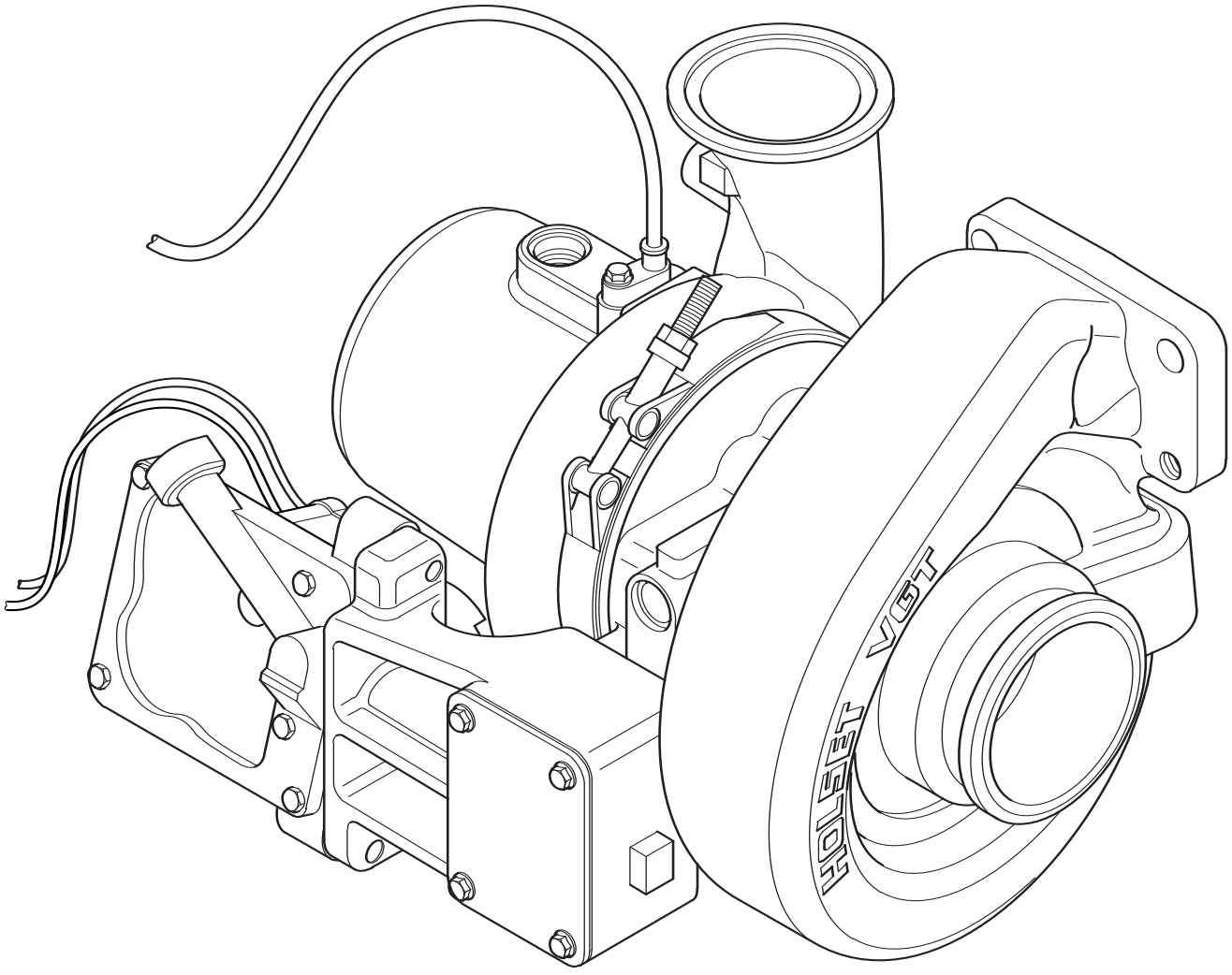
HOLSET®
TURBOCHARGERS

Holset HE341Ve
Service Manual



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Foreword

This publication was written to assist with turbocharger installation, maintenance and overhaul .
The specifications and procedures in this manual are based on information in effect at the time of publication. Holset Service 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 Holset 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.

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About the Manual

The procedures in this manual were developed to instruct in the correct overhaul of the Holset HE341Ve 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 unlikley event of a major turbocharger malfunction. **(This section is not available for the HE341V e turbocharger range at the present time)**

Section 6 quantifies build data to ensure the turbocharger will continue to operate to Holset Service 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.holset.co.uk. so that Holset can update the Service Data 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.holset.co.uk.



When using the manual on-line this icon will link to Holset's 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 Holset 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

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.

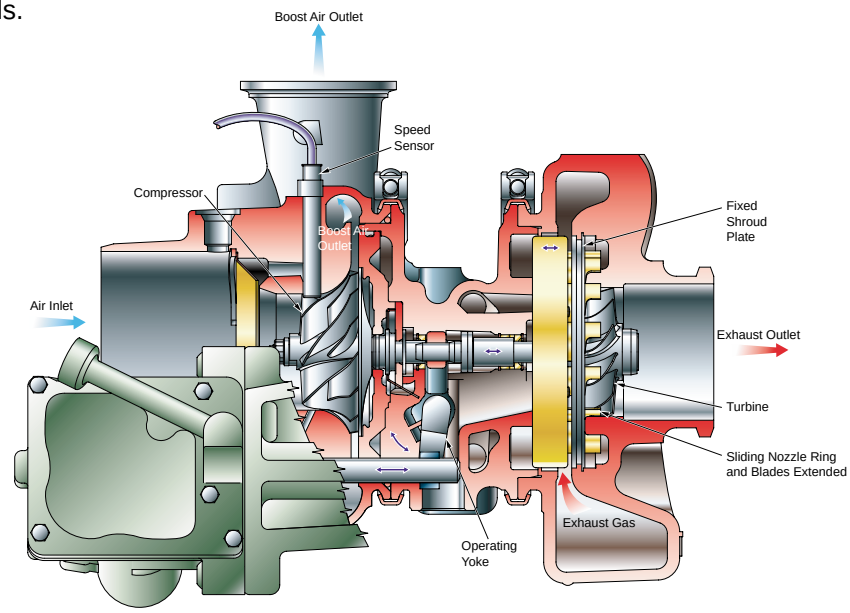
When rapid vehicle acceleration is required, the turbocharger will produce air for the engine more quickly than a conventional unit, thus eliminating turbocharger lag and giving improved vehicle drivability. As the engine and turbocharger run in, and eventually start to wear, the combination of the variable 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

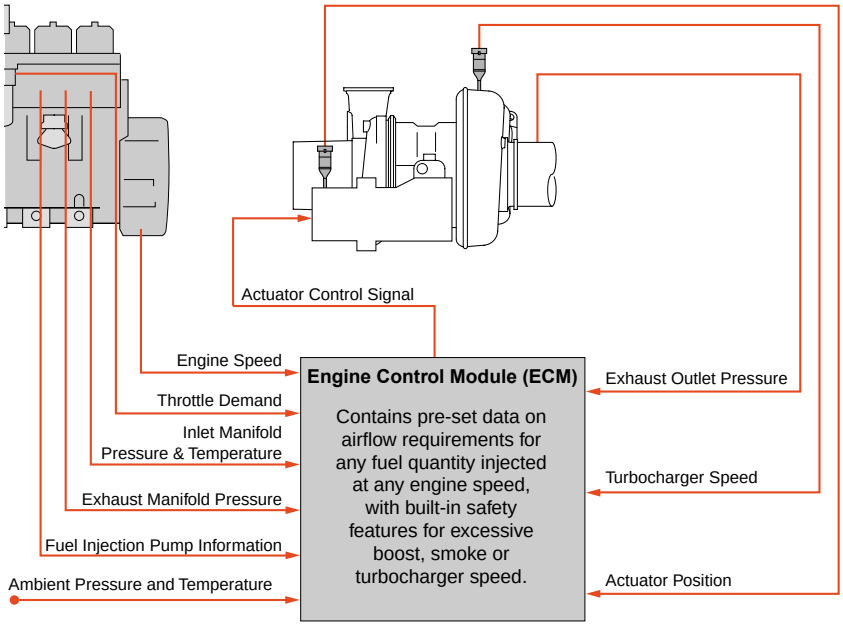
The bearing housing of your turbocharger and the variable geometry actuator both contain an internal liquid cooled jacket. The purpose of these is to reduce the operating temperature of the housings, to improve the operating environment of the position sensor and DC motor and reduce the high soak temperatures produced when the engine is switched off after being heavily loaded. The addition of liquid cooling has meant that there are two pairs of pipe connections to the turbocharger, to bring coolant to the housings and to take it away. It is important to observe the correct installation of these pipes, so that the circulation of the coolant is in the correct direction, or the effectiveness of the cooling system will be lost and severe damage may result.

The advantages of a Variable Geometry (VG) Turbocharging system

You may already have experience of the effect of a Wastegate turbocharger on the performance of your vehicle.
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, actuator position and pressure sensors feedback information to the Engine Control Module to provide the necessary control. 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. Wastegate turbochargers have no feedback controls.



The Holset VG system works by controlling the width of a nozzle guiding the gas flow into the turbine wheel. Control is achieved using an electric actuator powered by the vehicle system. The Engine Control Module continually senses the position of the actuator mechanism, engine operating condition and driver demands. It signals the actuator DC motor to move the actuator rod to a new position which slides 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.

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
Holset Service receives many turbocharger returns 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.

Warning ⚠
Turbocharger surface temperature during operation can achieve 700°C (1300°F). The designated turbocharger weighs up to 18.3 kg (40.5 lb) and is fitted with external parts that are sensitive to manual handling. They include electrical wiring and connectors.

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 Holset Engineering 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.

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

Installation Data

1. Holset Service receives many turbocharger returns 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. Limiting mass inertia loading is critical to turbocharger whole life operation. Maximum engine vibration input must not exceed 10g.
3. The air filter must remove particles greater than 5µm 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 capable of withstanding depressions up to 6.9 kPa (1.0 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 systems must be capable of operating at exhaust back pressures of up to 10 kPa (1.5 lbf/in^2). This limit is increased to 13.4 kPa (2.0 lbf/in^2) if a catalytic converter is fitted. Exhaust brake applications are permitted to impose 450 kPa (65.3 lbf/in^2) back pressure.
6. Oil should be filtered to 10µm with efficiency of 60% TWA (Time Weighted Average) /20 µm with efficiency of 85% TWA. Efficiency assessed using ISO Standard 4572/SAE J 1858.
7. The oil quality must be as specified by the engine manufacturer and will be a minimum API SE - CD (MIL - L - 2104C) specification. Improved life can be obtained by using super high performance diesel (SHPD) oils, particularly in industrial applications which use extended oil drain periods.
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, bearing housing and compressor cover is fixed according to application. During installation, do not attempt to rotate these components as it may affect the operation of the variable geometry actuating mechanism and may void warranty. Inclined turbocharger installation is not recommended. If an installed angle is necessary, oil inlet centreline must be +/- 10 degrees from vertical and rotor centreline +/- 5 degrees from horizontal.
11. Holset permits oil return pipes to decline at an overall angle of not less than 30 degrees below horizontal. All turbocharger applications require a pipe of internal diameter greater than 19 mm which has integrated connectors. To ensure oil returns into the engine under all operating conditions, the return connection into the engine sump must not be submerged and the outlet flange of the turbocharger must be 50 mm above the maximum oil level of the engine sump pan. Crankcase pressure should be limited ideally to 0.8 kPa (0.12 lbf/in^2) but 1.4 kPa (0.20 lbf/in^2) can be accepted by reference to Holset.
12. Oil pressure of 150 kPa (20 lbf/in^2) must show at the oil inlet within 3 - 4 seconds of engine firing to prevent damage to turbocharger bearing system. A flexible supply pipe is recommended.
13. The minimum oil pressure when the engine is on load must be 210 kPa (30 lbf/in^2). Normal maximum operating pressure is 500 kPa (72 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).
14. Recommended oil flows for the turbochargers are 2 litre/min at idle and 3 litre/min above maximum torque speed.
15. Ensure recommended coolant flows for the separate turbocharger and actuator circuits are achieved:

    Turbocharger: 3 litre/min at idle and 5 litre/min above max torque speed

    Actuator: 1 litre/min at idle and 3 litre/min above max torque speed
16. 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/in^2 =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. Torque fasteners to engine manufacturer's recommendation.
10. Assemble the air intake and boost outlet connections. Check that the connections are secure 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 secure and will not leak in use.
13. Assemble any coolant pipes and check that the connections are secure, without obstruction and will not leak in use.
14. Assemble the turbocharger oil inlet pipe and check that the connection is clean, secure 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 actuator motor, sensors and engine control module (ECM).
17. Make any ECM checks recommended by the engine manufacturer.
18. Crank the engine WITHOUT firing until engine oil flows out of the turbocharger drain flange.
19. Assemble the oil drain pipe and check that the connection is secure, without obstruction and will not leak in use.
20. Start the engine and run at idle speed for approximately 1 minute so that the oil supply system is fully operational.
21. Accelerate the engine and check that there are no leaks/obstructions of air/oil/coolant/gas under pressure.
22. Check that no hose or connection deforms under normal operation.
23. 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 Holset-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 Holset 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 Holset 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 Holset 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 mecânica 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 Holset mais perto.

