SERVICE MANUAL

T8.320 / T8.350 / T8.380 / T8.410 / T8.435 / T8.380 SmartTrax™ / T8.410 SmartTrax™ / T8.435 SmartTrax™ Continuously Variable Transmission (CVT)

Tractor

PIN ZFRE03123 and above

Part number 47917992
1st edition English
October 2015

SERVICE MANUAL

T8.320 CVT TIER 4B [ZFRE03123 -] , T8.350 CVT TIER 4B [ZFRE03123 -] , T8.380 CVT TIER 4B [ZFRE03123 -] , T8.380 SmartTrax™ PST TIER 4B [ZFRE03123 -] , T8.410 CVT TIER 4B [ZFRE03123 -] , T8.410 SmartTrax™ PST TIER 4B [ZFRE03123 -] , T8.435 CVT TIER 4B [ZFRE03123 -] , T8.435 SmartTrax™ CVT TIER 4B [ZFRE03123 -]

Link Product / Engine

Product	Market Product	Engine
T8.320 CVT TIER 4B [ZFRE03123 -]	Europe	F2CFE613G*B002
T8.350 CVT TIER 4B [ZFRE03123 -]	Europe	F2CFE614G*B003
T8.380 CVT TIER 4B [ZFRE03123 -]	Europe	F2CFE614D*B003
T8.410 CVT TIER 4B [ZFRE03123 -]	Europe	F2CFE614C*B002
T8.435 CVT TIER 4B [ZFRE03123 -]	Europe	F2CFE614A*B002
T8.380 SmartTrax™ PST TIER 4B [ZFRE03123 -]	Europe	F2CFE614D*B002
T8.410 SmartTrax™ PST TIER 4B [ZFRE03123 -]	Europe	F2CFE614C*B002
T8.435 SmartTrax™ CVT TIER 4B [ZFRE03123 -]	Europe	F2CFE614A*B002

Contents

INTRODUCTION

Contents

INTRODUCTION

Foreword - Important notice regarding equipment servicing

All repair and maintenance work listed in this manual must be carried out only by qualified dealership personnel, strictly complying with the instructions given, and using, whenever possible, the special tools.

Anyone who performs repair and maintenance operations without complying with the procedures provided herein shall be responsible for any subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional, or local dealers, reject any responsibility for damages caused by parts and/or components not approved by the manufacturer, including those used for the servicing or repair of the product manufactured or marketed by the manufacturer. In any case, no warranty is given or attributed on the product manufactured or marketed by the manufacturer in case of damages caused by parts and/or components not approved by the manufacturer.

The information in this manual is up-to-date at the date of the publication. It is the policy of the manufacturer for continuous improvement. Some information could not be updated due to modifications of a technical or commercial type, or changes to the laws and regulations of different countries.

In case of questions, refer to your NEW HOLLAND Sales and Service Networks.

Safety rules

Personal safety

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

DANGER indicates a hazardous situation that, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: *Notice indicates a situation that, if not avoided, could result in machine or property damage.*

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

NOTE: *Note indicates additional information that clarifies steps, procedures, or other information in this manual.*

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

Safety rules - General maintenance safety

⚠ General maintenance safety⚠

Keep the area used for servicing the machine clean and dry. Clean up spilled fluids.

Service the machine on a firm, level surface.

Install guards and shields after you service the machine.

Close all access doors and install all panels after servicing the machine.

Do not attempt to clean, lubricate, clear obstructions, or make adjustments to the machine while it is in motion or while the engine is running.

Always make sure that working area is clear of tools, parts, other persons and pets before you start operating the machine.

Unsupported hydraulic cylinders can lose pressure and drop the equipment, causing a crushing hazard. Do not leave equipment in a raised position while parked or during service, unless the equipment is securely supported.

Jack or lift the machine only at jack or lift points indicated in this manual.

Incorrect towing procedures can cause accidents. When you tow a disabled machine follow the procedure in this manual. Use only rigid tow bars.

Stop the engine, remove the key, and relieve pressure before you connect or disconnect fluid lines.

Stop the engine and remove the key before you connect or disconnect electrical connections.

Scalding can result from incorrect removal of coolant caps. Cooling systems operate under pressure. Hot coolant can spray out if you remove a cap while the system is hot. Allow the system to cool before you remove the cap. When you remove the cap, turn it slowly to allow pressure to escape before you completely remove the cap.

Replace damaged or worn tubes, hoses, electrical wiring, etc.

The engine, transmission, exhaust components, and hydraulic lines may become hot during operation. Take care when you service such components. Allow surfaces to cool before you handle or disconnect hot components. Wear protective equipment when appropriate.

When welding, follow the instructions in the manual. Always disconnect the battery before you weld on the machine. Always wash your hands after you handle battery components.

Safety rules - Personal Protective Equipment (PPE)

⚠ Personal Protective Equipment (PPE) ⚠

Wear Personal Protective Equipment (PPE) such as hard hat, eye protection, heavy gloves, hearing protection, protective clothing, etc.

Safety rules - Do Not Operate tag

⚠ Do Not Operate tag ⚠

Before you start servicing the machine, attach a ‘Do Not Operate’ warning tag to the machine in an area that will be visible.

Safety rules - Ecology and the environment

Soil, air, and water are vital factors of agriculture and life in general. When legislation does not yet rule the treatment of some of the substances required by advanced technology, sound judgment should govern the use and disposal of products of a chemical and petrochemical nature.

NOTE: *The following are recommendations that may be of assistance:*

- Become acquainted with and ensure that you understand the relative legislation applicable to your country.
- Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, antifreeze, cleaning agents, etc., with regard to their effect on man and nature and how to safely store, use, and dispose of these substances.
- Agricultural consultants will, in many cases, be able to help you as well.

Helpful hints

- Avoid filling tanks using cans or inappropriate pressurized fuel delivery systems that may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of them contain substances that may be harmful to your health.
- Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
- Avoid spillage when draining off used engine coolant mixtures, engine, gearbox and hydraulic oils, brake fluids, etc. Do not mix drained brake fluids or fuels with lubricants. Store them safely until they can be disposed of in a proper way to comply with local legislation and available resources.
- Modern coolant mixtures, i.e. antifreeze and other additives, should be replaced every two years. They should not be allowed to get into the soil, but should be collected and disposed of properly.
- Do not open the air-conditioning system yourself. It contains gases that should not be released into the atmosphere. Your NEW HOLLAND dealer or air conditioning specialist has a special extractor for this purpose and will have to recharge the system properly.
- Repair any leaks or defects in the engine cooling or hydraulic system immediately.
- Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
- Protect hoses during welding as penetrating weld splatter may burn a hole or weaken them, allowing the loss of oils, coolant, etc.

Torque - Minimum tightening torques for normal assembly

METRIC NON-FLANGED HARDWARE

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.2 N·m (19 lb in)	2.9 N·m (26 lb in)	3.2 N·m (28 lb in)	4.2 N·m (37 lb in)	2 N·m (18 lb in)	2.9 N·m (26 lb in)
M5	4.5 N·m (40 lb in)	5.9 N·m (52 lb in)	6.4 N·m (57 lb in)	8.5 N·m (75 lb in)	4 N·m (36 lb in)	5.8 N·m (51 lb in)
M6	7.5 N·m (66 lb in)	10 N·m (89 lb in)	11 N·m (96 lb in)	15 N·m (128 lb in)	6.8 N·m (60 lb in)	10 N·m (89 lb in)
M8	18 N·m (163 lb in)	25 N·m (217 lb in)	26 N·m (234 lb in)	35 N·m (311 lb in)	17 N·m (151 lb in)	24 N·m (212 lb in)
M10	37 N·m (27 lb ft)	49 N·m (36 lb ft)	52 N·m (38 lb ft)	70 N·m (51 lb ft)	33 N·m (25 lb ft)	48 N·m (35 lb ft)
M12	64 N·m (47 lb ft)	85 N·m (63 lb ft)	91 N·m (67 lb ft)	121 N·m (90 lb ft)	58 N·m (43 lb ft)	83 N·m (61 lb ft)
M16	158 N·m (116 lb ft)	210 N·m (155 lb ft)	225 N·m (166 lb ft)	301 N·m (222 lb ft)	143 N·m (106 lb ft)	205 N·m (151 lb ft)
M20	319 N·m (235 lb ft)	425 N·m (313 lb ft)	440 N·m (325 lb ft)	587 N·m (433 lb ft)	290 N·m (214 lb ft)	400 N·m (295 lb ft)
M24	551 N·m (410 lb ft)	735 N·m (500 lb ft)	762 N·m (560 lb ft)	1016 N·m (750 lb ft)	501 N·m (370 lb ft)	693 N·m (510 lb ft)

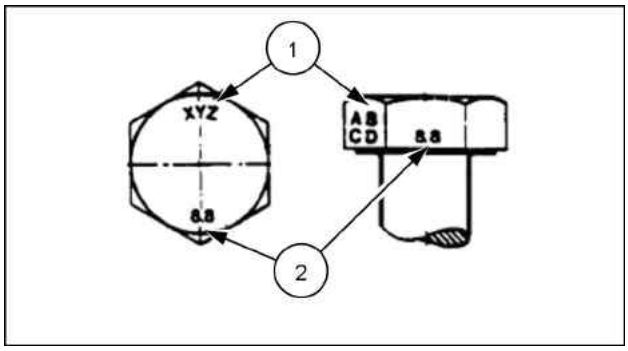
NOTE: *M4 through M8 hardware torque specifications are shown in pound-inches. M10 through M24 hardware torque specifications are shown in pound-feet.*

