HOLSET®
TURBOCHARGERS

Holset HY40V

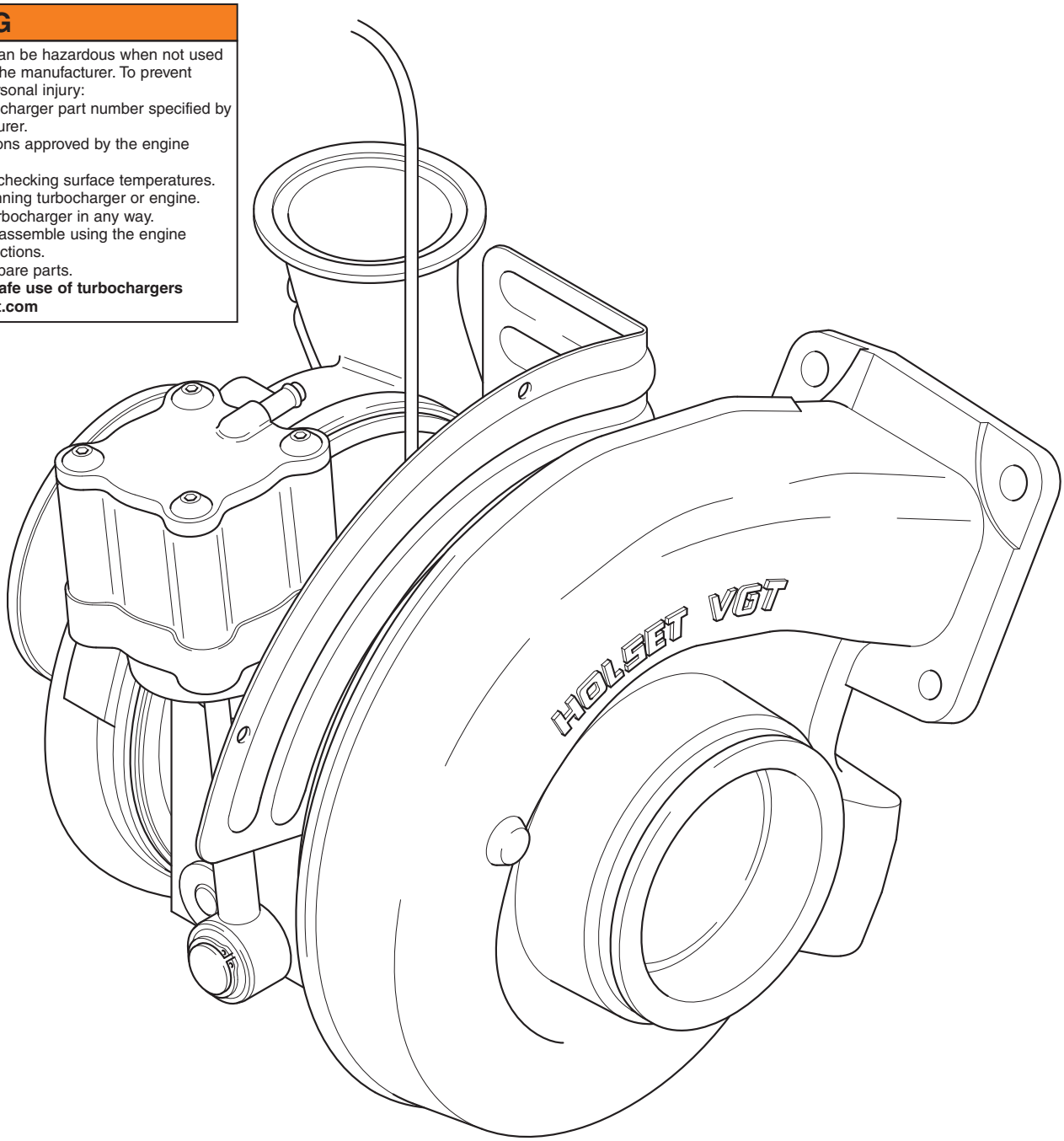
Service Repair Manual

⚠ WARNING

Turbochargers can be hazardous when not used as specified by the manufacturer. To prevent damage and personal injury:

- Always use the turbocharger part number specified by the engine manufacturer.
- Use only in applications approved by the engine manufacturer.
- Do not touch before checking surface temperatures.
- Do not work on a running turbocharger or engine.
- Do not modify the turbocharger in any way.
- Disassemble and re-assemble using the engine manufacturer's instructions.
- Use only approved spare parts.

For advice on the safe use of turbochargers contact www.holset.com



Foreword

This publication was written to assist with installation, maintenance and overhaul. It is not a warranty of any kind express or implied.

The specifications and procedures in this manual are based on information in effect at the time of publication. Cummins Turbo Technologies reserves the right to make any changes at any time without obligation. If differences are found between your turbocharger and the information in this manual, contact your local approved agent.

The latest technology and the highest quality standards are used in the manufacture of Holset Turbochargers. When replacement parts are needed, we recommend using only genuine Holset parts.

Table of Contents

1: Introduction

About the Manual 1:1
How to Use the Manual. 1:1
How to Order Holset Original Parts. 1:1
Description and Operation of Turbocharger 1:2
General Information **1:2**
Introduction to Variable Geometry Turbochargers **1:2**
Notes, Cautions and Warnings **1:4**
Installation Data **1:6**
Installation Checklist **1:7**
Symbols **1:8**

2: Component Identification

Turbocharger Identification 2:1
Dataplate 2:1
Installation Options 2:2
Exploded View 2:4
Component List 2:6

3: Troubleshooting and Diagnosis

Fault Finding Charts 3:1

4: Component Testing and Replacement

Service Tools 4:1
On Engine Checks 4:3
Speed Sensor 4:8
Control Valve 4:10
VG Actuator 4:11

5: Turbocharger Service and Overhaul

Service Tools 5:1
Preliminary Health Checks 5.3
Bearing Clearance 5.4
Turbine and Compressor Housings 5.5
Core Assembly 5:18
VG Turbine Actuating Assembly 5:33

6: Service Data Sheets

VG Range Service Data Sheets 6:1

About the Manual

The procedures in this manual were developed to instruct in the correct overhaul of the designated turbocharger for optimum performance and minimum maintenance operation.

How to Use the Manual

The manual is split into sections designed to provide service information in a logical sequence. The manual contains links to help the user navigate between relevant sections. Users who are unfamilier with navigating in PDF documents are refered to Navigating in PDF documents in the **Adobe® Acrobat® Reader™** help file.

Contents is an interactive page with links to all the sections. It can be accessed from any page in the manual by clicking this icon.

Section 1 defines the layout of the manual, introduces the reader to the operation of the turbocharger and presents important installation guidelines.

Sections 2, 3 and 4 concentrate on Turbocharger Component Identification, Troubleshooting and Diagnosis, Component Testing and Replacement.

Section 5 identifies the Service and Overhaul procedures to be followed in the unlikely event of a major turbocharger malfunction.

Section 6 quantifies build data to ensure the turbocharger will continue to operate to the specified standard on completion of overhaul.

Manual sections 1 to 5 where applicable, appear as a **self extracting** compressed file which is organised according to the steps needed to most easily and correctly maintain the operation of the turbocharger. Users are required to download this file to hard disk. Section 6 has its own file identity and resides at www.holsetaftermarket.com so that Service Data can be updated as changes occur. The links between manual and service data are active only when the user is connected to the Internet.

Chapter 6 has an expiry date to encourage users to discard outdated saved or printed versions and always access the latest information available at www.holsetaftermarket.com.

When using the manual on-line this icon will link to the website to help find your nearest agent for advice and how to order Holset original parts.

How to Order Holset Original Parts

To make sure of optimum performance, certain items must be discarded during disassembly and replaced with new for re-assembly. These items are indicated in the Service and Overhaul section with the use of a * symbol.

All items showing a * are available in a basic overhaul kit.

To get the correct parts for your turbocharger, refer to the ‘component identification’ section of this manual to help you find the following information:

1) Refer to the exploded view and component list to define the major components to be replaced.
2) Refer to the turbocharger’s dataplate which will be found on the compressor housing or actuator to define the identifying information about your turbocharger build standard.
3) Contact your local agent with componant identification nos. and dataplate assembly no., serial no. and turbocharger type.
4) With this information, your local agent can provide you with the optimum kit of parts for re-assembling your turbocharger for continued long life operation.

Description and Operation of Turbocharger

General Information

A turbocharger is a mechanical device which uses the engine's exhaust gases to force more air into the engine cylinders. Hot exhaust gas energy is used to turn a turbine wheel and shaft. At the other end of the shaft 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 and altitude compensation. 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.

Introduction to Variable Geometry Turbochargers (VGT™)

The need for Variable Geometry

The turbocharger on your vehicle's engine is of a very advanced type, which varies the effective size of its turbine in response to the driver's demands. Under all conditions of driving, the turbine is electronically controlled to change the amount of air supplied to the engine, to ensure maximum performance, lowest fuel consumption and minimum exhaust emission levels.

When rapid vehicle acceleration is required, the turbocharger will produce air for the engine more quickly than a conventional unit, thus eliminating turbocharger lag and giving improved vehicle drivability. As the engine and turbocharger run in, and eventually start to wear, the combination of the variable turbine and its associated electronic control, will change its characteristic to keep to the original performance and emission levels over a wide range of ambient temperatures and altitude.

The importance of correctly installing a Variable Geometry Turbocharger (VGT™)

The bearing housing of your turbocharger contains an internal water-cooled jacket. The purpose of this is to reduce the operating temperature of the housing, to improve the operating environment of the speed sensor and reduce the high soak temperatures produced when the engine is switched off after being heavily loaded. The addition of water cooling has meant that there are two extra pipe connections to the turbocharger, to bring water to the housing and to take it away. It is important to observe the correct installation of these pipes, so that the circulation of the water is in the correct direction, or the effectiveness of the cooling system will be lost and severe damage may result.

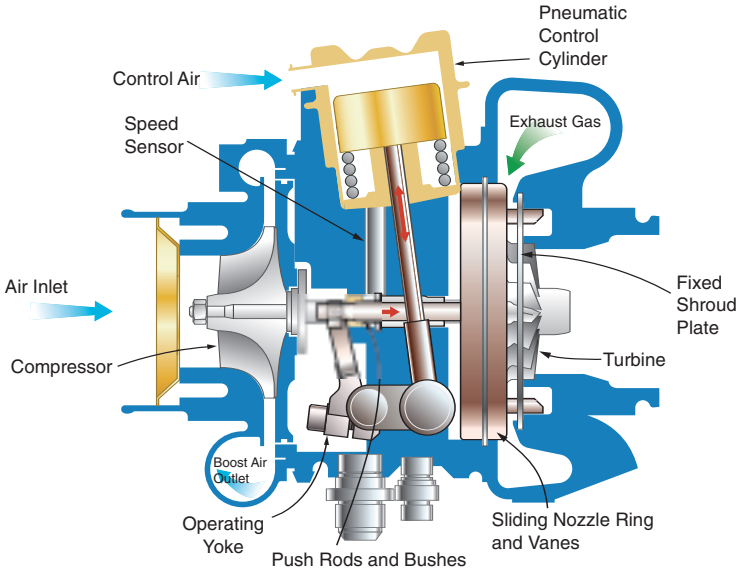
The Importance of Correct Operation of a Variable Geometry Turbocharger (VGT™)

A variable geometry turbocharger is controlled by the engine control module to optimise engine air fuel ratio for performance and emissions. A malfunction may cause a mismatch between air and fuel supply which could lead to progressive engine damage. It is important that any operating symptom which indicates incorrect turbocharger operation is dealt with immediately by taking the unit safely out of service.

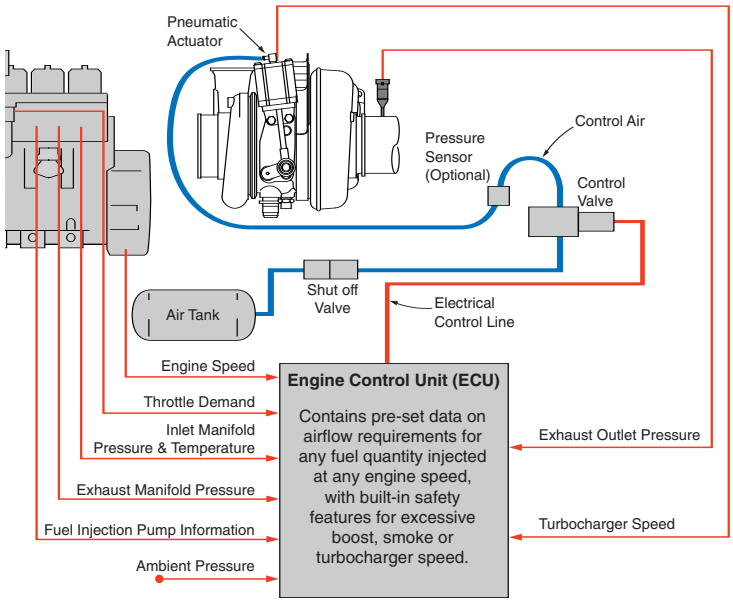
The advantages of a Variable Geometry Turbocharging (VGT™) system

You may already have experience of the effect of a Wastegate turbocharger on the performance of your vehicle. As the name suggests a Wastegate turbocharger allows exhaust gas to by-pass the turbine wheel. This by-passed gas contains energy which is lost to the turbine wheel.

The advantage of Variable Geometry over a Wastegate system is that all the exhaust gas flows through the turbine wheel to increase net turbine power output. In addition, turbine power can be set to provide just sufficient energy to drive the compressor at the desired boost level wherever the engine is operating. Speed and pressure sensors feedback information to the Engine Control Unit to provide the necessary control.



The Holset Variable Geometry Turbocharging (VGT™) system works by controlling the width of a nozzle guiding the gas flow into the turbine wheel. Control is achieved using an air supply from the vehicle's auxiliary air reservoir. The Engine Control Unit modulates the supply pressure to the turbocharger pneumatic actuator which acts on a rod and yoke system to slide the nozzle ring and blades relative to the fixed shroud plate. This movement varies the area through which exhaust gas enters the turbine wheel blades.



Notes, Cautions and Warnings

Notes, Cautions and Warnings are used in this manual to emphasise important or critical instructions.

Note
Information which is essential to highlight.

Caution
Maintenance or Service procedures which if not strictly followed, will result in damage or destruction of the turbocharger.

Warning
Maintenance or Service procedures which if not correctly followed will result in personal injury or loss of life.

Warning
'The designated turbochargers weigh up to 22 kgs (48.5 lb).

When lifting the turbocharger manually always get assistance to avoid back strain or dropping the unit and consequential injury.

External parts include electrical wiring and connectors which are sensitive to handling.

Warning
Some parts are manufactured in fluoroelastomers (eg Viton) or similar that require special treatment in the case of repair and service after fire.

Warning
Turbocharger surface temperature during operation can achieve 700°C (1300°F).

Caution
Orientation of the turbine housing of a variable geometry turbocharger is factory set. Any attempt to re-orientate the housing can cause severe damage to the VG mechanism and may void warranty.

Caution
This variable geometry turbocharger has been factory balanced using the core balance process.

Service overhaul/repair must be carried out by an approved agent to ensure the variable geometry system is correctly rebuilt. It is important to note that operating a turbocharger with rotor or core balance level greater than design limits could cause turbocharger or engine failure.

Caution
In the event of a suspected variable geometry turbocharger malfunction, symptoms which may include low power and black smoke, it is important to avoid potential progressive engine damage. The vehicle should be taken out of service and towed to an appropriate repair facility as soon as this can be accomplished without sacrificing the safety of the operator and/or passengers.

Notes, Cautions and Warnings

Note
Holset turbochargers can be remanufactured using recovered parts. Where it is necessary to dispose of components or whole turbochargers, an environmentally responsible process such as recycling should be used, with due regard to local laws.

Note
Many turbochargers are returned that are no fault found. Before assuming the turbocharger is not performing to specification always refer to the engine diagnostic system and the troubleshooting diagnostic procedures of this manual.

Installation Data

1. Many turbochargers are returned that are no fault found. Before assuming the turbocharger is not performing to specification always refer to the engine diagnostic system and the fault finding chart of this manual to make all the recommended health checks.
2. It is important that intake and exhaust systems are fitted in accordance with the recommendations of the Equipment and Engine manufacturers. It is important not to overload the turbocharger by external attachments or forces.
3. The air filter must remove particles greater than 5 μm at an efficiency of 95%and be of sufficient capacity to match the air consumption of the engine. Recommended filters should always be used with a pressure drop indicator. Intake systems must be tightened to the values specified by the Equipment and Engine manufacturers to withstand depressions up to 6.3 kPa (0.91 lbf/in^2)
4. Hose and clip connections of intake manifold systems must be capable of withstanding the turbocharger pressure ratio. V-band clamps are preferred and must be used above 3:1 pressure ratio.
5. Exhaust system connections must be tightened to the values specified by the Equipment and Engine manufacturers to be capable of operating at exhaust back pressures of up to 10 kPa (1.5 lbf/in^2). Subject to an extensive review and formal approval, this limit may be increased to 25 kPa (3.6 lbf/in^2) if a catalytic convertor is fitted. Exhaust brake applications are permitted to operate at a continuously rated pressure up to 450 kPa (65.3 lbf/in^2). Experience exists running at instantaneous pressures up to 700 kPa (101.5 lbf/in^2) but any application operating above 450 kPa (65.3 lbf/in^2) must be referred for approval.
6. Oil should be filtered to 10 μm with efficiency of 60% TWA (Time Weighted Average) /20 μm with efficiency of 85% TWA. Efficiency assessed using ISO Standard 4572/SAE J 1858. Always use filters recommended by the engine manufacturer.
7. The oil quality must be as specified by the engine manufacturer and will be a minimum API - CD (MIL - L - 2104C) specification. Improvement in life can be obtained by using super high performance diesel (SHPD) oils, particularly where extended oil drain periods are used.
8. Normal oil temperature is 95+/-5 °C (203+/-9 °F). It should not exceed 120 °C (248 °F) under any operating condition.
9. Any pre-lube oil must be clean and meet the minimum CD classification.
10. The orientation of turbine housing and bearing housing of a VG turbocharger is fixed. During installation, do not attempt to rotate these components, as it may affect the operation of the VG actuating mechanism and may void any warranty.
11. Oil drain pipes are permitted to decline at an overall angle of not less than 30 degrees below horizontal. These turbochargers require a drain pipe of 19 mm internal diameter minimum which has integrated connectors. To ensure oil drains into the engine under all operating conditions the return connection into the engine sump must not be submerged.
12. Crankcase pressure should be limited to 0.8 kPa (0.12 lbf/in^2). Pressure above this level should be referred for further evaluation. Closed crankcase ventilation (CCV) systems are known to operate at elevated pressure and all applications must be referred for approval.
13. Oil pressure must show at the turbocharger oil inlet within 3 - 4 seconds of engine firing to prevent damage to turbocharger bearing system. A flexible supply pipe is recommended.
14. The minimum oil pressure when the engine is on load must be 210 kPa (30 lbf/in^2). Normal maximum operating pressure is 400 kPa (58 lbf/in^2) although 600 kPa (88 lbf/in^2) is permitted during cold start up. Under idling conditions pressure should not fall below 70 kPa (10 lbf/in^2).
15. Recommended oil flow ranges for these turbochargers are 2 litre/min at idle and 3 litre/min at maximum engine speed.
16. Recommended coolant flows for these turbochargers are 2 litre/min at idle and 10 litre/min at maximum engine speed. Coolant hose design must permit flow to increase progressively with engine speed.
17. Do not use liquid gasket substances or thread sealant as any excess can enter the turbocharger oil and coolant systems to obstruct flow.

Note:

100 kPa = 1 bar (14.5037 lbf/in2 = psi).

Installation Checklist

1. Always understand why the original turbocharger needs replacing before fitting another unit.
2. Check the turbocharger dataplate to ensure the Part No. is correct for the engine/application.
3. Check the engine exhaust, intake and aftercooler systems are clean and without obstruction i.e. free from oil, gasket pieces, dust/dirt/carbon or foreign objects.
4. Replace the oil and air filters using replacement parts specified by the equipment manufacturer.
5. Change the engine oil using the type specified by the engine manufacturer.
6. Check that the turbocharger oil inlet and drain pipes and connectors are clean, free from obstruction and will not leak under pressure. Before re-installing flexible pipes always ensure any burnt-on lacquer or other adhered material is removed from internal bores. If in doubt, always fit new pipes.
7. Check that the coolant pipes of water cooled bearing housing applications and connectors are clean, free from obstruction and will not leak under pressure.
8. To pre-lube the turbocharger bearings, pour some clean engine oil into the oil inlet and rotate the turbocharger rotor assembly by hand.
9. Check that the exhaust manifold flange is flat and undamaged. Mount the turbocharger on the flange and check that the turbine inlet gasket fits properly without obstructing the gas passages.
10. Assemble the air intake and boost outlet connections. Check that the connections are well made and will not leak in use.
11. Check the exhaust system is fitted using the original mounting arrangement provided by the equipment manufacturer. Always re-fit any supports/brackets back in position to ensure the system is correctly supported.
12. Assemble the exhaust system to the turbine housing outlet. Check that the gasket/connection is well made and will not leak in use.
13. Assemble any coolant pipes and check that the connections are well made, without obstruction and will not leak in use.
14. Assemble the turbocharger oil inlet pipe and check that the connection is clean, well made and will not leak in use.
15. Check all clamps and fasteners are correctly tightened to the torque recommended by the equipment manufacturer.
16. Make the electrical connections between VG sensors and engine control unit (ECU). Check the electrical connection between control valve and ECU.
17. Check the air connection between the vehicle auxiliary tank and control valve.
18. Connect the air pipe from the control valve to the actuator ensuring the pipe bore is clean and dry before fitment.
19. Make any ECU checks recommended by the engine manufacturer.
20. Crank the engine WITHOUT firing until engine oil flows out of the turbocharger drain flange.
21. Assemble the oil drain pipe and check that the connection is well made, without obstruction and will not leak in use.
22. Start the engine and run at idle speed for approximately 1 minute so that the oil supply system is fully operational.
23. Accelerate the engine and check that there are no leaks/obstructions of air/oil/coolant/gas under pressure.
24. Check that no hose or connection deforms under normal operation.
25. Before switching off the engine, leave it running at idle speed for at least 1 minute to cool the turbine.

Symbols

Symbole - Deutsch

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

WARNUNG - Unterhaltungs und Wartungsverfahren müssen genau befolgt werden, da ein Nichtbeachten zu Personenschäden oder tödlichen Verletzungen führt.

ACHTUNG - Falls Unterhaltungs und Wartungsverfahren nicht genau beachtet werden, kann der Turbolader dadurch beschädigt oder zerstört werden.

AUSBAU bzw. **ZERLEGEN**.

EINBAU bzw. **ZUSAMMENBAU**.

INSRPEKTION erforderlich.

Teil oder Baugruppe **REINIGEN**.

DIMENSION - oder **ZEITMESSUNG**.

Teil oder Baugruppe **ÖLEN**.

WERKZEUGGRÖSSE wird angegeben.

ANZUG auf vorgeschriebenes Drehmoment erforderlich.

Sicherstellen, daß die **AUSWUCHTMARKEN** an der Rotor-Baugruppe richtig ausgerichtet sind.

Elektrische **MESSUNG DURCHFÜRHREN**.

Weitere Informationen an anderer Stelle bzw. in anderen Handbüchern.

Schutzkleidung muß immer getragen werden.

Deutet an, daß Teile schwer sein können.

Website-Verzeichnis mit Ihrem nächsten Händler.

Gehe zu Inhalt

Symbols - English

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.


Ensure that the **BALANCE MARKS** on the rotor assembly are in alignment


PERFORM an electrical **MEASUREMENT**.


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


Please wear protective clothing at all times.

Indicates components may be heavy.

Website access to find your nearest Agent.


Go to contents

Simbolos - Español

Los simbolos siguientes son usados en estes manual para clarificar el proceso de las instrucciones. Cuado aparece uno de estos simbolos, su significado se espcifica en la parte inferior.

ADVERTENCIA – Procedimientos de Mantenimiento o Servicio que al no seguirse resultarán en daños personales o pérdida de vida.

ATENCION – Procedimientos de Mantenimiento o Servicio que al no seguirse al pie de la letra, resultarán en el daño o la destrucción del turbosobrealimentador.

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** mec·nica o del tiempo.

LUBRIQUESE la pieza o el montaje.

Indica que se dar· una **LLAVE DE TUERCAS** o el **TAMA—O DE HERRAMIENTA**.

APRIETESE hasta un par torsor especifico.

Ceriórese de que est·n alineadas las marcas de balance en el rotor.

EJECUTESE una **MEDICION** eléctrica.

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

Favor de siempre llevar ropa protectora.

Indica que los componentes pueden ser pesados.

Acceso a Sitio Web para localizar su agente más cercano.

Ir a la tabla de materias

Symboles - Français

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

ATTENTION DANGER - Procédures de maintenance ou d'entretien qui, si elles ne pas observées correctement, auront pour résultat des lésions corporelles ou un décès.

MISE EN GARDE - Procédures de maintenance ou d'entretien qui, si elles ne sont pas observées strictement, auront pour résultat de causer des dégâts au turbocompresseur ou de conduire à sa destruction.

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.

S'assurer que les repères d'équilibrage sur l'ensemble de rotor sont alignés.

EFFECTUER une MEASURE électrique.

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

Il faut toujours mettre vêtements de protection.

Indique que les composants peuvent être lourds.

Accès au site Web pour trouver l'agent le plus proche.

Aller au sommaire

Símbolos - Português

Os símbolos a seguir serão utilizados neste manual para facilitar a comunicação das instruções e seue significados estão déscritos abaixo.

ATENÇÃO - Os procedimentos de Manutenção ou Serviços que não forem seguidos correctamente resultarão em ferimentos pessoais ou riscos de vida.

AVISO - Os procedimentos de Manutenção ou Serviço que não forem rigorosamente seguidos resultarão em danos ou destruição do carregador turbo.

Indica um passe de **DESMONTAGEM**.

Indica um passo de **MONTAGEM**.

Requer inspeção.

LIMPE a peça ou conjunto.

Requer Medição mecãnica ou de tempo.

LUBRIFIQUE a peça ou o conjunto.

Indica necessidade de **APERTO**.

TORQUEAR de acordo com o especificado.

Assegure-se de que as **MARCAS DE BALANCEAMENTO** do conjunto eixorotor estejam alinhadas.

Requer medição **ELÉTRICA**.

Procure em outra seção deste manual ou em publicação par obter informações adicionais

Por favor, sempre utilize EPI (Equipamento de Protecao Individual)

Indica que os componentes podem estar pesados.

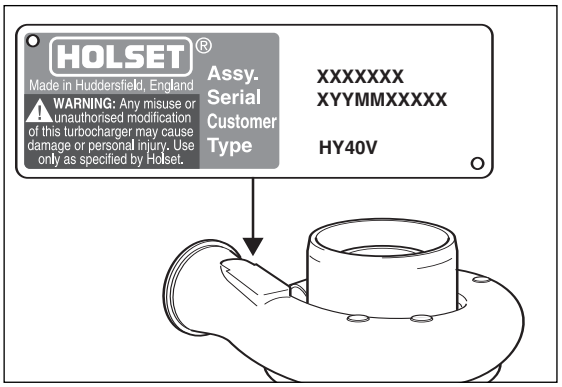
Visite o Website para encontrar o seu Agente mais perto.