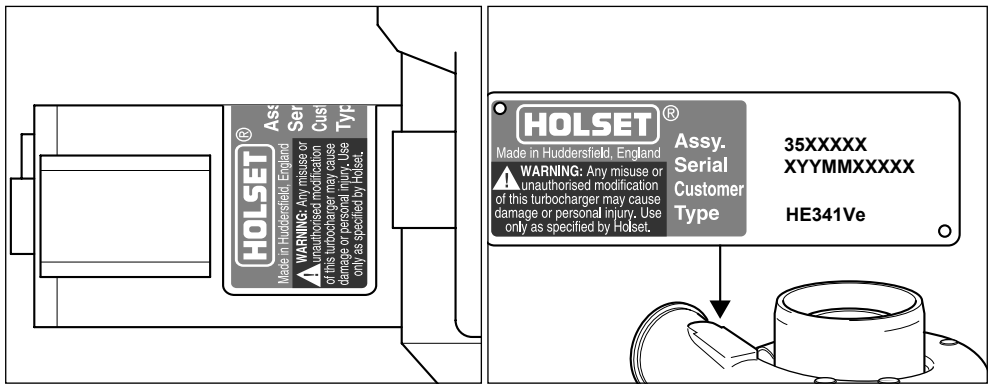


Vá para Conteúdo

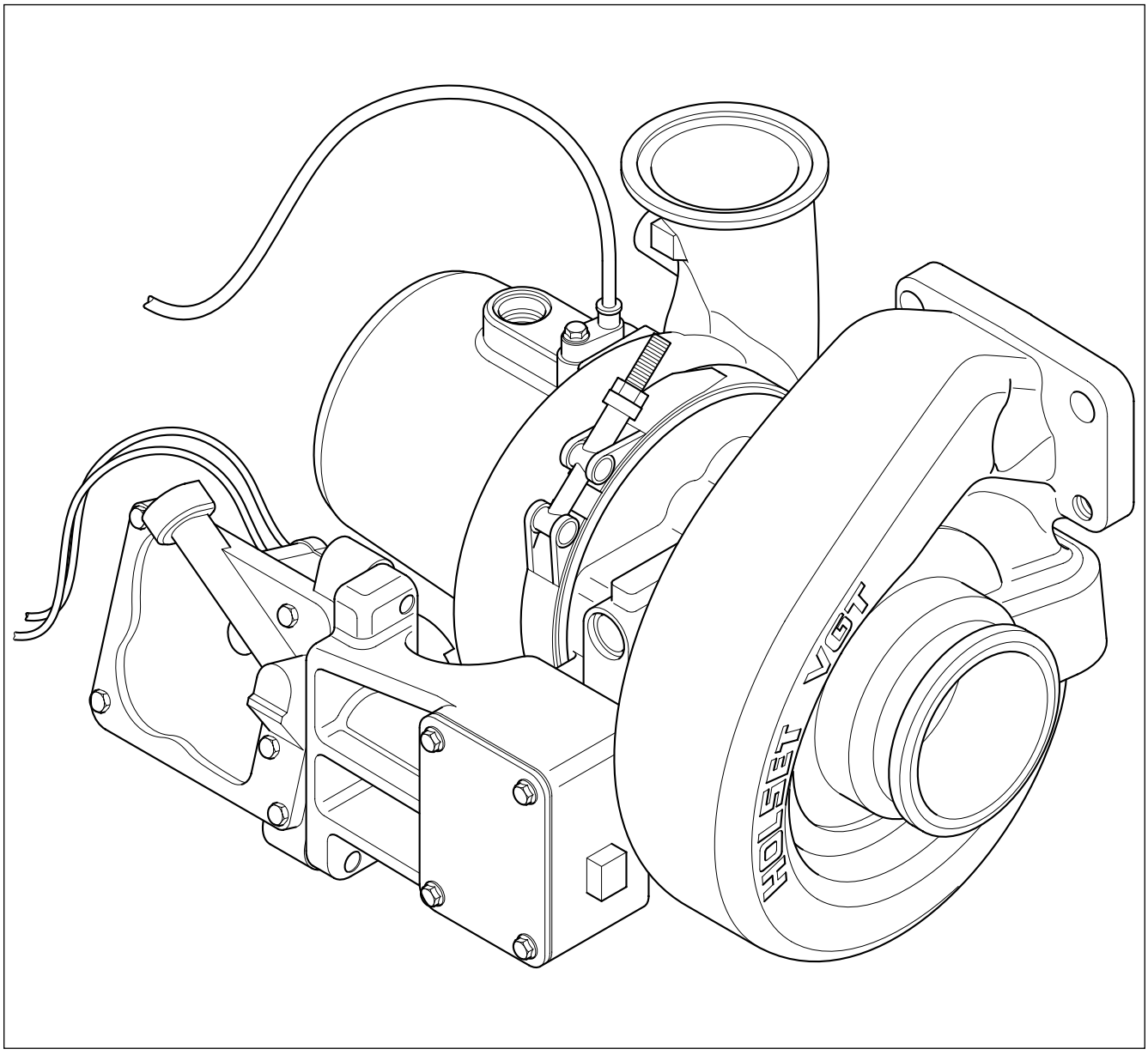
Turbocharger Identification

Dataplate

Note
Dataplates may be fitted to the DC motor of the VG actuator (126) or to the compressor housing (8). The information from the dataplate must be quoted for service and parts support.

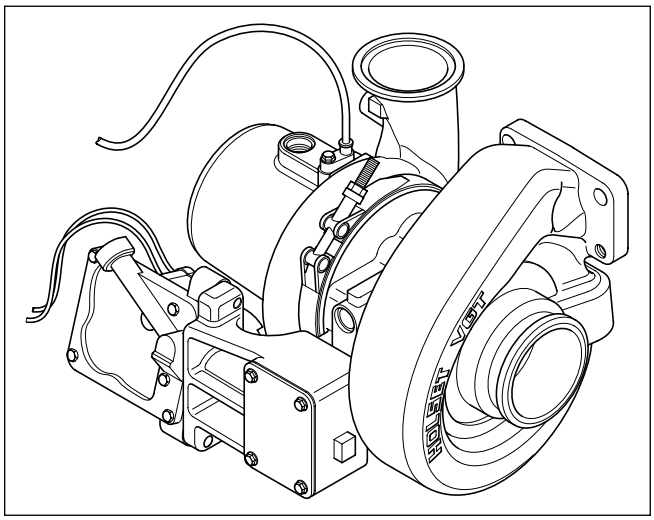


HE341Ve

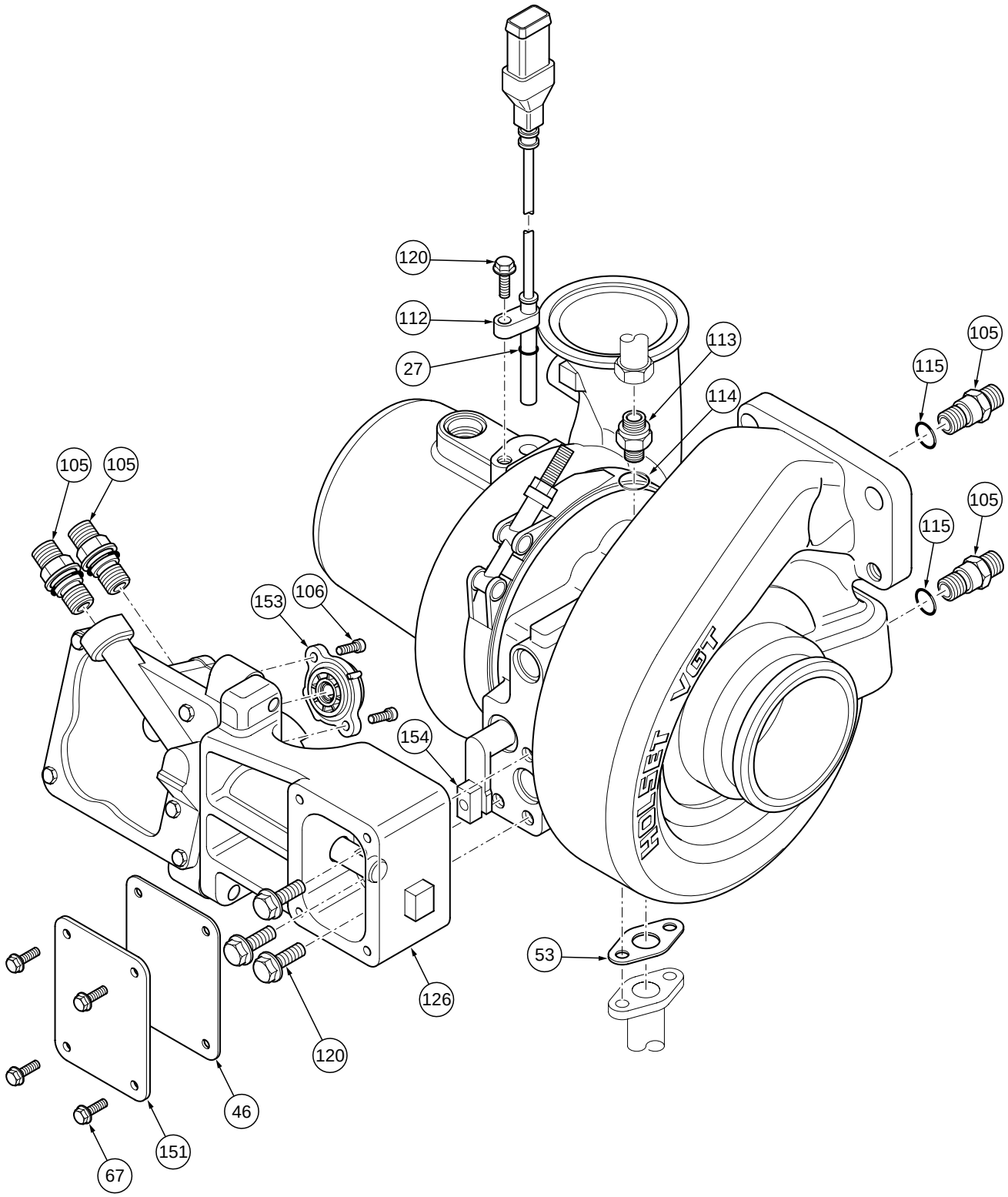


Installation Options

Type A



Exploded View - HE341Ve



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

Component List - HE341Ve

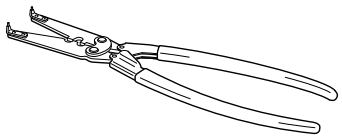
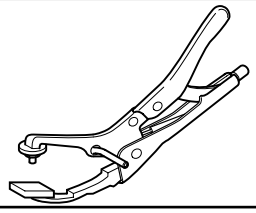
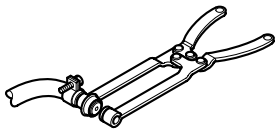
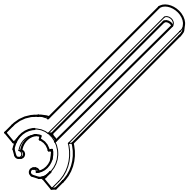
Item No.	Description	Quantity
121	**VG Actuator Kit comprising:**	**1**
126	VG Actuator	1
122	**VG Actuator Fittings Kit comprising:**	**1**
120	Screw, Cap Head	3
151	Coverplate, Actuator	1
46	Gasket, Coverplate	1
67	Bolt, Coverplate	4
154	Pivot Block	1
152	**VG Position Sensor Kit comprising:**	**1**
153	Position Sensor	1
106	Screw, Socket Head	2
105	Connector Male, Water	2
123	**VG Bearing Housing Seals and Adapter Kit (Water & Oil) comprising:**	**1**
053	Gasket, Oil Outlet	1
113	Adapter, Oil Inlet	1
114	O Ring Seal, Oil Inlet	1
105	Connector Male, Water	2
115	O Ring Seal, Water	2
124	**Speed Sensor Kit comprising:**	**1**
112	Speed Sensor	1
120	Screw, Cap Head	1
27	O Ring Seal	1

Note
Exploded views may not contain all listed components.