METRIC FLANGED HARDWARE

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.4 N·m (21 lb in)	3.2 N·m (28 lb in)	3.5 N·m (31 lb in)	4.6 N·m (41 lb in)	2.2 N·m (19 lb in)	3.1 N·m (27 lb in)
M5	4.9 N·m (43 lb in)	6.5 N·m (58 lb in)	7.0 N·m (62 lb in)	9.4 N·m (83 lb in)	4.4 N·m (39 lb in)	6.4 N·m (57 lb in)
M6	8.3 N·m (73 lb in)	11 N·m (96 lb in)	12 N·m (105 lb in)	16 N·m (141 lb in)	7.5 N·m (66 lb in)	11 N·m (96 lb in)
M8	20 N·m (179 lb in)	27 N·m (240 lb in)	29 N·m (257 lb in)	39 N·m (343 lb in)	18 N·m (163 lb in)	27 N·m (240 lb in)
M10	40 N·m (30 lb ft)	54 N·m (40 lb ft)	57 N·m (42 lb ft)	77 N·m (56 lb ft)	37 N·m (27 lb ft)	53 N·m (39 lb ft)
M12	70 N·m (52 lb ft)	93 N·m (69 lb ft)	100 N·m (74 lb ft)	134 N·m (98 lb ft)	63 N·m (47 lb ft)	91 N·m (67 lb ft)
M16	174 N·m (128 lb ft)	231 N·m (171 lb ft)	248 N·m (183 lb ft)	331 N·m (244 lb ft)	158 N·m (116 lb ft)	226 N·m (167 lb ft)
M20	350 N·m (259 lb ft)	467 N·m (345 lb ft)	484 N·m (357 lb ft)	645 N·m (476 lb ft)	318 N·m (235 lb ft)	440 N·m (325 lb ft)
M24	607 N·m (447 lb ft)	809 N·m (597 lb ft)	838 N·m (618 lb ft)	1118 N·m (824 lb ft)	552 N·m (407 lb ft)	

IDENTIFICATION

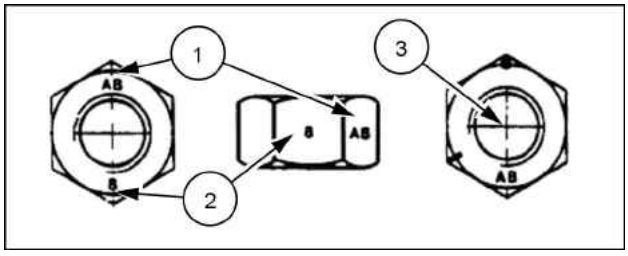
Metric Hex head and carriage bolts, classes 5.6 and up



20083680 1

1. Manufacturer's Identification
2. Property Class

Metric Hex nuts and locknuts, classes 05 and up



20083681 2

1. Manufacturer's Identification
2. Property Class
3. Clock Marking of Property Class and Manufacturer's Identification (Optional), i.e. marks **60 °** apart indicate Class 10 properties, and marks **120 °** apart indicate Class 8.

INCH NON-FLANGED HARDWARE

NOMINAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrB W/ Gr5 BOLT	LOCKNUT GrC W/ Gr8 BOLT
	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	**8 N·m (71 lb in)**	**11 N·m (97 lb in)**	**12 N·m (106 lb in)**	**16 N·m (142 lb in)**	**8.5 N·m (75 lb in)**	**12.2 N·m (109 lb in)**
5/16	**17 N·m (150 lb in)**	**23 N·m (204 lb in)**	**24 N·m (212 lb in)**	**32 N·m (283 lb in)**	**17.5 N·m (155 lb in)**	**25 N·m (220 lb in)**
3/8	**30 N·m (22 lb ft)**	**40 N·m (30 lb ft)**	**43 N·m (31 lb ft)**	**57 N·m (42 lb ft)**	**31 N·m (23 lb ft)**	**44 N·m (33 lb ft)**
7/16	**48 N·m (36 lb ft)**	**65 N·m (48 lb ft)**	**68 N·m (50 lb ft)**	**91 N·m (67 lb ft)**	**50 N·m (37 lb ft)**	**71 N·m (53 lb ft)**
1/2	**74 N·m (54 lb ft)**	**98 N·m (73 lb ft)**	**104 N·m (77 lb ft)**	**139 N·m (103 lb ft)**	**76 N·m (56 lb ft)**	**108 N·m (80 lb ft)**
9/16	**107 N·m (79 lb ft)**	**142 N·m (105 lb ft)**	**150 N·m (111 lb ft)**	**201 N·m (148 lb ft)**	**111 N·m (82 lb ft)**	**156 N·m (115 lb ft)**
5/8	**147 N·m (108 lb ft)**	**196 N·m (145 lb ft)**	**208 N·m (153 lb ft)**	**277 N·m (204 lb ft)**	**153 N·m (113 lb ft)**	**215 N·m (159 lb ft)**
3/4	**261 N·m (193 lb ft)**	**348 N·m (257 lb ft)**	**369 N·m (272 lb ft)**	**491 N·m (362 lb ft)**	**271 N·m (200 lb ft)**	**383 N·m (282 lb ft)**
7/8	**420 N·m (310 lb ft)**	**561 N·m (413 lb ft)**	**594 N·m (438 lb ft)**	**791 N·m (584 lb ft)**	**437 N·m (323 lb ft)**	**617 N·m (455 lb ft)**
1	**630 N·m (465 lb ft)**	**841 N·m (620 lb ft)**	**890 N·m (656 lb ft)**	**1187 N·m (875 lb ft)**	**654 N·m (483 lb ft)**	**924 N·m (681 lb ft)**

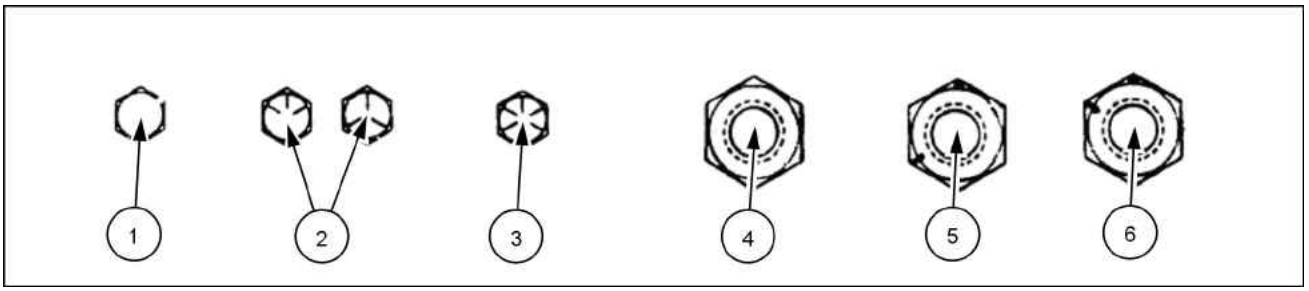
NOTE: *For Imperial Units,* ***1/4 in*** *and* ***5/16 in*** *hardware torque specifications are shown in pound-inches.* ***3/8 in*** *through* ***1 in*** *hardware torque specifications are shown in pound-feet.*

INCH FLANGED HARDWARE

NOM-INAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrF W/ Gr5 BOLT	LOCKNUT GrG W/ Gr8 BOLT
	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UNPLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	**9 N·m (80 lb in)**	**12 N·m (106 lb in)**	**13 N·m (115 lb in)**	**17 N·m (150 lb in)**	**8 N·m (71 lb in)**	**12 N·m (106 lb in)**
5/16	**19 N·m (168 lb in)**	**25 N·m (221 lb in)**	**26 N·m (230 lb in)**	**35 N·m (310 lb in)**	**17 N·m (150 lb in)**	**24 N·m (212 lb in)**
3/8	**33 N·m (25 lb ft)**	**44 N·m (33 lb ft)**	**47 N·m (35 lb ft)**	**63 N·m (46 lb ft)**	**30 N·m (22 lb ft)**	**43 N·m (32 lb ft)**
7/16	**53 N·m (39 lb ft)**	**71 N·m (52 lb ft)**	**75 N·m (55 lb ft)**	**100 N·m (74 lb ft)**	**48 N·m (35 lb ft)**	**68 N·m (50 lb ft)**
1/2	**81 N·m (60 lb ft)**	**108 N·m (80 lb ft)**	**115 N·m (85 lb ft)**	**153 N·m (113 lb ft)**	**74 N·m (55 lb ft)**	**104 N·m (77 lb ft)**
9/16	**117 N·m (86 lb ft)**	**156 N·m (115 lb ft)**	**165 N·m (122 lb ft)**	**221 N·m (163 lb ft)**	**106 N·m (78 lb ft)**	**157 N·m (116 lb ft)**
5/8	**162 N·m (119 lb ft)**	**216 N·m (159 lb ft)**	**228 N·m (168 lb ft)**	**304 N·m (225 lb ft)**	**147 N·m (108 lb ft)**	**207 N·m (153 lb ft)**
3/4	**287 N·m (212 lb ft)**	**383 N·m (282 lb ft)**	**405 N·m (299 lb ft)**	**541 N·m (399 lb ft)**	**261 N·m (193 lb ft)**	**369 N·m (272 lb ft)**
7/8	**462 N·m (341 lb ft)**	**617 N·m (455 lb ft)**	**653 N·m (482 lb ft)**	**871 N·m (642 lb ft)**	**421 N·m (311 lb ft)**	**594 N·m (438 lb ft)**
1	**693 N·m (512 lb ft)**	**925 N·m (682 lb ft)**	**979 N·m (722 lb ft)**	**1305 N·m (963 lb ft)**	**631 N·m (465 lb ft)**	**890 N·m (656 lb ft)**

