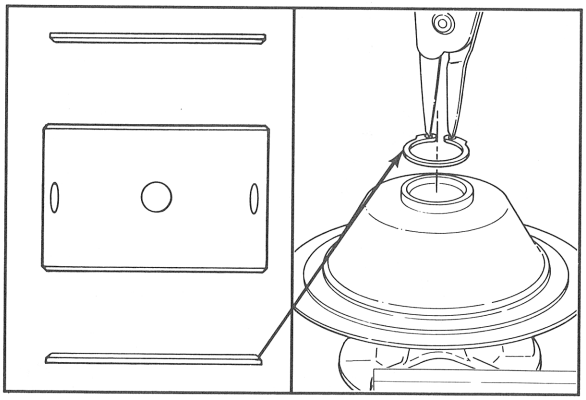


Two cracks **must** be separated by 6.4 mm [0.25 inch].



Assembly

Install the bearing housing (5) to the adapter plate, Part No. 3376474, which is used with the ball joint vise, Part No. ST-302.



Caution: The retaining rings (19) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear can result if the retaining rings are installed backward.

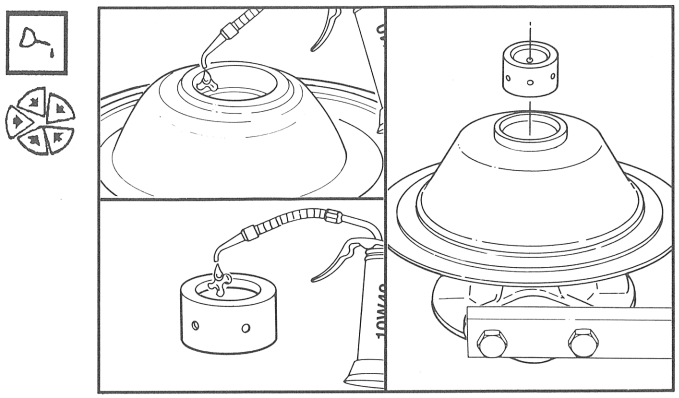
Position the housing so that the turbine end is facing up.

Snap Ring Pliers

Install the inner retaining ring.

Use clean engine oil to lubricate the bearing housing (5) bore and the bearing (20).

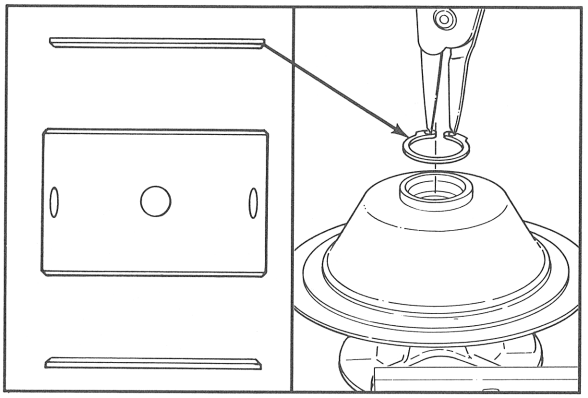
Install the bearing.



Caution: The retaining ring (19) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear can result if the retaining rings are installed backward.

Snap Ring Pliers

Install the outer retaining ring.

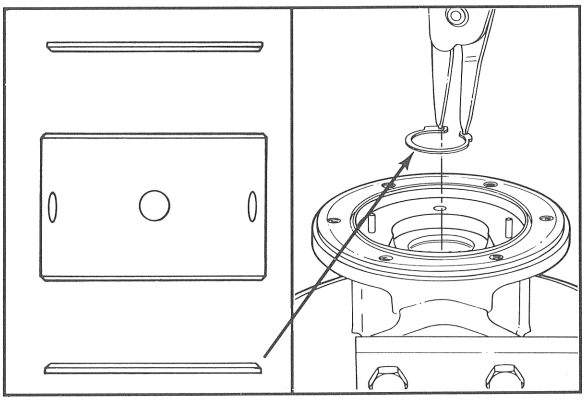


Caution: The retaining ring (19) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear can result if the retaining rings are installed backward.

Turn the bearing housing (5) so that the compressor end is facing up.