Purchasable Service Tools

Service Tools

The following special tools can be purchased from your local Authorised Repair Location. The use of these tools is recommended and where necessary they are shown in the appropriate service procedure.

Part No.	Tool Description	Tool Illustration
3575186	Circlip Pliers	
4027202	Wastegate Air Feed Adapter	
4027203	Wastegate Air Feed Adapter	
4027204	E-Clip Tool	

Caution △

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

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 Clean in accordance with details in the appropriate Holset publication				●	●	●	●	●	●	●	●
Turbocharger damaged Find and correct cause of failure, repair or replace turbocharger as necessary				●	●	●	●	●		●	●

Fault Finding Chart - Variable Geometry

	Engine will not Start	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 Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Check actuator wiring for bad connections. Check motor and sensor pin resistances with multimeter. Repair pin or wire damage by renewing connectors and leads. If no damage, remove 4-bolt actuator coverplate to expose actuator rod end. Apply key-on calibration to activate VG actuation sequence. If actuator rod travel is within range specified by service manual, replace position sensor. If still no rod movement, remove actuator assembly and reapply key-on calibration using equipment electrical supply. If rod does not move or if endplay exceeds range specified by service manual under light load replace actuator. If rod moves normally through specified travel, check ECM and, locking pliers (mole or vice grips), ensure check cross shaft lever moves under light to medium force. If cross shaft offers excessive or no resistance to movement replace turbocharger. If cross shaft motion is acceptable and rod of reassembled actuator does not move, recheck ECM.	●	●					●		●	●		
Note Normal motor operation is almost silent, hence a check of actuator rod movement is required to confirm lack of motor activity.	●	●					●		●	●		
DC motor not driving Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Check actuator wiring for bad connections. Check motor pin resistance with multimeter. Repair pin or wire damage by renewing connectors and leads. Remove 4-bolt actuator coverplate to expose actuator rod end. If actuator rod travel is within range specified by service manual, recheck ECM. If no rod movement, replace actuator. Refer to *'actuator rod not moving'* for further fault finding.												
Actuator motor or gears noisy If actuator operates with excessive motor or gear noise, replace actuator.						●		●				
Position sensor fault indication Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Ensure sensor wiring for bad connections. Check sensor pin resistance with multimeter. Repair pin or wire damage by renewing connectors and leads. If fault persists replace position sensor. If new sensor still not working check ECM. Where position sensor malfunction continues to affect engine operation, ECM will fully open VG nozzle to enable limp home facility.	●		●				●		●	●		
Position sensor nozzle open voltage outside range Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Check sensor wiring for bad connections. Check sensor pin resistance with multimeter. Repair pin or wire damage by renewing connectors and leads. Remove 4-bolt actuator coverplate to expose actuator rod end. Check cross shaft is not fouling on actuator body screws. Remove actuator and apply light axial load to rod to check endplay. If greater than specified in service manual replace actuator. Refer to *'position sensor voltage span outside range'* for further fault finding. Where position sensor malfunction continues to affect engine operation, ECM will fully open VG nozzle to enable limp home facility	●	●		●	●	●	●		●			
Position sensor nozzle closed voltage outside range Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Check sensor wiring for bad connections. Check sensor pin resistance with multimeter. Repair pin or wire damage by renewing connectors and leads. Remove 4-bolt actuator coverplate to expose actuator rod end. Check cross shaft is not fouling on actuator body screws. Remove actuator and apply light axial load to rod to check endplay. If greater than specified in service manual replace actuator. Refer to *'position sensor voltage span outside range'* for further fault finding. Where position sensor malfunction continues to affect engine operation, ECM will fully open VG nozzle to enable limp home facility.	●		●	●		●						
Position sensor voltage span outside range Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Check sensor wiring for bad connections. Check sensor pin resistance with multimeter. Repair pin or wire damage by renewing connectors and leads. Remove 4-bolt actuator coverplate to expose actuator rod end. Ensure stroke of assembled actuator is within range specified by service manual. If in range, check position sensor and ECM. If outside range, remove actuator. Using light to medium load and locking pliers, check linear travel of cross shaft pin is within same range specified for assembled actuator. If pin motion is not in range replace turbocharger. If pin motion is in range, recheck stroke of actuator rod. If less than specified by service manual, replace actuator. If turbocharger stroke and actuator stroke are both in range, then check ECM. Where position sensor malfunction continues to affect engine operation, ECM will fully open VG nozzle to enable limp home facility.	●	●					●		●	●		

Fault Finding Chart - Variable Geometry

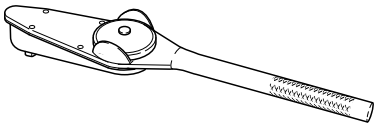
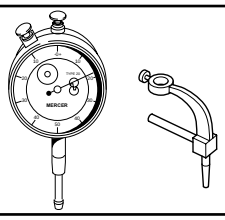
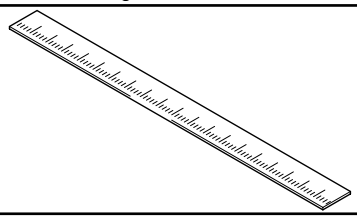
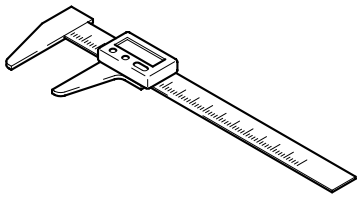
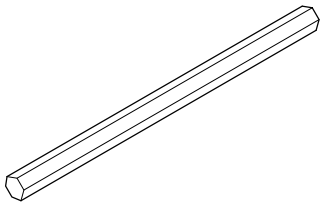
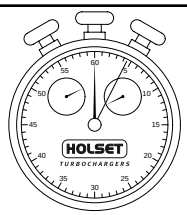
	Engine will not Start	Engine Lacks Power	Engine Overheats	Intermittent Engine Braking	Intermittent Low Power	Engine does not run Smoothly	Low Power at Low Engine Speed	Turbocharger Noisy	Poor Acceleration	Reduced Braking	Coolant Leak	Oil Leak
Variable geometry nozzle movement slow or inconsistent Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Check actuator wiring for bad connections. Repair pin or wire damage by renewing connectors and leads. If no damage, remove 4-bolt actuator coverplate to expose actuator rod end. Apply separate voltage to motor using service test equipment. Fully retract rod end using voltage toggle switch. Drive actuator through full cycle using toggle switch and measure cycle time. If time is within specification, replace position sensor. If nozzle movement remains slow or inconsistent, remove actuator assembly and, locking pliers, ensure cross shaft lever moves under light to medium force. If cross shaft offers excessive resistance to movement replace turbocharger. If cross shaft motion is acceptable, reapply separate voltage to motor. If rod shows signs of stiction, replace actuator. If rod of new assembled actuator still suspect, recheck ECM. Where position sensor malfunction continues to affect engine operation, ECM will fully open VG nozzle to enable limp home facility.	●	●		●	●	●	●		●	●		
VG mechanism intermittent jamming Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. Check actuator wiring for bad connections. Repair pin or wire damage by renewing connectors and leads. If no damage, remove 4-bolt actuator coverplate to expose actuator rod end. Apply separate voltage to motor using service test equipment. If actuator travels within range specified by service manual, fully retract rod end using voltage toggle switch. Drive actuator through full cycle using toggle switch and measure cycle time. If time is within specification, replace position sensor. If actuator movement remains slow or inconsistent, remove actuator assembly and, using locking pliers, ensure cross shaft lever moves under light to medium force. If cross shaft offers excessive resistance to movement replace turbocharger. If cross shaft motion is acceptable, reapply separate voltage to motor of replacement actuator using service tool. If rod of new assembled actuator still slow or inconsistent, then, recheck ECM. Where position sensor malfunction continues to affect engine operation, ECM will fully open VG nozzle to enable limp home facility.	●	●		●	●	●	●		●	●		
Pivot block seized on cross shaft pin Refer to ECM diagnostics for possible fault code data. To avoid feedback error to ECM always disconnect and reconnect actuator motor and position sensor in correct sequence. Disconnect motor before position sensor. Reconnect position sensor before motor. If actuator rod travel restricted, ensure pivot block moves freely on cross shaft pin. If no axial or rotary movement or if force required to move block, then replace turbocharger.	●	●		●	●	●	●		●	●		
No speed signal Refer to ECM diagnostics for possible fault code data. Check sensor connections. If pin resistance measurement is incorrect replace sensor. Where sensor may have been overheated check ECM diagnostic fault codes and if necessary replace sensor.	●	●			●	●		●			●	
Intermittent or noisy speed signal Refer to ECM diagnostics for possible fault code data. Check sensor with multimeter. If either resistance measurement is incorrect replace sensor. Where sensor may have been overheated check ECM diagnostic fault codes and if necessary replace sensor.	●	●			●	●		●			●	
No boost pressure signal (P2) If the ECM diagnoses a boost pressure signal error refer to engine manual.		●			●	●	●		●			
No air inlet temperature signal (T2) If the ECM diagnoses an air inlet temperature signal error refer to engine manual.		●			●	●	●		●			

Fault Finding Chart - Variable Geometry

	Engine will not Start	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 coolant circuit restricted Check coolant pipework and connections for damage. Replace damaged fittings using genuine replacement parts. Refer to engine manual for flow data and service instructions. If coolant flow remains restricted replace actuator.		●	●						●			
Actuator coolant pipework or connectors leaking Replace damaged pipes and tighten connectors to torque specified in engine service instructions. If leak persists replace damaged actuator fittings using genuine replacement parts and torque to specification. If leak persists, replace actuator.		●	●						●		●	
Actuator coolant joint leaking If coolant leaks from 5-bolt actuator mechanism coverplate joint, replace actuator. Never remove 5-bolt coverplate as this will adversely affect actuator clearance conditions.		●	●						●		●	
Coolant ingress into actuator bracket cavity Replace actuator		●	●						●		●	
Oil ingress into actuator bracket cavity Replace turbocharger		●	●						●			●
Air leakage from speed sensor Check o ring seal and replace if necessary. Refit sensor and torque fastener to value in service manual. If leak persists replace sensor. If leak continues replace turbocharger.		●	●				●	●	●			
Bearing Housing coolant circuit restricted Check coolant pipework and connections for damage. Replace damaged fittings using genuine replacement parts. Refer to engine manual for flow data and service instructions. If coolant flow remains restricted replace turbocharger		●	●						●			
Bearing housing coolant pipework or connectors leaking Replace damaged pipes and tighten connectors to torque specified in engine service instructions. If leak persists replace damaged fittings using genuine replacement parts and torque to specification. If leak persists, replace turbocharger.		●	●						●		●	
Bearing housing oil feed and return lines leaking Replace damaged pipes. Check o ring seals and gaskets. Replace if necessary. Tighten connectors to torque specified in engine service instructions. If leak persists replace damaged fittings using genuine replacement parts and torque to specification. If leak persists, replace 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.