IDENTIFICATION

Inch Bolts and free-spinning nuts

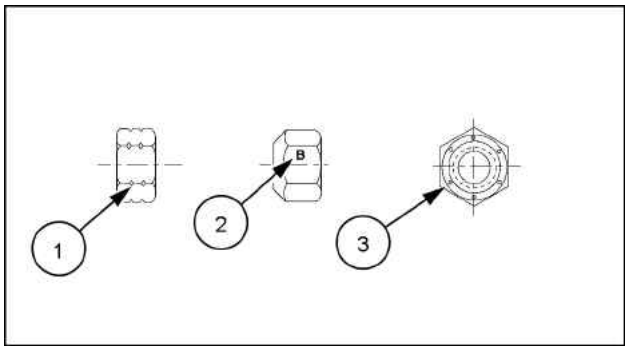


20083682 3

Grade Marking Examples

SAE Grade Identification			
1	Grade 2 - No Marks	4	Grade 2 Nut - No Marks
2	Grade 5 - Three Marks	5	Grade 5 Nut - Marks **120 °** Apart
3	Grade 8 - Five Marks	6	Grade 8 Nut - Marks **60 °** Apart

Inch Lock Nuts, All Metal (Three optional methods)



20090268 4

Grade Identification

Grade	Corner Marking Method (1)	Flats Marking Method (2)	Clock Marking Method (3)
Grade A	No Notches	No Mark	No Marks
Grade B	One Circumferential Notch	Letter B	Three Marks
Grade C	Two Circumferential Notches	Letter C	Six Marks

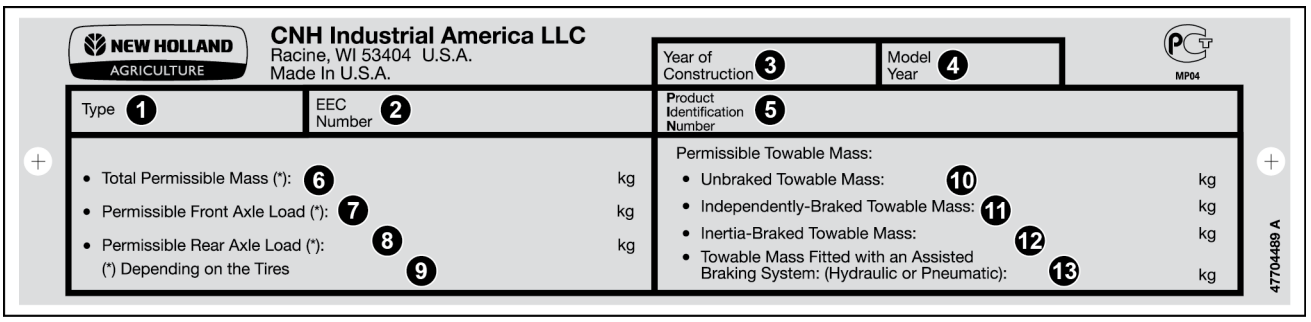
Capacities

System	Metric	U.S.	Imperial
9.0 l engine **NEW HOLLAND AMBRA UNITEK MASTERGOLD SBL CJ-4**			
Engine oil – no filter change	**25 l**	**6.6 US gal**	**5.5 UK gal**
Engine oil – with filter change	**25 l**	**6.6 US gal**	**5.5 UK gal**
Cooling system	**26.5 l**	**7 US gal**	**5.8 UK gal**
Transmission/hydraulic system – **NEW HOLLAND AMBRA MASTERTRAN® ULTRACTION**			
Wheeled Powershift with standard rear axle	**172 l**	**45.5 US gal**	**38 UK gal**
Wheeled Powershift with heavy duty rear axle	**184 l**	**48.5 US gal**	**40.4 UK gal**
Track Powershift with heavy duty rear axle	**160 l**	**42.5 US gal**	**35.2 UK gal**
Wheeled Continuously Variable transmission (CVT) with standard rear axle	**187 l**	**49.5 US gal**	**41.25 UK gal**
Wheeled Continuously Variable transmission (CVT) with heavy duty rear axle	**206 l**	**54.5 US gal**	**45.4 UK gal**
Track Continuously Variable transmission (CVT) with heavy duty rear axle	**184 l**	**48.5 US gal**	**40.4 UK gal**
Mechanical Front Drive (MFD) axles — **TUTELA HYPOIDE EP GEAR LUBE** or **NEW HOLLAND AMBRA HYPOIDE 140**			
Class 4.75 fixed and saddle suspended front axle			
Differential	**16.5 l**	**17.4 US qt**	**29.0 UK pt**
Planetary (each)	**4.3 l**	**9.1 US pt**	**7.6 UK pt**
Class 5.0 fixed and saddle suspended front axle			
Differential	**16.5 l**	**17.4 US qt**	**29.0 UK pt**
Planetary (each)	**4.5 l**	**9.5 US pt**	**8 UK pt**
Class 5.0 wide fixed and saddle suspended front axle			
Differential	**17.0 l**	**18.0 US qt**	**30.0 UK pt**
Planetary (each)	**4.5 l**	**9.5 US pt**	**8 UK pt**
Front PTO	**4.2 l**	**4.4 US qt**	--
Track undercarriage idler/roller wheel hubs			
Idler hub - SAE 50W TO 4 oil	**600 mL**	**20 US fl oz**	**21.1 UK fl oz**
Roller hub - SAE 30W engine oil	**250 mL**	**8 US fl oz**	**8.8 UK fl oz**
DEF/ADBLUE® tank	**87 l**	**23 US gal**	**23.8 UK gal**
Fuel tank			
Tractors with rear wheels	**636 l**	**168 US gal**	**140 UK gal**
Tractors with rear tracks	**662 l**	**175 US gal**	**146 UK gal**

Product identification

Tractor model and product identification number

Write your model number, product identification number (PIN) or serial number of major components on the lines provided. If needed, give these numbers to your dealer when you need parts or information for your machine.



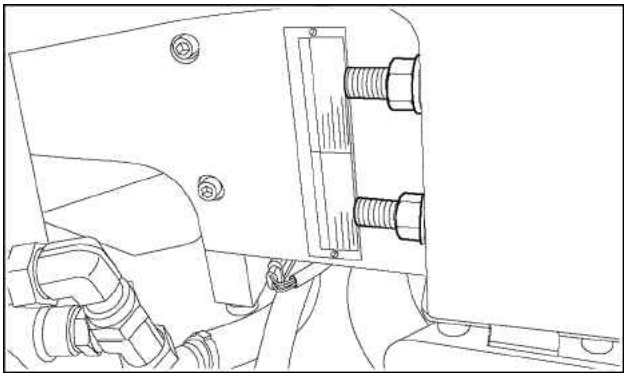
RAIL14TR02079EA 1

1. Type	8. Permissible rear axle load (*):
2. EEC number	9. (*) Depending on the tires
3. Year of construction	Permissible towable mass:
4. Model year	• 10. Unbraked towable mass:
5. Product identification number	• 11. Independently-braked towable mass:
6. Total permissible mass (*):	• 12. Inertia braked towable mass:
7. Permissible front axle load (*):	• 13. Towable mass fitted with an assisted braking system: (hydraulic or pneumatic)

Model :

Serial number:

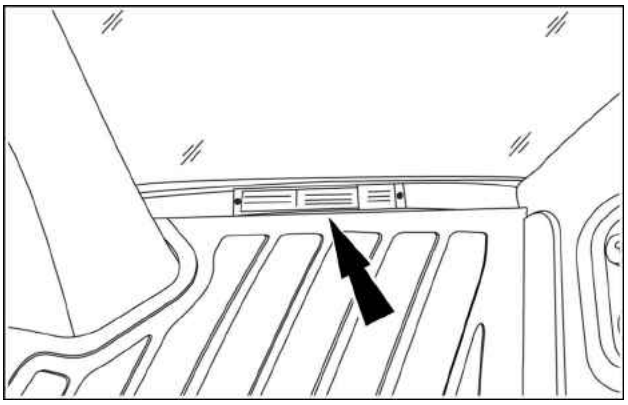
NOTE: *Located on right hand front casting. Pin plate may be mounted vertically or horizontally.*



RCPH11CCH117AAB 2

Roll Over Protective Structure (ROPS) serial number

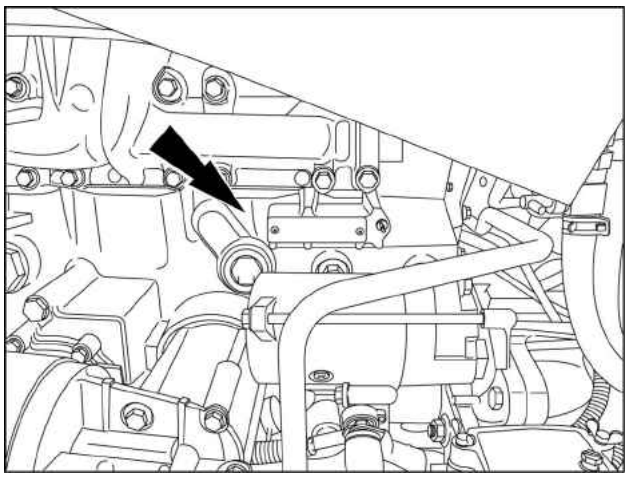
NOTE: *Located on the right hand cab floor.*