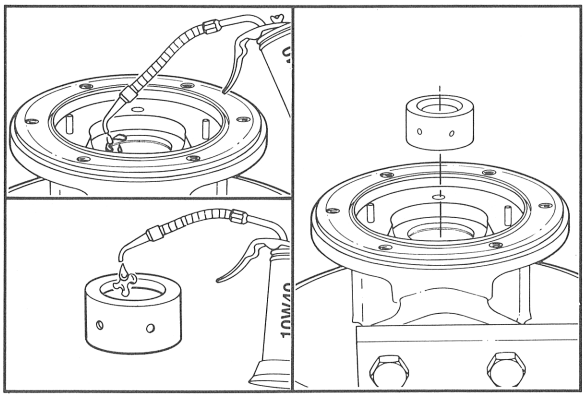
Snap Ring Pliers

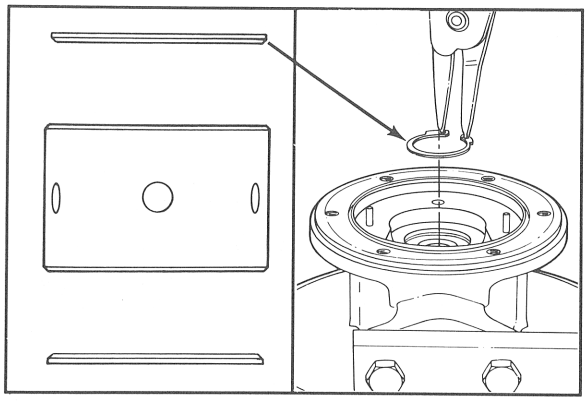
Install the inner retaining ring.



Use clean engine oil to lubricate the bearing housing (5) bore and the bearing (20).

Install the bearing.

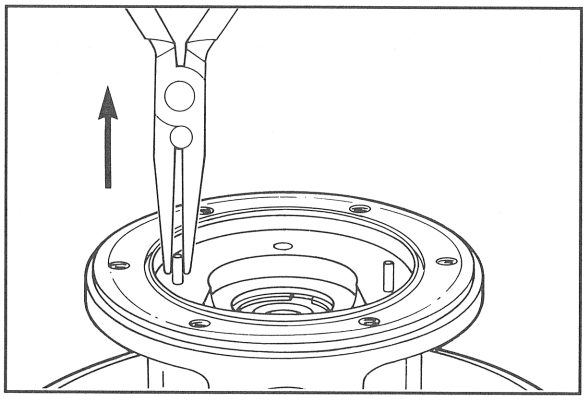




Caution: The retaining ring (19) must be installed with the beveled side (a) facing the bearing. Excessive bearing wear can result if the retaining rings are installed backward.

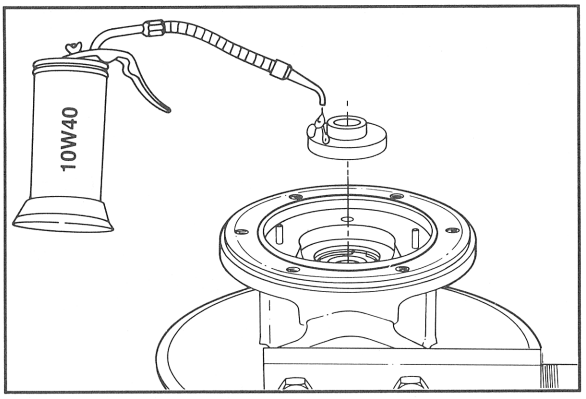
Snap Ring Pliers

Install the outer retaining ring.



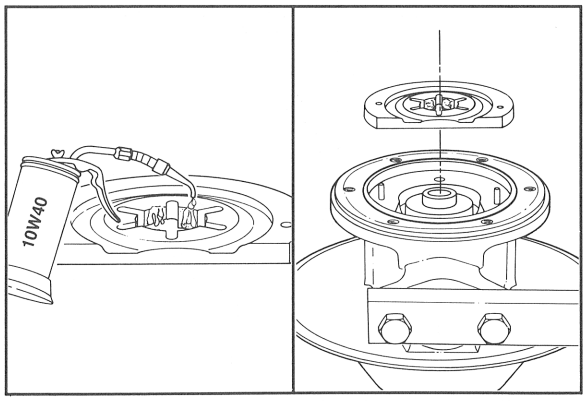
Use pliers to pull the two roll pins out 3 mm [1/10 inch] approximately.

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(18).

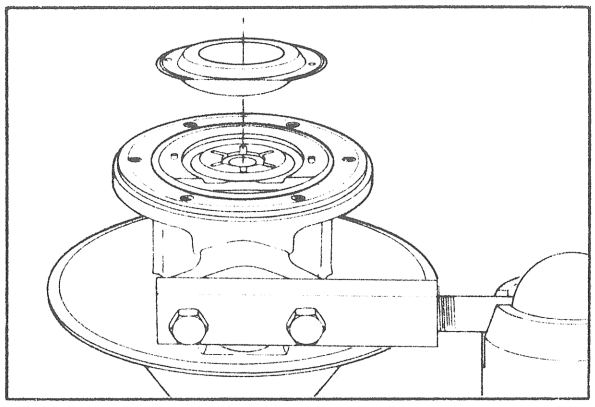
Install the thrust collar.