Vá para Conteúdo

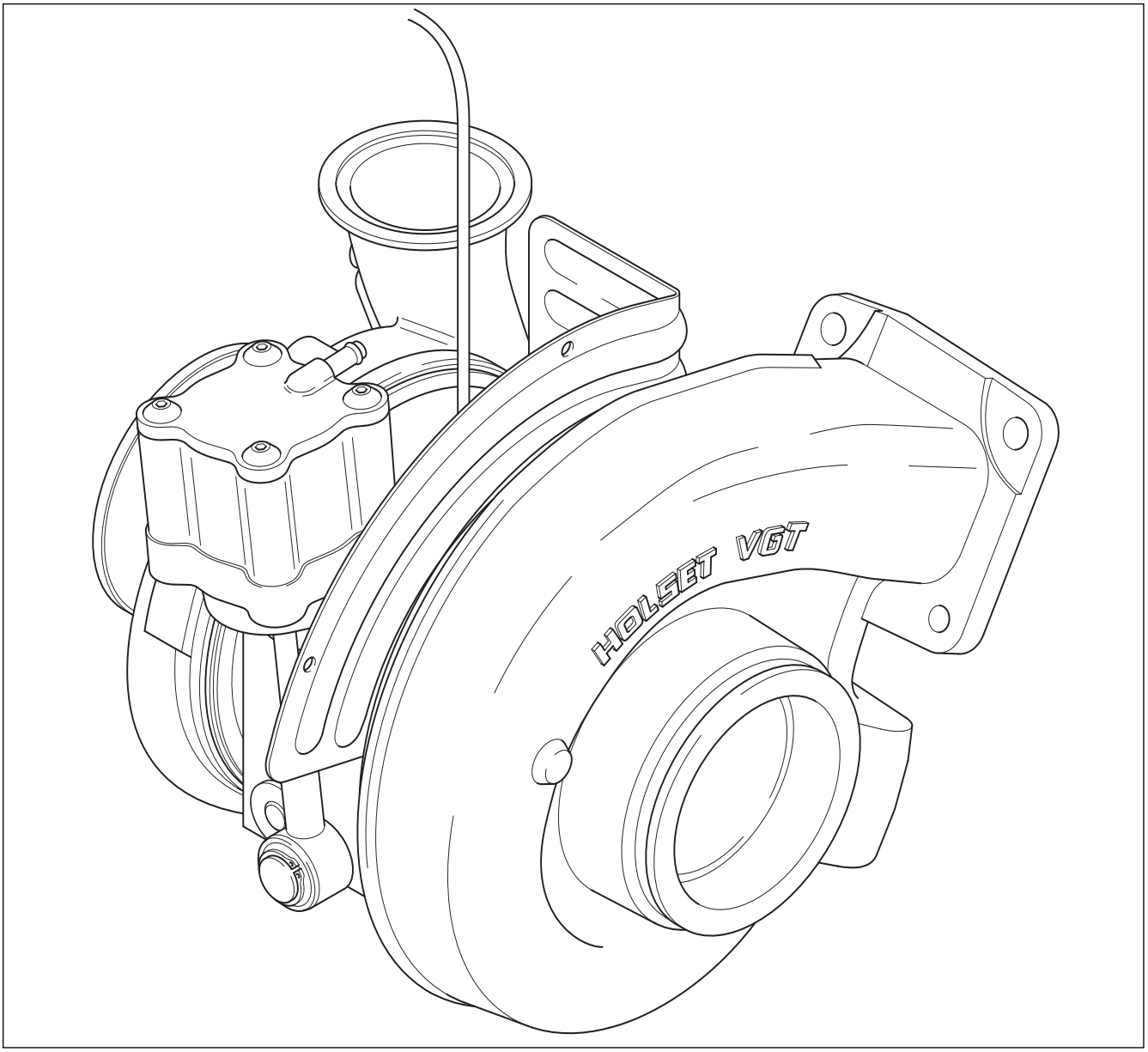
Turbocharger Identification

Dataplate

Note
The dataplate will be fitted to the compressor housing (8). The information from the dataplate must be quoted for service and parts support.

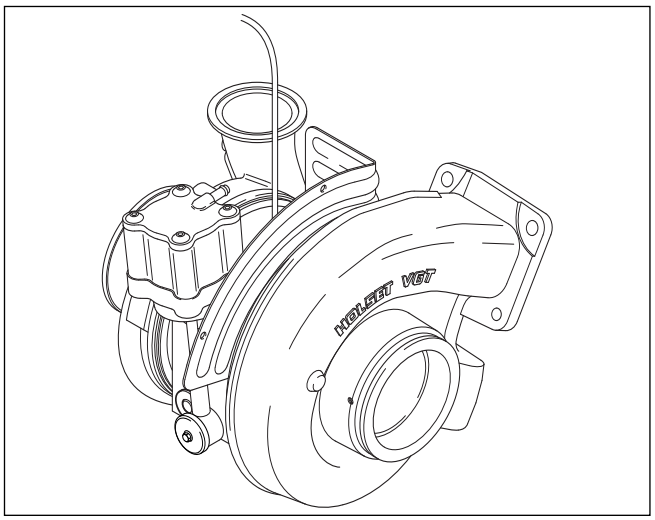


HY40V

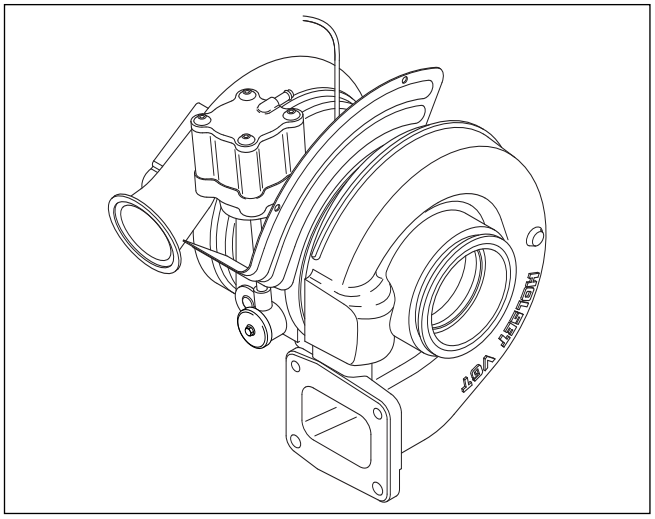


Installation Options

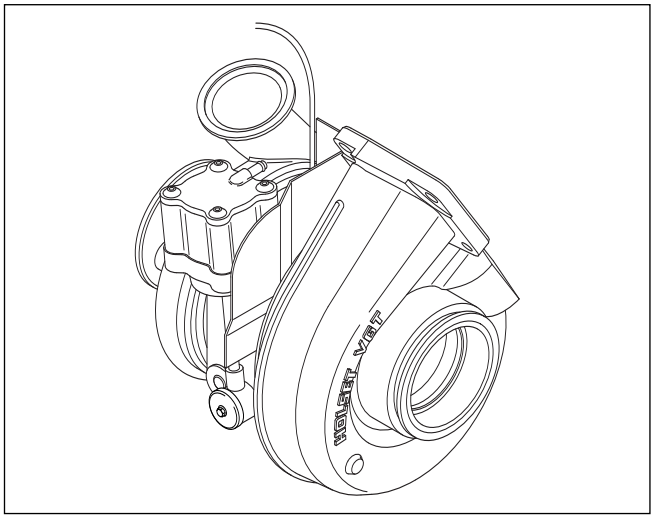
Type A



Type B

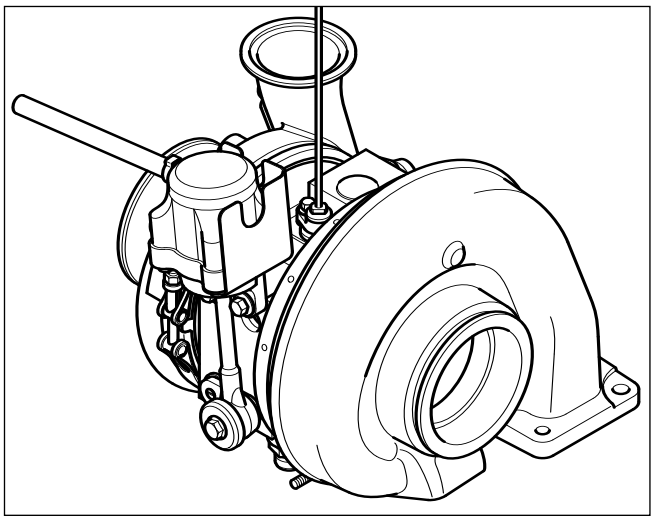


Type C

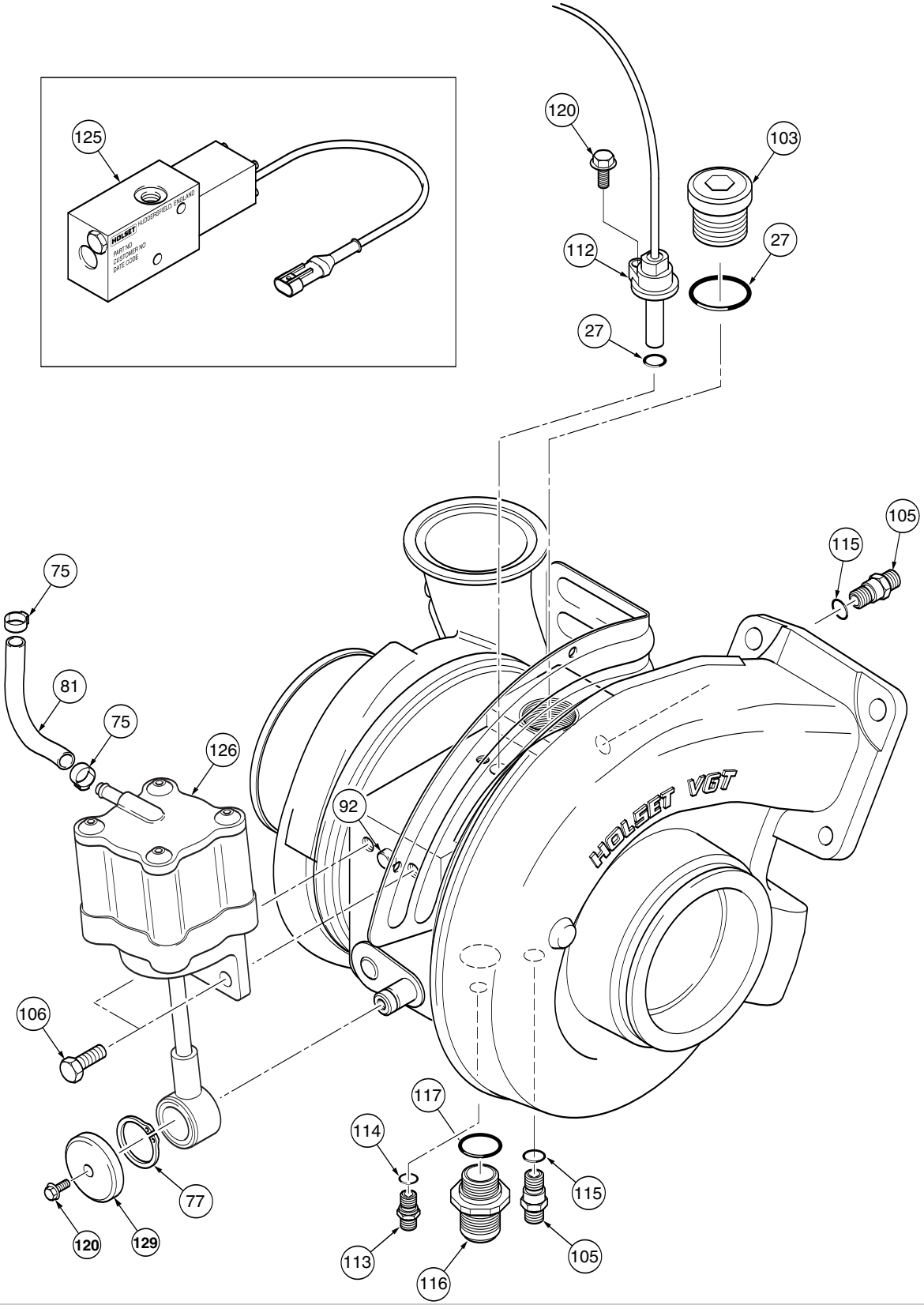


Installation Options

Type D

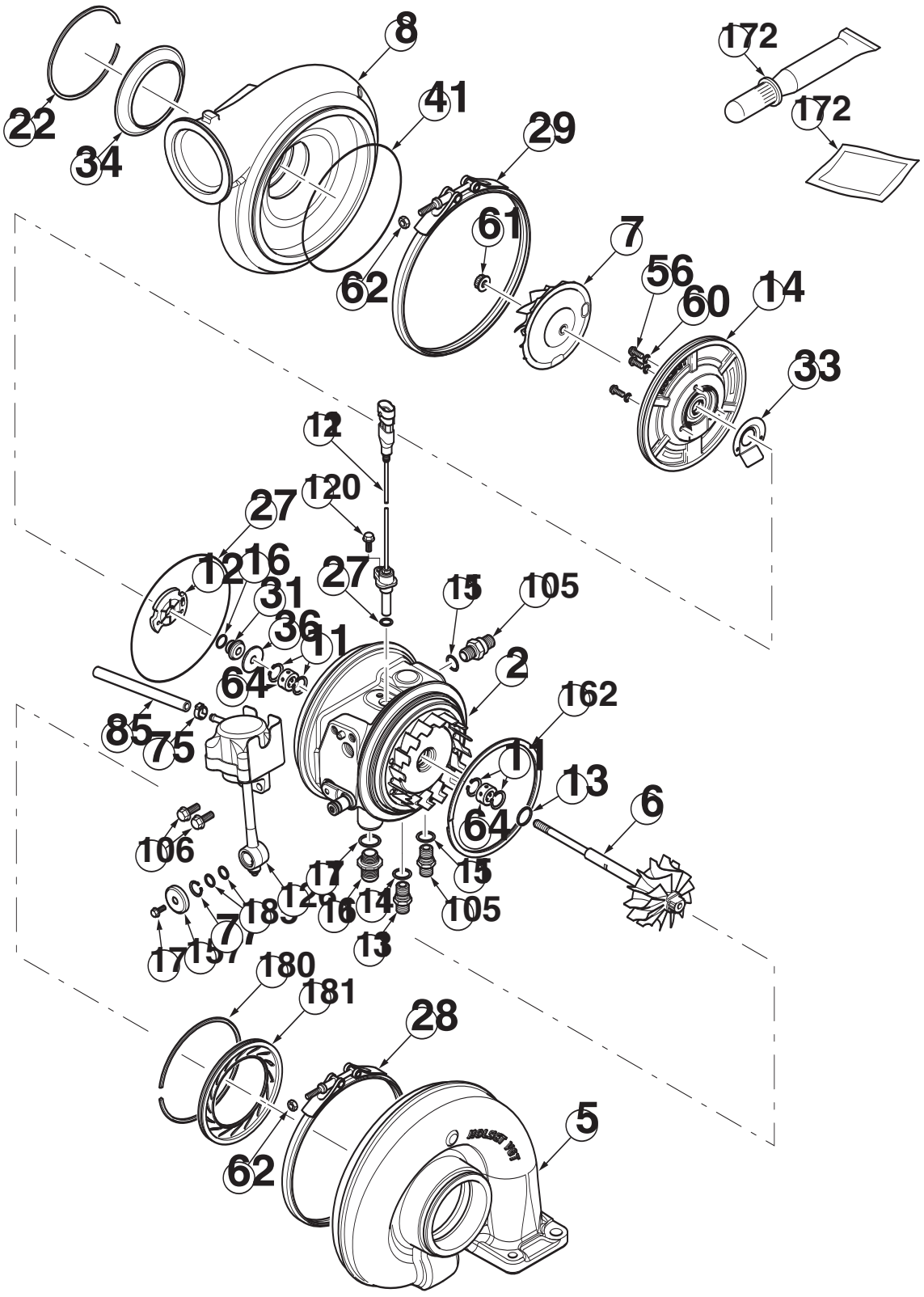


Exploded View - Original Equipment



Note
Exploded views represent a generic build standard. Parts may be added or subtracted in specific applications.

Exploded View - Rebuild Standard



Note
Exploded views represent a generic build standard. Parts may be added or subtracted in specific applications.

Component List

Item No.	Description	Quantity
1	**Repair Kit CHRA (core)* comprising:**	**1**
11	Journal Bearing*	2
12	Thrust Bearing*	1
13	Split Ring Seal, Turbine*	1
16	Split Ring Seal, Compressor*	1
27	O-Ring Seal *	1
41	O-Ring Seal, Compressor *	1
56	Screw, Diffuser*	3
60	Plain Washer*	3
62	Lock nut, V Band*	2
64	Retaining Ring, Bearing*	4
31	Oil Slinger	1
33	Oil Baffle	1
36	Thrust Collar	1
2	CHRA (Core)	1
5	Turbine Housing	1
8	Compressor Housing	1
14	Diffuser	1
	Housing fitting components:	
28	V-band Clamp, Turbine	1
62	Lock nut, V Band	1
29	V-band Clamp, Compressor	1
62	Lock nut, V Band	1
41	O-Ring seal, Compressor	1
34	Inlet Baffle	1
22	Retaining Ring, Inlet Baffle	1
180	Retaining Ring, Shroud Plate	1
181	Shroud Plate	1
162	Nozzle ring seal	1
103	**Blanking Plug with:**	**1**
27	O-Ring Seal	1

Note
Exploded views may not contain all listed components.

Component List

Item No.	Description	Quantity
123	**VG Bearing Housing Seals & Adapter Kit comprising:**	**1**
113	Adapter, Oil Inlet*	1
114	O-Ring Seal, Oil Inlet*	1
105	Connector Male, Water*	2
115	O-Ring Seal, Water*	2
116	Adapter, Oil Drain*	1
117	O-Ring Seal, Oil Outlet*	1
	Actuator fitting components:	
81	Hose	1
186	Split Ring Seal, Actuator Lever	2
121	**VG Actuator Kit* comprising:**	**1**
126	VG Actuator*	1
122	**VG Actuator Fittings Kit* comprising:**	**1**
172	Grease Pack*	1
106	Screw, Actuator*	2
75	Hose Clip*	2
90	Seal Washer*	2
27	O Ring*	1
120	Screw, Cover Plate*	1
157	Cover Plate*	1
173	Installation Sheet*	1
124	**Speed Sensor Kit* comprising:**	**1**
112	Speed Sensor*	1
120	Cap Head Screw*	1
27	O-Ring Seal*	1
125	Control Valve	1

Note
Exploded views may not contain all listed components.

Fault Finding Chart - All Applications

	Engine Running Hot	Poor Transient Response	Smoke	Engine Lacks Power	Black Exhaust Smoke	Blue Exhaust Smoke	High Oil Consumption	Turbocharger Noisy	Cyclic Sound from the Turbocharger	Oil Leak from Compressor Seal	Oil Leak from Turbine Seal
Dirty air cleaner Clean or replace element according to manufacturer's recommendations	●	●	●	●	●	●	●			●	
Restricted compressor intake duct Remove restriction or replace damaged parts as required	●	●	●		●	●	●	●	●	●	
Restricted air duct from compressor to intake manifold Remove restriction or replace damaged parts as required	●	●		●	●			●			
Restricted intake manifold Refer to engine manufacturer's manual and remove restriction	●	●		●	●			●			
Air leak in feed from air cleaner to compressor Replace seals, gaskets or tighten fasteners as required								●			
Air leak in feed from compressor to intake manifold Replace seals, gaskets or tighten fasteners as required	●	●	●	●	●	●	●	●			
Air leak between intake manifold and engine Refer to engine manufacturer's manual and replace gaskets or tighten fasteners as required	●		●	●	●	●	●	●			
Foreign object in exhaust manifold (from engine) Refer to engine manufacturer's manual and remove obstruction				●	●	●	●	●		●	
Restricted exhaust system Remove restriction or replace damaged parts as required	●			●	●					●	
Exhaust manifold cracked, gaskets blown or missing Refer to engine manufacturer's manual and replace gaskets or damaged parts as required		●	●	●	●			●			
Gas leak at turbine inlet/exhaust manifold joint Replace gasket or tighten fasteners as required		●	●	●	●			●			
Gas leak in ducting after turbine outlet Refer to engine manufacturer's manual and repair leak		●						●			
Restricted turbocharger oil drain line Remove restriction or replace damaged parts as required						●	●			●	●
Restricted engine crankcase breather Refer to engine manufacturer's manual, clear restriction						●	●			●	●
Turbocharger bearing housing sludged or coked Change engine oil and oil filter, overhaul or replace turbocharger as required						●	●			●	●
Fuel injection pump or fuel injectors incorrectly set Refer to engine manufacturer's manual and replace or adjust faulty components as required		●	●	●	●						
Engine valve timing incorrect Refer to engine manufacturer's manual for correct settings and adjust as required				●	●						
Worn engine piston rings or liners Refer to engine manufacturer's manual and repair as required				●	●	●	●			●	●
Burnt valves and/or pistons Refer to engine manufacturer's manual and repair as required				●	●	●	●			●	●
Excessive dirt build up on compressor wheel and/or diffuser vanes Contact your local approved dealer				●	●	●	●	●	●	●	●
Turbocharger damaged Find and correct cause of failure, or replace turbocharger as necessary				●	●	●	●	●		●	●

Fault Finding Chart - Variable Geometry

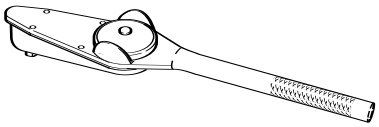
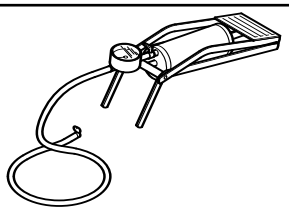
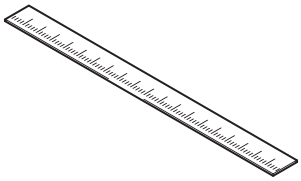
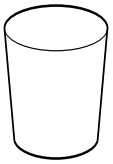
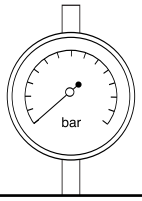
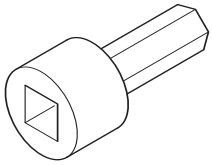
	Engine Lacks Power	Engine Overheats	Intermittent engine braking	Intermittent low power	Engine does not run smoothly	Low power at low engine speed	Turbocharger noisy	Poor acceleration	Reduced braking	Coolant leak	Oil leak
Actuator rod not moving Check for air leaks and change clips and hoses as appropriate. If actuator works with separate air supply, check control valve. If no actuator movement confirmed, replace actuator. If no movement with new actuator replace turbocharger.	●					●					
VG mechanism partially jammed Refer to Engine Control Unit (ECU) diagnostics for posible fault code data. Check for air leaks and change clips and hoses as appropriate. If air system OK, check actuator movement. If full and free movement not confirmed, replace actuator. If partial movement with new actuator replace turbocharger.			●	●		●		●	●		
Actuator loose or damaged Refer to ECU diagnostics for possible fault code data. Check for damage to actuator bracket and fasteners. If mechanical installation is OK, check actuator movement. If full and free movement not confirmed, replace actuator. If partial movement with new actuator replace turbocharger					●	●		●			
Actuator air feed lines or connectors leaking Check for air leaks and change clamps and hoses as appropriate. If actuator air system OK, refer to general turbocharger fault finding chart.	●						●		●		
No speed signal Check sensor connections. If pin resistance measurement is incorrect replace sensor. Where sensor may have been overheated check ECU diagnostic fault codes and if necessary replace sensor.	●				●	●		●		●	
Intermittent or noisy speed signal Check sensor with multimeter. If either resistance measurement is incorrect replace sensor. Where sensor may have been overheated check ECU diagnostic fault codes and if necessary replace sensor.			●	●	●					●	
No control valve drive signal To ensure drive signal is being received from ECU check control valve operation. If either 0 V or battery voltage condition is incorrect replace control valve and refer to engine manual.	●				●	●		●	●		
Intermittent control valve drive signal Refer to ECU diagnostics for possible fault code data. Check control valve connection to ECU. If control valve condition at either 0 V or vehicle battery voltage is incorrect or if intermittent fault persists replace control valve whilst referring to engine manual.			●	●							
No boost pressure signal (P2) If the ECU diagnoses a boost pressure signal error refer to engine manual.	●			●	●	●		●			
No air inlet temperature signal (T2) If the ECU diagnoses an air inlet temperature signal error refer to engine manual.	●			●	●	●		●			
Incorrect actuator pressure If the VG system has an actuator pressure sensor which reads an incorrect actuator pressure signal the fault is likely to be with the shut-off valve, control valve or pressure sensor itself. Refer to engine manual for repair and replacement instructions for shut-off valve and pressure sensor test and replacement. Check and replace control valve whilst referring to engine manual.	●										
Incorrect control valve supply pressure Likely causes are malfunctions of shut-off valve or control valve. Refer to engine manual for repair and replacement instructions for shut-off valve. Check and replace control valve whilst referring to engine manual.			●	●	●	●		●	●		
Control valve sticking Check actuator pressure if sensor fitted. If control valve sticking is likely cause, spray light penetrating oil into control valve inlet. Allow to lubricate the valve mechanical parts. Conduct pressure check. If either 0 V or battery voltage condition is incorrect change valve whilst referring to engine manual.	●		●	●	●	●		●	●		

Fault Finding Chart - Variable Geometry Continued

	Engine Lacks Power	Engine Overheats	Intermittent engine braking	Intermittent low power	Engine does not run smoothly	Low power at low engine speed	Turbocharger noisy	Poor acceleration	Reduced braking	Coolant leak	Oil leak
Coolant flow restricted Check coolant pipework and connections for damage. Replace damaged bearing housing fittings using only Holset recommended parts. Refer to engine manual for flow data and service instructions for all other connections and pipework.	●	●						●			
Coolant pipework or connectors leaking Check coolant pipework and connectors for leakage. Tighten connections and if leak persists, replace failed connectors or pipes using Holset recommended parts.										●	
Oil feed and return lines or adaptors leaking Check oil feed and return pipes and adaptors for leakage. Check O-ring seals and replace if necessary. Tighten adaptors and if leak persists, replace failed adaptors or pipes using Holset recommended parts.											●
Oil leakage from speed sensor Check O-ring seal and replace if necessary. Refit sensor and if leak persists replace speed sensor.											●
Bearing housing damaged If O-ring or connector replacement does not resolve an oil leak, the bearing housing tappings may be damaged requiring replacement of the turbocharger. Where water connector replacement does not resolve a water leak, the bearing housing tappings may be damaged requiring replacement of the turbocharger.										●	●

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.

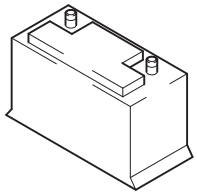
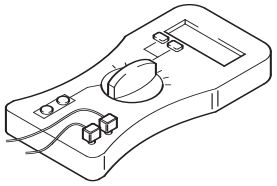
Part No.	Tool Description	Tool Illustration
	Torque Wrench (Refer to ***Service Data Sheet*** for required torque ranges)	
	Regulated Air Supply	
	Steel Rule	
	13 mm Diameter Clean Rubber Plug	
	0-10 bar Pressure Gauge	
	Allen Key (6mm)	

Caution

All Service and Maintenance settings are shown in Service Data Sheet at www.holsetaftermarket.com. It is essential that these settings are used. Common tools found in mechanic's tool box not included.

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 Authorised Repair Location.

Part No.	Tool Description	Tool Illustration
	Vehicle Battery Supply	
	Multi-meter	

Caution

All Service and Maintenance settings are shown in Service Data Sheet at www.holsetaftermarket.com. It is essential that these settings are used. Common tools found in mechanic's tool box not included.

On Engine Checks

Variable geometry turbochargers have potential oil, gas, coolant and air leak paths. They are fitted with a sensor and an actuator which contain sensitive components. When checking and correcting leaks it is essential that good practice and the correct tools are used to avoid damaging the turbocharger.

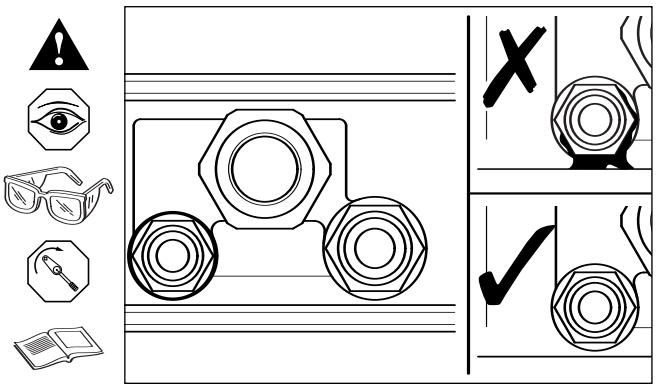
Oil Leakage

M14 (19 mm A/F)

Warning
Always wear safety glasses.