RCPH11CCH014AAB 3

Engine serial number

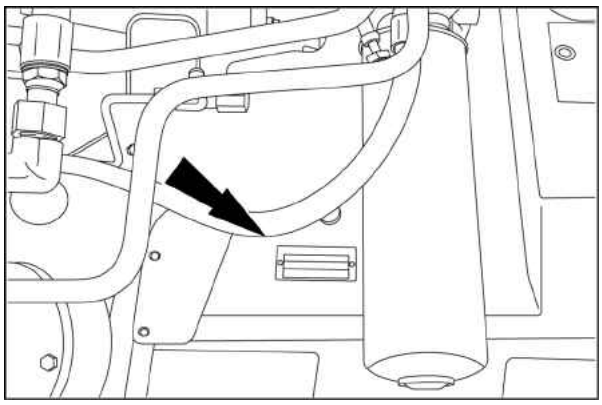
NOTE: *Located on the valve cover. The serial number is also etched into the left hand side of the engine block, just below the oil cooler.*



RAIL12TR02140AA 4

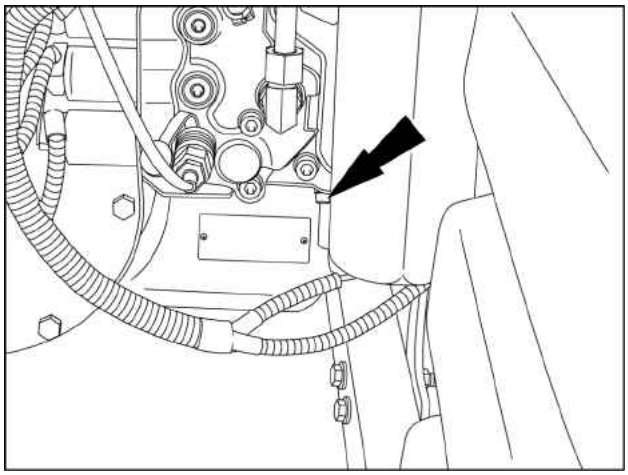
Transmission serial number

NOTE: *Located on the right hand side of the transmission to the left of the main hydraulic filter.*



RAIL12TR01410AA 5

Powershift transmission

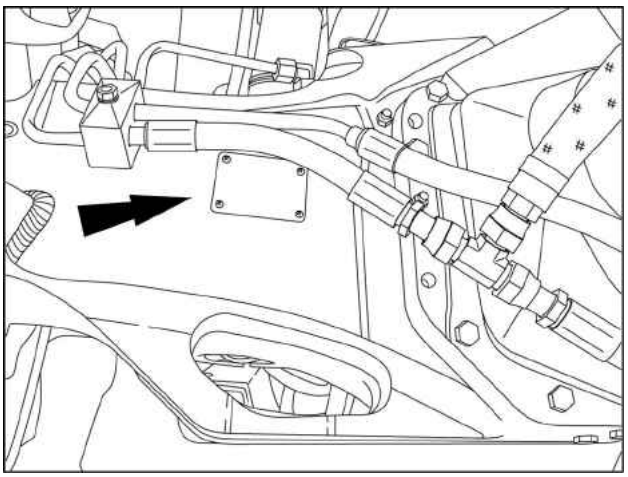


RAIL12TR02191AA 6

Auto Command

Axle serial number

Located on the rear left hand side of the class 4.75 fixed, 4.75 saddle suspended, 5.0 fixed and 5.0 saddle suspended front axle housings. (example shown)



RAIL12TR02142AA 7

SERVICE MANUAL

Engine

T8.320 CVT TIER 4B [ZFRE03123 -] , T8.350 CVT TIER 4B [ZFRE03123 -] , T8.380 CVT TIER 4B [ZFRE03123 -] , T8.380 SmartTrax™ PST TIER 4B [ZFRE03123 -] , T8.410 CVT TIER 4B [ZFRE03123 -] , T8.410 SmartTrax™ PST TIER 4B [ZFRE03123 -] , T8.435 CVT TIER 4B [ZFRE03123 -] , T8.435 SmartTrax™ CVT TIER 4B [ZFRE03123 -]

Contents

Engine - 10

Engine - 10

Engine and crankcase - 001

T8.320 CVT TIER 4B [ZFRE03123 -] , T8.350 CVT TIER 4B [ZFRE03123 -] , T8.380 CVT TIER 4B [ZFRE03123 -] , T8.380 SmartTrax™ PST TIER 4B [ZFRE03123 -] , T8.410 CVT TIER 4B [ZFRE03123 -] , T8.410 SmartTrax™ PST TIER 4B [ZFRE03123 -] , T8.435 CVT TIER 4B [ZFRE03123 -] , T8.435 SmartTrax™ CVT TIER 4B [ZFRE03123 -]