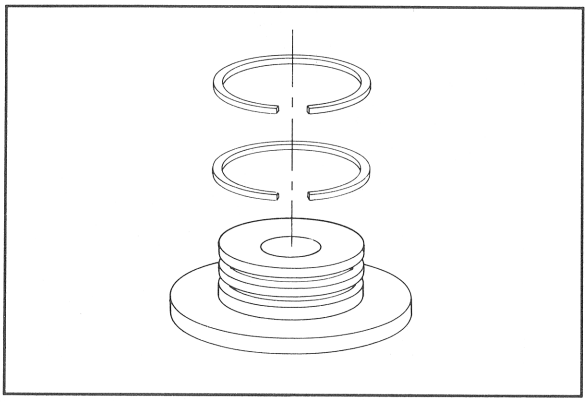
Use clean engine oil to lubricate the thrust bearing (17).

Install the thrust bearing.

Install the oil baffle (11).

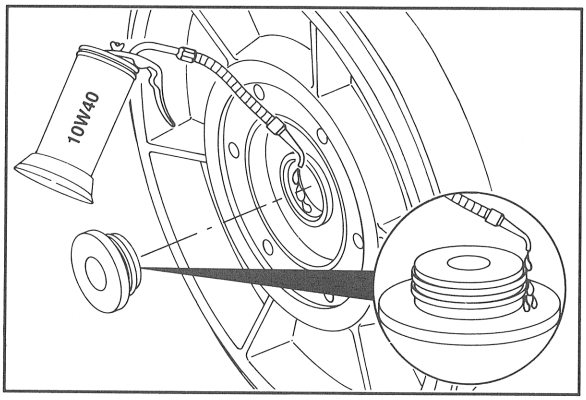


Install new split ring seals (15) on the oil slinger (12).

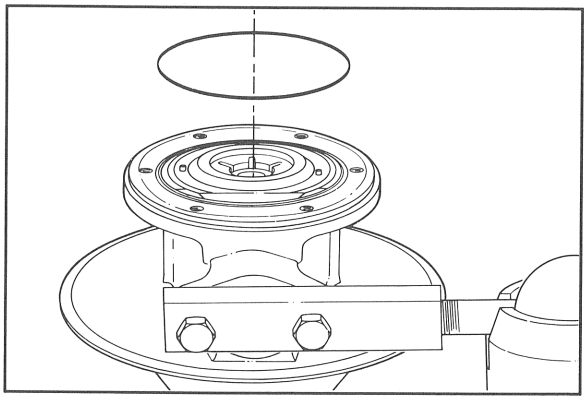


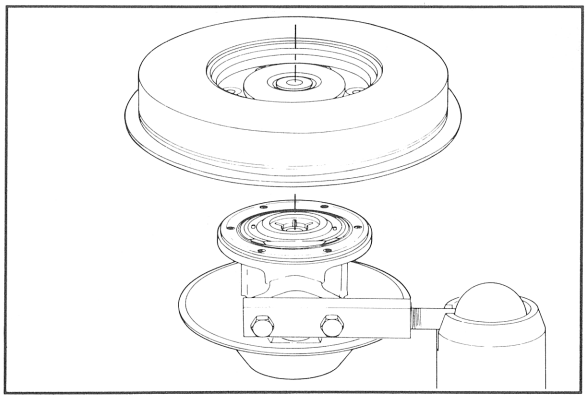
Use clean engine oil to lubricate the turbocharger diffuser (7) bore and the split ring seals (15).

Install the oil slinger (12) into the turbocharger diffuser (7) bore.

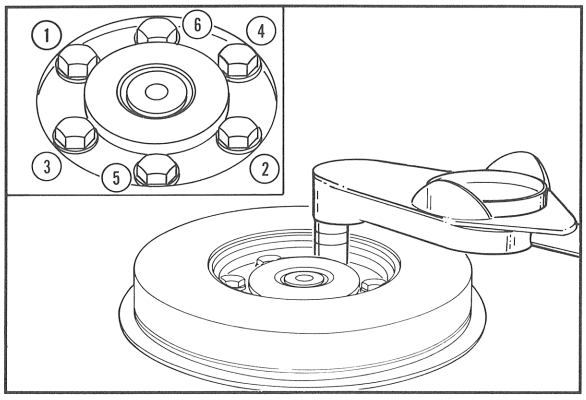


Install a new o-ring seal (16).





Install the turbocharger diffuser (7) on the bearing housing (5).

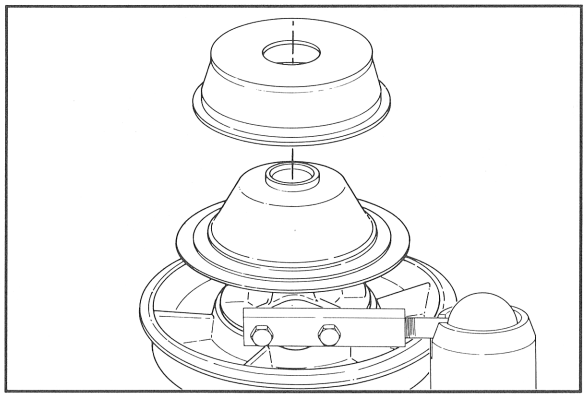


Install six new plain washers (10) and six new hexhead capscrews (9).