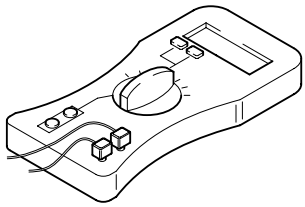
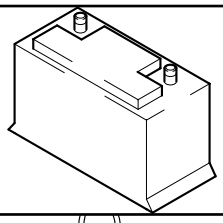
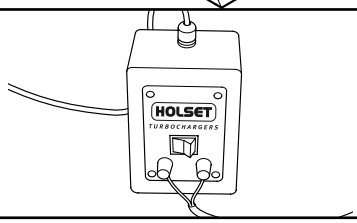
Part No.	Tool Description	Tool Illustration
	Torque Wrench	
	Dial Gauge and Dial Gauge Adapter	
	Steel Rule	
	Vernier Caliper	
	Allen Key	
	Stopwatch	

Caution △

All Service and Maintenance settings are shown in Holset's Service Data Sheet. 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
	Multi-meter	
	Vehicle Battery Supply	
	Service Test Equipment	

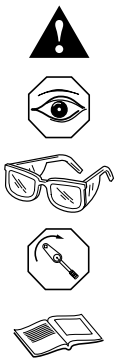
Caution ⚠

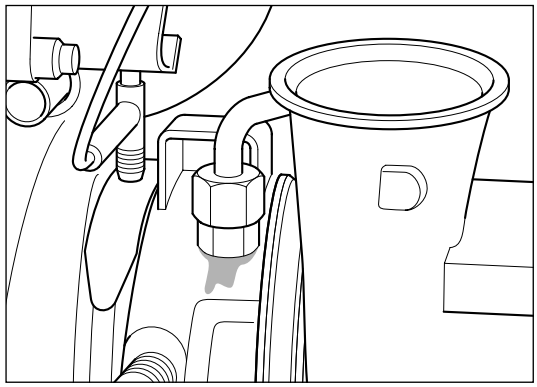
All Service and Maintenance settings are shown in Holset's Service Data Sheet. It is essential that these settings are used. Common tools found in mechanic's tool box not included.

On Engine Checks

Variable geometry turbochargers have potential oil, gas, coolant and air leak paths. They are fitted with sensors 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 . Bearing housing seals and adapter kits (123) are available.

Oil Leakage



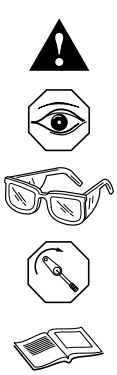


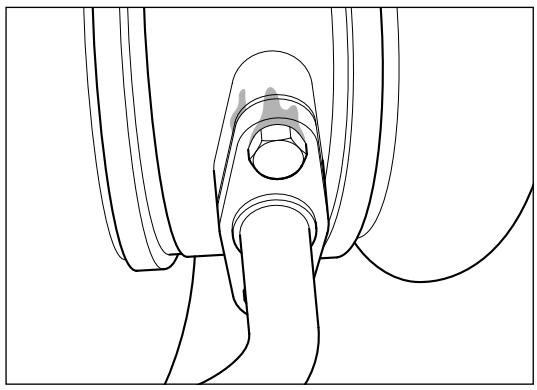
M12 x 1.5

Warning
The oil inlet is pressurized and no service action should be taken with the engine running.

Replacement seals and adapters should be fitted without sealant as this can contaminate the oil. Torque tighten adapter to value specified by engine manufacturer.

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



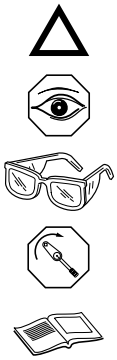


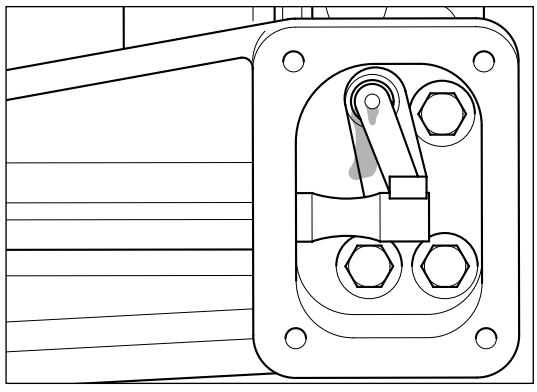
M8 x 1.25

Warning
Outlet oil is hot and no service action should be taken with the engine running.

Replacement gaskets should be fitted without sealant as this can contaminate the oil. Torque tighten flange fasteners to value specified by engine manufacturer.

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



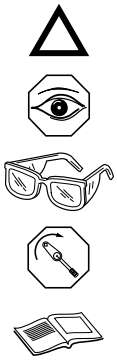


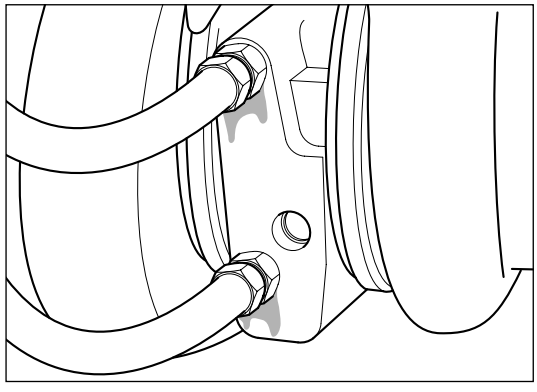
M6 x 1.0 (8 mm)

The variable geometry (VG) cross shaft is sealed against oil leakage by a spring backed oil seal. Leakage can be detected by removing the 4-bolt actuator coverplate. If leak is detected, remove and replace turbocharger.

Caution
Seals must be replaced using specialised equipment. Do not attempt to replace in service.

Coolant Leakage





M16 x 1.5

Repair bearing housing coolant leaks by refitting / replacing inlet and outlet adapters. Torque tighten adapters to value specified by engine manufacturerer.

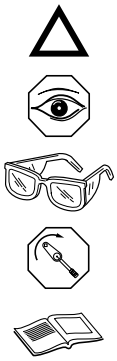
Where housing threads are damaged replace turbocharger.

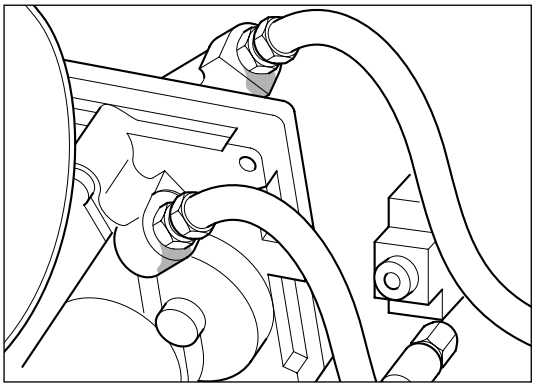
Caution
Do not use sealant as this may affect performance of o-ring seals.

M10 x 1.0 (16 mm)

Repair actuator coolant leakage by re-fitting replacement of coolant inlet and outlet adapters. Torque tighten adapters to value specified by engine manufacturerer.

Where actuator threads are damaged replace actuator by reference to ***VG Actuator Replacement***.

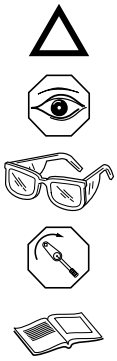


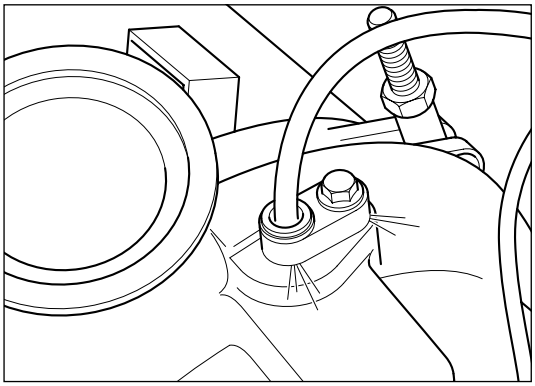


Caution
Ensure new actuator coolant adapters are fitted with o ring and washer prior to insertion.

Air Leakage

M6 x 1.0 (8 mm)





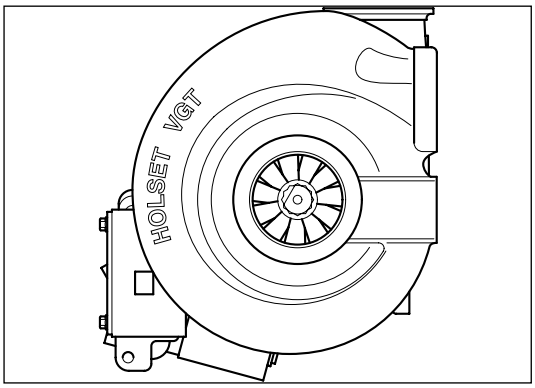
Caution
Visual and audible checks for air leaks may be completed safely with a running engine.

Check for air leaks from the speed sensor. Where leakage occurs replace o-ring and torque tighten new cap head screw to value specified in ***Service Data Sheet***. Speed sensor service kit (124) is available.

Caution
Always use new cap head screw. Ensure thread in compressor housing is clean and oil free before torque tightening.

Visual Checks



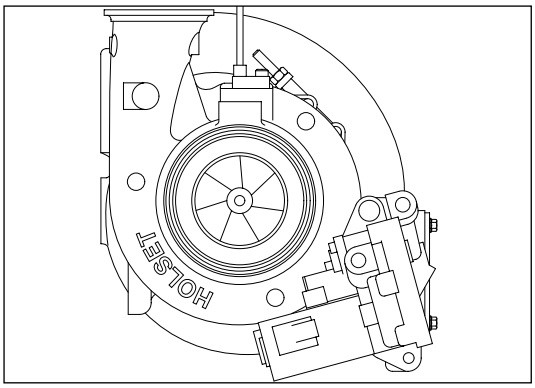


Caution
Do not remove turbine housing as this may damage variable geometry control mechanism.

Make visual check for damaged or bent blades. Replace turbocharger if damaged or bent.

Caution
Never attempt to straighten blades.





Caution
Do not remove compressor cover as this may damage variable geometry control mechanism.

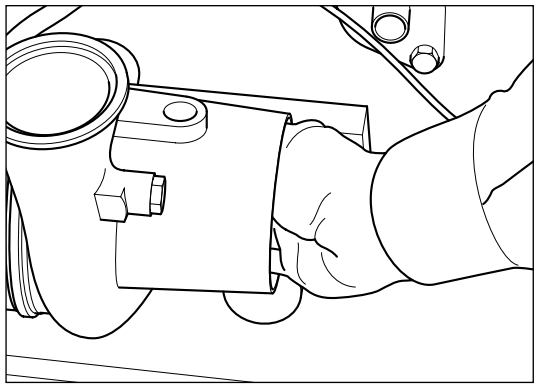
Make visual check for damaged and fouling of impeller blades. Replace turbocharger if damaged or bent.

Caution
Never attempt to straighten blades.

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

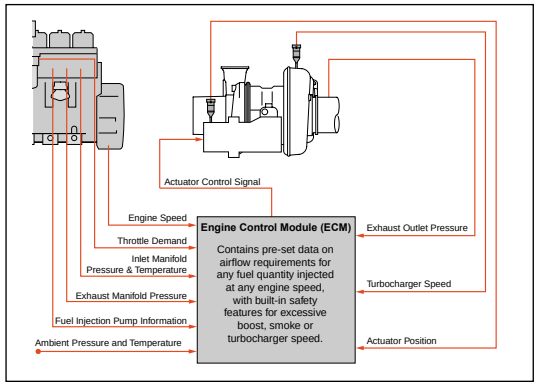
If light finger pressure causes contact between compressor or turbine wheel and respective housing replace turbocharger.

If in doubt, the turbocharger must be removed from engine to check bearing clearance against recommended values shown in ***Service Data Sheet***. Replace turbocharger where service limits are exceeded.



On Engine Actuation Checks

Note
Always refer to ECM diagnostics for possible actuation fault data.

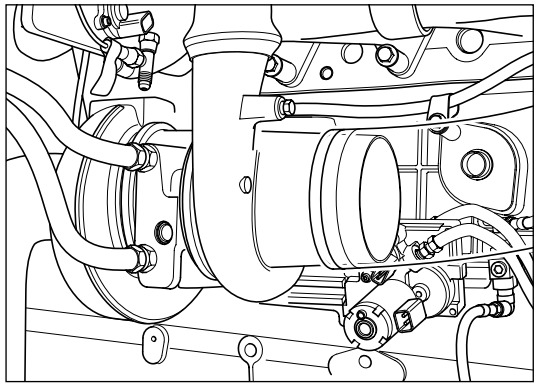


The Engine Control Module (ECM) features a key-on calibration check to monitor the health of the VG actuation system. It will potentially detect faults in:

- Position sensing
- VG actuation
- Speed sensing

It may be possible to verify a key-on calibration error using on-engine visual checks.