Replacement seals and adapters should be fitted without sealant as this can contaminate the oil. Torque tighten adaptor to value shown in ***Service Data Sheet***.

It is important to avoid kinked or worn pipes during servicing and operation.

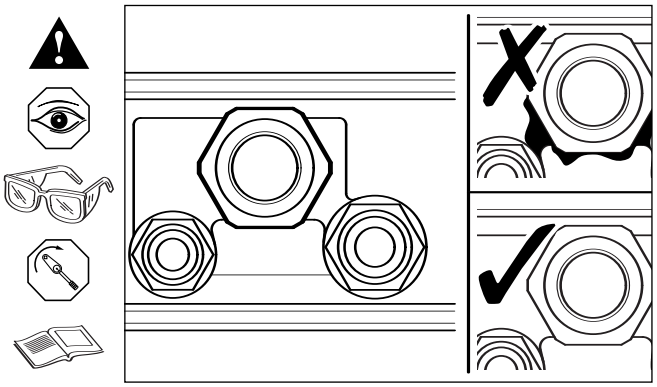


M22 (36 mm A/F)

Warning
Inlet oil is pressurized and outlet oil is hot. Never take service action with engine running. Protect face and hands from hot fluid leakage.

Replacement seals and adapters should be fitted without sealant as this can contaminate the oil. Torque tighten adapter to value shown in ***Service Data Sheet***.

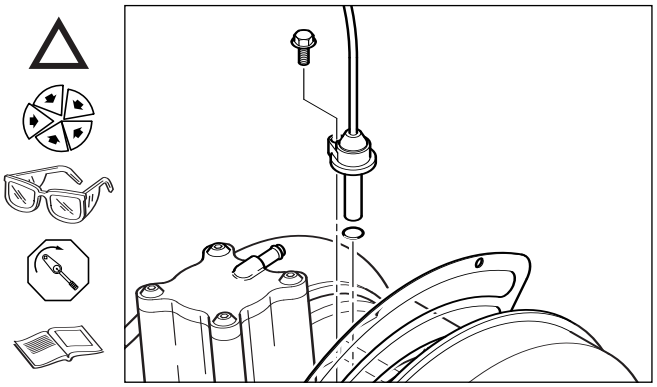
All outlet pipes should be free flowing without kinks and sharp bends and decline at overall angle not less than 30 degrees below the horizontal.



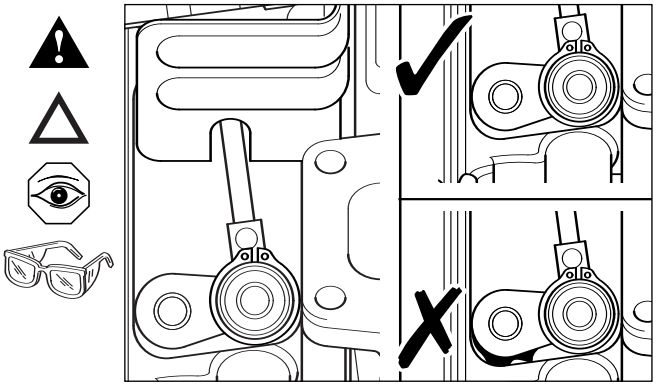
M6 (8 mm A/F)

Speed sensor is sealed with o-ring and fastened using set screw. Always use new set screw with patch sealant feature provided in Holset Service Kit when re-fitting sensor. Torque tighten sensor to value shown in ***Service Data Sheet***.

Caution
Do not use sealant when fitting speed sensor as this may contaminate oil and bearings.



Caution
If leak occurs at lever change turbocharger.

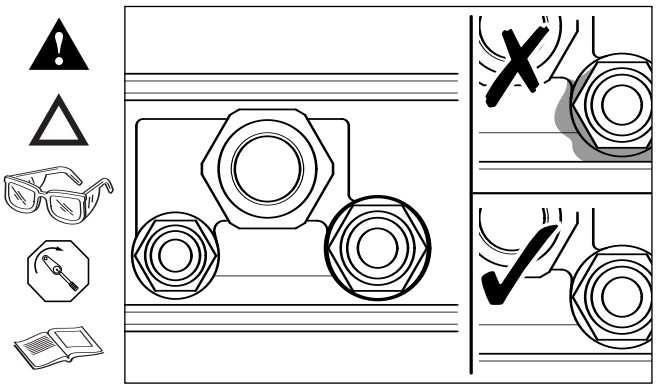


Coolant Leakage

M16 (22 mm A/F)

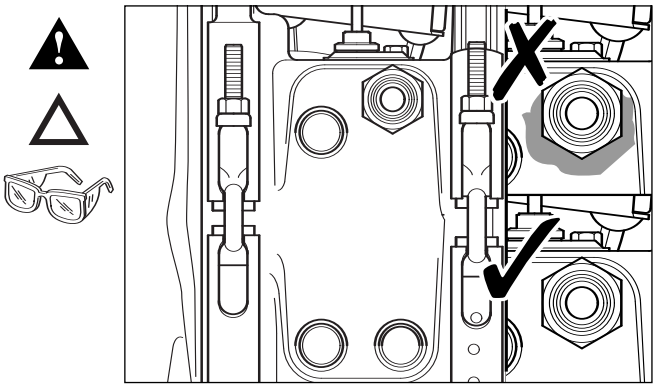
Warning
Always wear safety glasses.

Repair by replacement of fitting. Where housing threads are damaged replace turbocharger. Torque tighten adapter to value shown in ***Service Data Sheet***.



Warning
Water connections may be hot and pressurized. Never take service action with engine running. Protect face and hands from hot fluid leakage.

Caution
Do not use sealant as this may affect performance of o-ring seals.

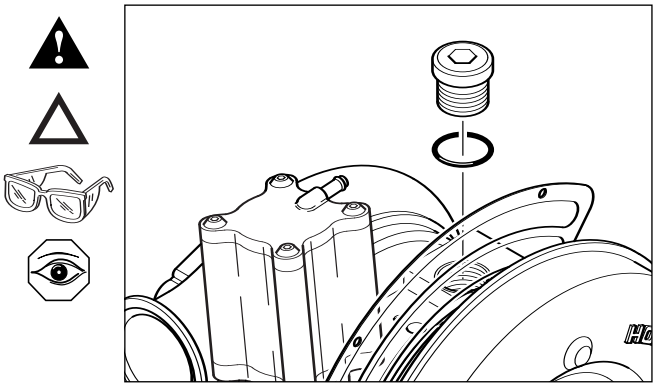


Gas Leakage

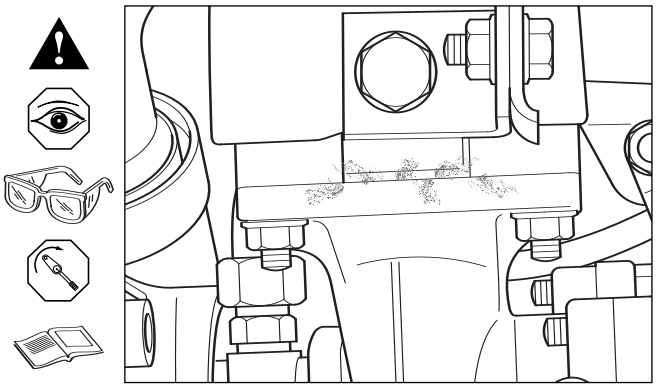
M10 x 1.5 (6 mm Allen Key)

Do not cut o-ring seal by plug threads during fitment and ensure seal is seated on chamfer. Torque tighten pressure plug to value shown in ***Service Data Sheet***.

Caution
Do not use sealant when fitting pressure plug as this may contaminate bearing system.

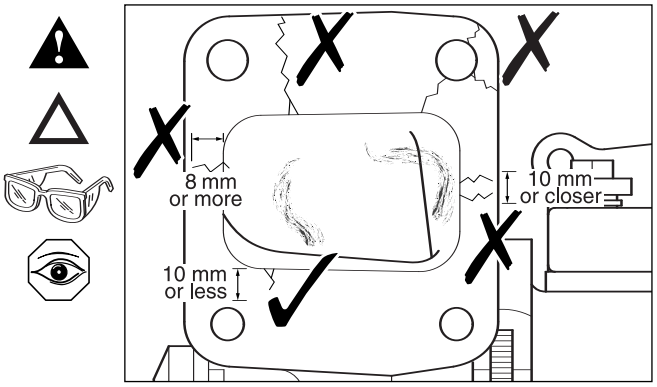


Turbine housing flange leakage will cause soot formation on flange. Check exhaust manifold to flange seal ensuring fastener torque meets engine manufacturer's recommendation.



Warning
Always wear safety glasses.

Caution
Turbine housings can exhibit cracking when subject to excessive thermal and mechanical loads.



Cracking of inlet duct requires turbocharger replacement.

Check flange for cracks and ensure flatness is within 0.1 mm (0.004 in).

Acceptance and rejection guidelines are shown in this illustration. If exhaust gasket is available, always ensure that any cracks lie within its sealing area.

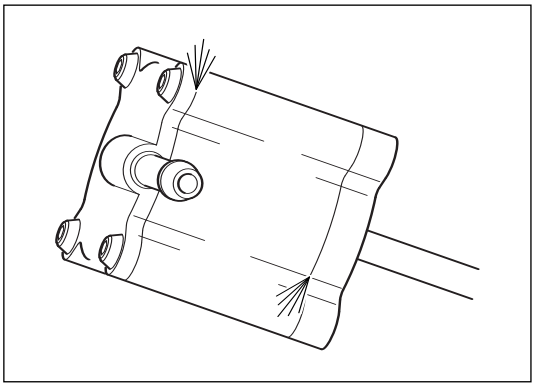
Check fastener hole diameter is not more than 1.5 mm larger than max. thread diameter of fastener.

M12 x 1.75

Check flange threaded holes with thread gauge.

Air Leakage

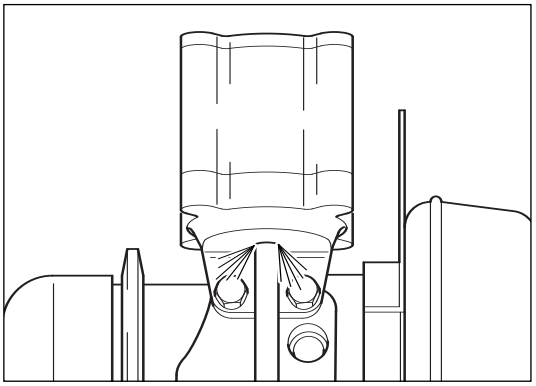
Caution
Visual checks and audible checks for air leaks may be completed safely with a running engine. Alternatively, apply an external air source.



Check for air leaks at the end plates and air hose to actuator air inlet fitting.

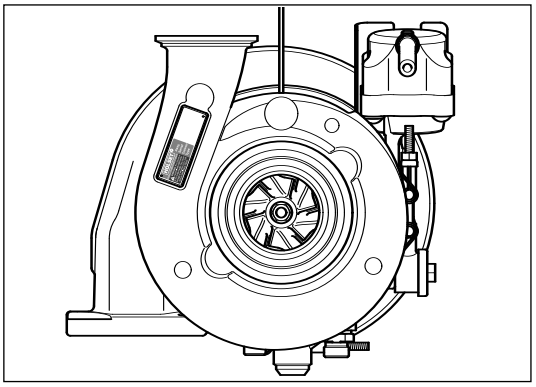
Check for air leak at the base of the actuator housing.

Caution
If the actuator leaks air, however little, it must be replaced. Using a damaged actuator will result in inferior performance of turbocharger and engine.



Visual Checks

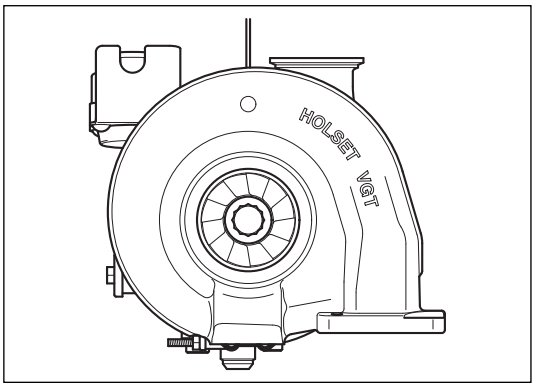
Caution
To avoid damage to variable geometry control mechanism always refer to ***Turbine and Compressor Housings*** before attempting to remove turbine housing.



Visual check for damaged or bent blades only.

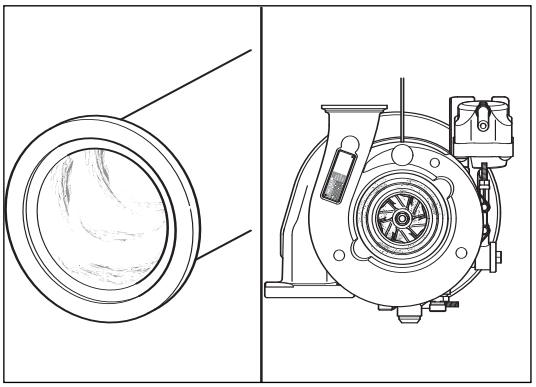
Caution
Never attempt to straighten blades.

Caution
To avoid damage to impeller, always refer to ***Turbine and Compressor Housings*** before attempting to remove compressor housing.



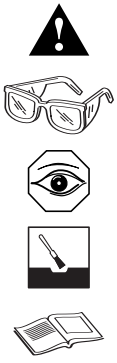
Visual check for damaged and fouling of impeller blades only.

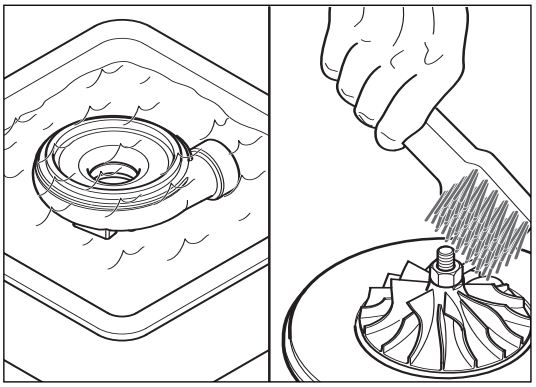
Closed crankcase ventilation systems have a tendency to deposit oil in the compressor housing. Where practical remove intake system pipework every 50,000 km (30,000 miles) to check housing, compressor wheel and inlet baffle condition.



Warning
Always wear safety glasses.

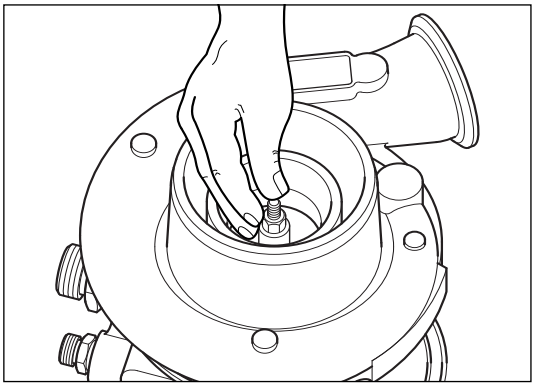
Always refer to ***Compressor Housing Cleaning*** to clean housing. Rotor components can be cleaned using a non metallic bristle brush.





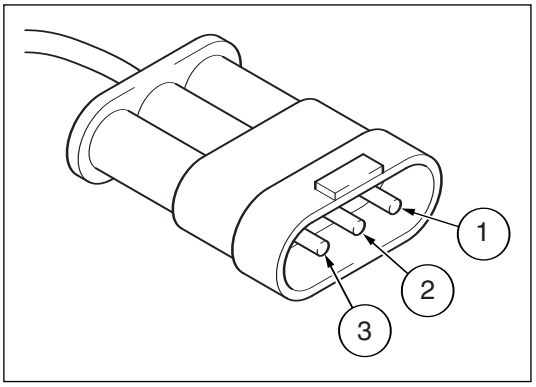
With intake system disconnected from compressor housing, it may be possible to check visually for excess bearing axial and radial clearances.

If in doubt, the turbocharger must be removed from engine to check ***Bearing Clearance*** against recommended values shown in ***Service Data Sheet***.



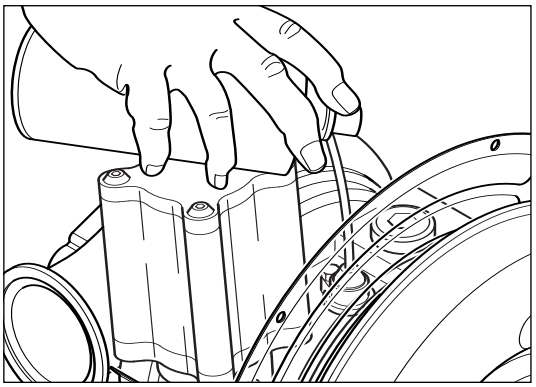
Speed Sensor

Disconnect sensor at its electrical connector. Using multi-meter, check resistance between connector pins 1 and 2 is 880+/- 50 ohms with sensor at 20°C. Check pins 1 to 3 and 2 to 3 have very high ((min 1 MOhm) resistance.



Where road spray, dirt and fluid ingress has caused fouling or corrosion of speed sensor fastener apply penetrating oil in accordance with manufacturer's instructions.

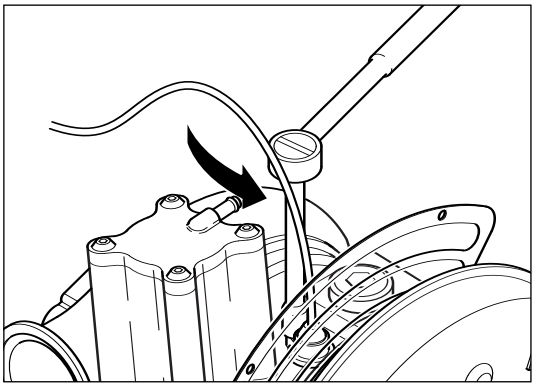
Warning
Always wear safety glasses.



M6 (8 mm A/F)

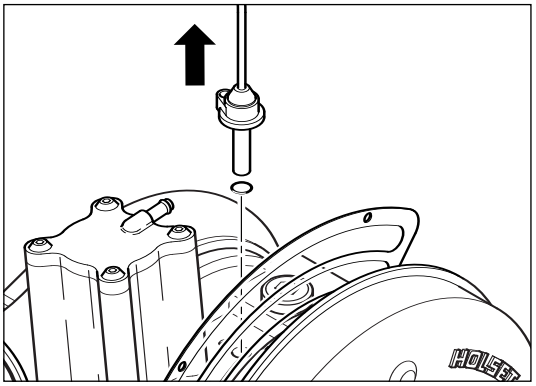
Using socket wrench and ratchet, loosen and remove cap head screw, speed sensor.

Caution
Breaking sealed fastener joint may require significant torque. It is essential that socket spanner is properly engaged on fastener to avoid inadvertent damage to speed sensor cable and connector resulting from spanner slip.



Extract speed sensor ensuring that o-ring seal is removed with sensor. This is conveniently achieved by tilting sensor as it exits recessed bore.

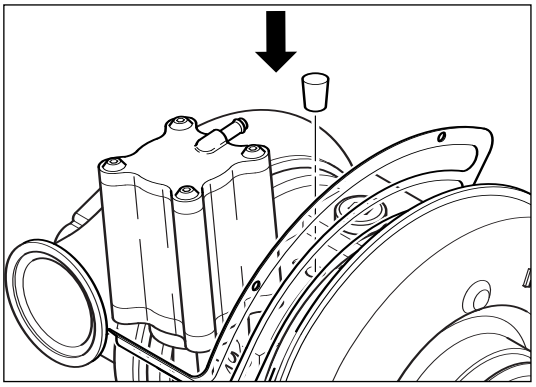
Place speed sensor on clean surface to avoid collection of metal particles.



Warning
Always wear safety glasses.

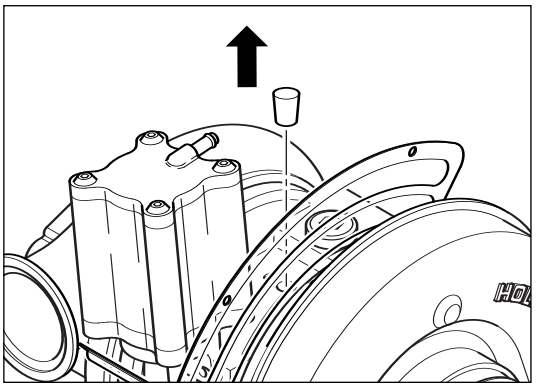
Caution
Removal of speed sensor leaves open access to bearing housing. It is essential that no dirt or fluids enter bearing housing cavity during speed sensor replacement.

Insert clean rubber plug.

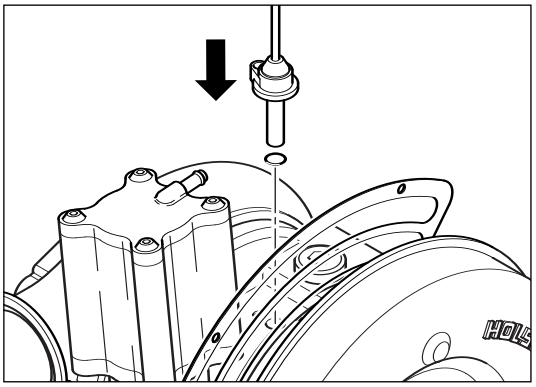


Speed Sensor Replacement

Remove clean rubber plug.



Prior to inserting speed sensor ensure it is clean and unable to collect metal particles as it is inserted. Ensure o-ring seal is in position on sensor body.

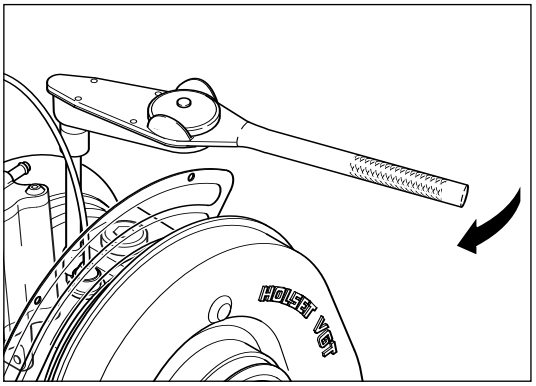


M6 (8 mm A/F)

Use new cap head screw with patch sealant feature provided in service kit to fasten speed sensor flange to bearing housing.

Torque tighten set screw to value specified in ***Service Data Sheet***.

Caution
It is recommended NOT to re-use original fastener. Where original fastener must be used, it is important threads are clean and thread locking compound is applied. Fastener torque must be applied within time specified by thread lock manufacturer.



Dcon Control Valve

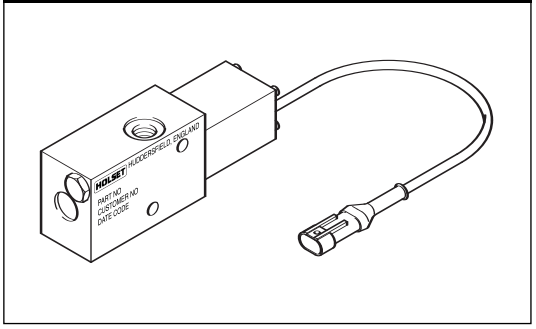
Control valve is remote from turbocharger. It is connected pneumatically to VG actuator and electrically to engine control module (ECM).

Valve controls pressure applied to actuator in response to signals sent from ECM. Where ECM signals control valve error, check wiring harness is good. If error persists check contol valve operation.

To check electrically, disconnect control valve at its electrical connector. Use multi-meter to check resistance between pins 1 and 2. Resistance for 24 Volt control valve should be 24.5 +/- 0.5 Ohm at 20°C.

If engine diagnostics indicate problem with valve it must be serviced by replacement as it contains no serviceable parts.

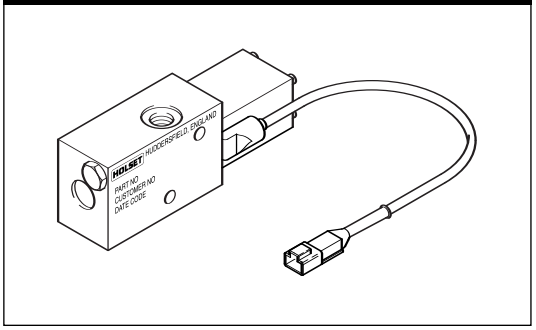
24 V - Control Valve



To check electrically, disconnect control valve at its electrical connector. Use multi-meter to check resistance between pins 1 and 2. Resistance for 12 Volt control valve should be 6.5 +/- 0.5 Ohm at 20°C.

Contact your approved agent for parts and availability.

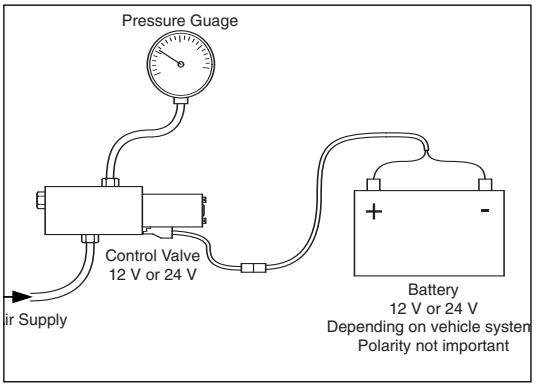
12 V - Control Valve



Control Valve Removal & Replacement

Fixing and position of control valve is dependent on engine application. Process of replacement will be included in engine manual.

The Dcon valve can be cleaned when installed using pressure wash or steam cleaning equipment.



Warning
Always wear safety glasses.

Warning
Care must be taken when breaking pneumatic connections as these may be pressurised.

Caution
Always ensure valve is non-operational but connected pneumatically and electrically during cleaning.

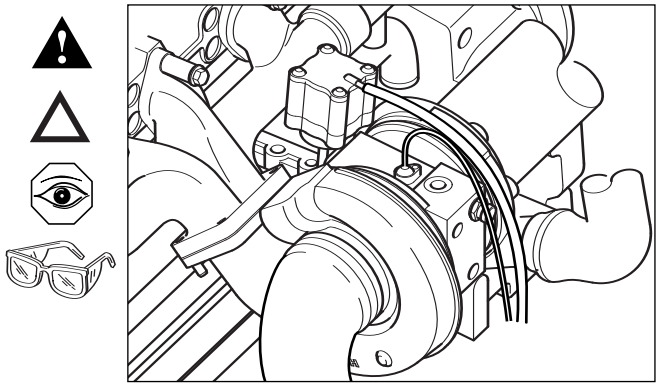
Caution
Where it is necessary to break the inlet, outlet and capsule pressure sensor pneumatic connections, it is essential that open pipes and connectors are protected from dirt and fluid entry using clean rubber plugs.

VG Actuator

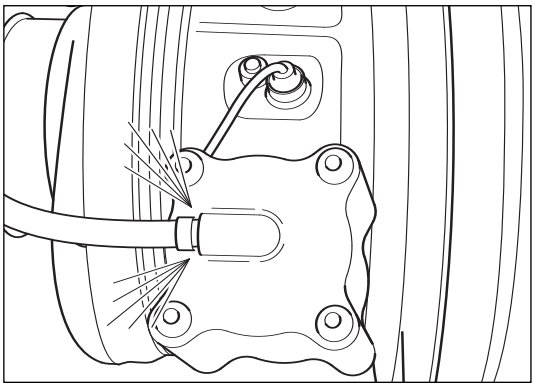
Warning
Always wear safety glasses.

Caution
Actuator movement and leak checks should be carried out on engine. If turbocharger removal is necessary it may require:

- Drainage of water system
- Disassembly of oil circuit
- Disconnection of speed sensor



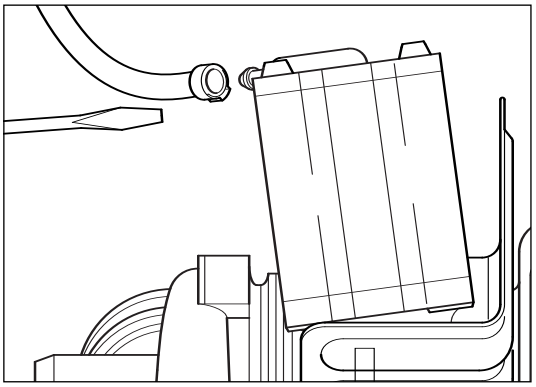
Warning
Pneumatic connections may be pressurised. Always ensure engine keyswitch is in off-position before taking service action and use face protection.