13 mm

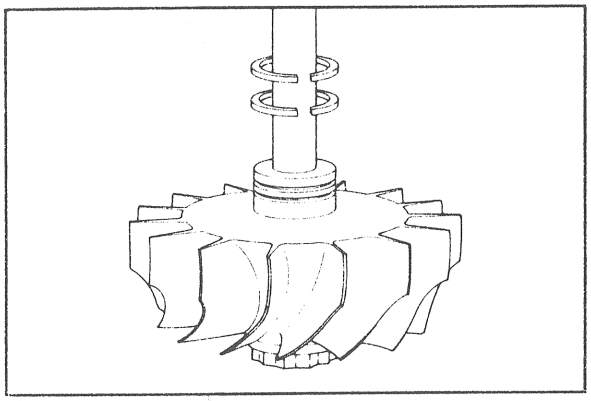
Tighten the capscrews in a diagonal pattern to 27 N•m [230 in-lb] torque.

NOTE: Torque the capscrews twice to make sure that all six are tightened equally.



Turn the bearing housing (5) so that the turbine end is facing up.

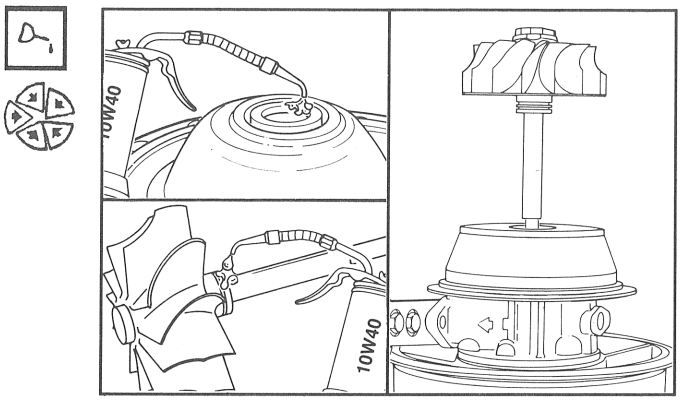
Install the heat shield (3).



Install new split ring seals (21) on the shaft and wheel (1).

Use clean engine oil to lubricate the bearing housing bore, the split ring seals (21) and the shaft and wheel journals (1).

Install the shaft and wheel.

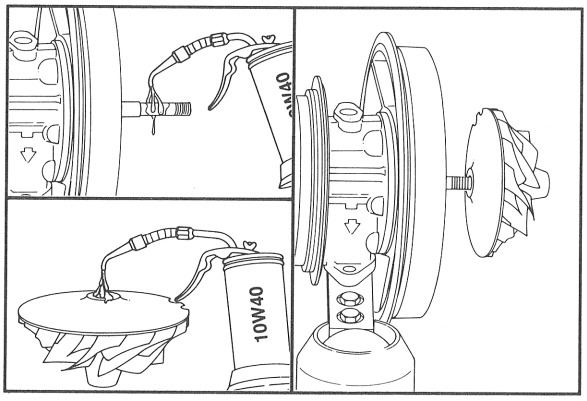


Turn the bearing housing (5) to the horizontal position.

Use clean engine oil to lubricate the shaft and wheel (1) journal.

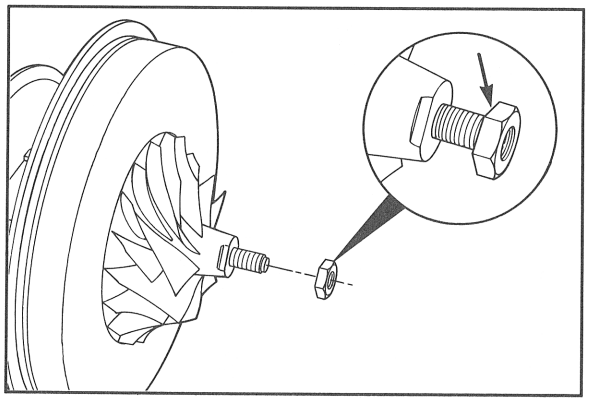
Install the compressor impeller (14).