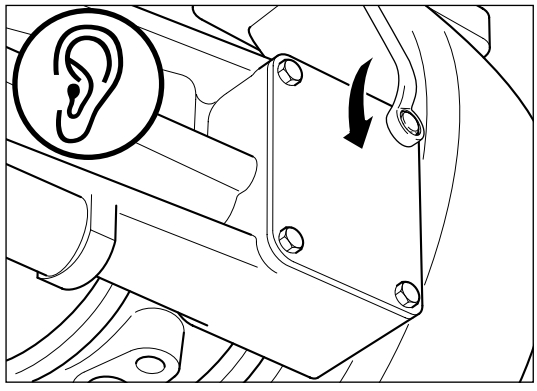
Check speed sensor, position sensor and actuator wiring and connectors for damage and bad connections. Remake connections and if fault persists repair wiring by replacement.



Caution △
To avoid feedback error to ECM always disconnect motor before position sensor. Reconnect position sensor before motor.

Warning ⚠
Always wear safety glasses.

M6 x 1.0 (8 mm)



Where it is not possible to remove 4-bolt actuator coverplate on engine due to space claim constraints, it might be possible to hear actuator movement.

Apply key-on calibration to activate VG actuation sequence. As actuator motor operates correctly with low electrical hum, no noise does not necessarily imply no actuation. However, high noise may indicate an actuator problem In this case, refer to ***Actuator Check and Removal*** and ***Actuator Replacement***.

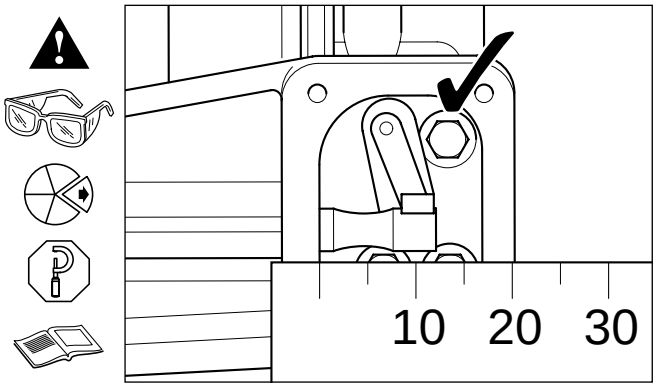
Warning
Key-on calibration sequence automatically extends/retracts actuator over its full travel. Keep fingers away from rod.

Apply key-on calibration sequence to actuator motor and use steel rule to measure travel.

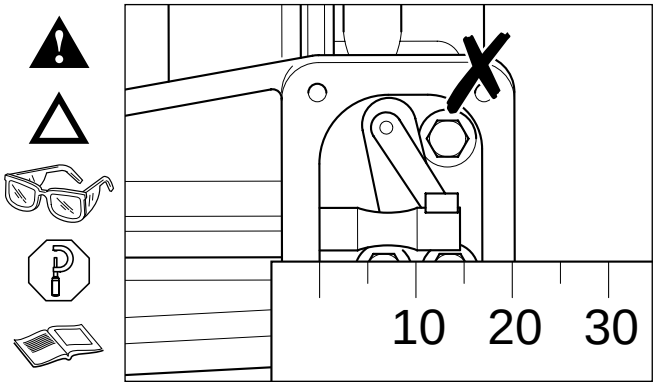
If VG mechanism travel is within permissible range shown in ***Service Data Sheet*** there may be a position sensor fault. In this case, refer to ***Position Sensor Check and Removal***.

If VG mechanism does not move or if travel is outside permissible range shown in ***Service Data Sheet*** remove actuator by reference to ***Actuator Check and Removal***.

If on-engine actuator removal is possible use equipment electrical system and key on calibration sequence to check rod travel of remote actuator is within permissible range. If outside range replace actuator by refering to ***Actuator Replacement***.



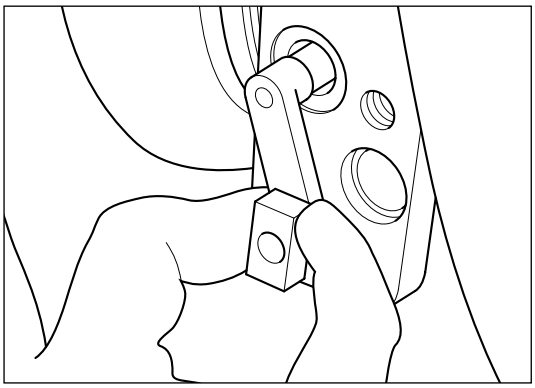
Caution
Detached actuator stroke is greater than stroke when attached to VG nozzle. Ensure correct range is read from ***Service Data Sheet***.



If actuator rod travel is within permissible range shown in ***Service Data Sheet*** check pivot block is free to rotate and move axially on cross shaft pin.

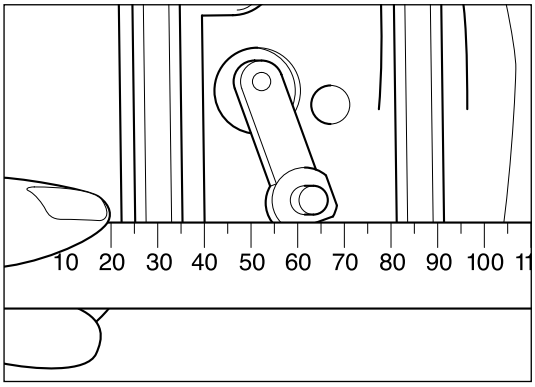
If pivot block is seized or if force is required to move pivot block on pin remove block and check pin for damage. Replace turbocharger if damaged.

If pivot block is loose on pin refer to ***Actuator Check and Removal*** to check pin and pivot block hole diameters.



Caution
Always check pivot block for wear and refit to cross shaft pin before refitting actuator.

If pivot block rotates freely, remove pivot block and check linear travel of VG cross shaft pin is within permissible range shown in ***Service Data Sheet***.



Caution
Use moderate hand force only to rotate cross shaft.

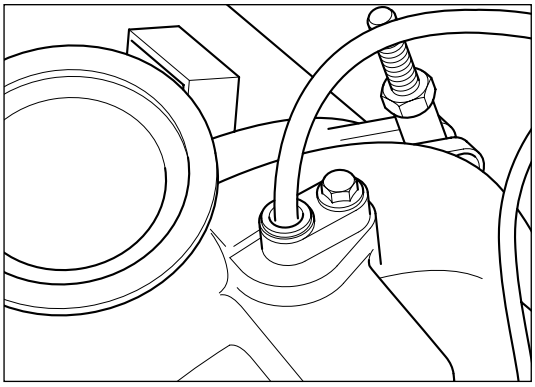
If pin shows no resistance to motion or does not travel within permissible range replace turbocharger. If pin travels within permissible range replace actuator by refering to ***Actuator Replacement***.

Note
Always check VG cross shaft movement prior to refitting or replacing actuator.

M6 x 1 (8 mm)

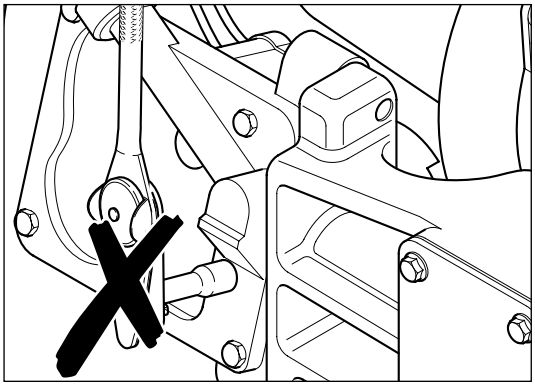
Where ECM indicates a speed sensor fault and no wiring or connector problems are found refer to ***Speed Sensor Check and Removal*** for further health checks.

Replace sensor by refering to ***Speed Sensor Replacement***.



Caution △

Never remove actuator mechanism 5-bolt cover plate as this will adversely effect actuator clearance conditions.

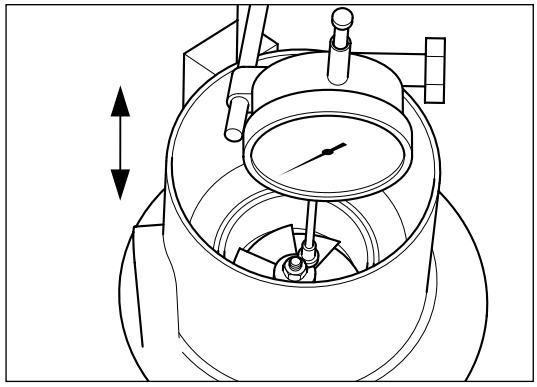


Bearing Clearance

Secure the turbine housing and check the axial clearance at compressor impeller nose using a dial gauge.

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

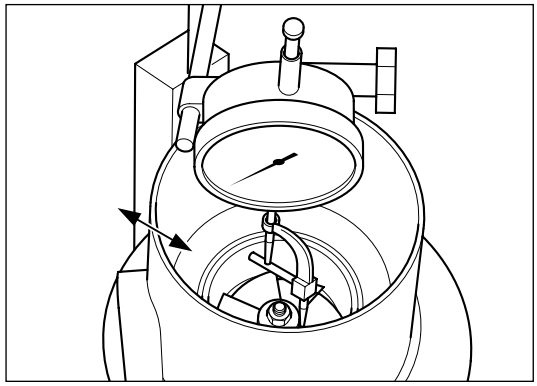
If axial clearance does not meet specification replace the turbocharger.



Check the radial movement at compressor impeller nose using a dial gauge.

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

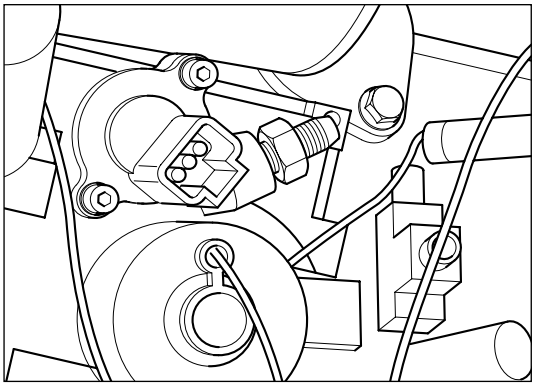
If radial movement does not meet specification replace the turbocharger.



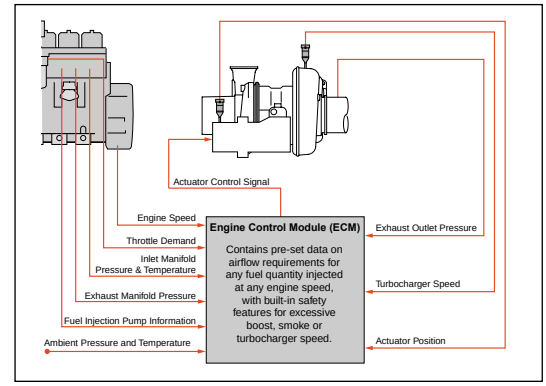
Position Sensor Check and Removal

Where space claim allows, position sensor checks and removal should be done on engine. If this is not possible, remove actuator by reference to ***Actuator Check and Removal***.

If actuator removal is not possible, remove turbocharger from engine.



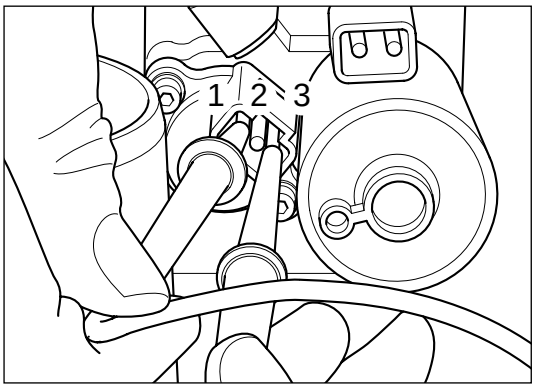
Note
Always refer to ECM diagnostics for possible actuation fault data.



Where key-on calibration or ***On Engine Actuation Checks*** have indicated a position sensor fault, final confirmatory checks are recommended.

Ensure electrical integrity of sensor wiring and connectors.

Caution △
To avoid feedback error to ECM always disconnect motor before position sensor. Reconnect position sensor before motor.