If hose is still connected to air inlet fitting, use small screwdriver to remove hose clip.

Remove hose.

Caution
During VG actuator checks and replacement it is necessary to break pneumatic connection between control valve and actuator. It is essential that open pipe is protected from dirt and fluid entry.

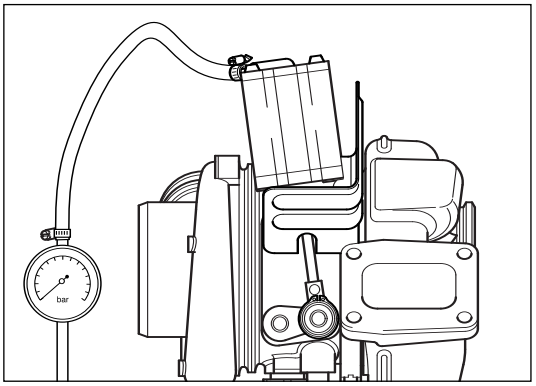


Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.

Warning
Avoid touching the VG mechanism as finger injury may result from sudden movement of the assembly when air is supplied.

Connect and secure hose from regulated air supply to actuator air inlet fitting.

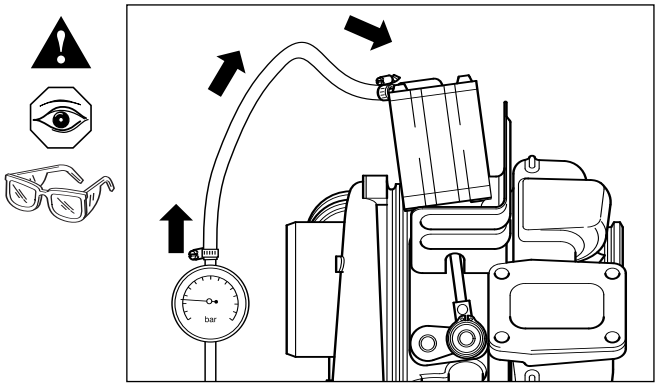
Caution
Ensure regulated air supply is dry and filtered to avoid damage to actuator piston and o-ring seals.



Warning
Always wear safety glasses.

Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.

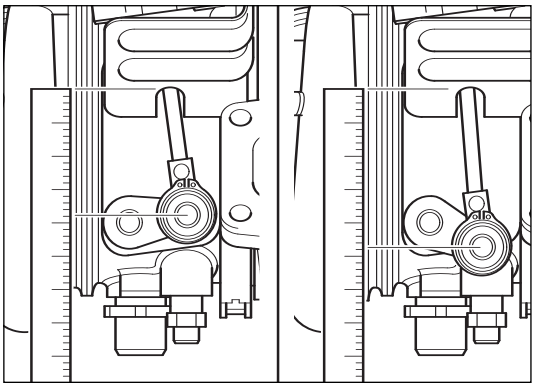
Progressively apply 450 kPa (65 lbf/in²) from regulated supply and ensure actuator rod moves lever.
If there is no movement or if movement is not smooth, remove turbocharger.



Control regulated air supply to 0 and 300 kPa (43.5 lbf/in²) and measure actuator rod stroke which should be in range specified in ***Service Data Sheet***.

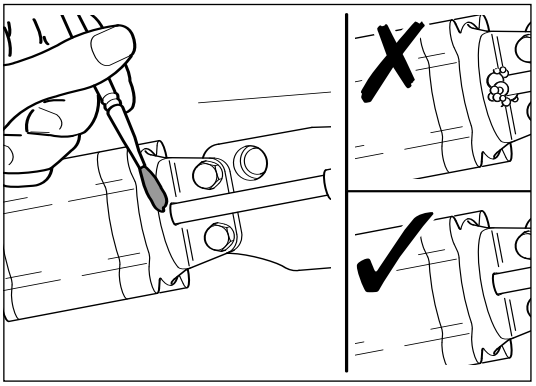
Warning
Avoid touching VG mechanism as finger injury may result from sudden movement of assembly when air is supplied.

If actuator travel is not within permissible range remove by reference to ***VG Actuator Removal and Checks***.

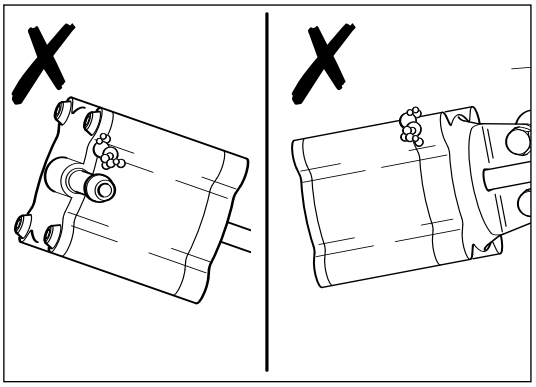


Warning
Actuator internal parts are not serviceable items. Do not disassemble as release of in-built separating forces may cause personal injury.

Whilst air pressure is still applied at 300 kPa (43.5 lbf/in²), check actuator for leaks. Use soapy water and small brush. Small bubbles will appear if actuator is leaking. If actuator is leaking, it must be removed and replaced. Contact your local approved agent for details.



Caution
If actuator leaks air, however little, it must be replaced. Using damaged actuator will result in inferior performance of turbocharger and engine.



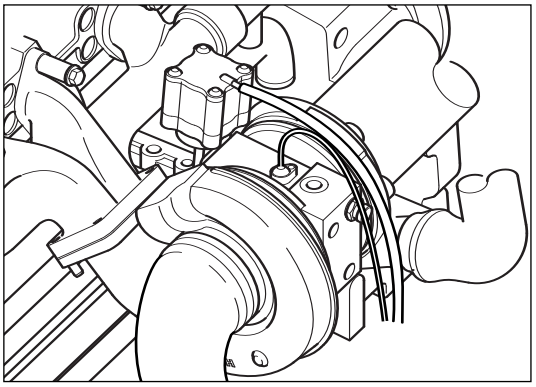
VG Actuator Removal and Checks

Warning
Always wear safety glasses.

Where actuator movement is outside range or where actuator air leaks have been discovered it is necessary to remove actuator to continue with fault diagnosis. If possible these procedures should be carried out on engine.

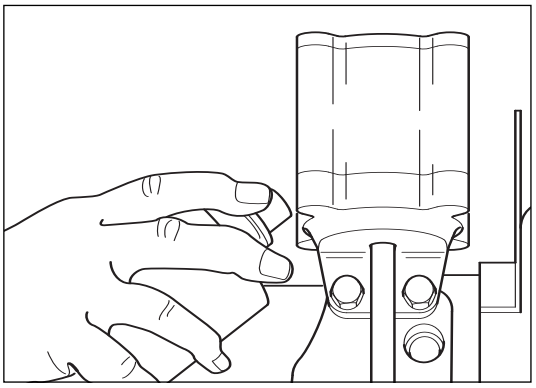
If removal of turbocharger is necessary it may require:

- Drainage of water system
- Disassembly of oil circuit
- Disconnection of sensors



Warning
Pneumatic connections may be pressurised. Always ensure engine keyswitch is in off-position before taking service action and use face protection.

Where road spray, dirt and fluid ingress has caused fouling or corrosion of the actuator integrated bracket fasteners apply penetrating oil in accordance with the manufacturer's instructions.

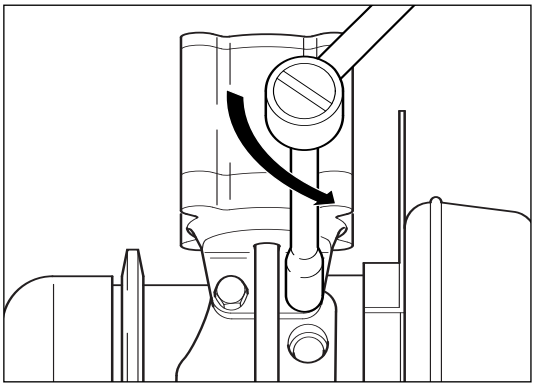


M8 (13 mm A/F) (10 mm A/F)

Loosen 2 actuator screws.

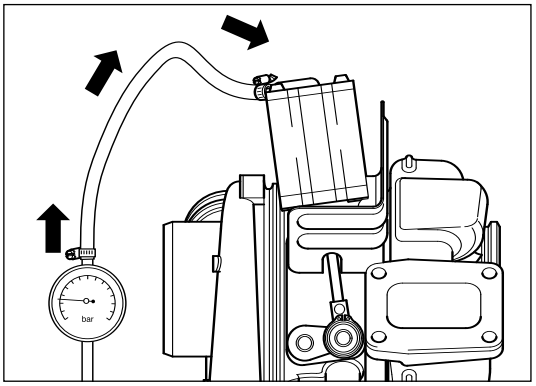
To gain access to actuator screws it may be necessary to rotate v-band clamp. Always mark relative position between v-band clamp, bearing housing and turbine housing.

Caution
Avoid any housing separation. This may damage the turbine wheel or VG nozzle vanes.



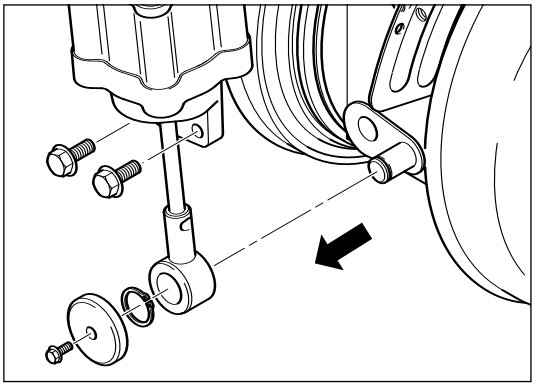
Connect clean dry regulated air supply to air inlet fitting and apply 200 kPa (29 lbf/in^2) to release actuator pre-load between bracket and crank journal.

Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.



Warning
Always wear safety glasses.

Warning
Rod may retract quickly when freed from crank journal. Avoid touching the VG assembly until rod is at rest and there is no risk of finger injury.



M8 (8 mm A/F) (10 mm A/F)

Either:

Remove end link cap head screw, sacrificial anode and discard.

Remove end link retaining ring. Slide the actuator rod off crank journal.

Remove actuator scews, actuator and discard.

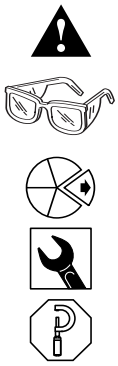
Or:

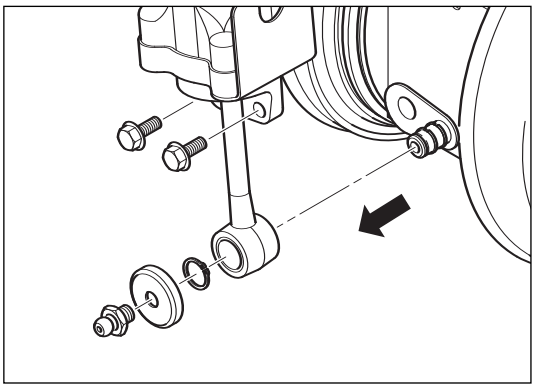
Remove grease nipple and cover plate.

Remove end link retaining ring. Slide the actuator rod off crank journal.

Remove actuator scews and discard. Remove actuator.

If loaded section of crank journal is worn by more than 0.013 mm (0.005 in) replace turbocharger.



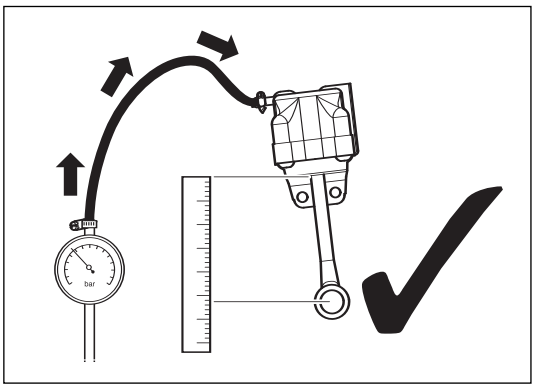


Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.

Connect and secure the hose from a regulated air supply to the actuator air inlet fitting.

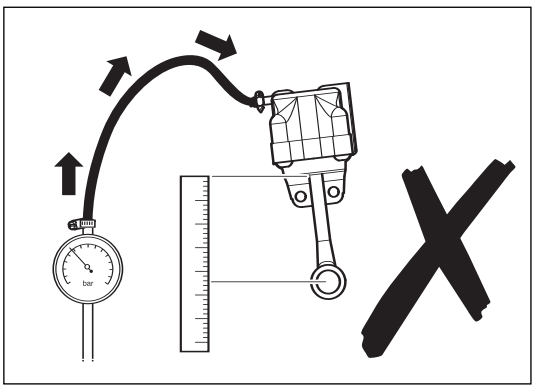
Control regulated air supply to 0 and 300 kPa (43.5 lbf/in^2) and confirm actuator travel is smooth and within permissible range shown in ***Service Data Sheet***.

Caution
Detached actuator stroke is greater than stroke when attached to VG mechanism. Ensure correct range is read from ***Service Data Sheet***.



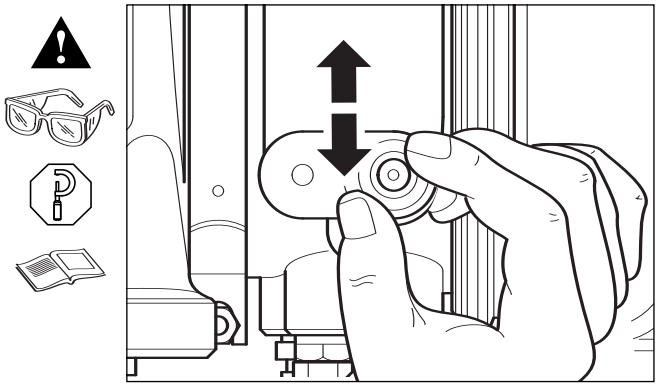
If actuator travel is not smooth nor within permissible range shown in ***Service Data Sheet*** replace actuator.

Warning
Actuator is not a serviceable item. Do not disassemble actuator as release of in-built separating forces may cause personal injury.



If actuator travel **is** within permissible range shown in ***Service Data Sheet*** use light force to check linear travel of VG crank pin.

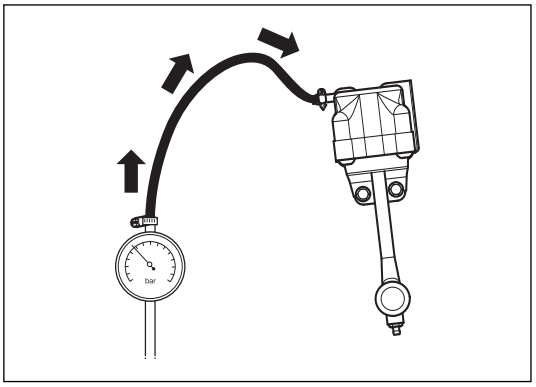
If crank pin does not travel smoothly within permissible range shown in ***Service Data Sheet*** replace turbocharger.



VG Actuator Replacement

Service Actuator Kit (121)

Connect clean dry regulated air supply to actuator air inlet fitting and apply 200 kPa (29 lbf/in^2) to release actuator pre-load.

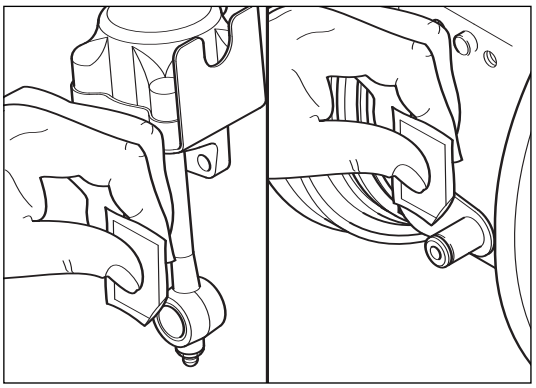


Warning
Always wear safety glasses.

Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.

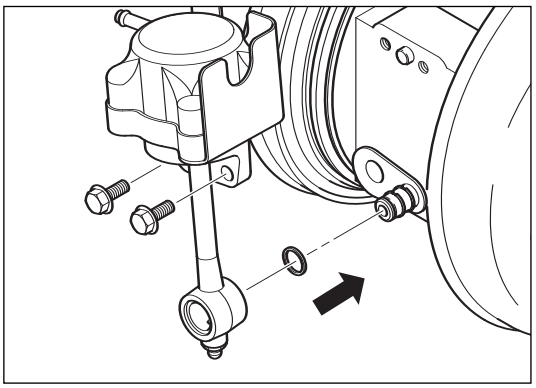
Warning
Avoid touching VG assembly until it is clear that actuator rod is at rest and there is no risk of finger injury.

Caution
Always refit actuator with greased end link and integral heat shield



Clean crank journal with lint free cloth and non-corrosive metal cleaner or plastic scouring pad. Apply grease from pack (172)* to crank journal and actuator end link bore.

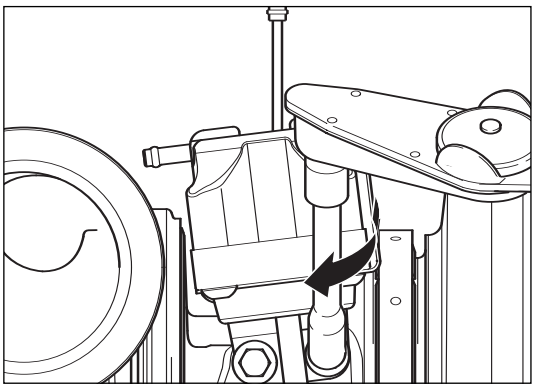
Push plain plastic washer (90)* on to crank journal. Locate against crank lever face. Where fitted ensure split ring seals, which are fit for life item, are in position. Slide actuator end link on to crank journal and ease actuator mounting flange into place on bearing housing roll pin location. Insert two new patch treated actuator screws (106)* to locate actuator to bearing housing.



M8 (10 mm A/F)

Torque tighten screws to value specified in ***Service Data Sheet***.

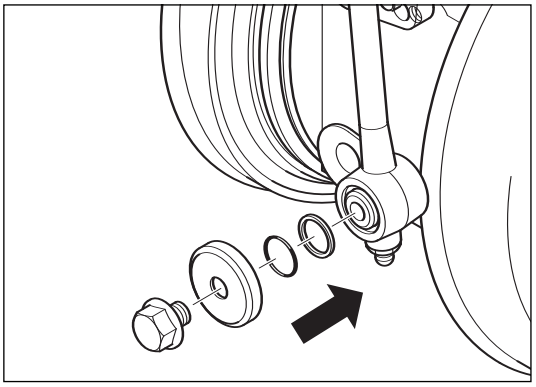
Caution
It is recommended NOT to re-use original actuator screws. Where original fasteners must be used, it is important that threads are clean and thread locking compound is applied. Fastener torque must be applied within time specified by thread lock manufacturer.



Warning
Always wear safety glasses.

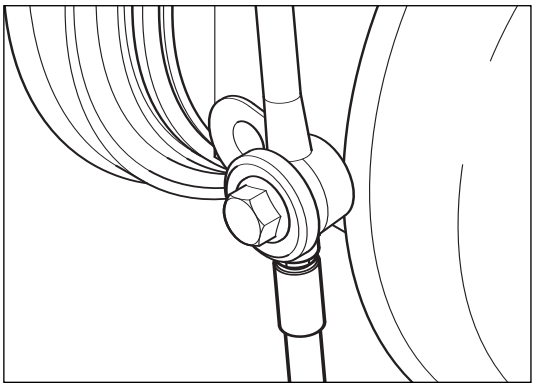
M8 (10 mm A/F)
Fit plain plastic washer (90)* on to crank journal, followed by o-ring seal (27)*. Ensure washer and o-ring engage against end link bush. Fit new cover plate (157)* and hand tighten new cap head screw (120)*

Carefully tighten screw until cover plate is in metal contact with end link face. Torque tighten to value specified in ***Service Data Sheet***.



Caution
Length of cap head screw is controlled. Always use screw from service kit.

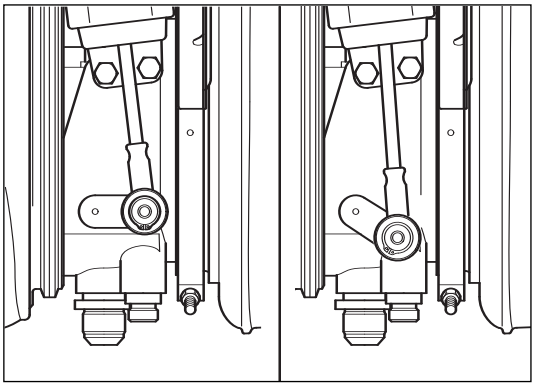
Apply Kluberpaste 46 MR 401 grease through end link grease nipple.



Note
This proprietary grease is **HIGHLY RECOMMENDED** due to its lubrication and temperature capabilities. If not available, a high quality Lithium "LM" grease may be used.

VG Actuator Replacement Check

Warning
Always wear safety glasses.

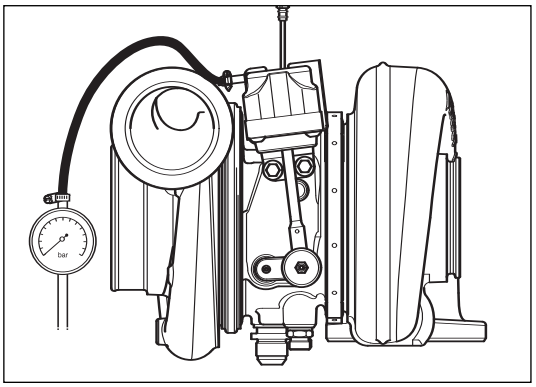


Following installation it is necessary to check that actuator moves smoothly through its complete stroke.

Ensure hose from dry regulated air supply is still properly attached and secured to the actuator air inlet fitting.

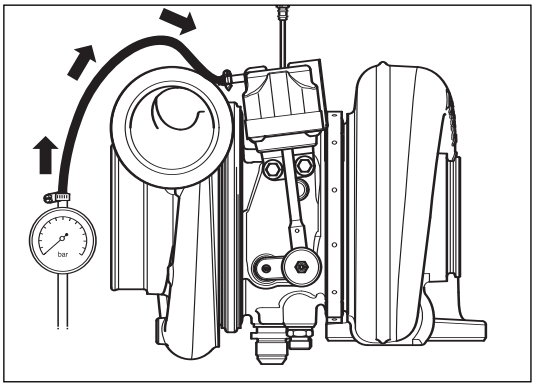
Warning
Avoid touching VG assembly until it is clear that actuator rod is at rest and there is no risk of finger injury.

Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.



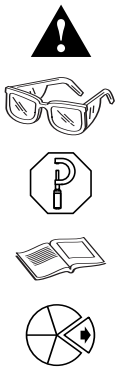
Progressively apply 0 to 450 kPa (65 lbf/in^2) to actuator until actuator is moving freely over its whole stroke.

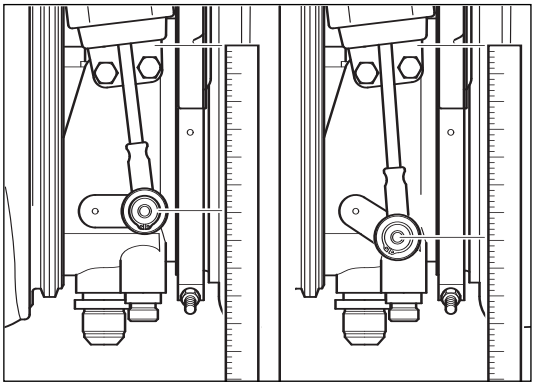
Caution
Where progressive motion cannot be achieved it is probable that element of variable geometry mechanism internal to turbocharger is damaged. In this case replace turbocharger.



Control regulated air supply to 0 and 300 kPa (43.5 lbf/in^2). Using underside of actuator as reference measuring point, check actuator stroke is within permissible range shown in ***Service Data Sheet***.

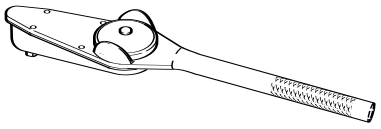
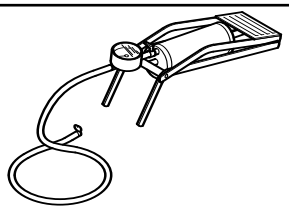
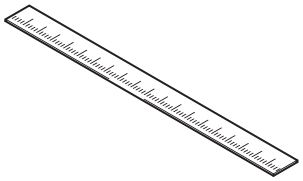
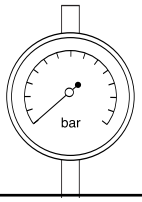
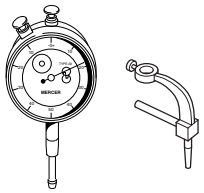
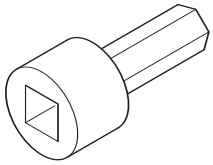
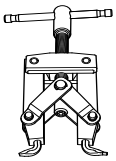
Remove air supply.





Service Tools

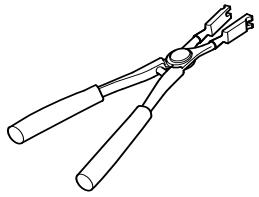
The following special tools are recommended to perform procedures in this manual. The use of these tools is shown in the appropriate procedure.

Part No.	Tool Description	Tool Illustration
	Torque Wrench (Refer to ***Service Data Sheet*** for required torque ranges)	
	Regulated Air Supply	
	Steel Rule	
	0-10 bar (0 to 1000 KPa) Pressure Gauge	
	Dial Gauge and Dial Gauge Adapter	
	Allen Key (6mm)	
	Diffuser Puller	

Caution ⚠

All Service and Maintenance settings are shown in Service Data Sheet at www.holsetaftermarket.com. It is essential that these settings are used. Common tools found in mechanic's tool box not included.

The following special tools are recommended to perform procedures in this manual. The use of these tools is shown in the appropriate procedure.

Part No.	Tool Description	Tool Illustration
J50968	V-band Spreader	

VG Turbine Actuating Assembly (Not possible without remanufacturing facilities)

J90037 J90279	Drill Jig (Drawings Only)
J90290 J90291	Shroud Plate Retaining Ring Removal Tool (Drawings Only)

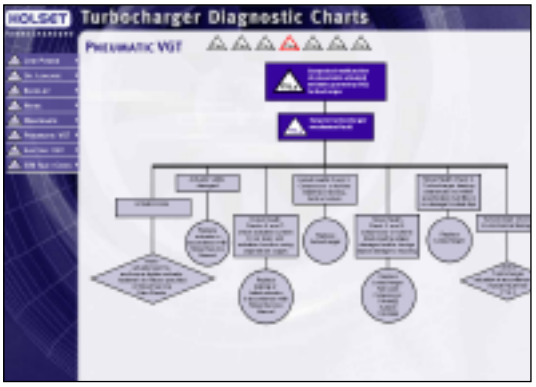
Caution △

All Service and Maintenance settings are shown in Service Data Sheet at www.holsetaftermarket.com. It is essential that these settings are used. Common tools found in mechanic's tool box not included.

Preliminary Health Checks

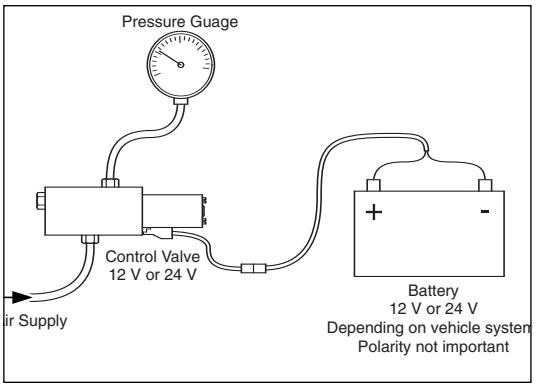
Caution

Many turbochargers are removed from engines before engine, turbocharger and vehicle systems have been health checked. Always conduct engine turbocharger system fault diagnosis before commencing turbocharger service and overhaul.