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



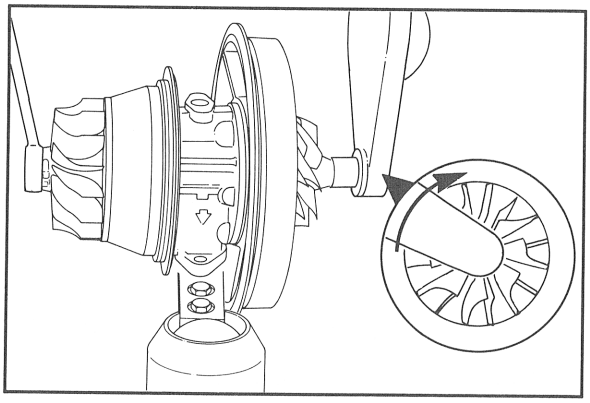
Caution: The impeller nut (13) must be installed with the flat side toward the compressor impeller (14). Improper installation will cause compressor impeller damage.

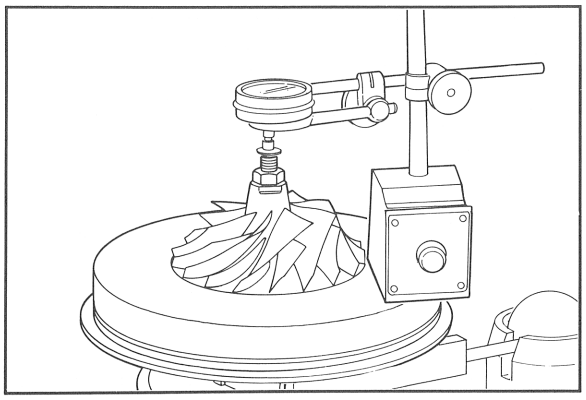
Install the nut.



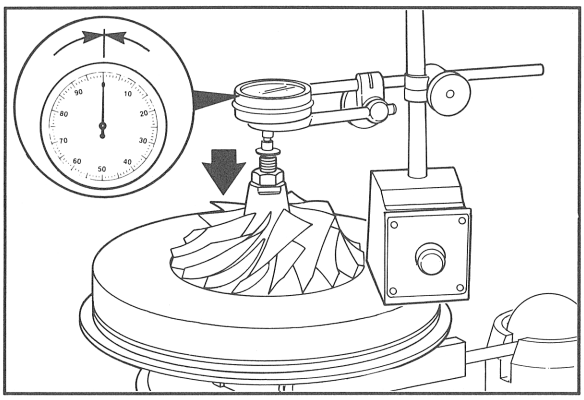
22 mm

Tighten the nut to 109 N•m [80 ft-lb] torque.



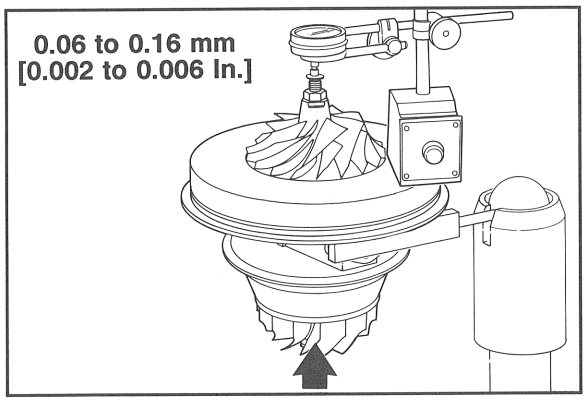


Use a magnetic base dial indicator to check the axial clearance.



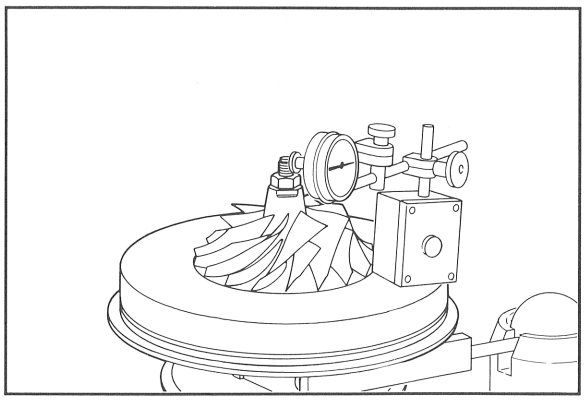
Push the rotor assembly away from the gauge.

Set the gauge on "0".



Push the rotor assembly toward the gauge.

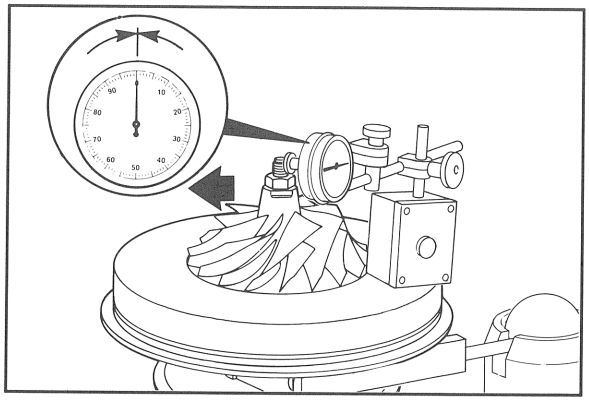
Total gauge reading **must** be between 0.06 mm [0.002 inch] and 0.16 mm [0.006 inch].