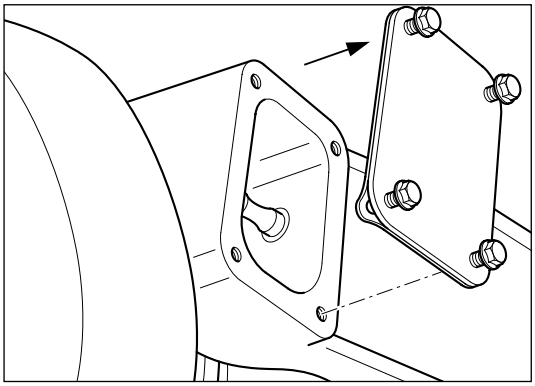


Disconnect the sensor at its electrical connector. Using a multi-meter, check the resistance between connector pins 1 and 3 is 800 / 1200 ohms with the sensor at 20°C.

Apply key-on calibration check and measure voltage from position sensor pin 1 to pin 3 is in the range 1 to 5 volts dc.

M6 x 1.0 (8 mm)

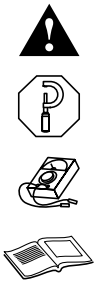
Remove 4-bolt actuator coverplate and gasket to expose actuator rod end.

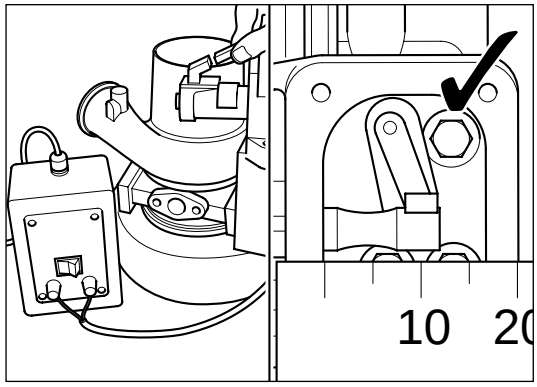


Warning ⚠
Key-on calibration sequence automatically extends/retracts actuator over its full travel. Keep fingers away from rod.

Warning ⚠
Always wear safety glasses.

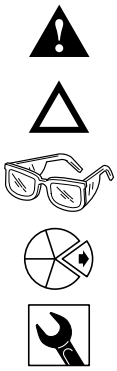
Apply system voltage to fitted or remote actuator motor through on/off switch. Confirm travel is within permissible range shown in ***Service Data Sheet***.

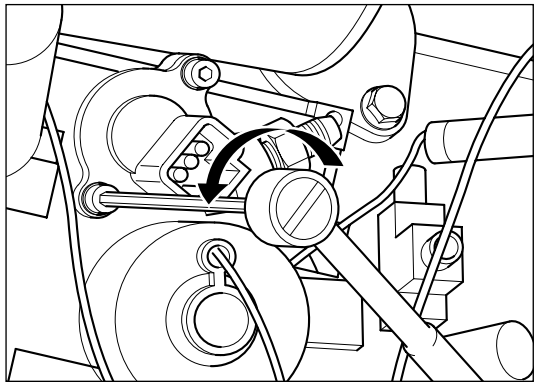




Warning
Keep fingers away from rod during actuation sequence.

M4 x 0.7 (3 mm)



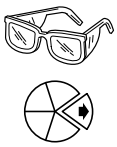


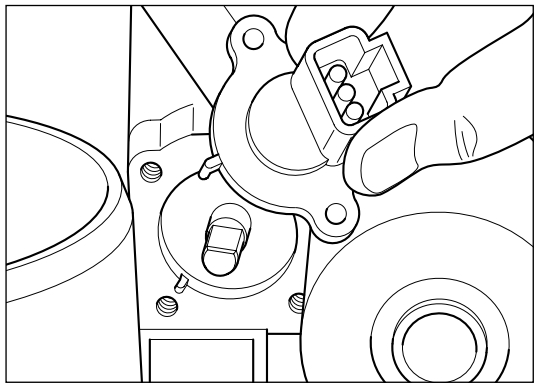
Warning
Always wear safety glasses.

Where an electrical fault is diagnosed or correct actuation is confirmed, use a socket wrench and rachet to loosen and remove 2 socket head screws.

Caution
Breaking the sealed fastener joints may require significant torque. It is essential that the socket wrench is properly engaged to avoid inadvertent damage to connector resulting from spanner slip.

Extract the position sensor and refer to ***Position Sensor Replacement***.



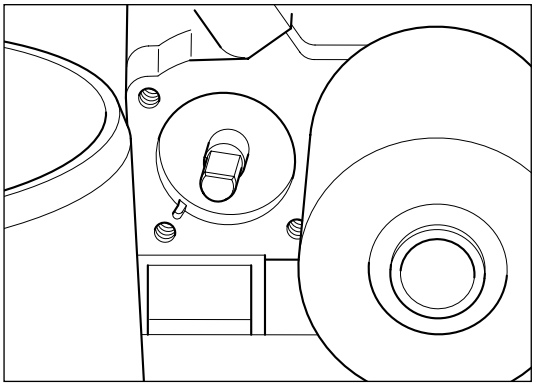


Position Sensor Replacement

Position sensor kits (152) are available.

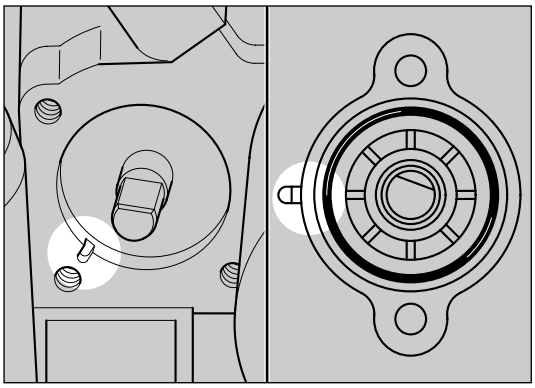
Warning
Always wear safety glasses.

Ensure clamped surfaces are clean prior to inserting position sensor.



The sensor flange features a mechanical baulk (tab) to ensure correct sensor orientation.

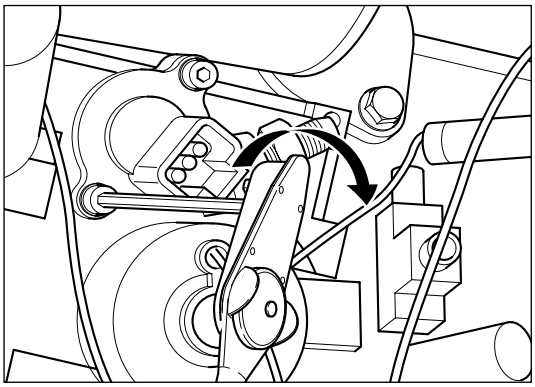
First ensure o ring seal is greased and in position. Engage sensor on to flatted shaft then locate flange baulk into housing face location.



4 mm X 0.7 (3mm)

New socket head screws are provided in position sensor service kit (152). These have patch sealant feature and must be fitted dry.

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



Caution
It is not recommended to use the original fasteners when re-fitting an original or new position sensor.

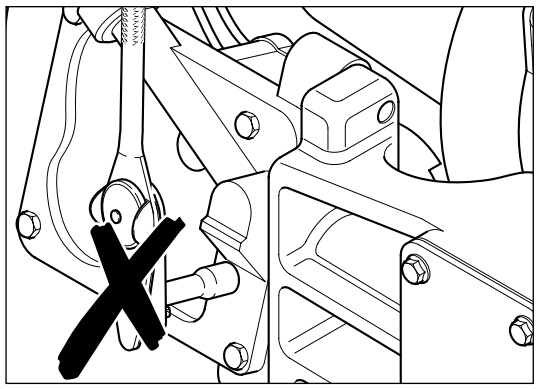
Caution
Where an original fastener must be used, it is important that the threads are clean and thread locking compound is applied to achieve a vibration proof connection. Fastener torque must be applied within the time allowed by the sealant manufacturer.

Caution
To avoid feedback error to ECM always disconnect motor before position sensor. Reconnect position sensor before motor.

Actuator Check and Removal

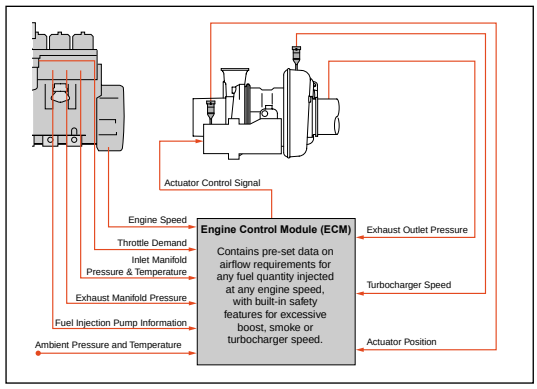
Caution
Actuator checks should be carried out on engine. If actuator or turbocharger removal is necessary, engine systems are disrupted:

- Water system drained
- Position sensor disconnected
- Speed sensor disconnected
- Oil circuit disassembled



Caution
Never remove actuator mechanism 5-bolt cover plate as this will adversely effect actuator clearance conditions.

Note
Always refer to ECM diagnostics for possible actuation fault data.



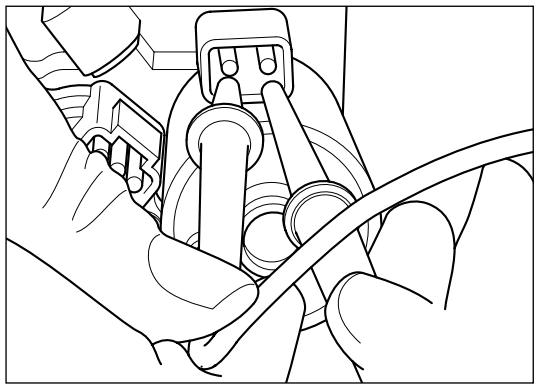
The Engine Control Module (ECM) features a key-on calibration check of the VG actuation system. When combined with electro-mechanical checks, it will potentially detect faults in:

- VG mechanism
- VG actuator
- Position sensor

Where key-on calibration or ***On Engine Actuation Checks*** have indicated an actuation fault, confirmatory electromechanical checks are recommended.

Ensure electrical integrity of actuator motor wiring and connectors.

Disconnect the DC motor at its electrical connector. Using a multi-meter, check the resistance between connector pins 1 and 2 is 0.25 / 1.25 ohms.

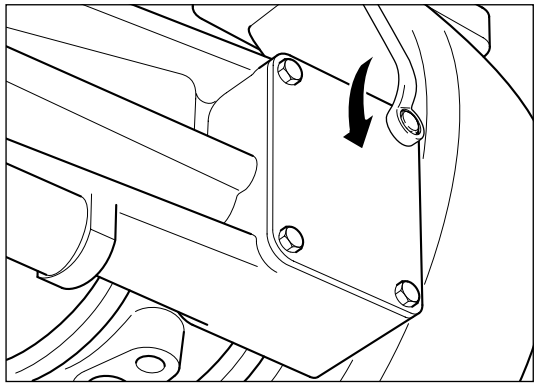


Caution
To avoid feedback error to ECM always disconnect motor before position sensor. Reconnect position sensor before motor.

If resistance is outside range replace actuator by refering to ***Actuator Replacement***.

M6 x 1.0 (8 mm)

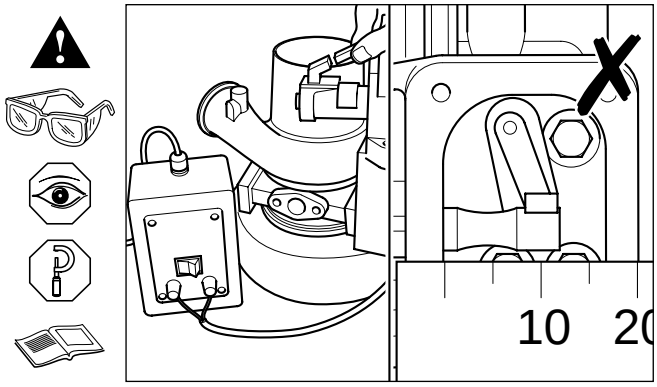
If resistance is within range remove 4 bolt actuator coverplate and gasket to expose actuator rod end.



Warning
Always wear safety glasses.

Note
Where it is not possible to remove actuator coverplate on engine remove turbocharger from engine in accordance with engine service manual.