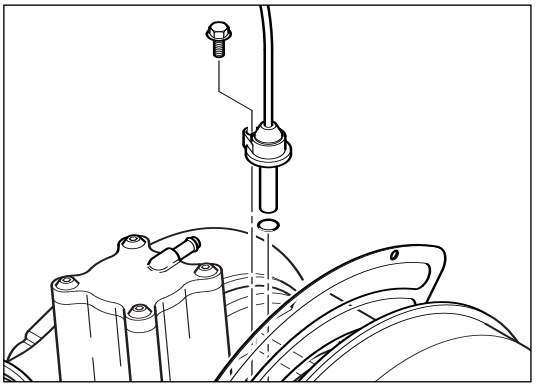


Always refer to Engine Control Module (ECM) diagnostic data and Holset's ***Turbocharger Diagnostic Charts*** to identify the cause of any fault and to help select the most economical repair.

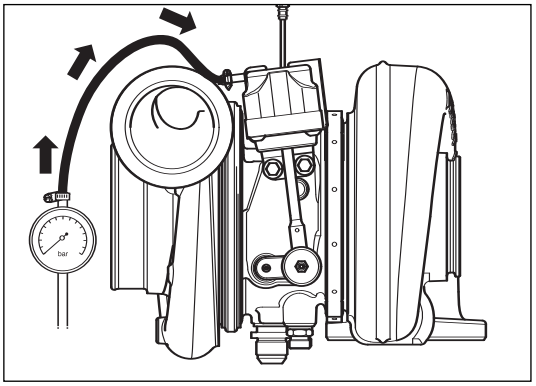
Always check control valve functions by reference to ***Dcon Control Valve***.



Always check speed sensor functions by reference to ***Speed Sensor Check and Replacement***.



Always check VG actuator and VG mechanism by reference to ***Actuator Checks and Replacement***.



Bearing Clearance

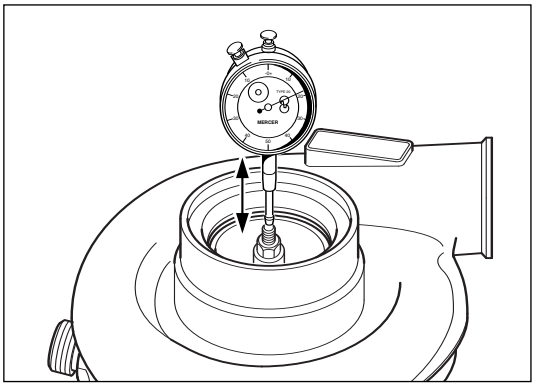
Caution ⚠

Always check bearing clearances before commencing turbocharger service and overhaul.

Secure turbine housing and check thrust clearance using dial gauge.

Ensure clearance is within MIN and MAX values shown on ***Service Data Sheet***.

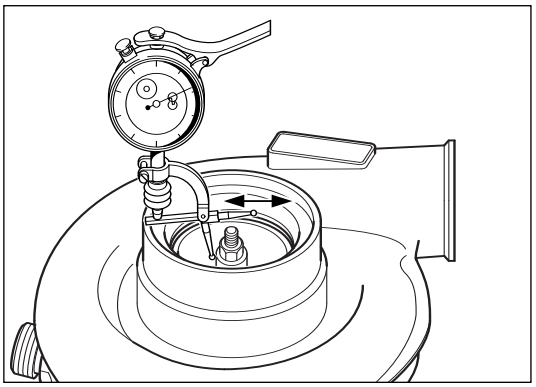
If axial clearance does not meet specification refer to ***Bearing System Replacement***.



Check radial movement at compressor impeller nose using dial gauge.

Ensure movement is within MIN and MAX TIR (Total Indicator Reading) values shown on ***Service Data Sheet.***

If radial movement does not meet specification refer to ***Bearing System Replacement***.



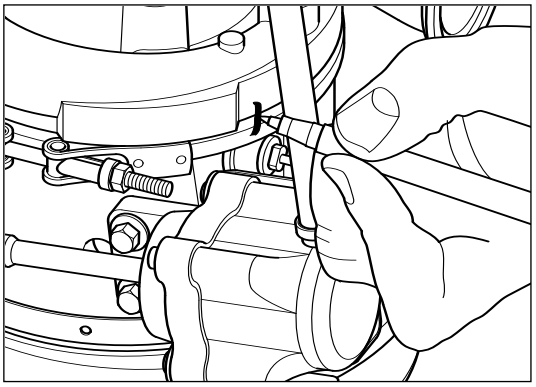
Turbine and Compressor Housings

Compressor Housing

Compressor Housing Removal

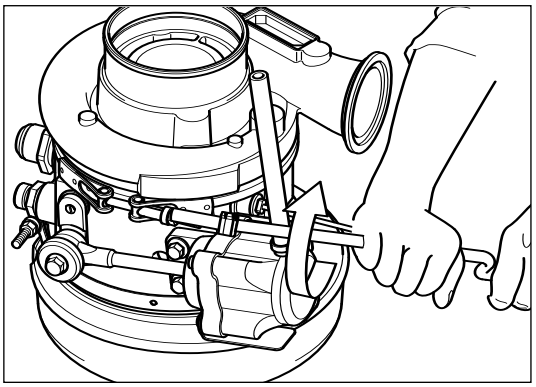
Warning
Always wear safety glasses.

Place turbine housing on clean flat surface. Mark compressor housing, bearing housing, v-band clamp and v-band nut position to record correct orientation. This action assists in housing and v-band orientation during re-assembly.

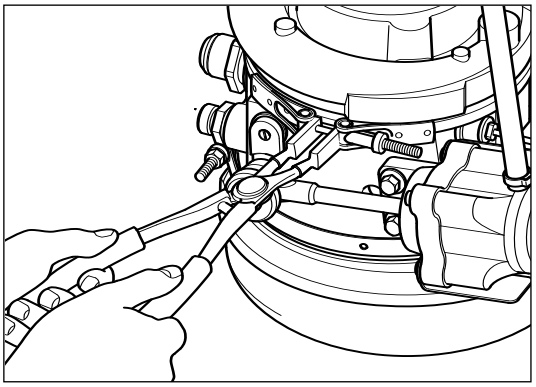


1/4 UNF 28 tpi (7/16 in A/F)

Loosen and remove v-band locknut and discard.

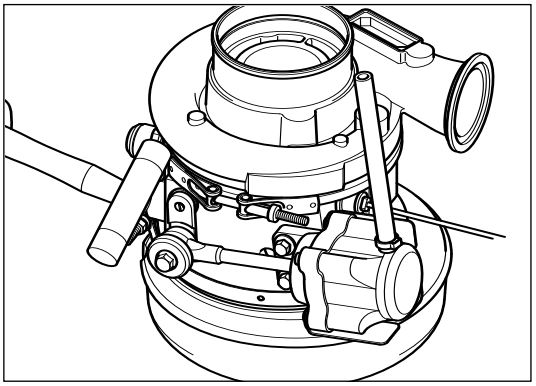


Spread v-band and slide on to bearing housing.



Apply soft hammer around major diameter of compressor housing until housing is loose. Lift housing off core assembly.

Caution
Compressor blades can be damaged when compressor housing is removed

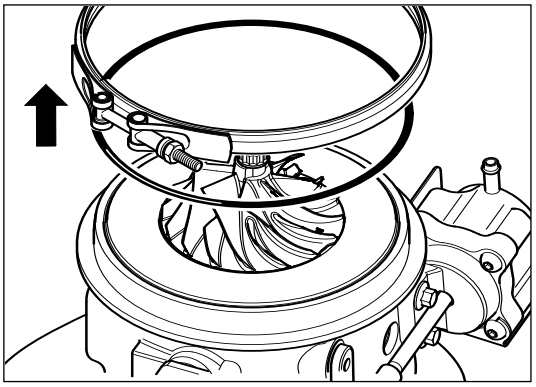


Warning
Always wear safety glasses.

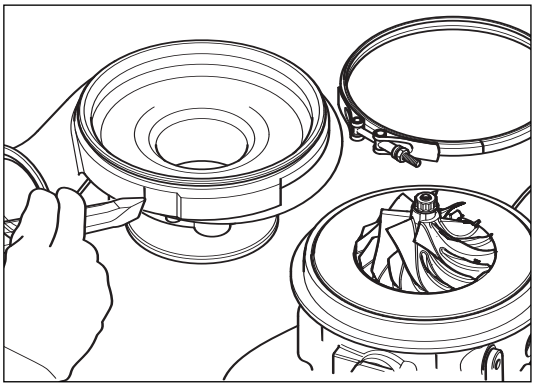
Remove compressor o-ring seal and discard. Remove v-band clamp.

Warning
If o-ring has been subject to fire, always use neoprene gloves when handling.

Caution
Always fit new seal on re-assembly.



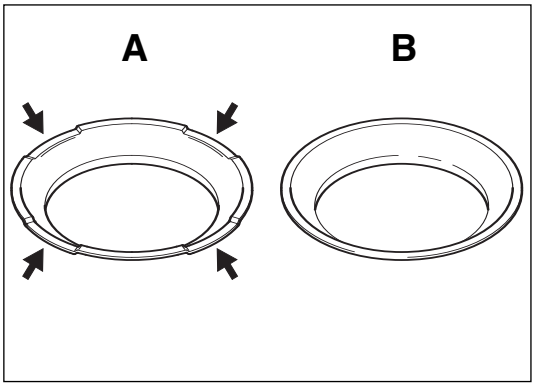
Pen marker lines may be removed by cleaning processes. Once the housing is removed strike or score all pen marks on housings and v-band.



Inlet Baffle Removal and Replacement

To clean compressor housings fitted with inlet baffle it is necessary to remove baffle.

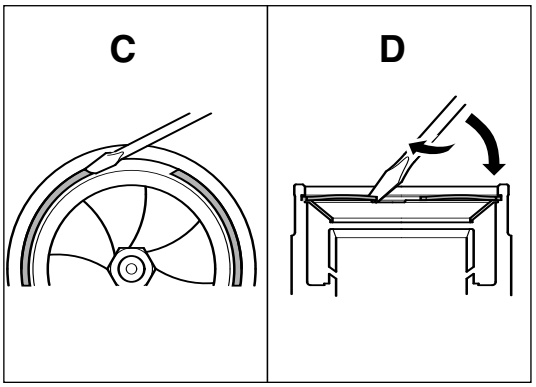
Inlet baffle (A) is old type; inlet baffle (B) is new type. Baffle (B) has been improved and no longer incorporates four stepped areas. This gives new baffle increased service life.



Warning
Always wear safety glasses.

Caution
When removing inlet baffle retaining ring, be careful not to damage compressor wheel with screw driver. Use rag or rubber bung to protect wheel.

Using flat screw driver, carefully apply force in area shown (C) as retaining ring starts to move, force screwdriver under ring as shown in (D).

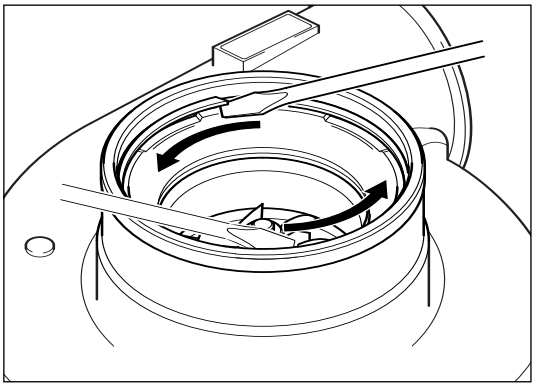


Push screwdriver in anti-clockwise (counter-clockwise) direction to force retaining ring out of groove.

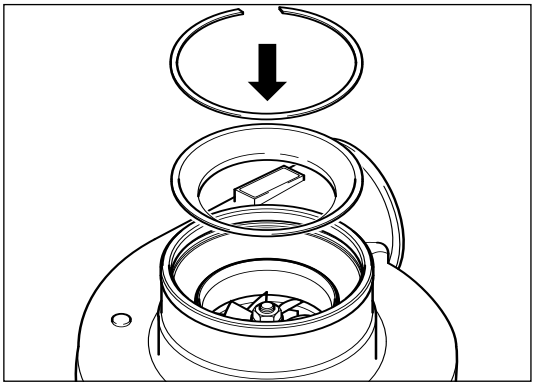
Remove retaining ring.

Remove inlet baffle.

Refer to ***Compressor Housing Cleaning***.



Following cleaning of compressor housing, locate inlet baffle onto location ledge of compressor housing inlet.

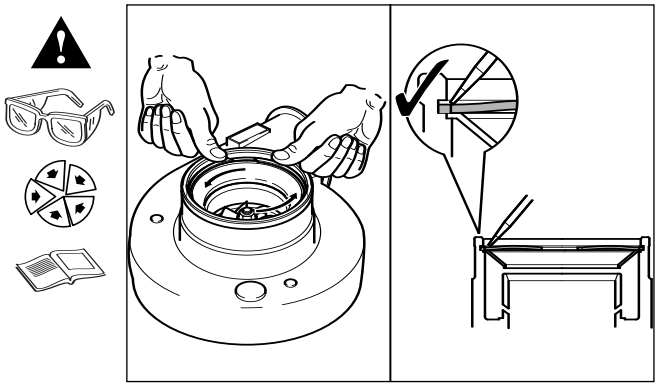


Hold one end of retaining ring in position in compressor housing groove. Press remainder of retaining ring into position using free hand.

Use flat screw driver to make sure retaining ring is correctly seated in compressor housing groove.

Refer to ***Compressor Housing Re-assembly***.

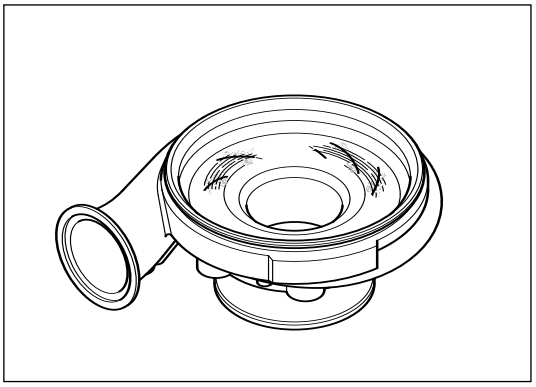
Warning
Always wear safety glasses.



Compressor Housing Cleaning

Warning
Always wear safety glasses.

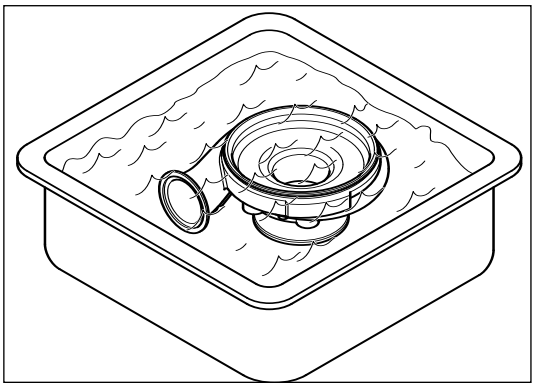
Caution
Housing surfaces adjacent to compressor wheel must be clean smooth and free from deposits.



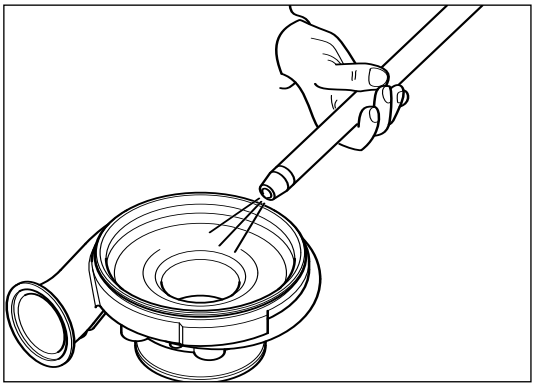
Inspect internal profile of housing for scoring damage due to possible contact with compressor wheel.

Visually inspect housing in order to obtain as much information as possible before washing.

Soak housing in non-corrosive low flash point metal cleaner to loosen deposits.

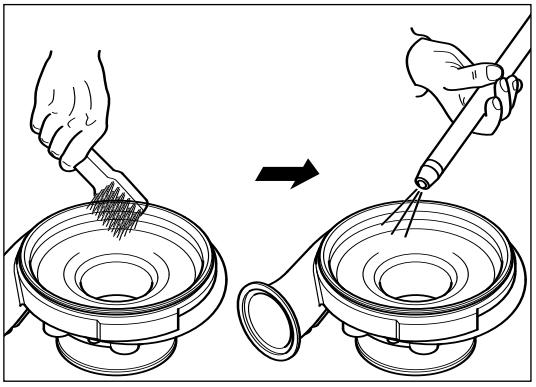


Dry component using compressed air.



Remove scale-like and carbon deposits, if any, using non-metallic bristle brush. After removing deposits re-wash and dry components.

Caution
Do not bead blast aluminium components.

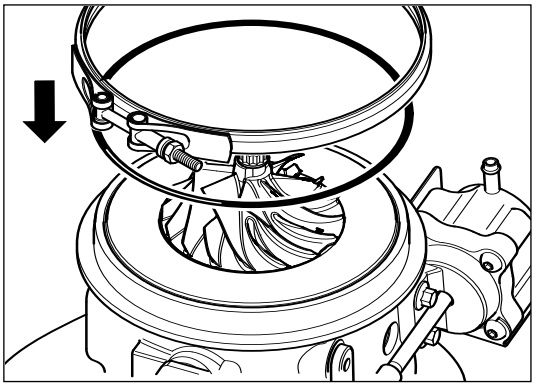


Compressor Housing Re-assembly

Warning
Always wear safety glasses.

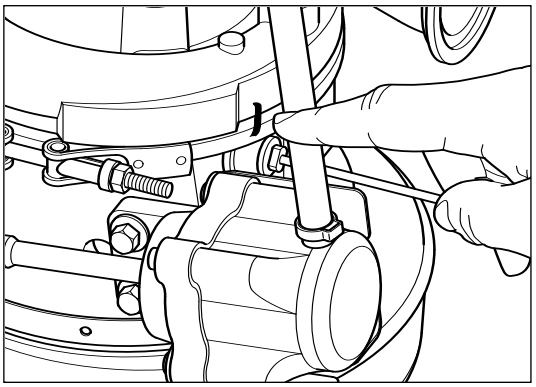
Place turbine end assembly on clean surface. Ensure diffuser to o-ring mating face is clean. Lubricate new o-ring seal (41) with clean engine oil and install.

Loosely fit v-band clamp.



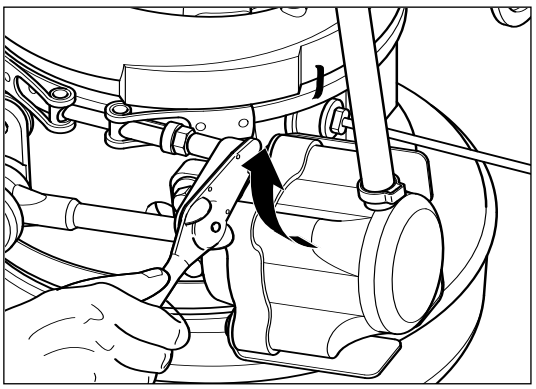
Align v-band and bearing housing and locate compressor housing over compressor wheel. Refer to marks on housings and v-band, made during disassembly, to ensure correct v-band, v-band nut and housing orientation.

Caution
Avoid compressor wheel damaged.



1/4 UNF 28 tpi (7/16 in A/F)

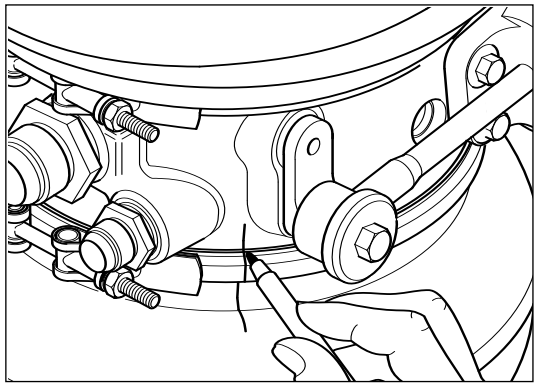
Place v-band clamp in position and torque tighten new dry locknut (62)* to value specified in the ***Service Data Sheet***.



Turbine housing

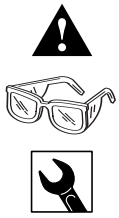
Turbine Housing Removal

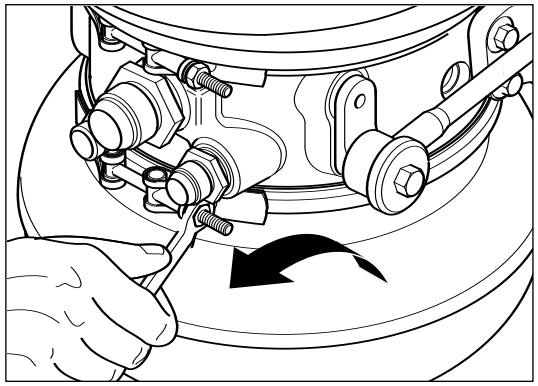
Mark turbine housing, bearing housing, v-band clamp and v-band nut position to record correct orientation. This action assists in housing and v-band orientation during re-assembly.



Warning
Always wear safety glasses.

Caution
Always complete engine turbocharger system ***Preliminary Health Checks*** before commencing turbine housing removal.



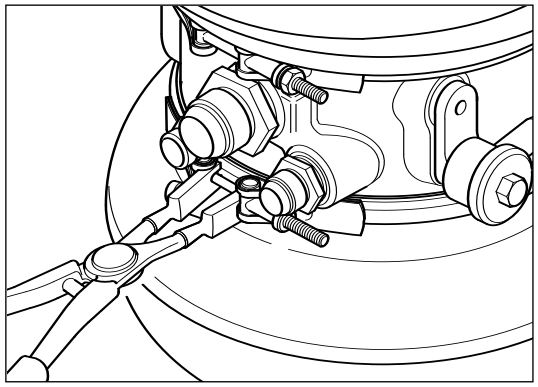


1/4 UNF (7/16 in A/F).

To avoid v-band nut thread seizure, apply penetrating oil in accordance with manufacturer's instructions.

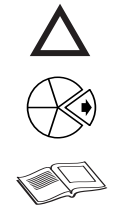
Remove v-band lock nut.

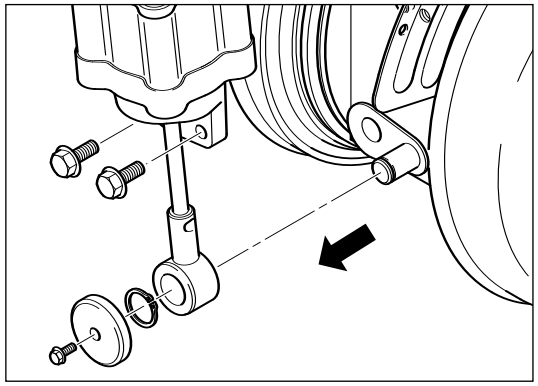
Spread v-band and slide on to bearing housing,



Caution
V-band will move small distance only.

Caution
Always remove actuator before commencing VG Core Assembly Cleaning.

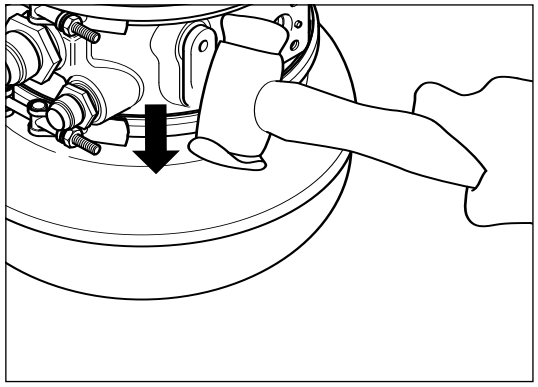




Refer to ***VG Actuator Removal*** when removing actuator.

Warning
Always wear safety glasses.

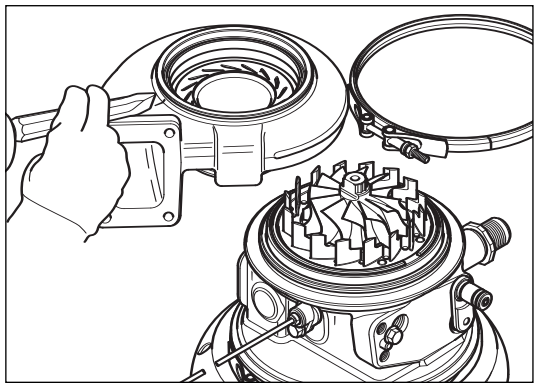
To separate turbine housing and bearing housing, use a soft metal hammer on two opposing areas of turbine housing at 180 degrees.



Caution
Do not apply hammer to turbine housing flange.

Caution
Avoid significant housing separation at one side. This may damage the turbine wheel or VG nozzle vanes.

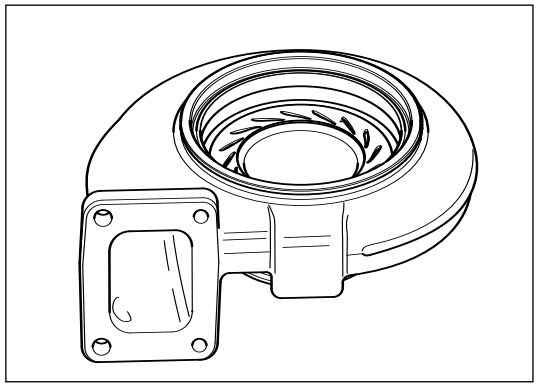
Pen marker lines may be removed by cleaning processes. Once the housing is removed strike or score pen marks on housings and v-band.



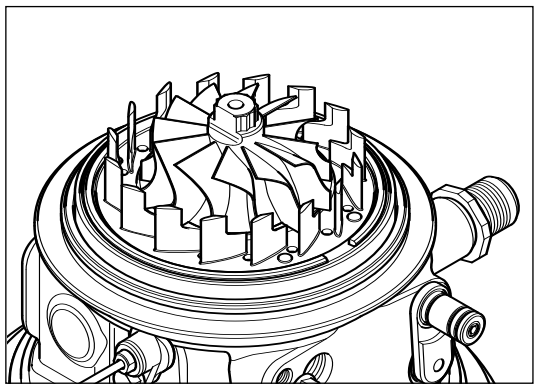
Remove turbine housing to expose shroud plate and nozzle ring and guide vane assembly. Cracking of housing inlet duct requires turbocharger replacement.

Caution
Turbine housings can exhibit cracking when subject to excessive thermal and mechanical loads.

Shroud plate renewal is not possible without remanufacturing facilities. If shroud plate is damaged refer to ***VG Turbine Actuating Assembly***



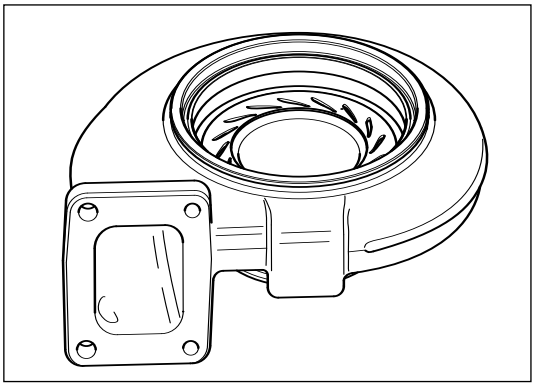
Refer to ***Turbine Housing Cleaning with Shroud Plate*** and ***VG Core Assembly Cleaning*** for guidance before attempting to clean turbine housing and shroud plate assembly or exposed areas of bearing housing assembly.



Turbine Housing Cleaning with Shroud Plate

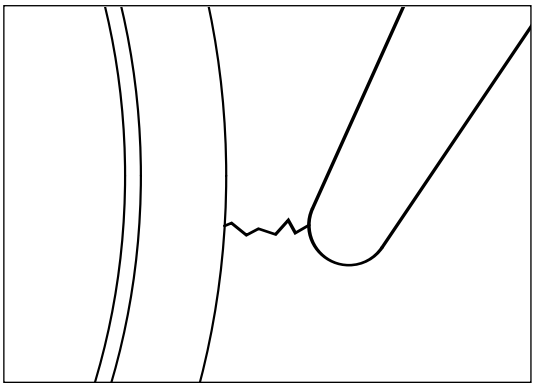
Warning
Always wear safety glasses.