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

Push the rotor assembly away from the gauge.

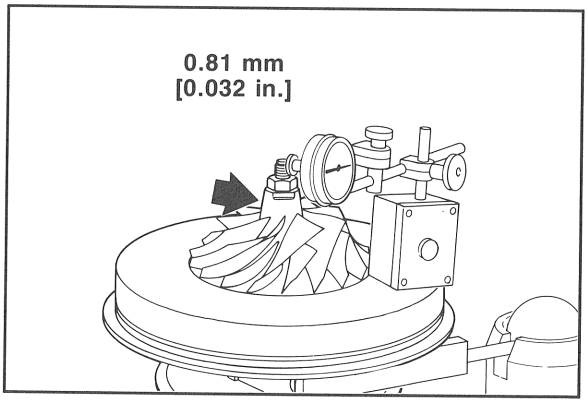
Set the gauge on "0".



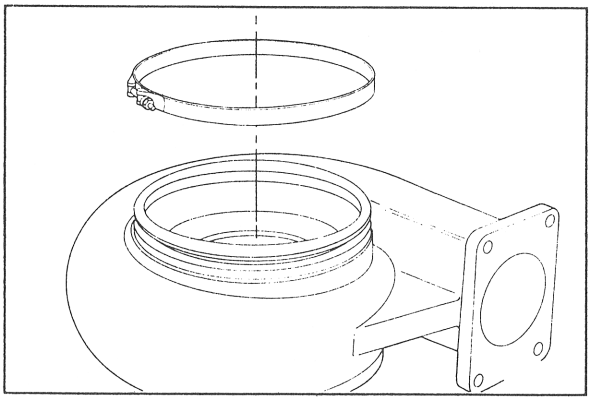
Push the rotor assembly toward the gauge.

Measure the clearance in three places.

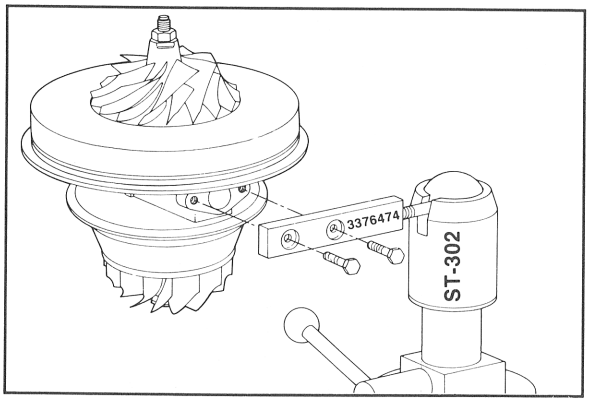
The maximum acceptable radial clearance is 0.81 mm [0.032 inch].

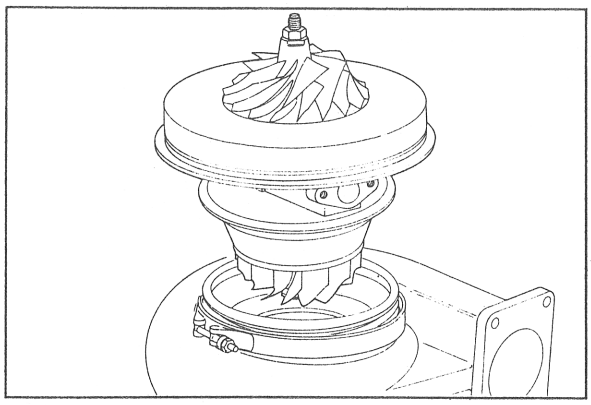


Place the clamp on the turbine end of the housing.



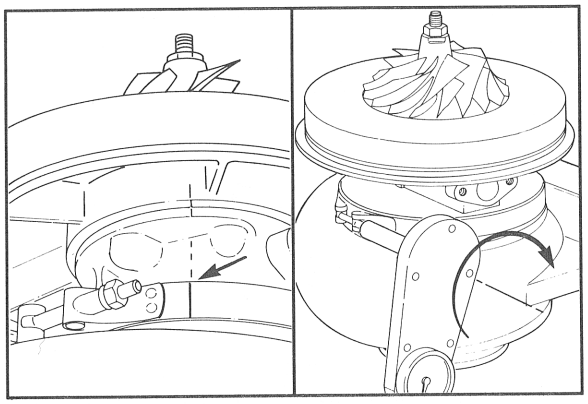
Remove the assembly from the plate.





Caution: The turbine blades can be easily damaged when the bearing housing assembly (5) is installed into the turbine housing (2).