Apply system voltage to actuator motor through on/off switch. If actuator travel is outside range shown in ***Service Data Sheet***, remove actuator.



Warning
Keep fingers away from rod during on/off actuating sequence.

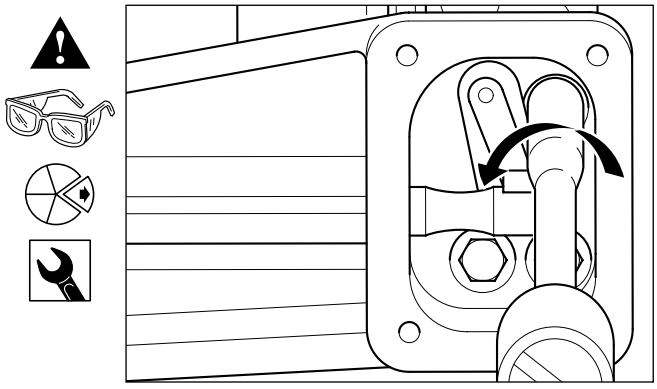
Warning
Always wear safety glasses.

Actuator Removal

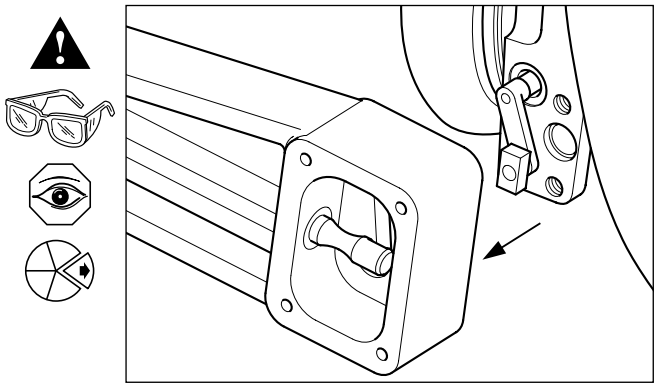
M8 x 1.25 (10 mm)

Where it is not possible to remove actuator coverplate on engine remove turbocharger from engine in accordance with engine service manua.l.

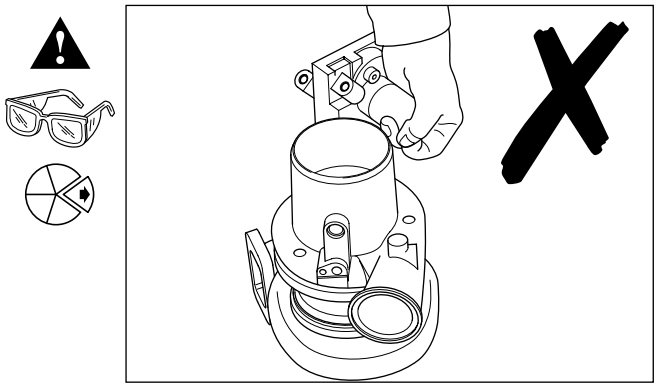
4 bolt coverplate and gasket removal provides access to 3 actuator caphead fasteners. Use socket wrench and ratchet to loosen and extract screws whilst holding actuator in position.



Carefully slide actuator rod from slot location with pivot block.



Remove actuator.



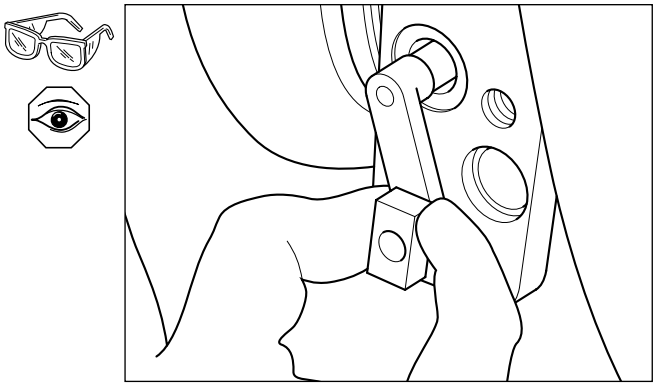
Warning
Do not use actuator motor as a lifting handle particularly when actuator is assembled to turbocharger.

Note
With actuator removed it is logical to carry out ***VG mechanism check*** before continuing with actuator diagnostic.

VG Mechanism Check

With actuator removed it is possible to check that pivot block if free to rotate and move axially on cross shaft crankpin.

If pivot block is seized or if force is required to move pivot block on crankpin, replace turbocharger.

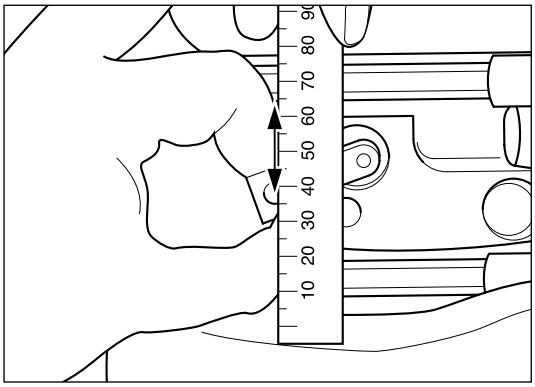


If pivot block rotates freely, remove pivot block and check linear travel of VG cross shaft pin is within permissible range shown in ***Service Data Sheet***.

If pin shows no resistance to motion, does not travel within permissible range replace turbocharger.

Caution △

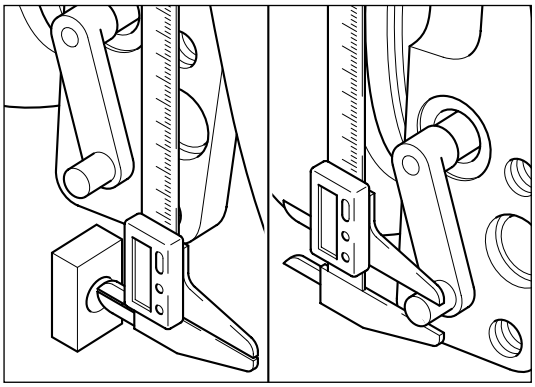
Use moderate hand force only to rotate cross shaft



If pin travel within range, check pivot block bore and crankpin diameter.

If pivot block bore is greater than 6.04 mm (0.238 in) replace pivot block.

If crankpin diameter is less than 5.99 mm (0.236 in) replace turbocharger.

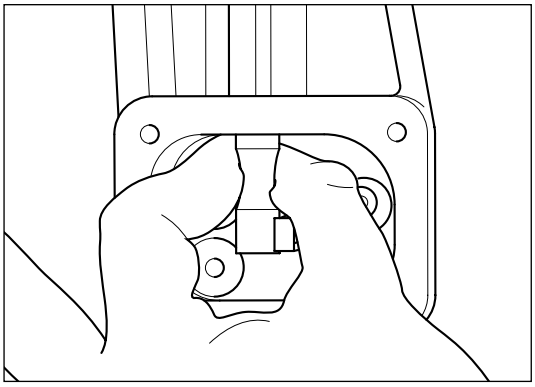


Remote Actuator Check

Note
Always refer to ECM diagnostics for possible actuation fault data.

Disconnect electrical supply. Check actuator rod backlash is less than the value shown in the ***Service Data Sheet***.

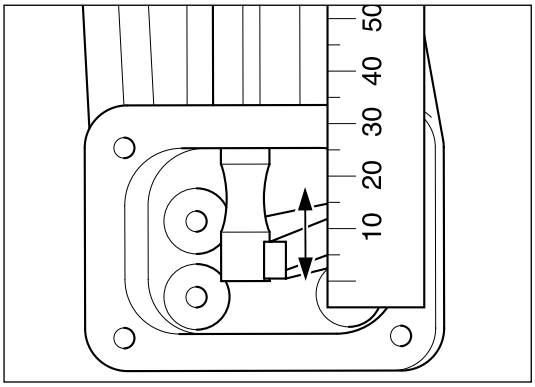
Caution
To avoid feedback error to ECM always disconnect motor before position sensor. Reconnect position sensor before motor.



Apply system voltage to actuator motor.

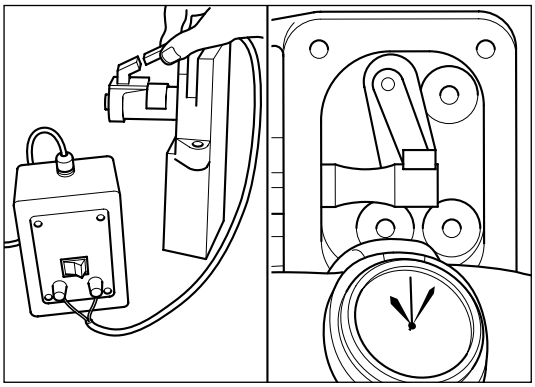
Use a steel rule to check actuator travel is within permissible range shown in ***Service Data Sheet***.

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

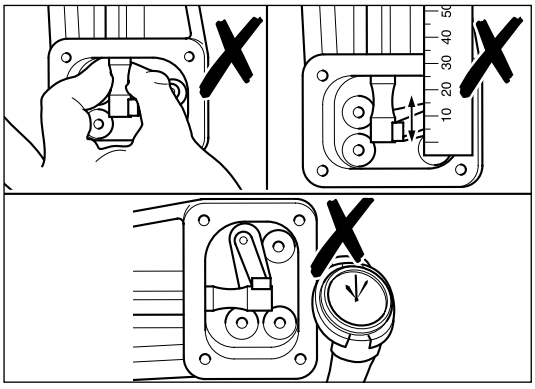


Apply system voltage to actuator motor through on/off switch. Switch voltage to retract and extend actuator rod. Check actuation cycle can be completed in 5 seconds.

Warning
Keep fingers away from rod during actuation sequence.



If any of three test results are outside specified value replace actuator by refering to ***Actuator Replacement***.



Actuator Replacement

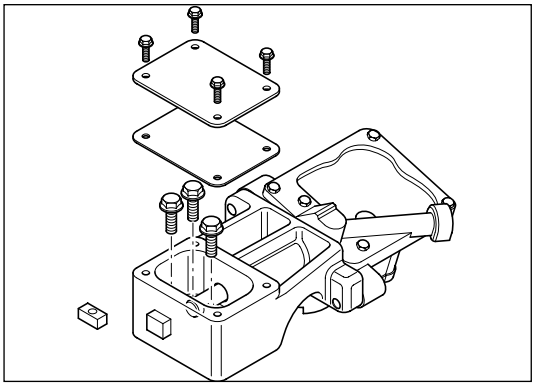
Warning
Always wear safety glasses.

Actuator service kits are available (121).

Used actuators may be refitted depending on ECM fault diagnostics and confirmatory turbocharger investigations using the processes set out in this Service Manual.

Actuator fitting kit (122) is recommended when refitting used actuator.

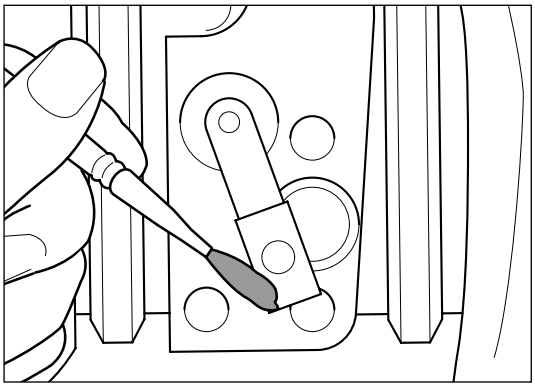
Apply high temperature grease (eg Molycote) to cross shaft pin.



Caution
Ensure cross shaft pin, grease applicator and pivot block bore are clean.

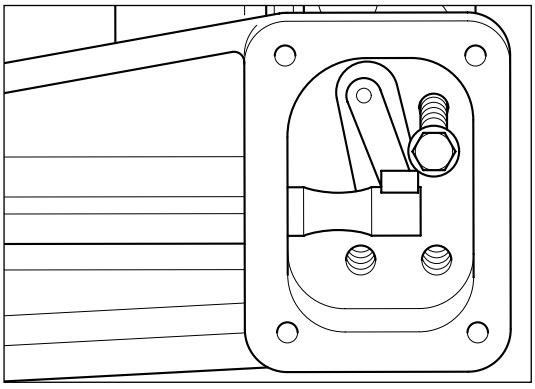
Position pivot block on pin ensuring it is in line with crank arm.