Heavy carbon build-up on faces shown must be removed. Cleaning process must not contaminate turbine housing and shroud plate assembly with loose particles. If in doubt, refer to your nearest agent.



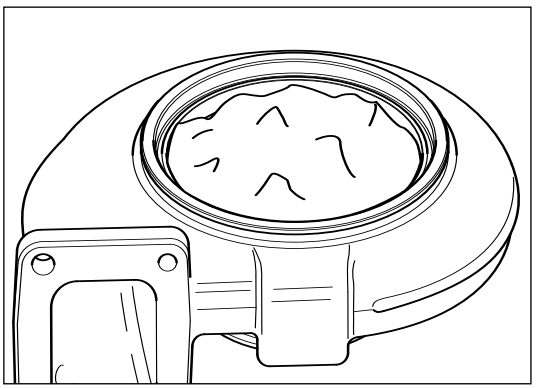
Caution
Refer to ***Gas Leakage*** for acceptable housing flange conditions.

Caution
Turbine housings can exhibit cracking when subject to excessive thermal and mechanical loads. Cracking of inlet duct requires turbocharger replacement.



Caution
Small cracks may be visible running from the slots in shroud plate to inner diameter. This is acceptable and will have no detrimental affect on turbocharger performance.

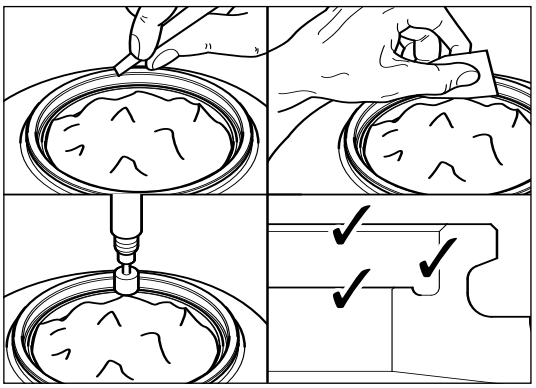
Caution
Abrasive cleaning processes may affect shroud plate operation causing failure of variable geometry mechanism. If in doubt refer to ***VG Turbine Actuating Assembly.***



Place large lint free rag over shroud plate and push edges into turbine volute to block debris from abrasive cleaning process entering vane guide slots or volute.

Carefully clean three turbine housing joint faces shown with scraper.

Sanding band/abrasive cloth grade: P180 can be used as non-preferred alternative. Power tools can be used carefully but ensure only corroded material is removed from each face.

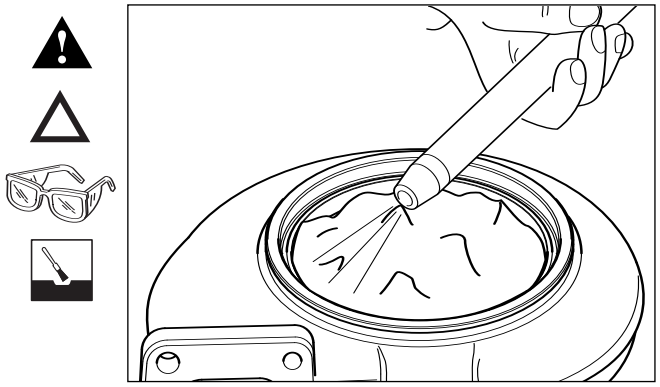


Caution
Removal of base metal by excessive abrasive cleaning will destroy component geometry and scrap turbocharger.

Warning
Always wear safety glasses.

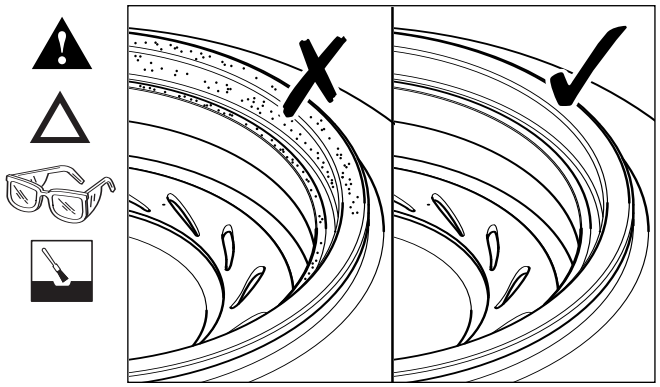
After abrasive cleaning remove rag containing cleaning debris.

Use compressed air to blow any remaining debris out of component.



Caution
Always protect vane slots in shroud plate against debris ingress.

Check cleaned surfaces for pitting. Non pitted and pitted surfaces are shown as a qualitative guide only.

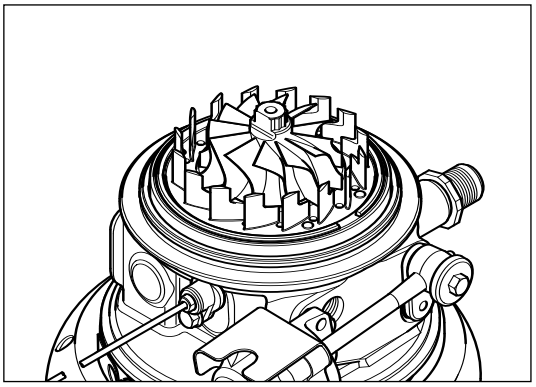


Caution
If any of three critical surfaces is pitted STOP procedure and replace turbocharger.

Pre-assembly Check

Before reassembly of turbine housing refer to ***Core Assembly*** for bearing housing cleaning and inspection.

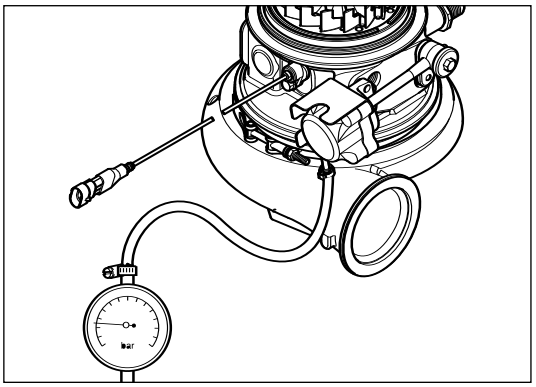
Refer to ***VG Actuator Checks and Replacement*** for information on fitting actuator.



Caution
Quote dataplate information for service and parts support.

Warning
Always wear safety glasses.

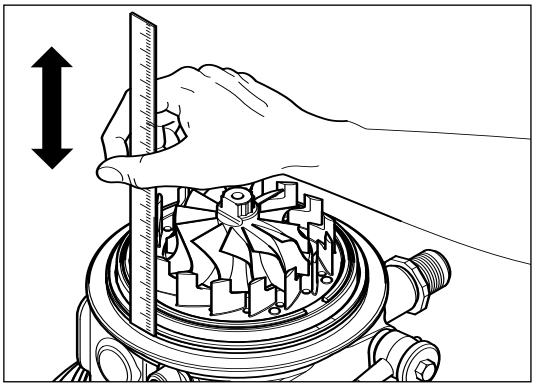
Connect clean dry air supply to actuator air inlet fitting.



Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.

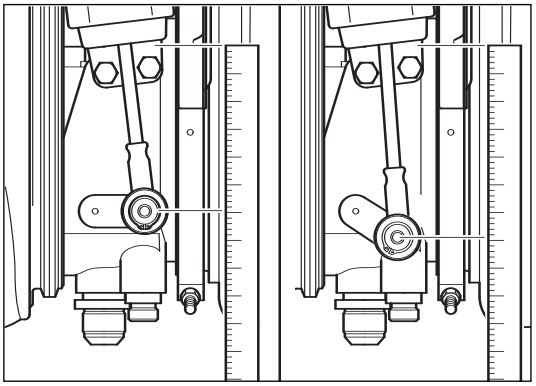
Warning
Avoid touching VG mechanism as finger injury may result from sudden movement of assembly when air is supplied.

Repeat application of 450 kPa (65 lbf/in^2) pressure from regulated air supply to ensure actuator rod and VG mechanism move freely over whole stroke.

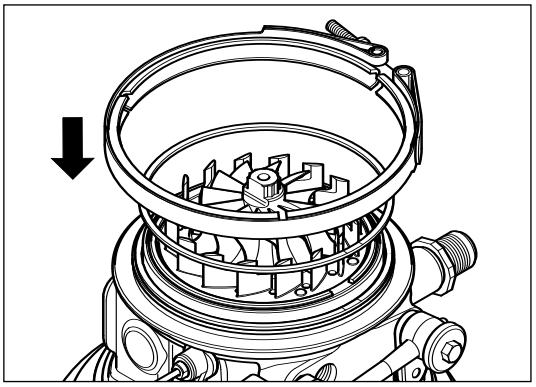


Verify actuator stroke lies within range specified in ***Service Data Sheet***. Note actuator stroke.

Caution
If travel is not within permissible range or movement is not smooth, **STOP** procedure and replace turbocharger.



Turbine Housing Re-assembly



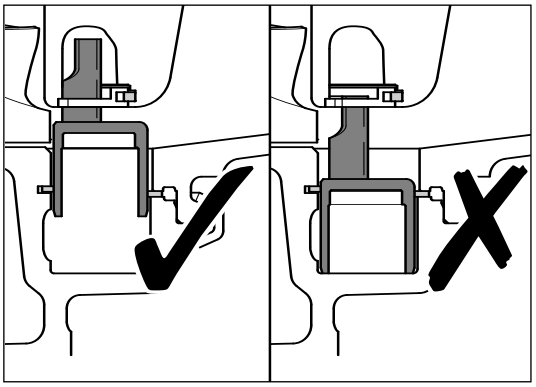
Warning
Always wear safety glasses.

Stand the turbocharger on compressor inlet face. Fit nozzle ring seal (162). Loosely assemble new v-band, turbine (28) ensuring correct clamp orientation.

Caution
Always rebuild with new v-band without integral heat shield. Refer to turbocharger data plate when ordering parts.

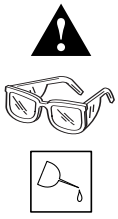
Caution
Replacement v-band clamp does not have integral heat shield. To prevent actuator overheating, always ensure turbocharger is fitted with actuator with integral heat shield.

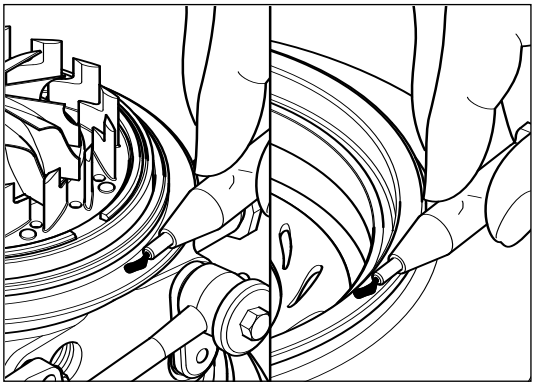
Apply 450 kPa (65 lbf/in^2) to extend nozzle ring and vanes to fully closed position.



Apply a thin layer of engine oil to nozzle ring seal, turbine housing and core assembly joint faces.

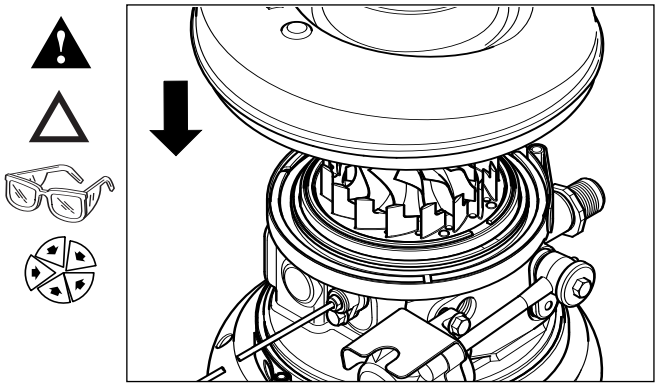
Ensure nozzle ring seal is seated correctly.





Warning
Always wear safety glasses.

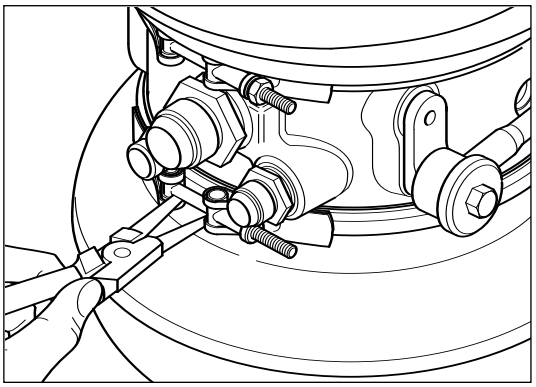
Caution
Where turbine housing inlet duct is cracked or flange condition does not meet rebuild standard defined in ***Gas Leakage,*** replace turbocharger.



Align turbine housing, bearing housing, v-band and v-band nut according to marks made during disassembly.

Lower the turbine housing on to bearing housing assembly. Take care not to damage turbine wheel and nozzle ring vanes when aligning with shroud plate.

Caution
Never force turbine housing into position as this will damage nozzle ring assembly.



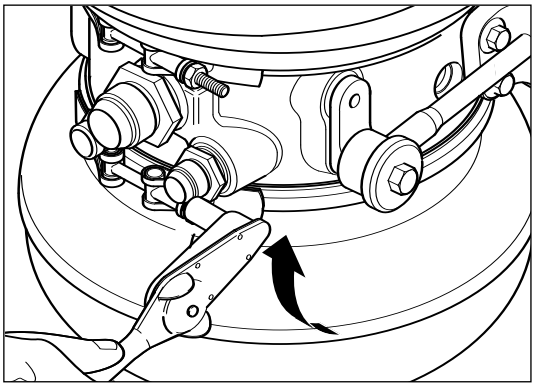
Ensure there is no gap between the turbine and bearing housing joint surfaces.

Caution
Quote dataplate information for service and parts support.

Position new v-band (28)* over the joint using v-band spreader.

1/4 UNF (7/16 in A/F).

Fit new v-band nut (62)* without grease or oil and torque tighten to value specified in ***Service Data Sheet***.

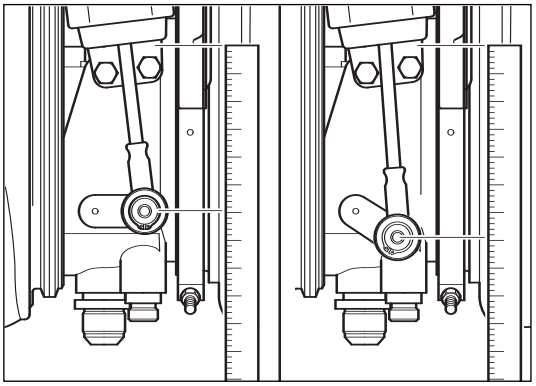


Turbine Housing Post-assembly Check

Repeat actuator rod movement check defined in ***VG Actuator Replacement Check***.

Ensure actuator travel is within permissible range shown in ***Service Data Sheet*** and cross checks with value measured at pre-assembly stage.

Remove air supply.

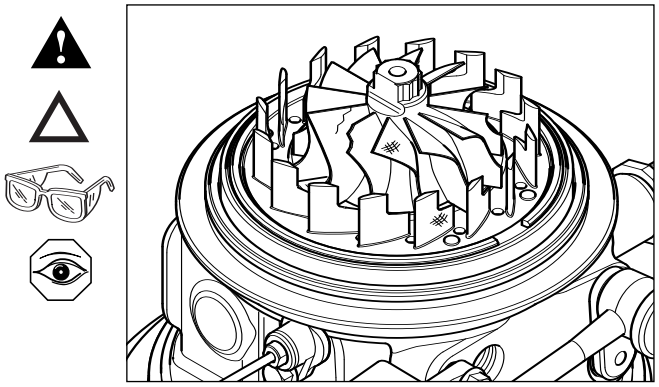


Core Assembly

Cleaning and Inspection

Warning
Always wear safety glasses.

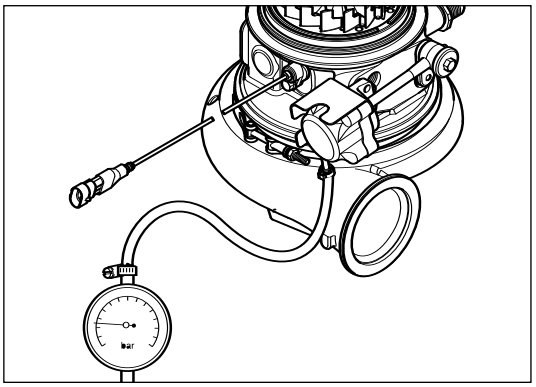
Refer to ***Turbine Housing*** for removal instructions. Check turbine wheel and VG nozzle vanes for signs of damage. For example, bent blades, missing blade sections, and scoring.



Caution
If damage is found, STOP procedure and replace turbocharger.

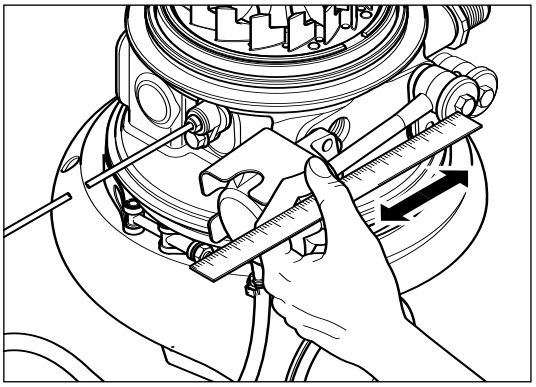
Connect clean dry regulated air supply to actuator air inlet fitting and apply 450 kPa (65 lbf/in^2) maximum.

Warning
Avoid touching VG mechanism as finger injury may result from sudden movement of assembly when air is supplied.



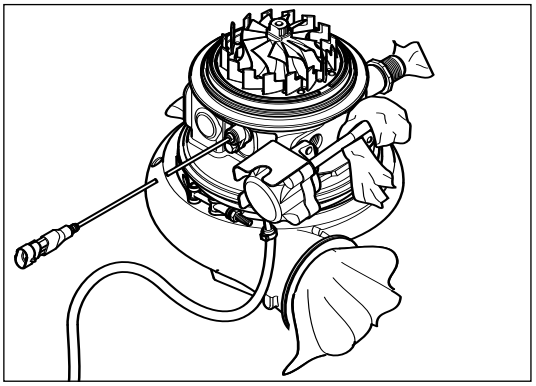
Warning
Ensure hose is securely fastened to air inlet fitting using appropriate hose clip and clamp load.

Check nozzle ring and vane assembly travel is within specification. This can be verified by checking actuator stroke lies within range specified in ***Service Data Sheet***.



Caution
If actuator travel is not within range or if movement is not smooth, **STOP** procedure and replace turbocharger.

Block off all openings to prevent debris from cleaning processes entering turbocharger.

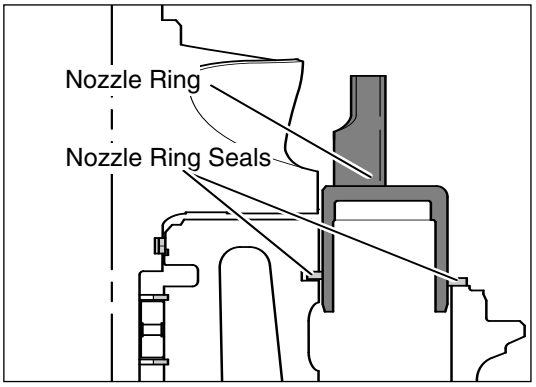


Caution
Always clean bearing housing surfaces with nozzle ring seal fitted and nozzle ring in fully closed position.

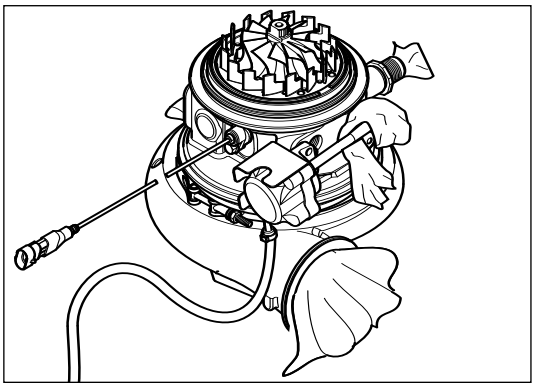
Caution
Removal of base metal by excessive abrasive cleaning will destroy component geometry and scrap turbocharger.

Caution
When cleaning surface next to nozzle ring, **DO NOT** remove material from nozzle ring side wall.

Warning
Always wear safety glasses.



Protect all apertures with lint free rag.



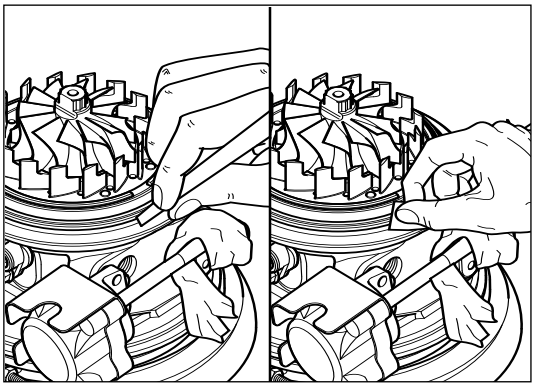
Caution
Do not use power tools.

Carefully clean three bearing housing joint faces shown with scraper. Abrasive cloth grade: P180 can be used as non-preferred alternative.

Clean away all debris with lint free cloth.

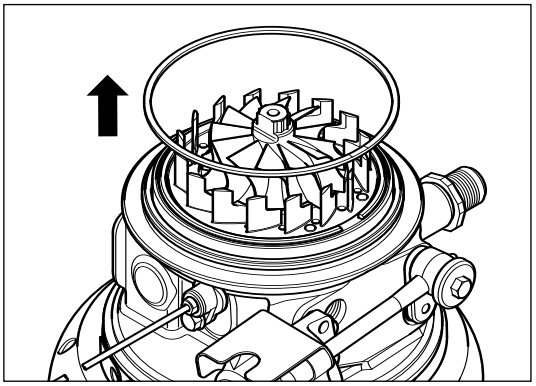
Use clean compressed air to blow residual debris from cleaned bearing housing surfaces.

Direct air through holes in nozzle assembly to remove loose carbon behind nozzle.



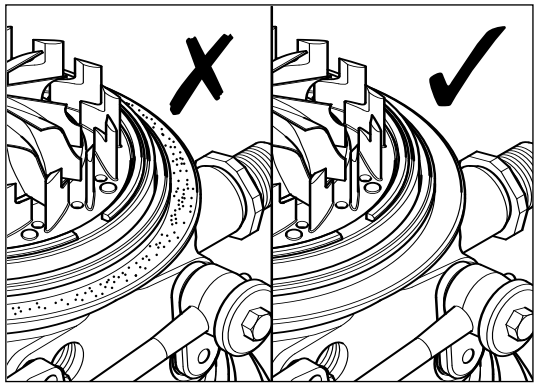
Remove nozzle ring seal.

Remove actuator air supply.



Warning
Always wear safety glasses.

Caution
If any of three critical surfaces is pitted **STOP** procedure and replace turbocharger.



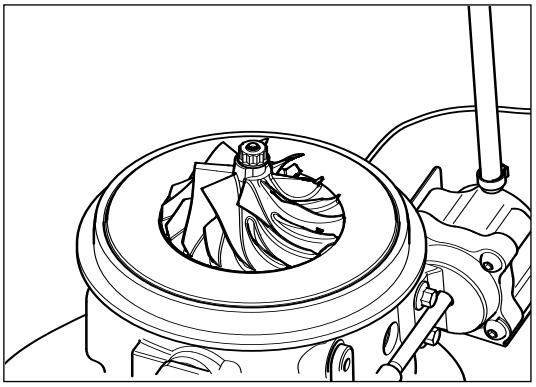
Check that cleaned bearing housing faces are not pitted. Non pitted and pitted surfaces are shown as qualitative guide only.

Bearing System Replacement

Warning
Always wear safety glasses.

Refer to ***Compressor Housing***, ***Turbine Housing***, ***VG Actuator*** and ***Speed Sensor*** for removal instructions. Locate the CHRA (2) on to a 19 mm 12 point socket located in a suitable fixture.

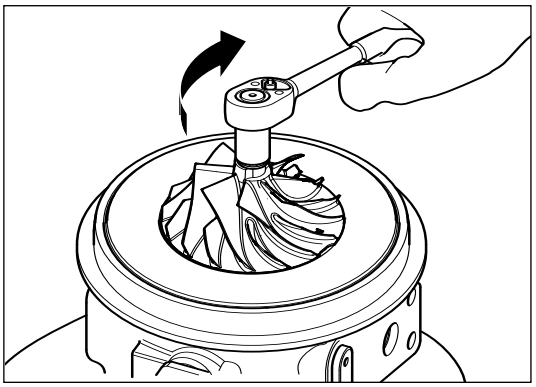
Caution
Ensure turbine wheel shaft and compressor wheel have alignment marks before disassembly.



If no marks exist scribe shaft and compressor wheel before removing compressor wheel lock nut. File mark on shaft and scribe line on compressor wheel nose.

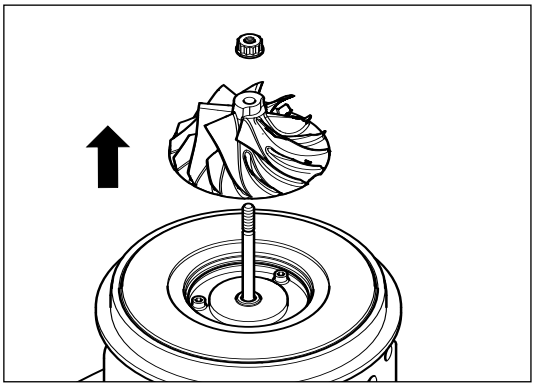
M8 L.H. (13mm)

Remove locknut, compressor wheel (61).



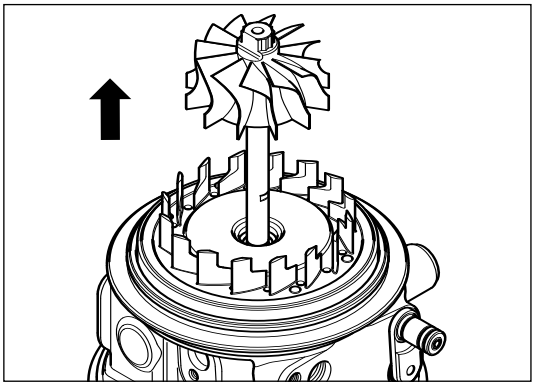
Note
Left hand thread.

Remove compressor wheel (7).



Remove remaining CHRA from fixture. Rotate assembly and slide assembly turbine wheel (6) off bearing housing assembly.

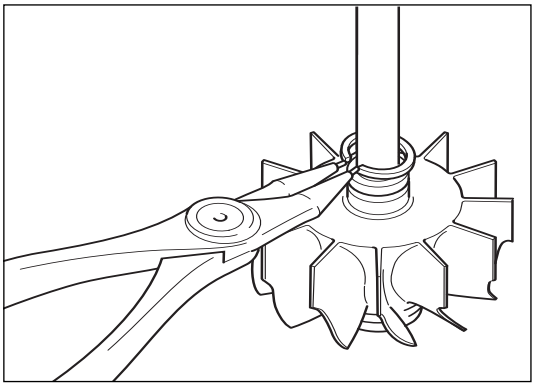
It is permissible to tap protruding turbine shaft gently with a soft hammer to free dual split ring seals stuck in bore.



Carefully remove split ring seal, turbine (13)* and discard.

Warning
Always wear safety glasses.

Caution
Care should be taken not to score turbine wheel shaft assembly.

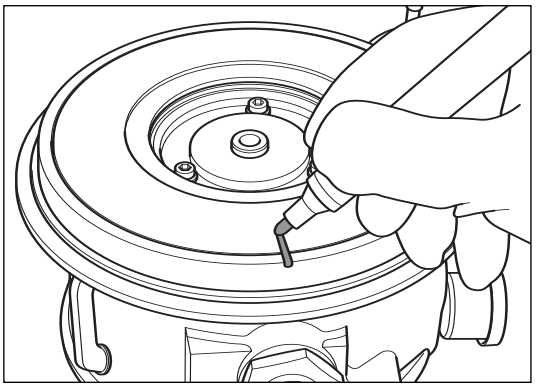


Locate bearing housing assembly in suitable fixture or vice using soft jaws.