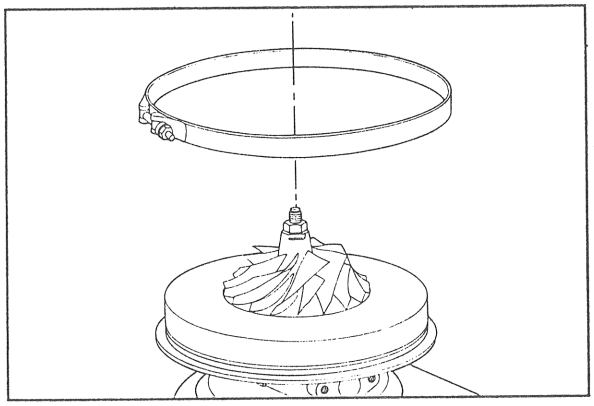
Hold the bearing housing with both hands and carefully install it into the turbine housing.



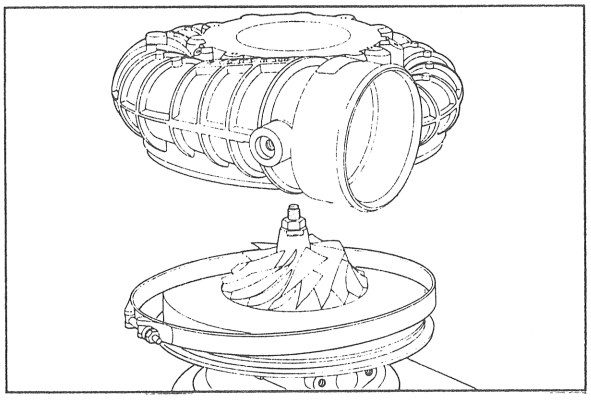
Align the scribe marks on the bearing housing assembly, turbine housing, and V-band clamp.

11 mm

Tighten the V-band clamp regular hexagon nut to 8.5 N•m [75 in-lb] torque.



Install the V-band clamp on the compressor end of the bearing housing assembly.



Caution: The compressor impeller (14) blades can be easily damaged when the compressor housing (8) is installed.

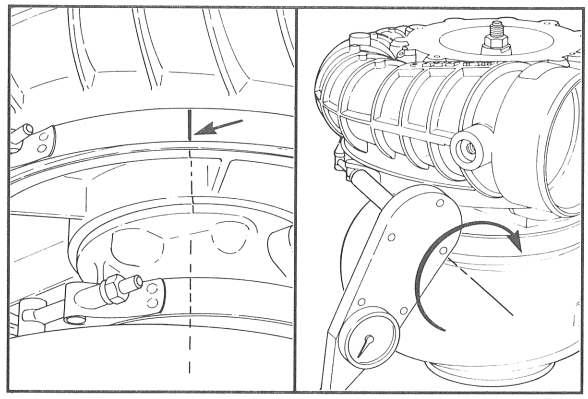
Hold the compressor housing with both hands. Carefully install the compressor housing on the bearing housing.

Position the V-band (6) over the flanges.

Align the scribe marks on the bearing housing (5), compressor housing (8), and the V-band clamp (6).

11 mm

Tighten the clamp regular hexagon nut to 8.5 N•m [75 in-lb] torque.

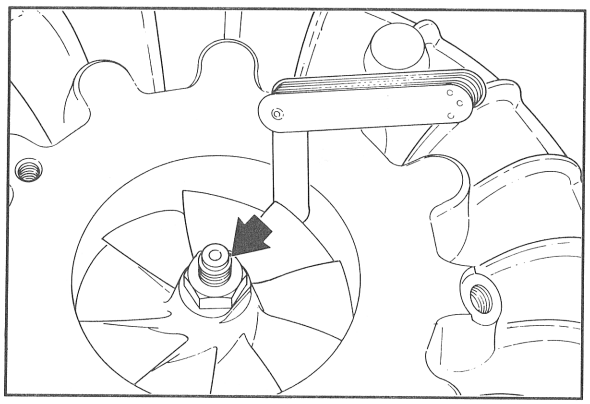


Caution: Insufficient compressor wheel to compressor housing clearance will cause serious engine damage.

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 narrow flat feeler gauge to check the clearance.

Push the compressor wheel away from the compressor housing.

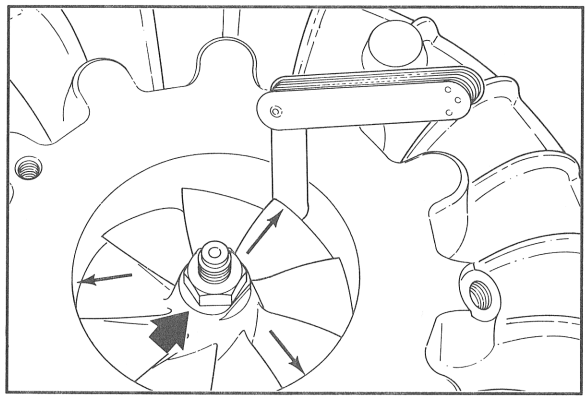


Insert the gauge between the compressor wheel and the compressor housing.