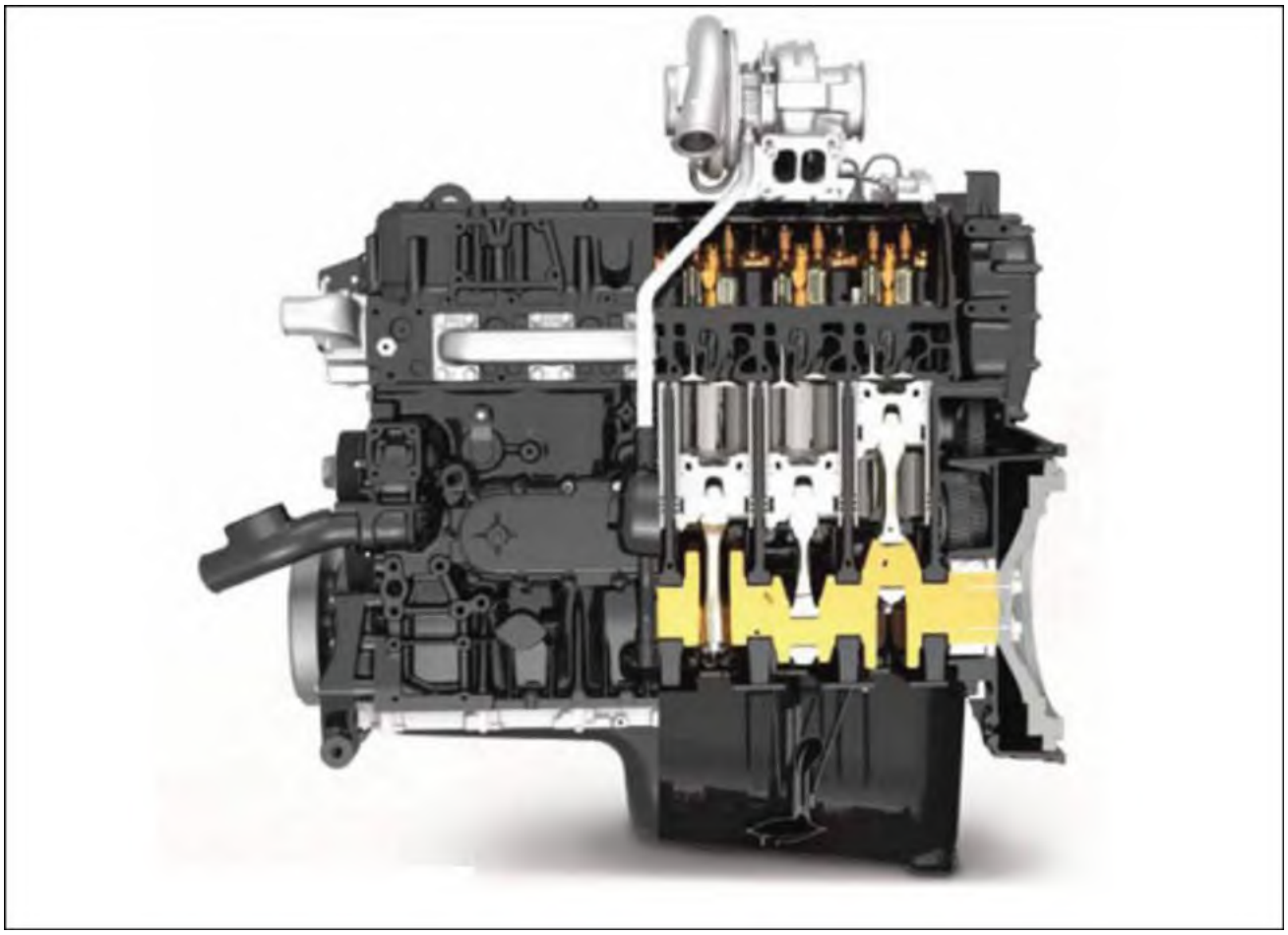
Contents

Engine - 10

Engine and crankcase - 001

Engine - Overview

The Cursor® 9



RAIL15TR00417GA 1

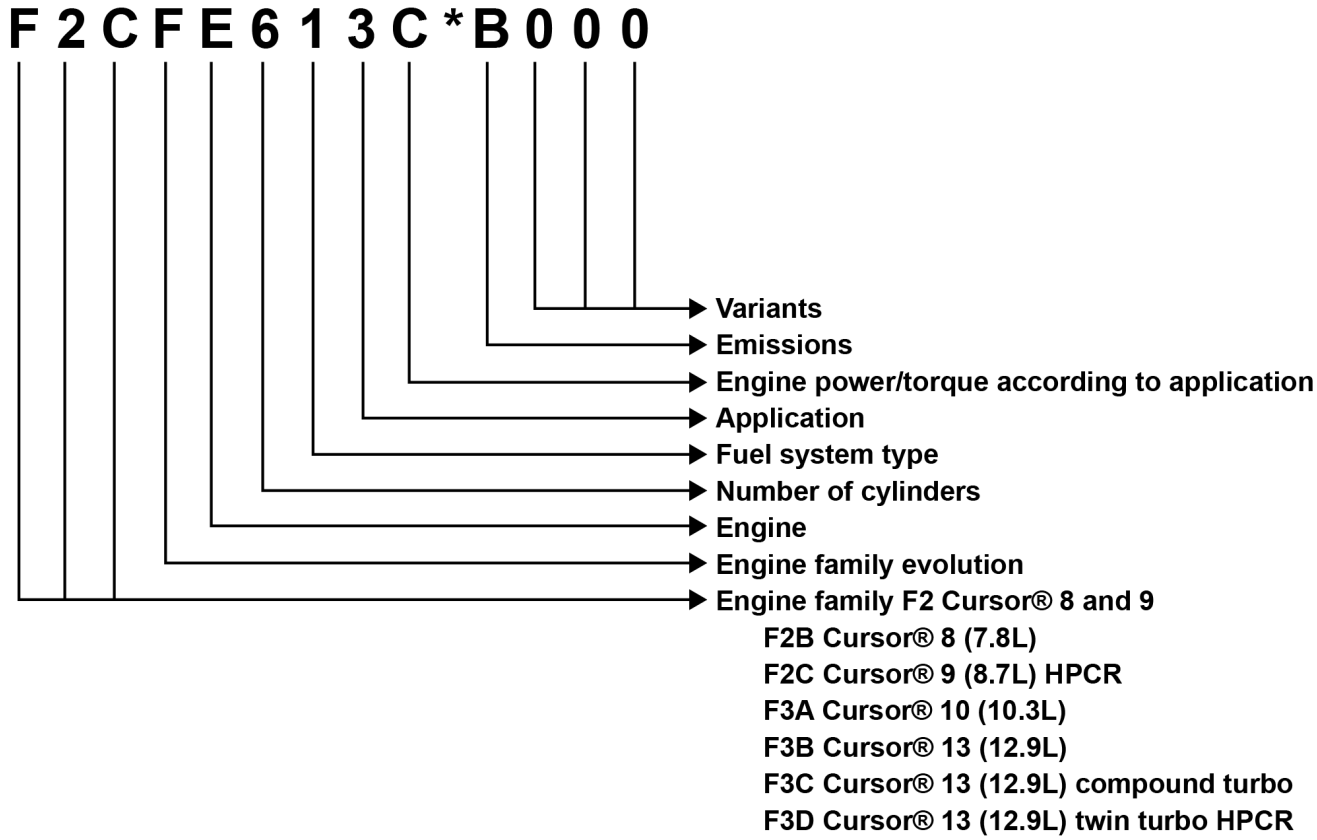
The **Cursor®** 9 is a state of the art engine developed by Fiat Powertrain Technologies (FPT) The **Cursor®** 9 used in the T8. tractors has some significant internal and external differences from **Cursor®** 9 engines used in other CNH products. There are procedures specific to the T8. engines that are different from the **Cursor®** 9 used in other CNH applications. These changes were made to fit the engine into the T8. series frames without losing our featured visibility around the hood and chassis.

The **Cursor®** 9 engine was introduced in the CNH combines in 2006 and migrated into the T9. series tractors. It has proven itself to be a consistent reliable performer. The introduction in the T8. series brings it to new heights with up to **275 kW** (**374 Hp**) (rated) and **316 kW** (**429 Hp**) in power boost mode.

- 6 cylinder, 24 valve, turbocharged and aftercooled
- Single overhead cam with roller rocker arms
- Wastegate turbo/Electronic Variable Geometry Turbocharger (EVGT)
- High pressure common rail fuel system
- Selective Catalytic Reduction (SCR) emissions control
- TIER 4B compliant without internal or external Exhaust Gas Recirculation (EGR)

FPT model number designation

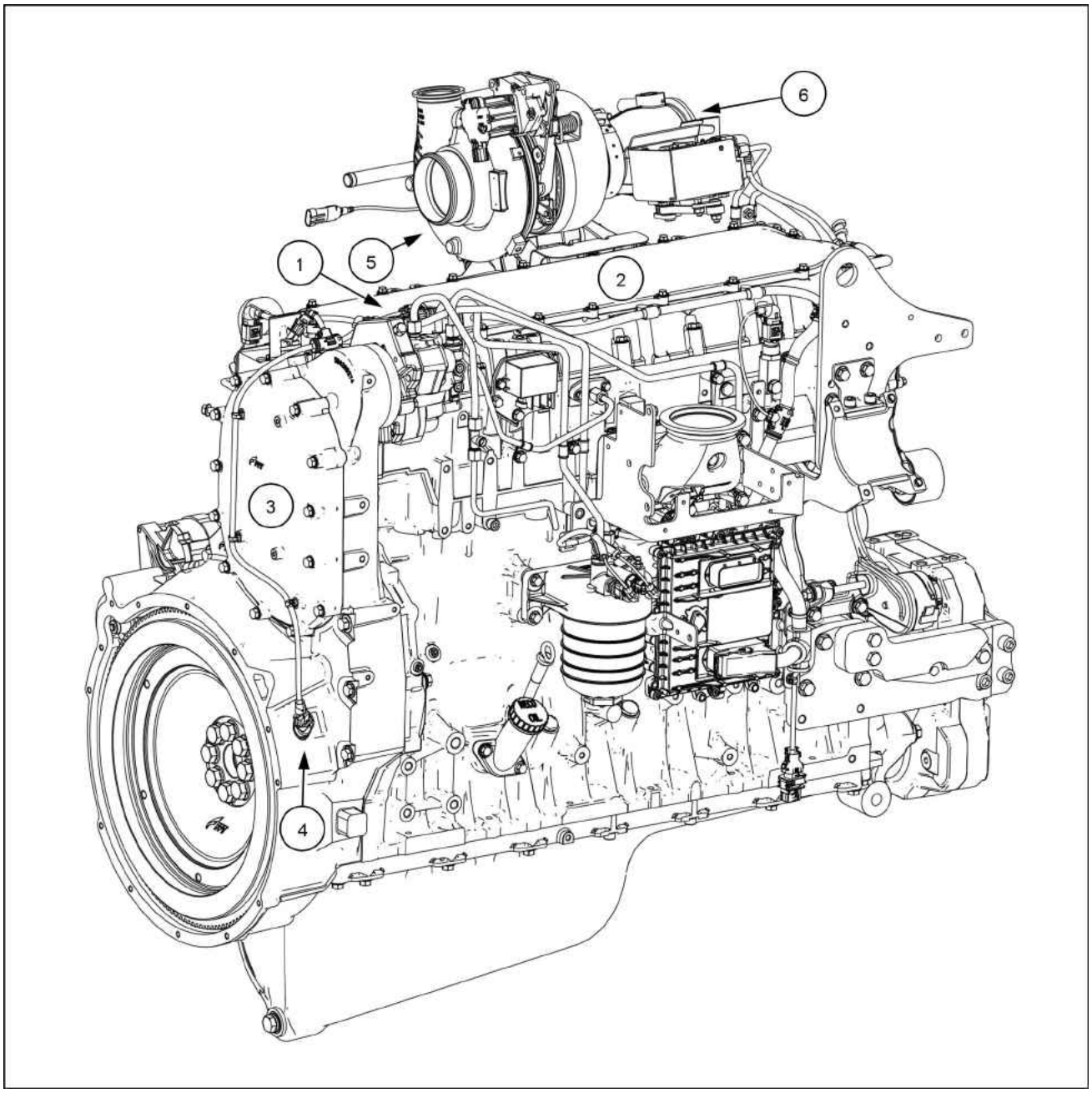
NOTE: *The FPT engine designation code has evolved over the years. This is the best current information and may not be applicable to previous FPT engines.*



RAIL15TR01380GA 2

Visual external differences for T8. tractor engines

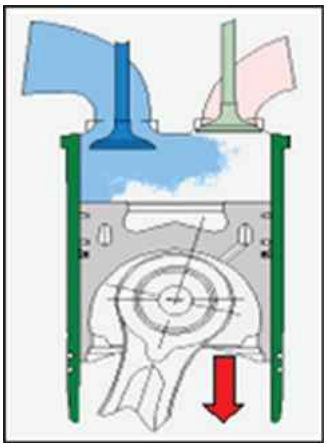
There are a few things that make the FPT **Cursor®** 9 engine used in the T8. tractors visually and mechanically different from other **Cursor®** 9 applications.



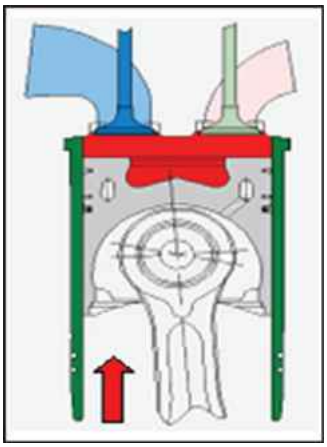
RAIL15TR00608GA 3

1. The fuel pump sits higher and closet to the center line of the engine.
2. A two piece valve cover assembly that allows for valve adjustment without removing the entire cover.
3. The rear cover is an oval shape where on other **Cursor®** 9 engines it's round.
4. The flywheel speed sensor is located on the right side of the engine, others have on the left side of the engine.
5. The turbocharger is moved higher and toward the center line of the engine.
6. Exhaust flap for TIER 4B.