Mark diffuser and bearing housing for re-assembly.

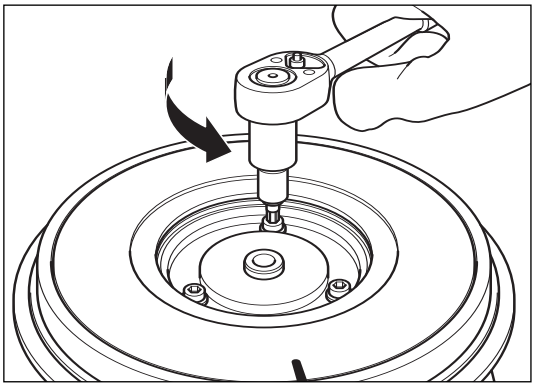
Caution
Ensure nozzle ring and vanes are protected from damage.

Pen marker lines may be removed by cleaning processes. Once the diffuser is removed score pen marks on diffuser and housing.

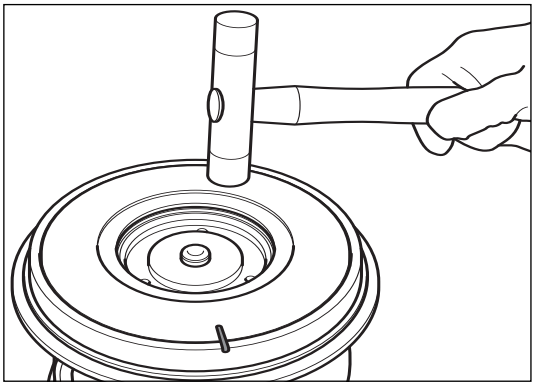


8 mm x 1.25 (6 mm Allen Key)
Remove and discard three diffuser patch screws (56)* and washers (20)*.

Note
Diffuser patch screws may be tight. Apply small amount of penetrating oil to help free.

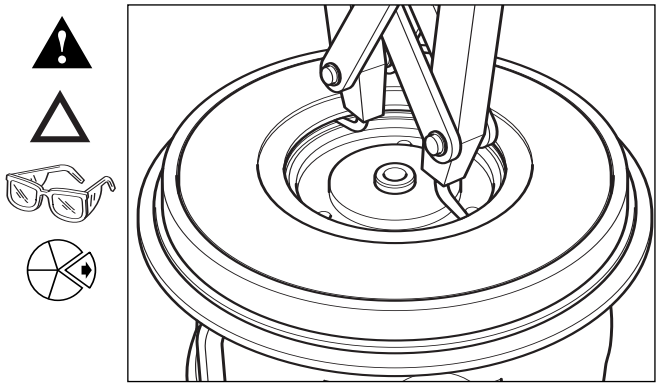


Use soft hammer to loosen diffuser.

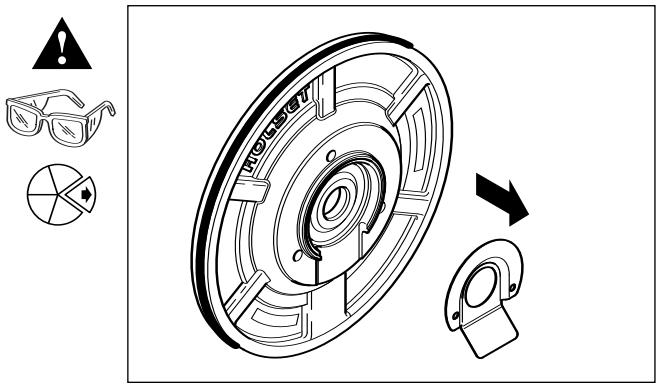


Warning
Always wear safety glasses.

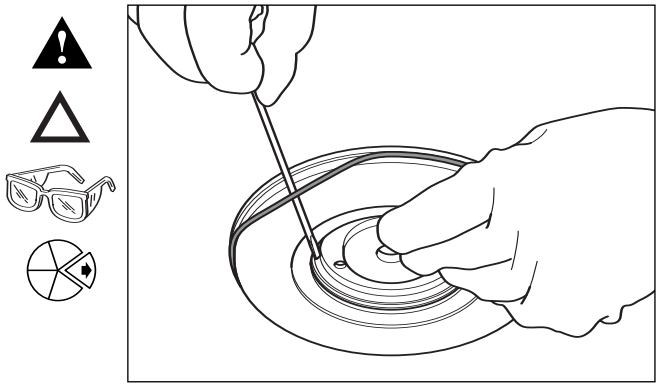
Use puller to remove diffuser (14) and oli baffle (33).



Remove oil baffle (33).

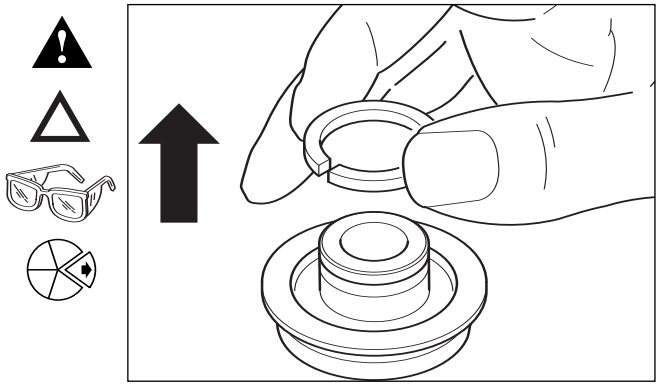


Remove and discard diffuser o-ring seal (27)*.



Remove thrust collar (36) from diffuser.

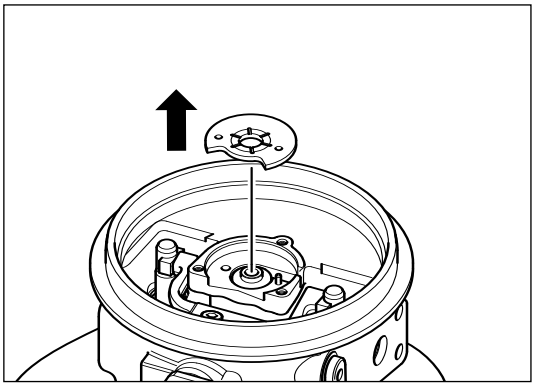
Remove and discard piston ring seal (16)*.



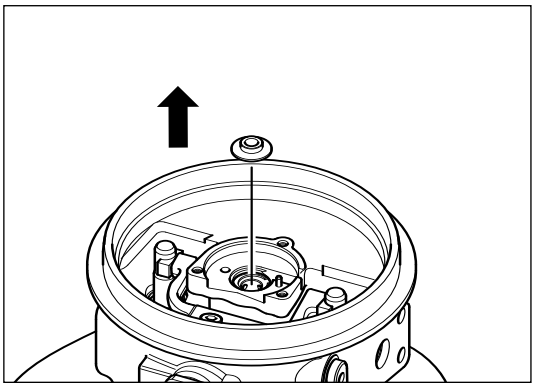
Warning
Always wear safety glasses.

Caution
Ensure nozzle ring and vanes are protected from damage.

Remove thrust bearing (12)* and discard.



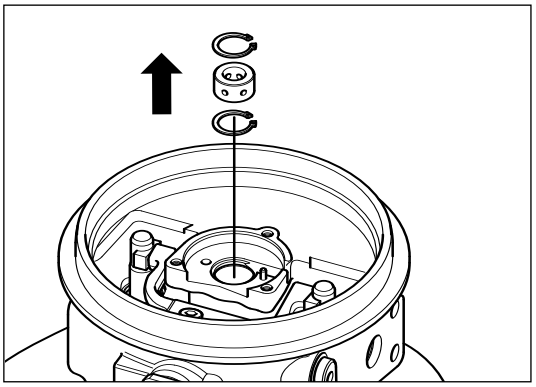
Remove oil slinger (31).



Using suitable circlip pliers, remove and discard two bearing retaining rings (64)* and journal bearing (11)* from compressor end.

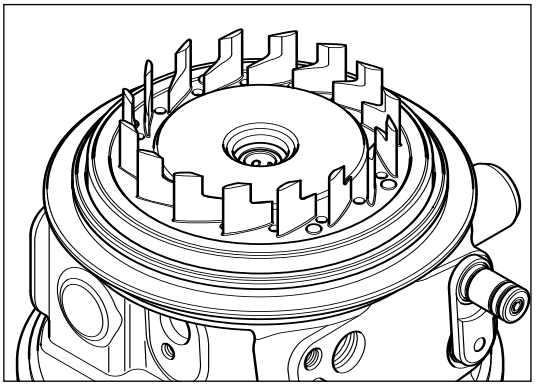
Remove o-ring seal, compressor (41)* and discard.

Caution
Never slacken yoke pinch bolt as this will destroy VG turbine setting



Rotate bearing housing assembly and place on clean work surface.

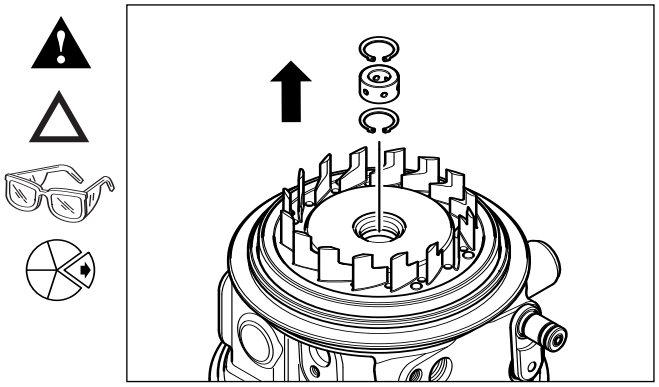
Caution
Ensure nozzle ring and vanes are protected from damage.



Warning
Always wear safety glasses.

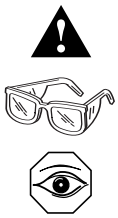
Caution
Ensure nozzle ring and vanes are protected from damage.

Remove two bearing retaining rings (64)* and journal bearing (11)* and discard.

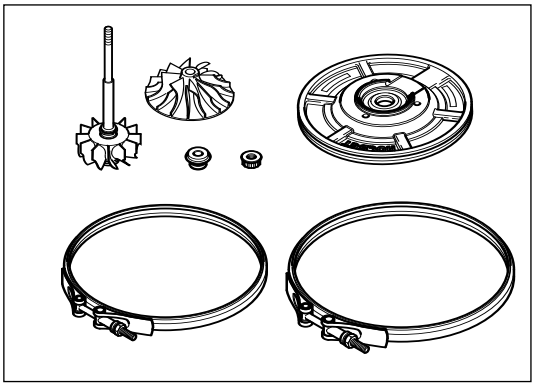


Component Cleaning

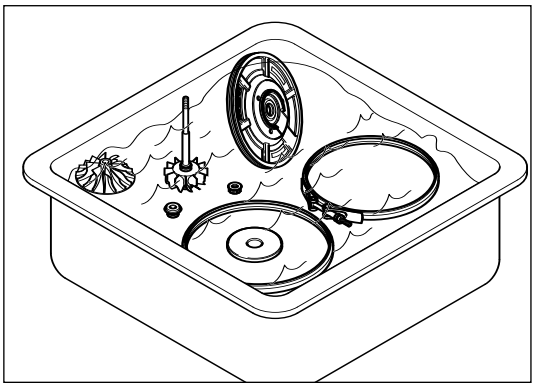
Warning
Always wear safety glasses.



Visually inspect all parts to detect signs of burning and other fault conditions in order to obtain as much information as possible before washing.

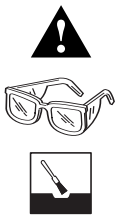


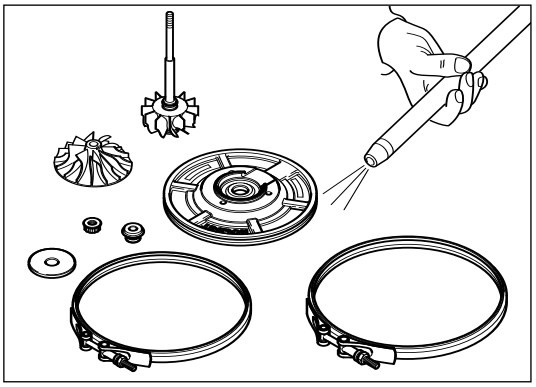
Soak components in non-corrosive low flash point metal cleaner to loosen deposits.



Dry components using compressed air.

Protect sliding surfaces of cleaned parts against corrosion by applying clean engine oil.

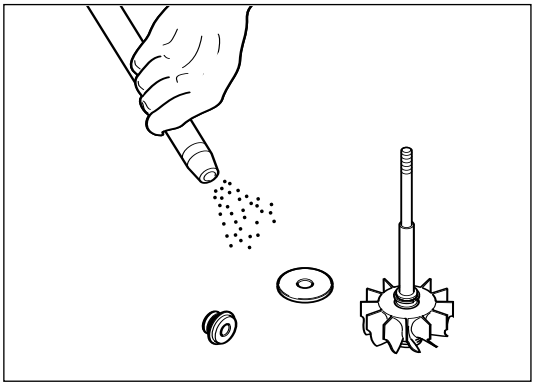




It is permissible to bead blast steel rotating parts.

Caution
Blasting specific areas for long periods of time may affect component balance. Protect thread of turbine wheel assembly.

Caution
Always re-wash components after blasting. Dry with compressed air.

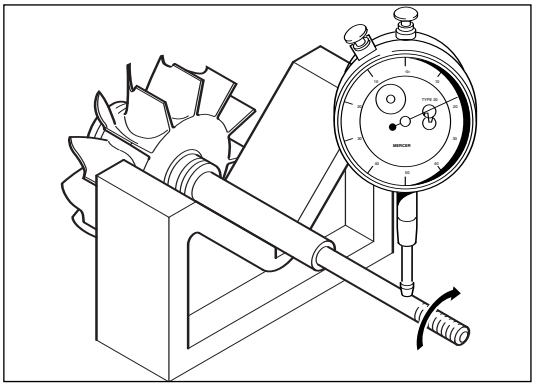


Inspection and Testing

Major Components

Assembly Turbine Wheel

Place assembly, turbine wheel (6) on vee block. Position dial gauge on turned surface of shaft at threaded end. Check dial gauge reading. Where shaft bend is greater than recommended maximum of 0.025 mm (0.001 in) replace assembly.



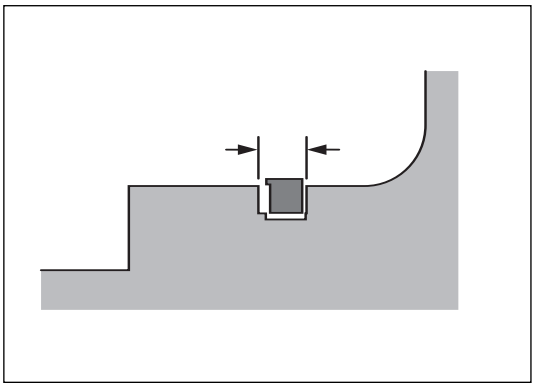
Caution
Do not attempt to straighten turbine shaft.

Inspect split ring seal, turbine (13)* groove walls for wear. If groove width exceeds recommended maximum replace turbocharger.

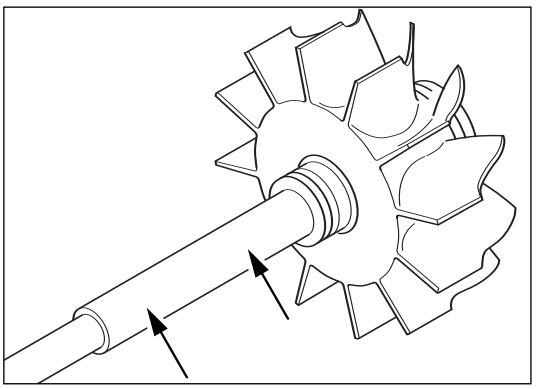
Single ring seal 1.69 mm (0.067 in).

If wear step on the ring face exceeds 0.102 mm (0.004 in) replace split ring seal, turbine (13)*.

If free gap of the ring is less than 2.0 mm (0.08 in) replace split ring seal, turbine (13)*.



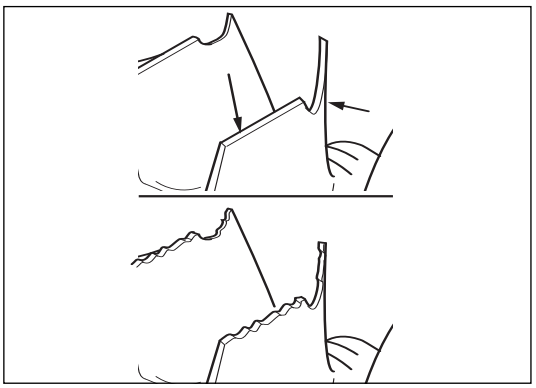
Inspect bearing journals for excessive scratches and wear.Where scratching is excessive or where either journal diameter is less than the recommended minimum of 10.97 mm (0.43 in) replace turbocharger.



Inspect for cracked, bent or damaged blades.

Caution
Never attempt to straighten blades.

Replace with new if any damage found.

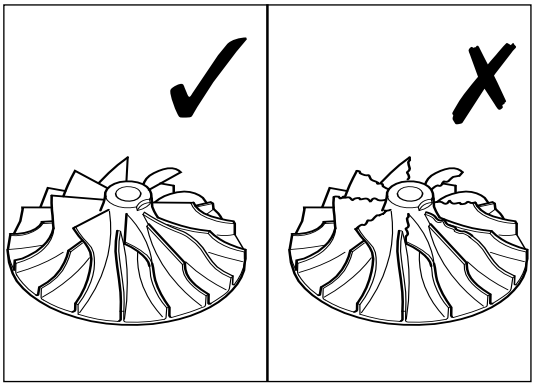


Compressor Wheel

Inspect compressor wheel (7), for cracked, bent or damaged blades.

Caution
Do not attempt to straighten turbine shaft.

Replace with new if any damage found.



Small Components

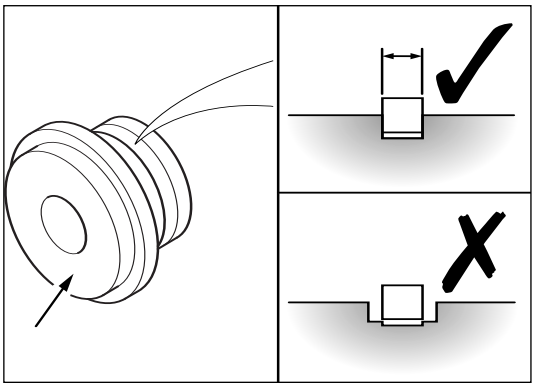
Oil Slinger

Inspect and replace oil slinger (31) if piston ring groove walls are scored or damaged or if groove width exceeds maximum of 1.69 mm (0.067 in).

Check for signs of rubbing and scoring on thrust surface and replace where damage is severe.

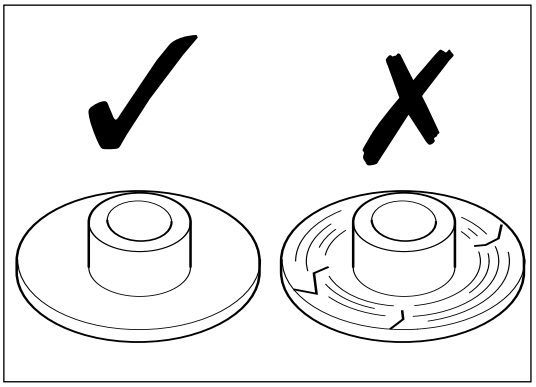
If ring faces show any signs of wear replace split ring seal, compressor (16)*.

If free gap of ring is less than 2.0 mm (0.08 in) replace split ring seal, compressor (16)*.



Thrust Collar

Check and replace if thrust collar (36) is scored on thrust face or if any cracks are visible.

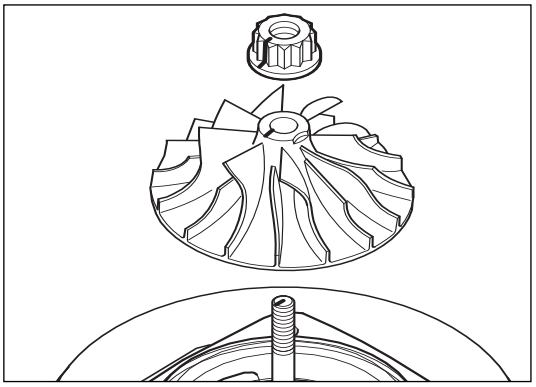


Reassembly

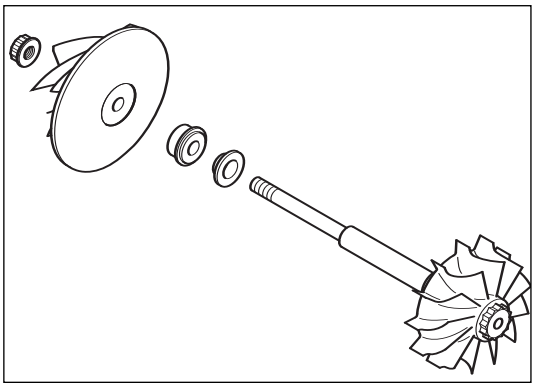
Balance

Caution
This turbocharger was manufactured using ‘separately piece part balanced’ process. Core or rotor balance balance MUST always be checked on re-build.

Caution
Only use genuine Holset compressor wheel and turbine wheel assemblies which are individually check balanced for long life and quiet operation.



Turbocharger should always have co-relation marks on end of turbine shaft and impeller nose if it has been disassembled according to defined process. Thrust collar and oil slinger will not have co-relation marks.



Rotor Balance

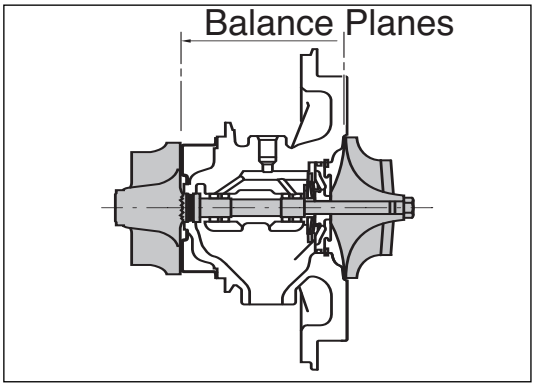
Components that should be included in rotor balance are turbine wheel and shaft, thrust collar, oil slinger, compressor wheel and nut.

Rotor balance limits appear in ***Service Data Sheet***. On achieving balance, parts should be permanently marked for subsequent re-alignment during reassembly.

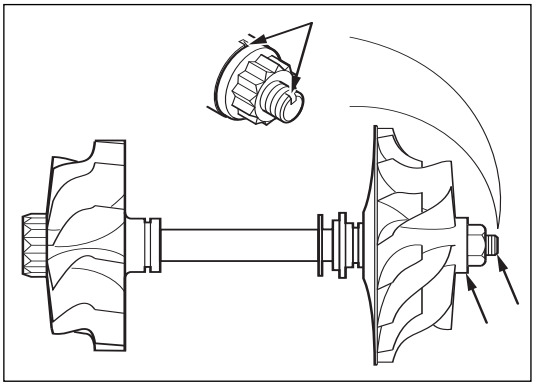
Core Balance

On completion of core build some turbochargers require core balance. Core balance process requires purpose built rig and compliance with rig procedure.

Where applicable, core balance limits appear in ***Service Data Sheet***.



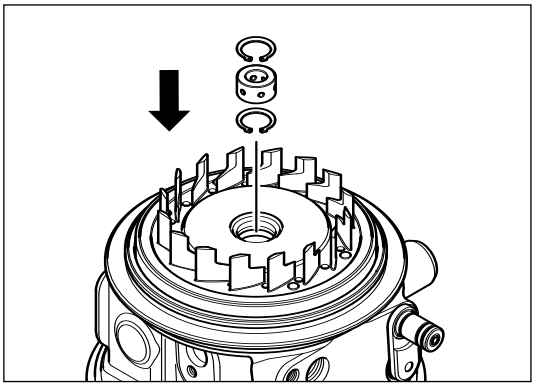
Caution
Always make sure balance marks on rotor assembly are in alignment when rebuilding turbocharger core.



Turbocharger Reassembly

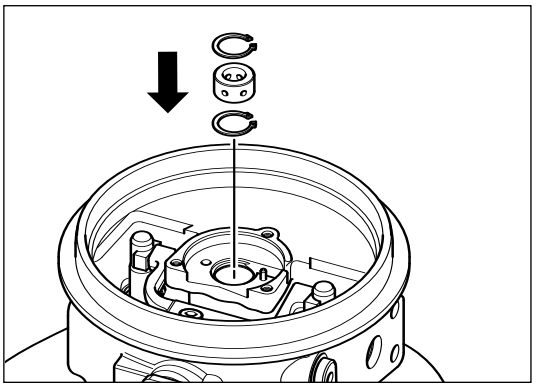
Warning
Always wear safety glasses.

Using suitable circlip pliers, insert two new turbine end bearing retaining rings (64)* and journal bearing (11)*



Rotate bearing housing assembly and place on a clean work surface.

Insert two retaining rings (64)* and journal bearing (11)*.

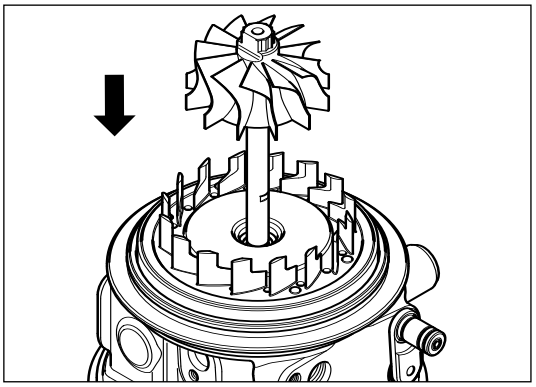


Caution
Never slacken yoke pinch bolt as this will destroy VG turbine setting.

Caution
Ensure nozzle ring and vanes are protected from damage.

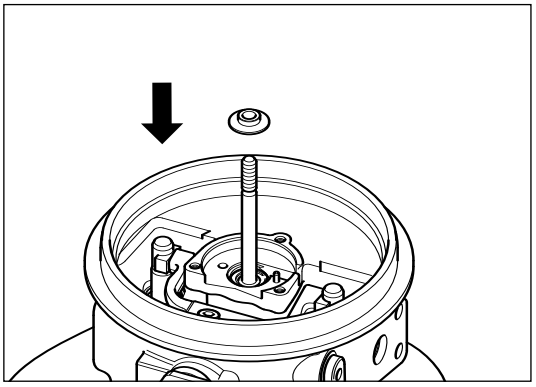
Rotate bearing housing assembly and place on a clean work surface.

Set split ring seal gaps at 180 deg and insert turbine wheel and shaft.



Locate the turbine wheel on to 19 mm 12 point socket located in suitable fixture.

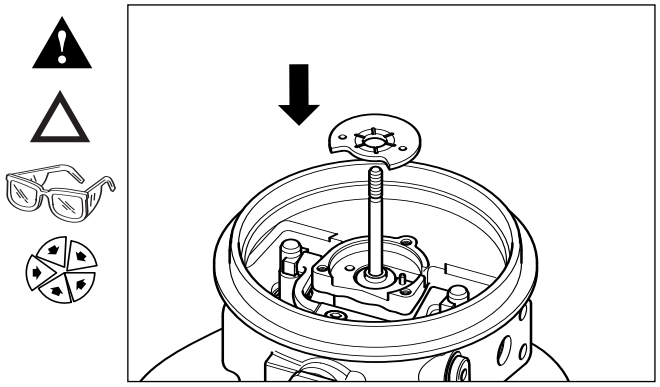
Insert oil slinger (31).



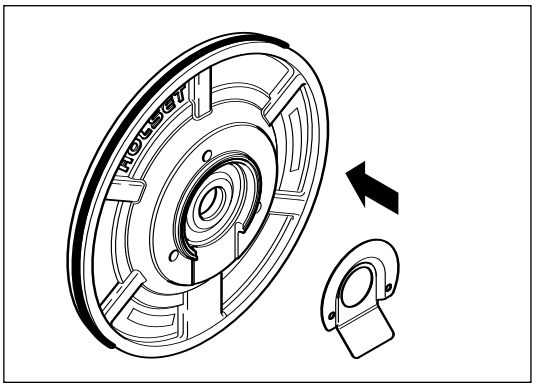
Warning
Always wear safety glasses.