Push the compressor wheel toward the compressor housing.

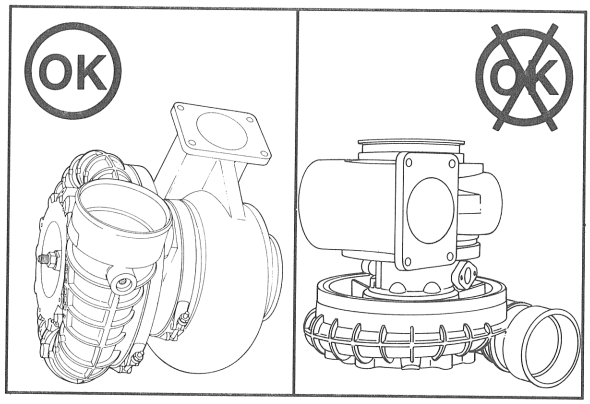
The minimum acceptable radial clearance is 0.25 mm [0.010 inch].

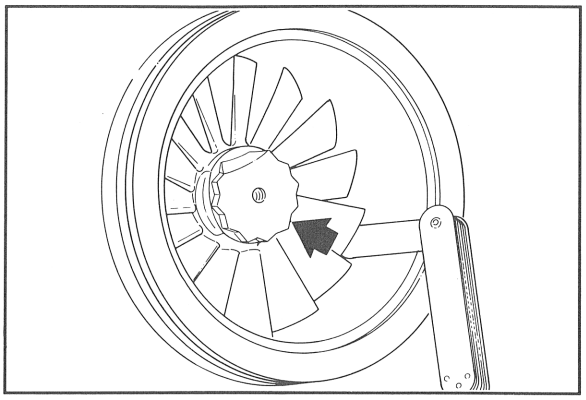
Measure in three places.



Caution: Do not set the turbocharger on the compressor housing inlet.

Turn the turbocharger on its side to measure the clearance on the turbine end.



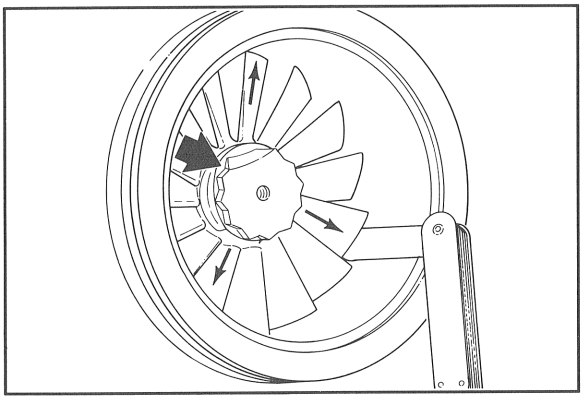


Caution: Insufficient turbine wheel to turbine housing clearance will cause serious engine damage.

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 narrow flate feeler gauge to measure the clearance.

Push the turbine 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 0.38 mm [0.015 inch].

Measure in three places.

Dimensions And Specifications

Part or Location	mm		in	
Compressor Impeller Radial Clearance	0.25 0.46	MIN MAX	0.010 0.018	
Turbine Wheel Radial Clearance	0.38 0.53	MIN MAX	0.015 0.021	
Axial Clearance	0.06 0.16	MIN MAX	0.002 0.006	
Thrust Bearing Width at Bore	7.400 7.470	MIN MAX	0.2941 0.294	
Bearing Outside Diameter	34.885 34.870	MIN MAX	1.3734 1.3728	Replace if any bronze material is visible.
Bearing Inside Diameter	19.988 20.000	MIN MAX	0.7869 0.7874	Replace if any bronze material is visible.
Shaft Bearing Journal Diameter	19.936 19.950	MIN MAX	0.7849 0.7854	
Bearing Housing Bore at Bearing	35.000 35.033	MIN MAX	1.3780 1.3793	
Thrust Collar Thickness	6.31 6.39	MIN MAX	0.2484 0.2516	
Shaft and Wheel Split Ring Seal to Groove Clearance	0.0762 0.1524	MIN MAX	0.003 0.006	
Oil Slinger Split Ring Seal to Groove Clearance	0.0762 0.1524	MIN MAX	0.003 0.006	

Assembly Torque Specifications

V-Band Clamp Nut Compressor	8.5 N•m	75 in-lb
Impeller Nut	109 N•m	80 ft-lb
V-Band Clamp Nut Turbine	8.5 N•m	75 in-lb
Turbocharger Diffuser Hexhead Cap-screws	27 N•m	230 in-lb

NOTES

Errata: PP 14, 15, 20, 21, 22: There are steel shims between the journal bearings and the snap rings

P 18 The journal bearings are no longer tin plated
There is also an annular groove around the bearing O.D.

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