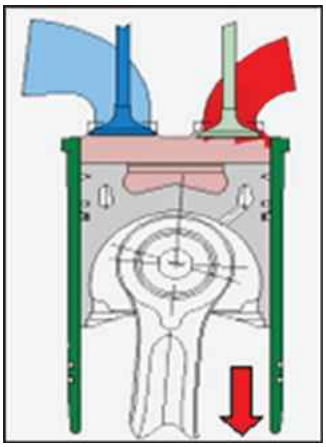
Exhaust brake



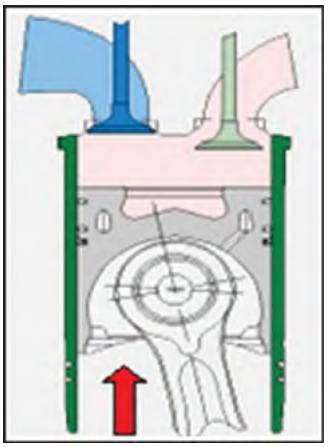
Admission phase:
Intake of fresh air.



Compression phase:
Energy is stored in the compressed air, braking effect increases with compression



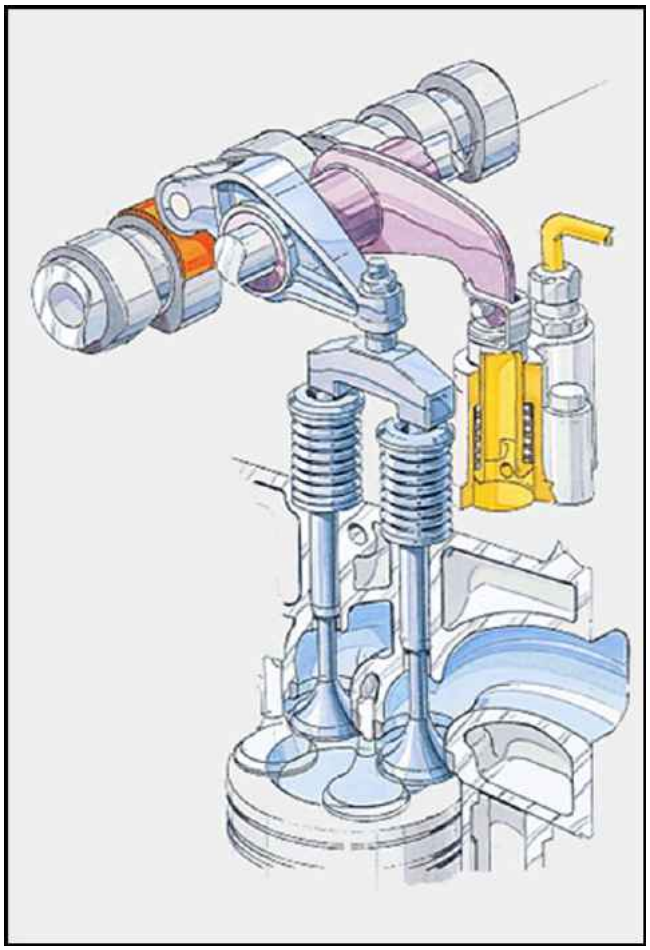
Top dead center:
Exhaust valves open, compressed air is released, energy is blown out.



Exhaust phase:
Cylinder is empty, no energy exchange. Exhaust gases impact against the turbine, creating an additional braking effect.

All **Cursor®** engines are equipped with an advanced engine brake system: the Iveco Turbo Brake (IBT) system.

- Decompression engine brake
- Quick responding
- Integrated in the engine control
- Linked to cruise control
- Linked to EBS



Advantage

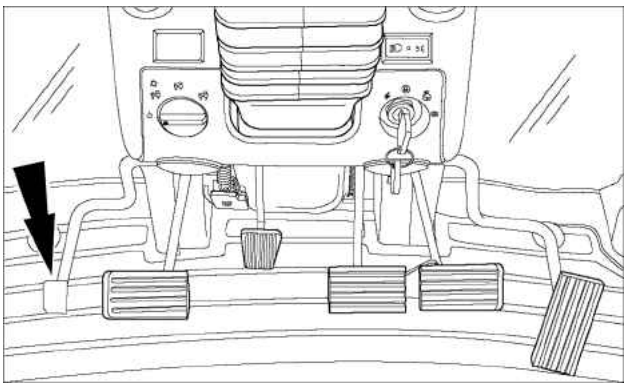
- Less brake pad wear
- Automatically engaged

Benefit

- Reduced operation cost
- Operator ease

The engine brake is controlled by the Tractor Control Unit (TCU). The Electronic Service Tool (EST) is used to configure the TCU as to whether or not the tractor has an engine brake.

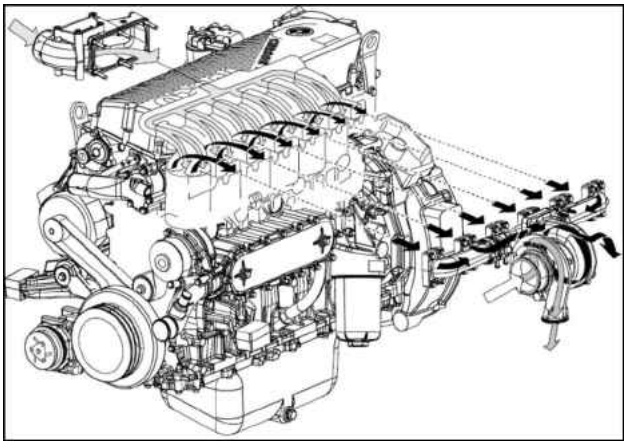
The engine brake is activated when the pedal left of the clutch is depressed.



RCPH11CCH481AAA 4

Air Induction - cross flow cylinder head

The cylinder head is of the cross flow design, inlet on one side and exhaust on the other. This and four valves per cylinder give it excellent breathing ability and efficient temperature control. The air is supplied to the inlet by a wastegate turbocharger or a Variable Geometry Turbocharger (VGT).

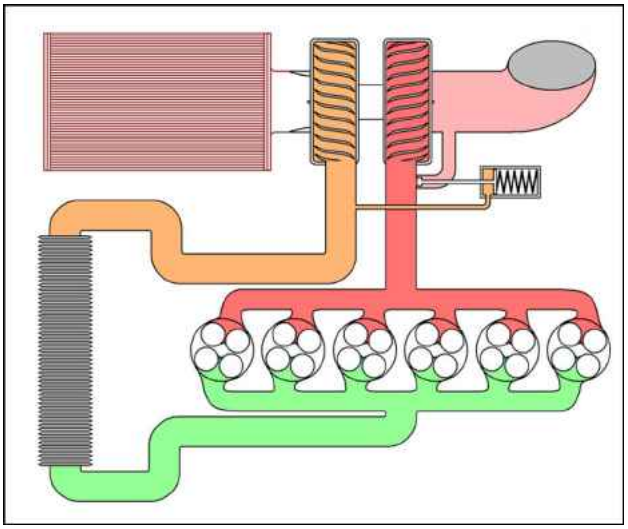


RAIL15TR00376BA 5

Wastegate turbocharger

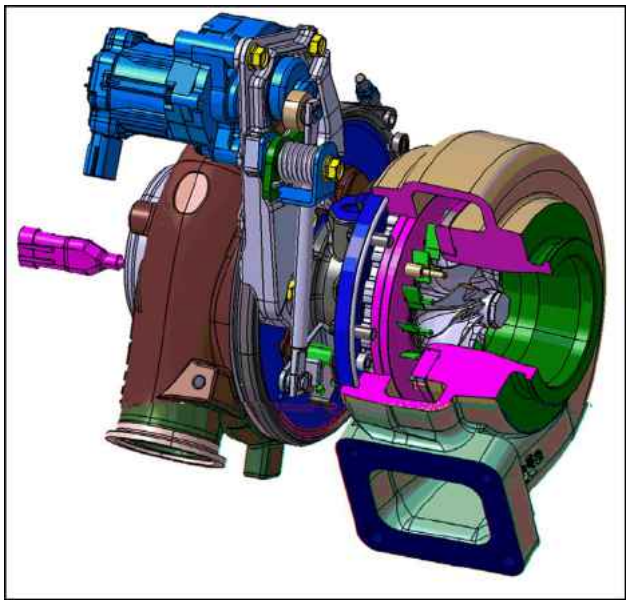
The wastegate turbocharger allows for a larger turbocharger to be installed producing higher boost pressures in the low and midrange rpm while not over-boosting at high rpm.

Intake pressure builds against a diaphragm in the wastegate and opens a valve allowing exhaust to bypass the turbine therefore slowing the compressor and limiting the pressure in the intake manifold.