Caution
Never slacken yoke pinch bolt as this will destroy VG turbine setting.

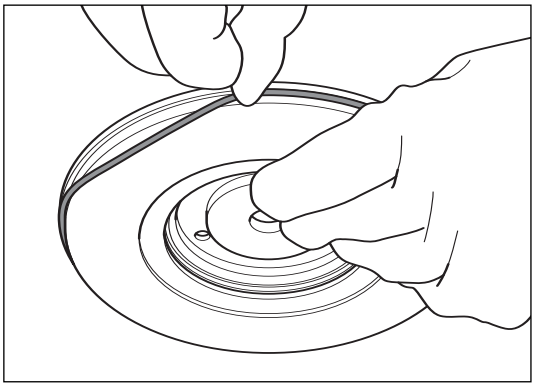
Locate new thrust bearing (12)* on roll pin.



Locate oil baffle (33) into diffuser (14).

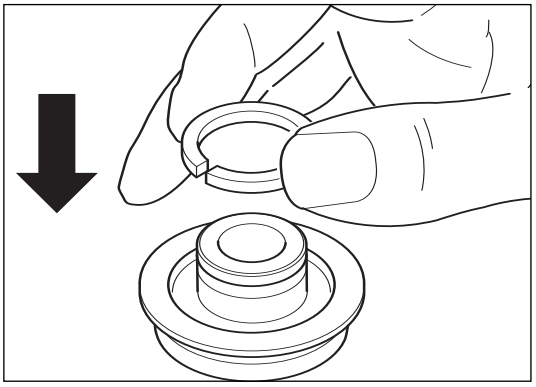


Insert new diffuser o-ring seal (27)*.



Fit new piston ring seal (16)* to thrust collar (36).

Insert thrust collar into diffuser and oil baffle assembly. Insert into assembly from oil baffle side.

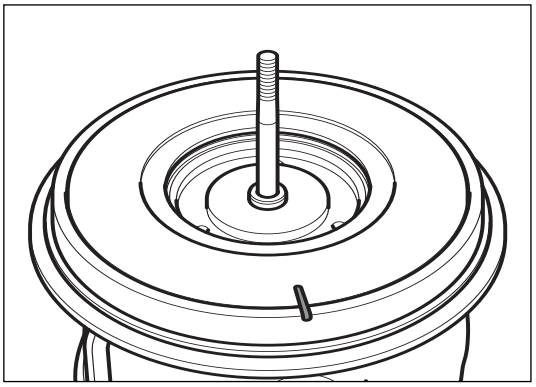


Warning
Always wear safety glasses.

Ensure score marks applied on disassembly are free from burrs or raised edges.

Using marks, align diffuser screw holes with threaded holes in bearing housing.

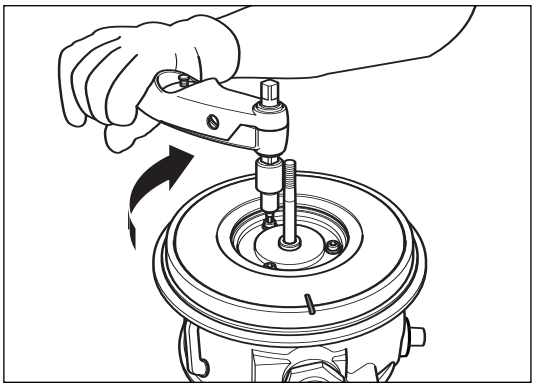
Using hand pressure, carefully insert diffuser into bearing housing assembly.



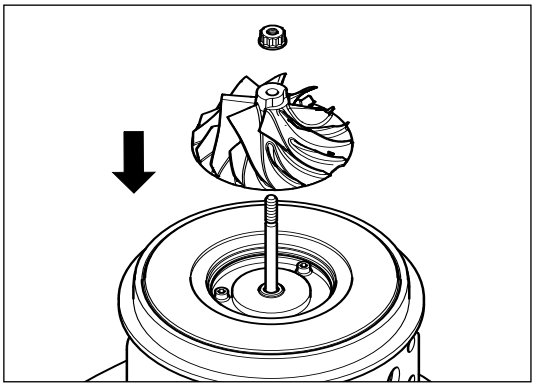
8 mm x 1.25 (6 mm Allen Key)

Insert three new diffuser screws (56)* and washers (20)*.

Torque tighten to value specified in ***Service Data Sheet***.



Fit compressor wheel (7) and compressor wheel nut (61).

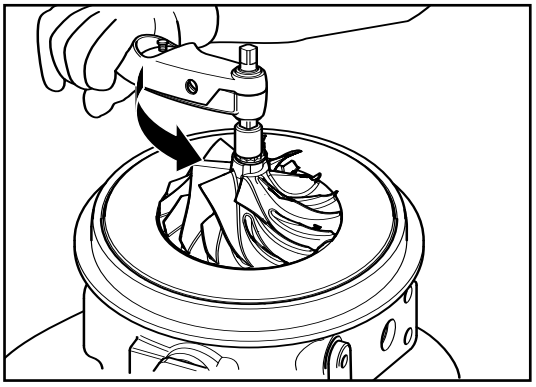


M8 L.H. (13mm)

Torque tighten compressor nut to value specified in ***Service Data Sheet***.

Some turbochargers require core balancing. Check ***Service Data Sheet*** for core balance limits, if applicable.

Refer to ***Compressor Housing Re-assembly*** and ***Turbine Housing Re-assembly*** to complete turbocharger re-build.



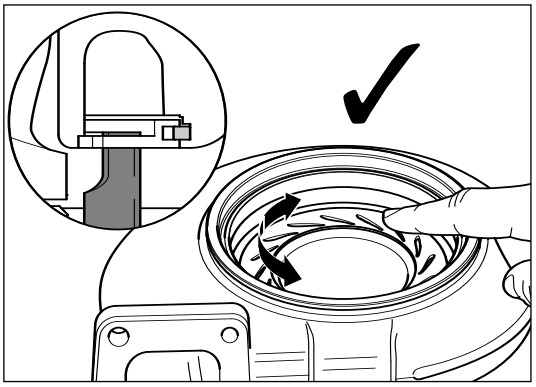
VG Turbine Actuating Assembly

Shroud Plate Removal and Re-assembly

Parallel Section Ring Design

Serial Numbers up to H060500572

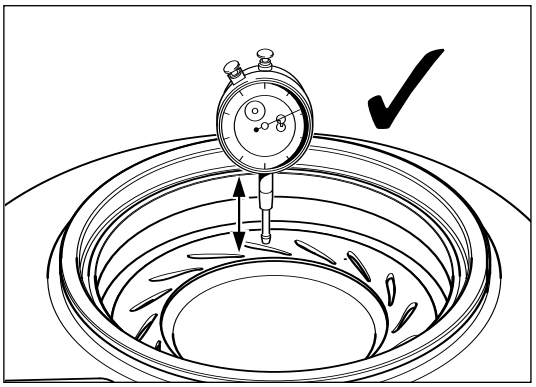
Warning
Always wear safety glasses.



Two types of parallel section retaining ring have been used to hold shroud plate in position. Original ring had chamfered ends. This was superceded by parallel section ring with square ends.

Using finger pressure ensure shroud plate and its retaining ring are not seized into the housing. Check shroud plate is free to rotate.

Caution
If shroud plate does not move, STOP procedure and replace turbocharger.



Check clearance of shroud plate retaining ring is within the wear allowance of 0.10 mm (0.004 in) TIR.

Caution
If shroud plate retaining ring clearance is outside wear allowance, STOP procedure and replace turbocharger.

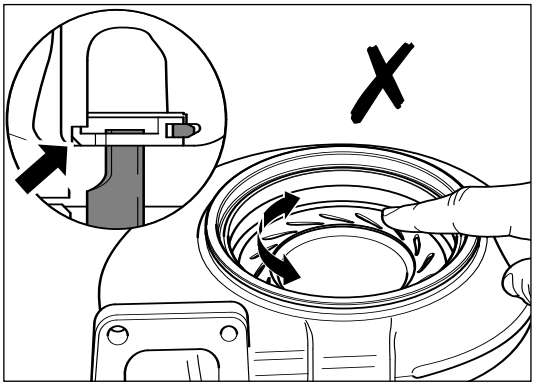
Double Bevel Ring Design

Serial Numbers from H060500572

Latest ring has double bevel cross-section at outer diameter which engages with bevel feature of ring groove in turbine housing. Ring assembly creates friction fit between shroud plate and turbine housing to minimise potential for shroud plate rotation and axial movement.

Warning
Removal of shroud plate with double bevel ring profile requires turning fixtures and special tooling. Always refer to Cummins Turbo Technologies for safe removal and remanufacture.

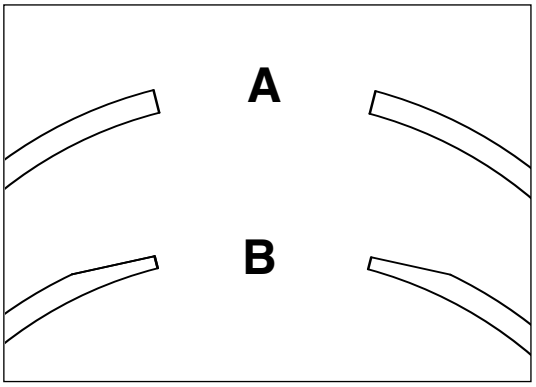
Caution
Any attempt to remove shroud plate may damage turbine housing requiring turbocharger replacement.



Caution
Do not attempt to rotate this assembly by hand.

Parallel section retaining ring end options

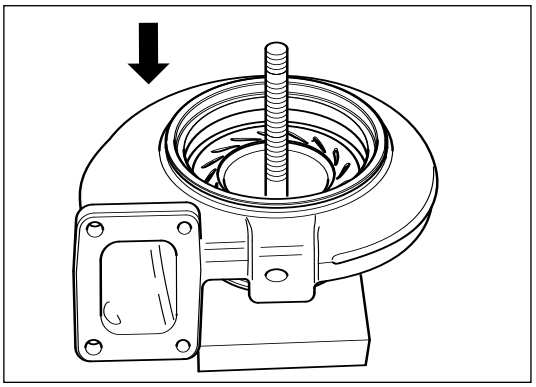
There are two designs of shroud plate retaining ring. Ring with chamfered ends can be removed without preliminary drilling process. Squared end ring must be drilled before removal.



Option A - Ring removal (square ends)

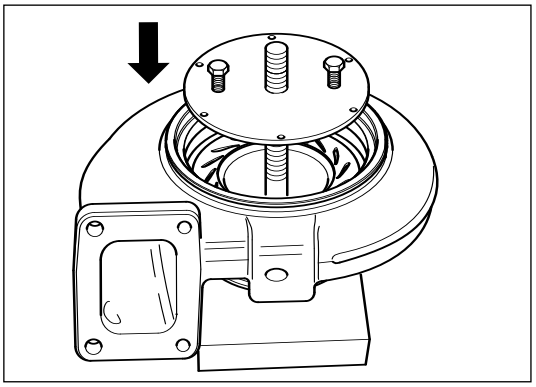
Warning
Always wear safety glasses.

Caution
Before commencing ring removal, check turbine housing inlet duct is not cracked and flange condition meets rebuild standard defined in ***Gas Leakage***. If housing does not meet rebuild standard **DO NOT** commence ring removal, replace turbine housing.



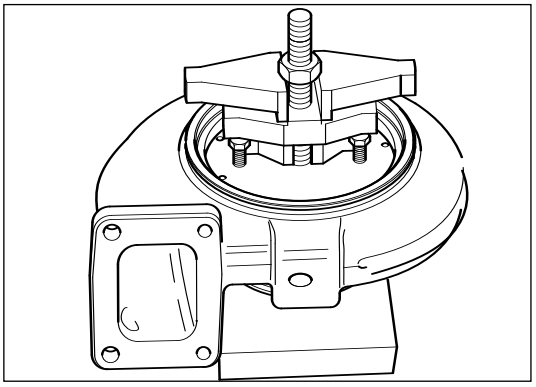
Locate Turbine Housing on Clamping Fixture J90037.

Position drilling plate J90279 on threaded centre shaft of clamp fixture and lower into turbine housing.



Locate spacer on centre shaft and in contact with bolt head locations of drill plate J90279. Align spacer so that it runs parallel with the turbine housing flange. Fit bridge clamp on to the spacer and centre shaft.

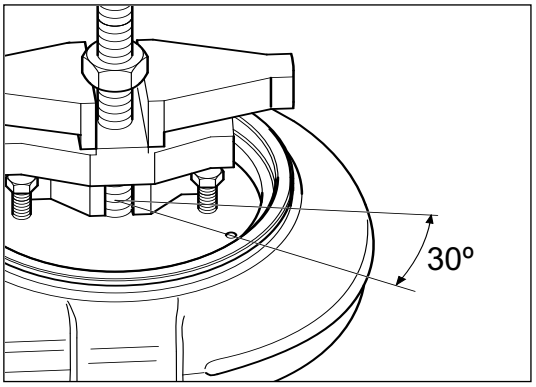
Fit centre shaft nut and tighten to locate drilling fixture in position.



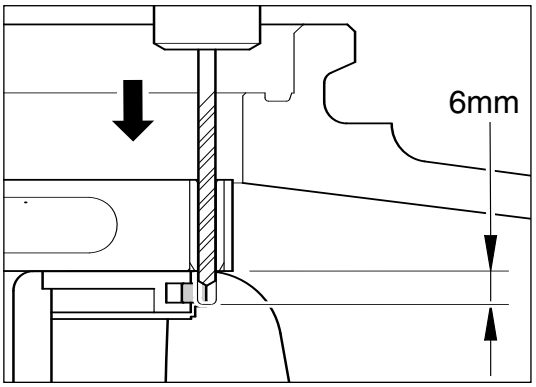
Warning
Always wear safety glasses.

Using drill jig bolt head locators as guide relative to turbine housing flange, drill through retaining ring to a depth of 6 mm with a hand held drill and 3.5 mm dia drill bit.

Where drill jig is not available drilling position can be marked on turbine housing at 133.5 mm PCD.



Remove drill jig and ensure outer circumference of retaining ring is accessible.

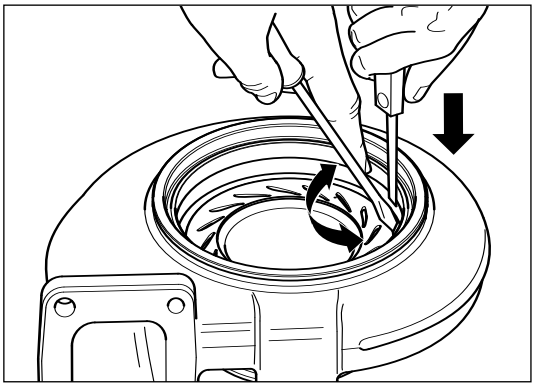


Insert flat screw driver into drilled hole.

Twist screw driver to compress retaining ring into shroud plate ring groove.

Insert 0.1/0.15 mm (0.004/0.006 in) feeler to retain ring compression.

Remove screwdriver.

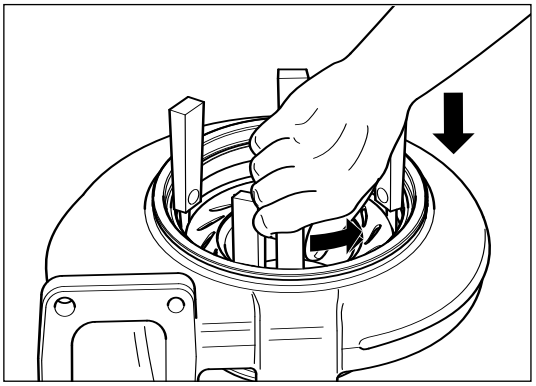


Insert removal tool (J90290) fitted with feeler plate (J90291) adjacent to inserted feeler.

Alternatively a 0.25 mm (0.010 in) in feeler plate can be used as removal tool.

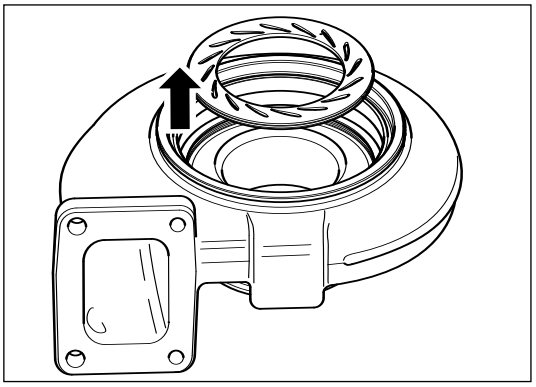
Force tool around clearance between turbine housing and shroud plate inserting a 0.1/0.15 mm (0.004/0.006 in) feeler at 72 degree intervals until five feelers are in place. Soft hammer can be used to force tool around clearance.

Shroud plate retaining ring is now fully compressed within shroud plate ring groove.



Warning
Always wear safety glasses.

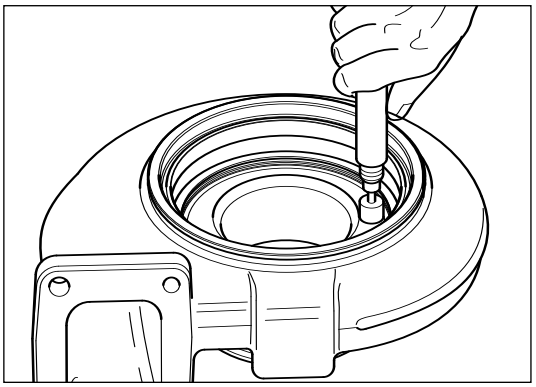
Remove shroud plate and compressed ring from turbine housing.



Remove sharp edges from drilled hole in the turbine housing. This can be achieved using a hand scraper or a suitable power tool and abrasive wheel.

Steel shroud plate and cast iron turbine housing are now ready for cleaning and inspection.

Always refer to
Turbine Housing Cleaning without Shroud Plate.

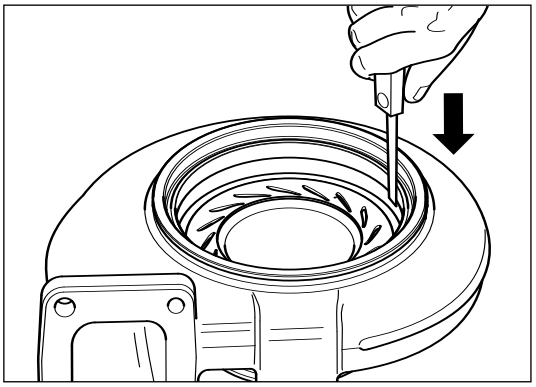


Option B - retaining ring removal (chamfered ends)

Caution
Before commencing ring removal, check turbine housing inlet duct is not cracked and flange condition meets rebuild standard defined in ***Gas Leakage***. If housing does not meet rebuild standard **DO NOT** commence ring removal, replace turbine housing.

Insert removal tool (J90290) fitted with feeler plate (J90291) into clearance between turbine housing and shroud plate. Rotate tool around clearance until chamferred ring end gap is located.

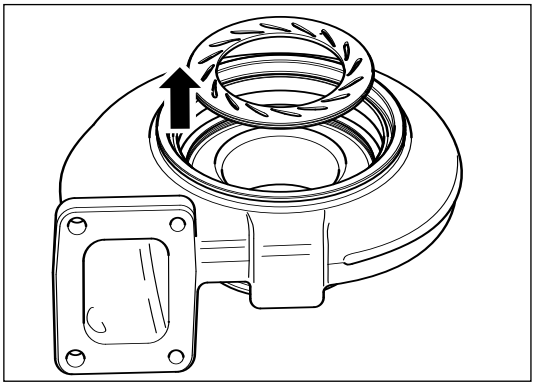
Alternatively 0.25 mm (0.010 in) in feeler plate can be used as removal tool.



Force tool around clearance between turbine housing and shroud plate inserting a 0.1/0.15 mm (0.004/0.006 in) feeler at 72 degree intervals until five feelers are in place. Soft hammer can be used to force tool around clearance.

Shroud plate retaining ring is now fully compressed within shroud plate ring groove.

Remove shroud plate and compressed ring from turbine housing.



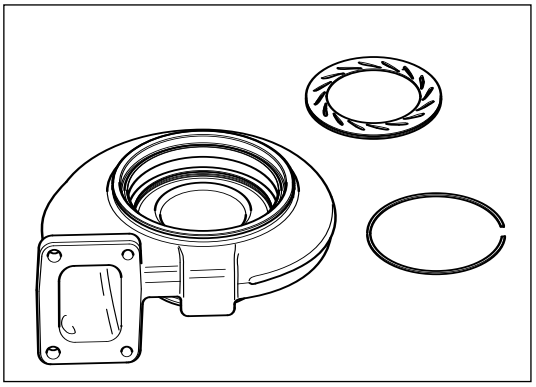
Steel shroud plate and cast iron turbine housing are now ready for cleaning and inspection.

Always refer to
Turbine Housing Cleaning without Shroud Plate.

Turbine Housing Cleaning without Shroud Plate

Warning
Always wear safety glasses.

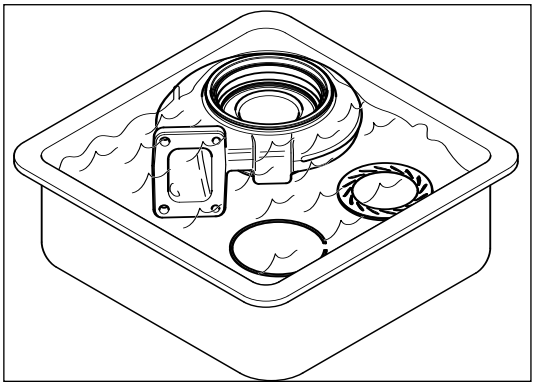
Caution
Housing surfaces adjacent to turbine wheel must be clean smooth and free from deposits.



Visually inspect housing in order to obtain as much information as possible before washing.

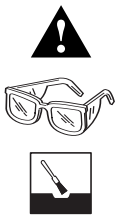
If in doubt, return turbocharger for remanufacture.

Caution
Check turbine housing inlet duct is not cracked and flange condition meets rebuild standard defined in ***Gas Leakage***. If housing does not meet rebuild standard **ALWAYS** replace turbocharger.

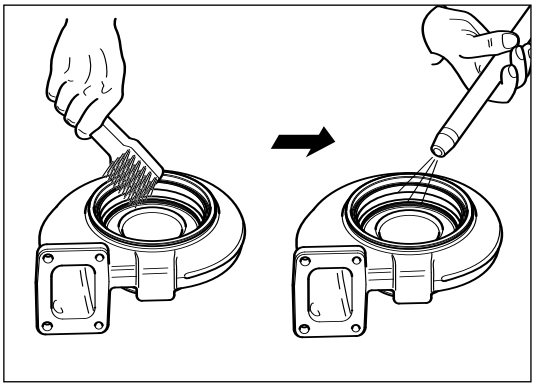


Soak housing in non-corrosive low flash point metal cleaner to loosen deposits.

Dry components using compressed air.

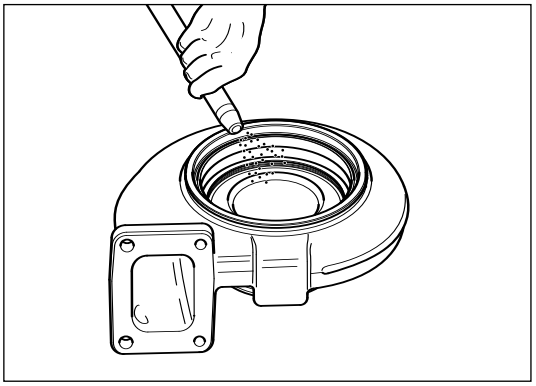


Remove scale-like deposits, if any, using non-metallic bristle brush. After removing deposits re-wash and dry components.



It is permissible to bead blast turbine housing if chemical and brush cleaning is not effective.

Caution
Prevent bead spray impinging directly on turbine flange threads or housing joint faces by masking or plugging.

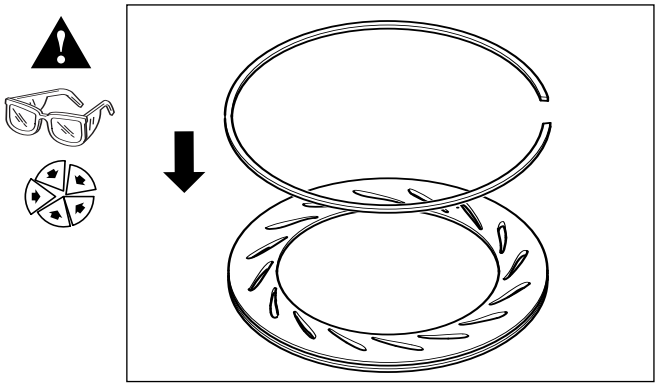


After removing deposits re-wash and dry housing.

Shroud plate re-assembly

Warning
Always wear safety glasses.

Where it has been necessary to remove shroud plate from turbine housing, locate new retaining ring (180) in shroud plate groove.



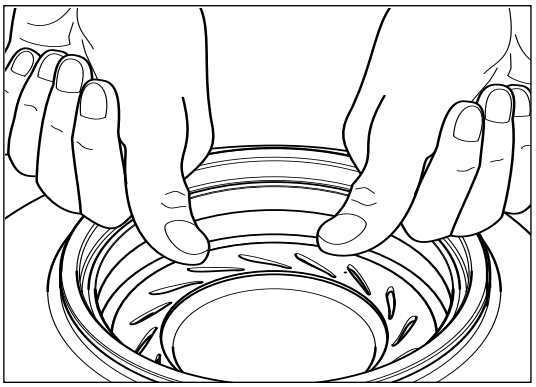
Caution
Parallel section and double bevelled section shroud plate ring designs are not interchangeable. Always select ring type compatible with turbine housing ring groove detail.

Holding shroud plate push retaining ring ends into shroud plate groove.

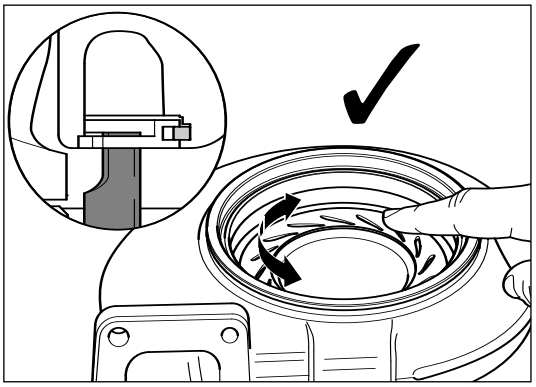
Insert exposed ring section into tubine housing groove.

Press remainder of retaining ring into position using thumb pressure.

When correctly installed retaining ring will click into position.

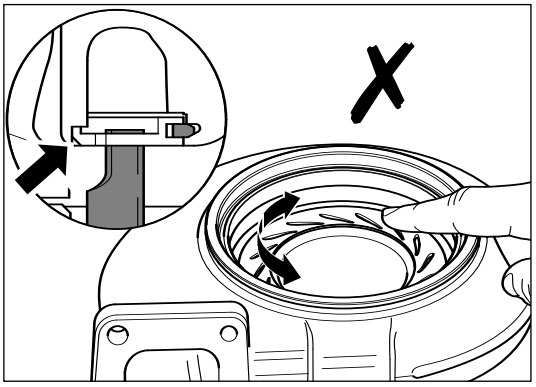


Check axial clearance of parallel section ring options is within allowable range of 0.1 mm (0.004 in) and shroud plate is free to rotate in turbine housing.



Double bevelled ring creates a friction fit between shroud plate and turbine housing to minimise potential for rotation and axial movement.

Caution
Do not attempt to rotate double bevel ring assembly by hand..



HOLSET®
TURBOCHARGERS

Holset HY40V
Service Repair Manual

Cummins Turbo Technologies Ltd.
Aftermarket Division
Croset Avenue
Huddersfield
West Yorkshire
HD1 6SE
www.holsetaftermarket.com

Part No. 4029523 Rev. 00 Ref. JV/KD Effect date 09.06

Cummins Turbo Technologies