Ensure actuator rod is in mid travel. This assists with insertion of pivot block through aperture in actuator mounting face and location into mating slot in actuator rod.



Note
Always check VG cross shaft movement prior to refitting or replacing actuator.

Ensure actuator fasteners and tapped holes in bearing housing are clean and dry before inserting fasteners.

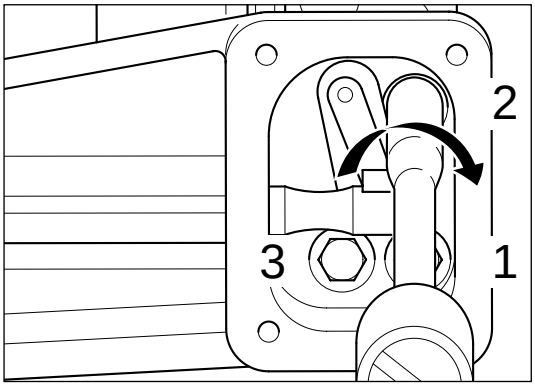


Caution
It is not recommended to use the original fasteners when re-fitting an original or new actuator.

Caution
Where an original fastener must be used, it is important that the threads are clean and thread-locking compound is applied to achieve a vibration proof connection. Fastener torque must be applied within the time allowed by the sealant manufacturers.

Warning
Always wear safety glasses.

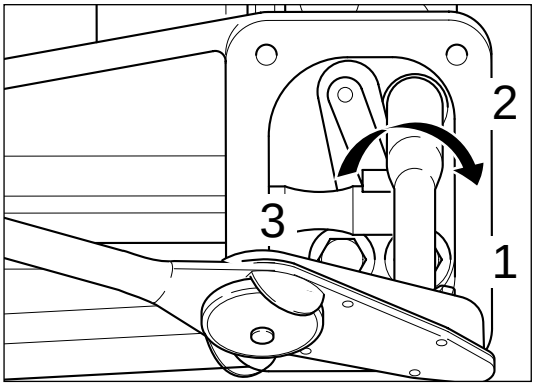
Assemble three fasteners loosely in sequence.



Use a calibrated torque wrench to tighten three screws in sequence to value specified in ***Service Data Sheet***.

Warning
Always wear safety glasses.

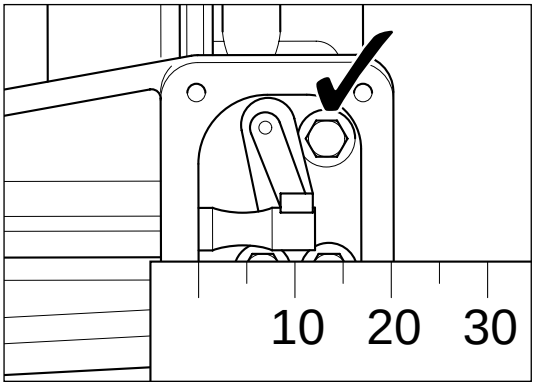
Caution
The torquing sequence is important to prevent road spray ingress.



At this stage, prior to fitting coverplate. It is possible to verify correct actuator movement.

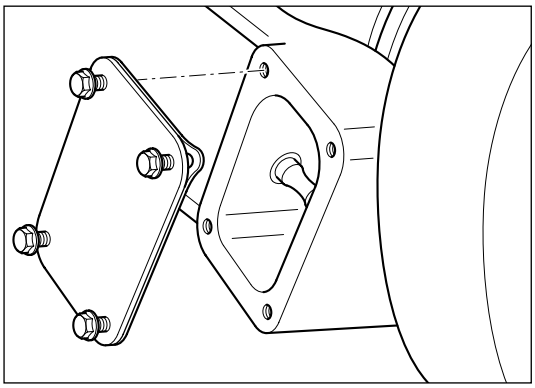
Apply system voltage to actuator motor through on/off switch. Check rod end travel is within range shown in ***Service Data Sheet***.

Caution
To avoid feedback error to ECM always disconnect Motor before position sensor. Reconnect position sensor before motor.

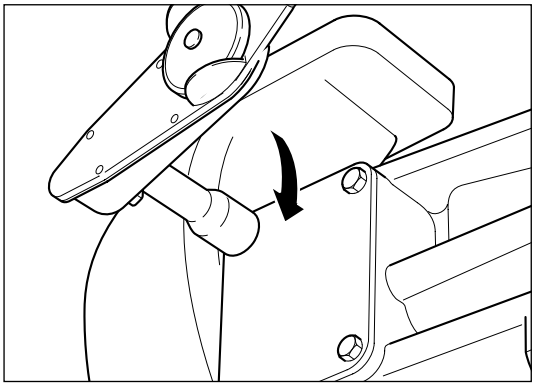


M6 X 1.0 (8 mm)

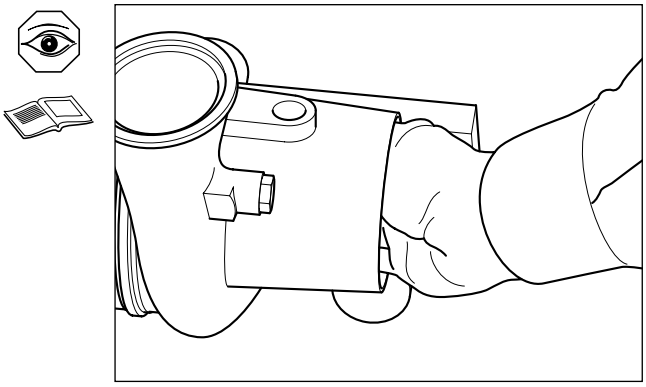
Sub-assemble 4-bolt coverplate and gasket using the push fit of the cap head screws in the gasket.



Using a calibrated torque wrench, torque tighten the 4 cap head screws to the value shown in the ***Service Data Sheet***.



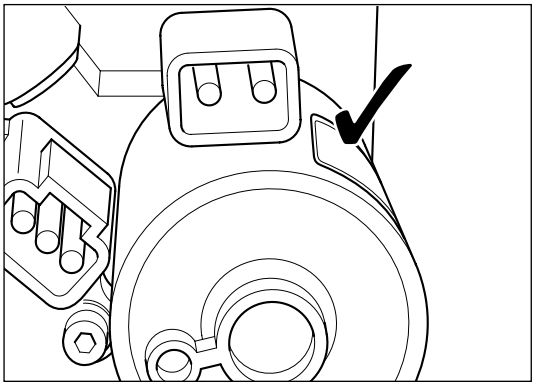
Ensure rotor assembly freely rotates prior to engine mounting.



Caution △

Ensure dataplate label is transferred from old to new actuator to maintain record of essential turbocharger information.

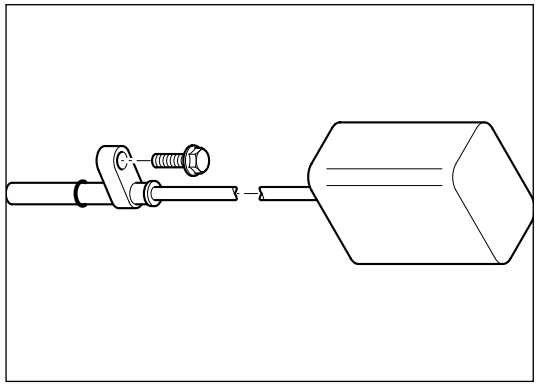
△



Speed Sensor Check and Removal

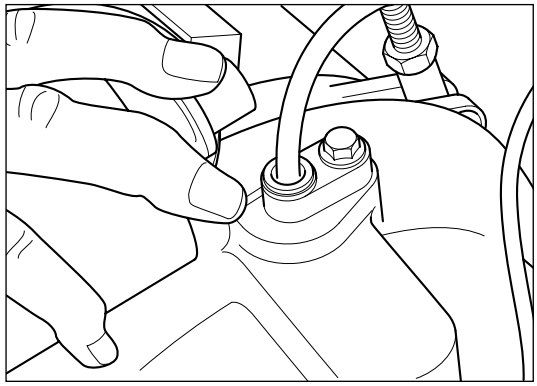
Where the ECM signals a speed signal error, check the connection to the engine wiring harness is good. If error persists change speed sensor.

Caution
The speed sensor connector contains electronic components. Multimeter or other electrical tests can damage the sensor.



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

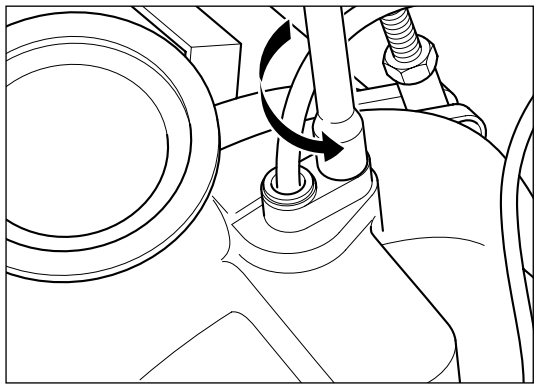
Warning
Always wear safety glasses during disassembly.



M6 x 1.0 (8 mm)

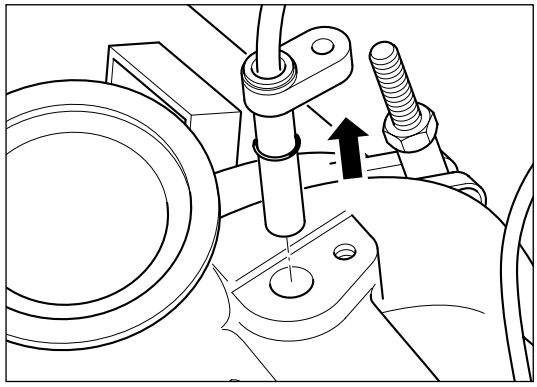
Using the socket wrench and ratchet, loosen and remove the cap head screw, speed sensor.

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



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

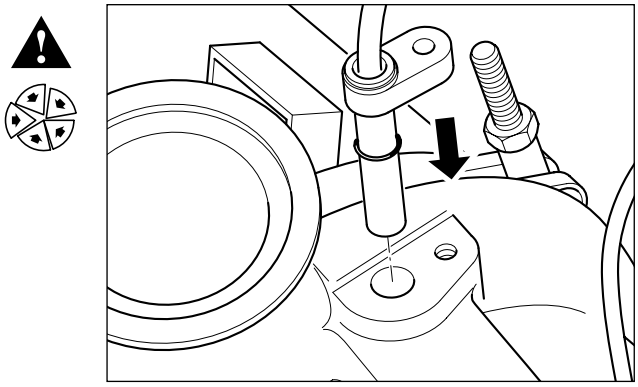
Place the speed sensor on a clean surface to avoid collection of unwanted ferrous particles.



Speed Sensor Replacement

Speed sensor kits (124) are available.

Warning
Always wear safety glasses during disassembly.



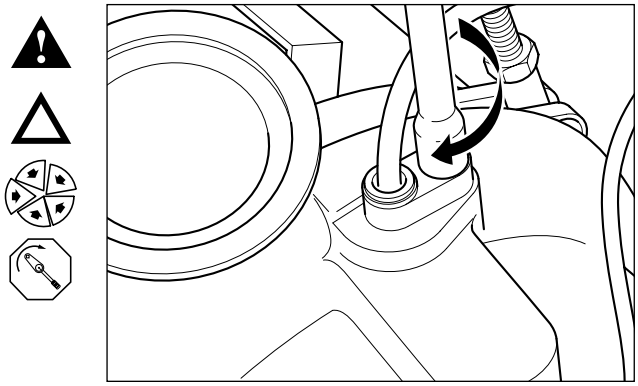
Prior to inserting speed sensor ensure it is clean and unable to collect magnetic particles as it is inserted. Ensure the o-ring seal is in position on the sensor body.

The o-ring moves automatically into its fitted position during insertion.

M6 x 1.0 (8 mm)

Use new cap head screw with patch sealant feature provided in service kit (124) to fasten speed sensor flange to bearing housing.

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



Caution
It is not recommended to use the original fastener when re-fitting an original or new speed sensor.

Caution
Where an original fastener must be used, it is important that the threads are clean and thread locking compound is applied to achieve a vibration proof connection. Fastener torque must be applied within the time allowed by the sealant manufacture.

HOLSET®
TURBOCHARGERS

Holset HE341Ve
Service Manual

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