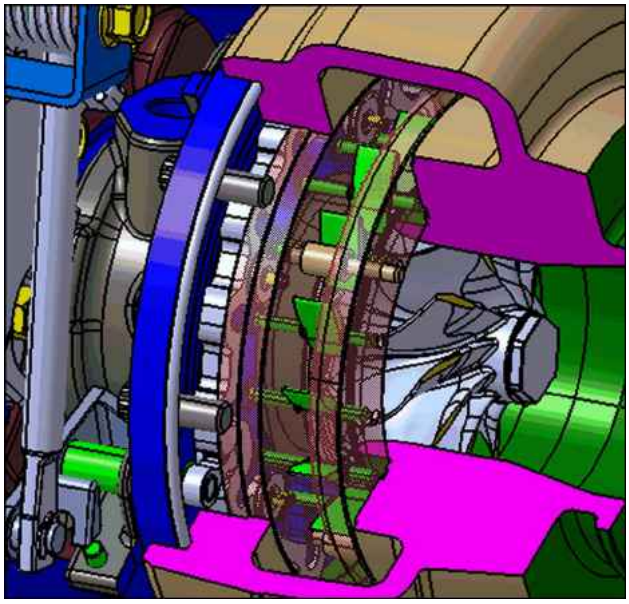
RAIL15TR00396BA 6

Electronically Variable Geometry Turbocharger (eVGT)



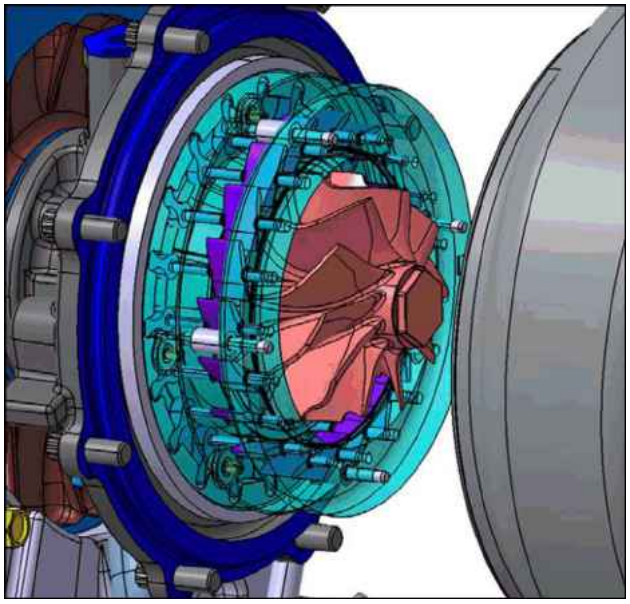
RAIL15TR00383BA 7

The electronically Variable Geometry Turbocharger (eVGT) is used on the TIER 4A T8.420 and TIER 4B T8.350, T8.380, T8.410 and T8.435. The eVGT is electronically controlled by the Engine Control Unit (ECU).



RAIL15TR00395BA 8

Vanes open (low boost)



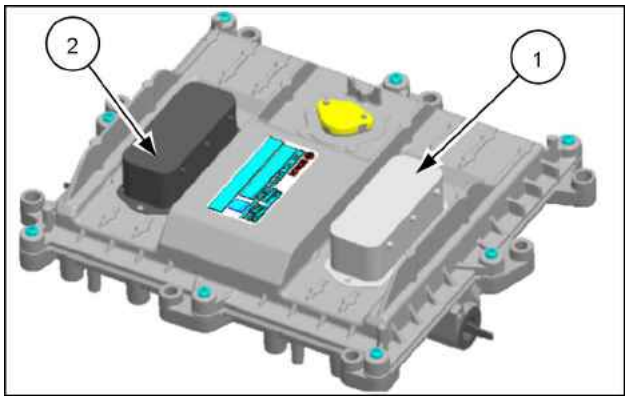
RAIL15TR00394BA 9

Vanes closed (high boost)

The eVGT uses a series of aerodynamic vanes to direct exhaust toward the turbine controlling both the velocity and angle the exhaust contacts the turbine. This gives the ECU the ability to dynamically “tune” the boost pressure at any given engine speed and load, Improving performance and fuel economy.

Fully open the velocity slows and the angle is decreased therefore the turbine and compressor turn slower producing less boost. When needed, the vanes close increasing the velocity and angle, therefore increasing turbine and compressor speed, producing higher boost anytime it is needed across the entire operating range of the engine.

EDC17CV41



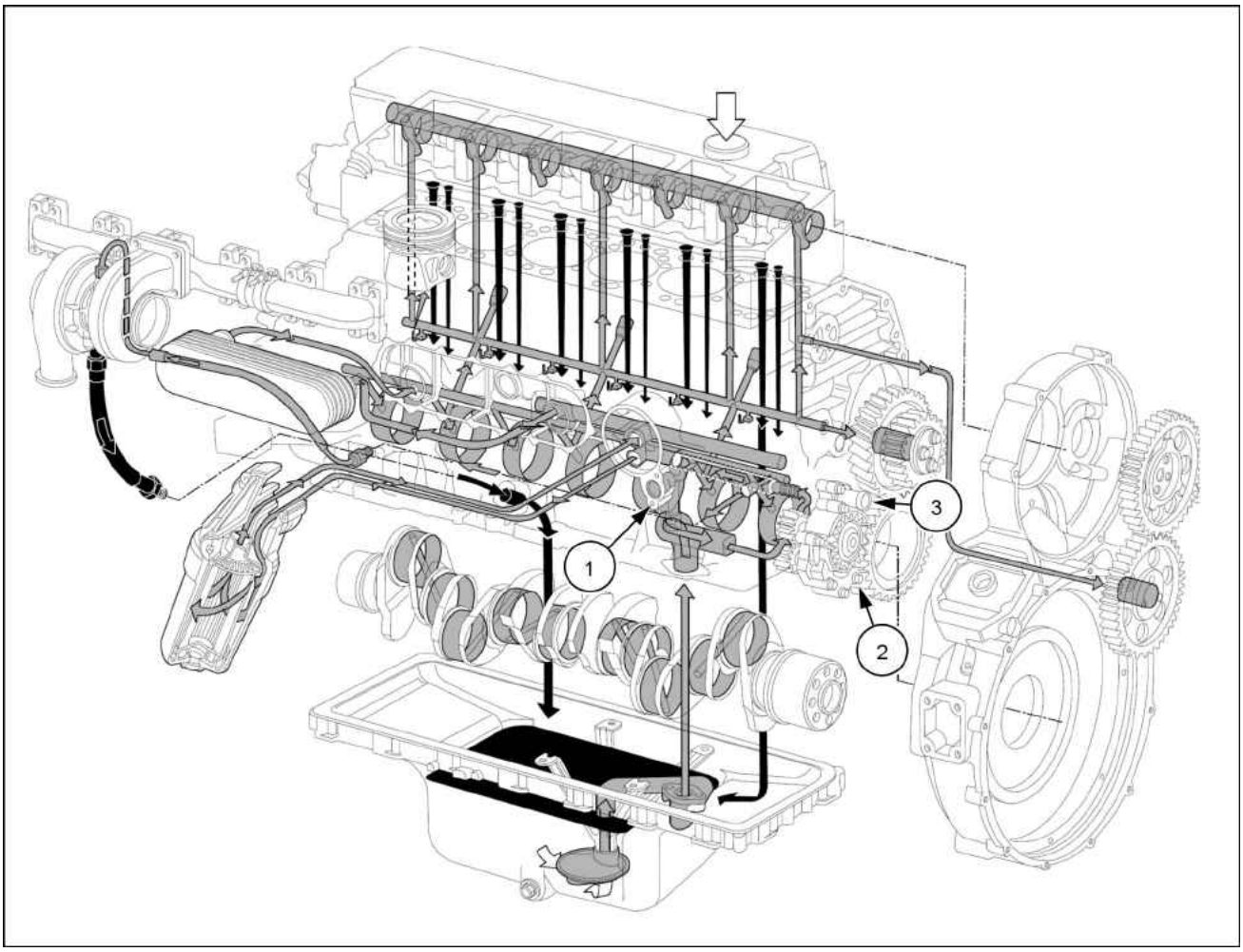
RAIL14TR00234PA 10

A new Engine Control Unit (ECU) is used on TIER 4B engines, the EDC17CV41. It is used on FPT engines from the **4.5 L** NEF to the **12.9 L Cursor®** engines. t has two 96–pin electrical connectors: one for the engine components and one for the tractor connections. Pin connections will be common for all the CNH/FPT engines using this controller.

1. Tractor connector
2. Engine connector

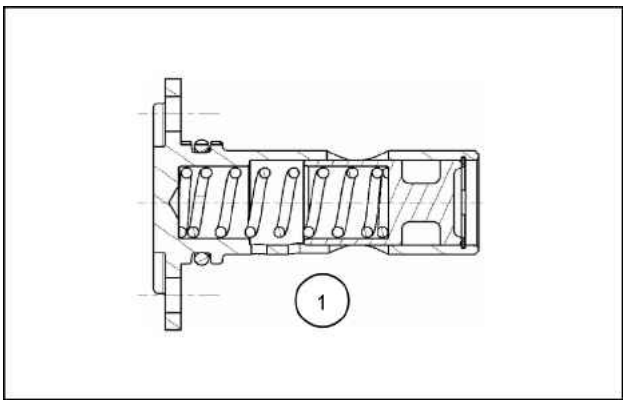
The EDC17CV41 controls all engine and Selective Catalytic Reduction (SCR) functions.

Lubrication System

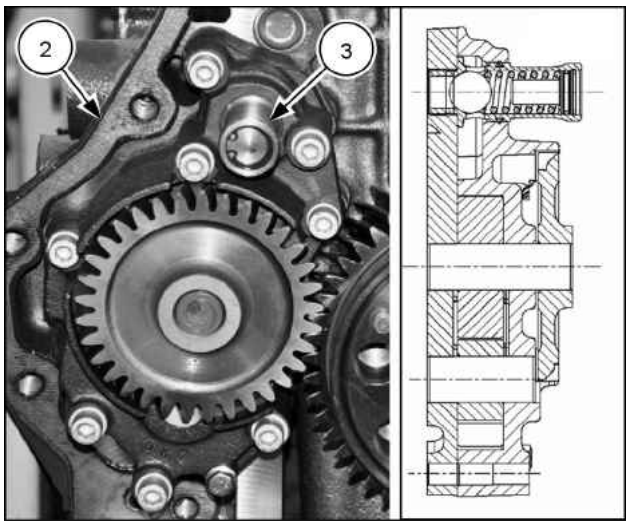


RAIL15TR00416GA 11

Oil pressure is controlled by a **5 bar** (**72.5 psi**) relief valve **(1)** in the oil galley coming from the gear type oil pump **(2)** located behind the rear cover of the engine. The oil pump also has an over pressurization relief valve **(3)** set at approximately **10 bar** (**145 psi**).



RAIL15TR00367AA 12



RAIL15TR00389BA 13

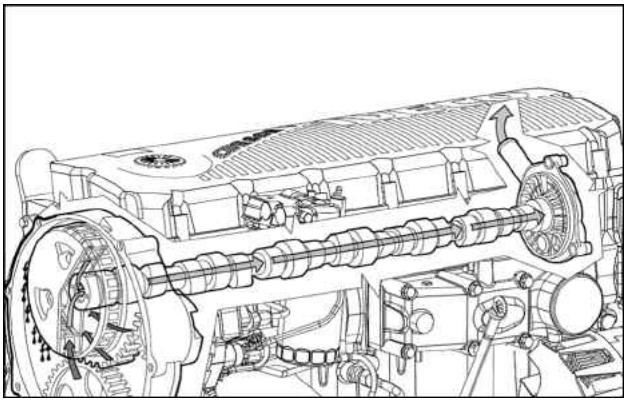
A **5 bar** (**72.5 psi**) oil pressure control valve **(1)** is located on the left hand side of the engine. The oil pump assembly **(2)** includes an over pressurization relief valve **(3)** that protects the pump. The valve opens at **9.4 - 10.8 bar** (**136.3 - 156.6 psi**).

Blow-by recirculation

Blow-by is controlled by a rotary filter bolted to the rear of the camshaft. As the cam turns excess oil is thrown off by centrifugal force, finer oil is filtered out.

The blow-by then passes through the center of the camshaft and exits at the front.

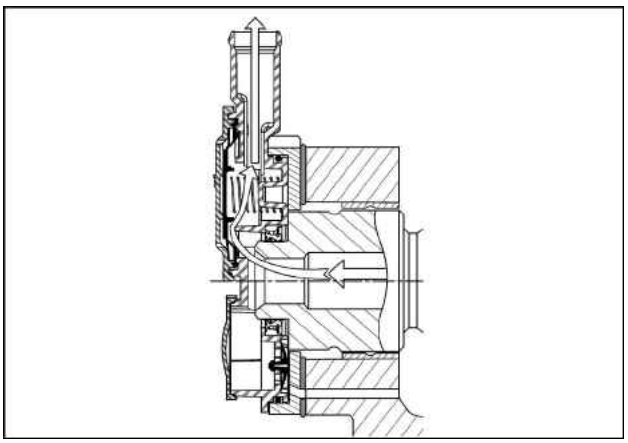
This filter must be replaced at regular intervals or the engine will build up excessive pressure in the crank case.



RAIL15TR00366AA 14

Built into the cover at the front is a valve that allows blow-by pressures out, but will not allow atmospheric pressure into the crankcase.

This filtered air is directed back into the inlet and re-burned.



RAIL15TR00377BA 15

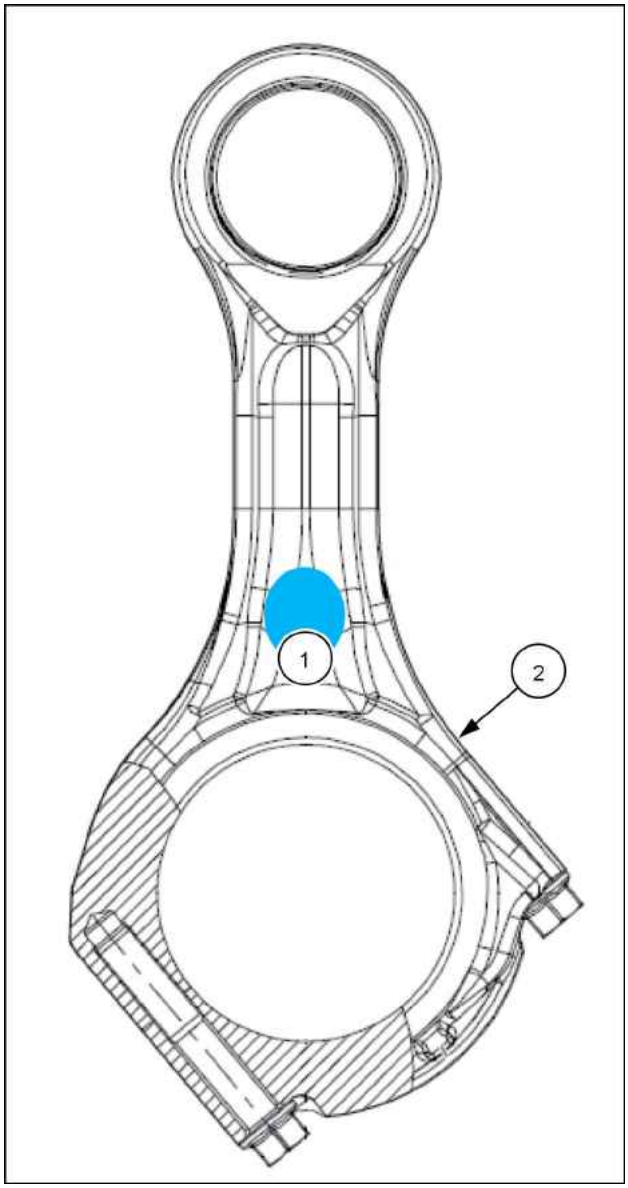
Connecting Rods

Connecting rods must all be the same weight class in an engine. The weight class is identified by a color swatch on the connecting rod.

There are three classes of crankshaft bearing diameters (bore size) on the connecting rod. The bore size is marked by a color code on the rod. The oil clearance is determined by the connecting rod bore size and the crankshaft journal size. Based on connecting rod bore diameter and the crankshaft journal diameter a bearing set must be determined.

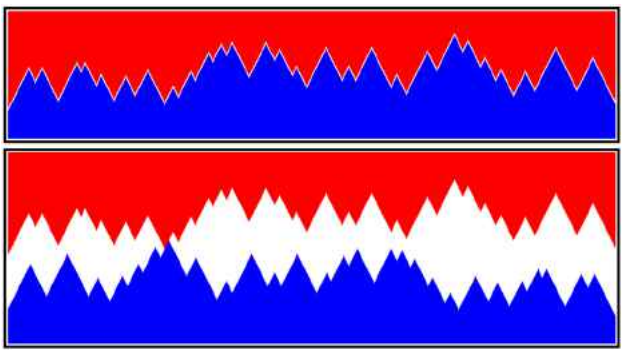
Connecting rods are the fracture split type. Care must be taken when handling these rods as any damage to the cap/rod mating area requires that the rod be replaced.

Connecting rod weight, class and color	Bore diameter and color designation	
3450 – 3470 grams Grade A, Yellow	85.987 - 58.996	Yellow
	85.997 - 86.005	Green
	86.006 - 86.013	Blue
3471 – 3490 grams Grade B, Green	85.987 - 58.996	Yellow
	85.997 - 86.005	Green
	86.006 - 86.013	Blue
3491 – 3510 grams Grade C, Blue	85.987 - 58.996	Yellow
	85.997 - 86.005	Green
	86.006 - 86.013	Blue



RAIL15TR00397CA 16

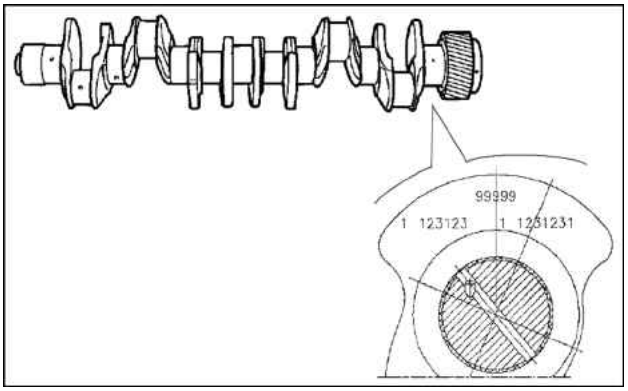
Fracture split rods give nearly perfect alignment. In both examples the red (rod) profiles are identical as are the blue (cap) profiles. In the top example the rod fits perfectly with the cap. In the lower example the rod is in the same position but the cap is reversed, here the material peaks align peak to peak and keeps cap from mating with the rod.



RAIL15TR00375AA 17

Crankshaft

- The crankshaft are classified in three classes: there are three classes for the connecting rod journals and three classes for the main journals.
- The crankshaft journal sizes are stamped on the rear flyweight for both the connecting rod journals and the main journals.
- Six digits for the connecting rods and seven digits for the mains.
- The crankshaft may have been ground - **0.127 mm** undersize from the factory. A (1) preceding the six digits is a standard crankshaft, a (2) preceding is for a crankshaft that has been ground undersize.
- The main bearing bores in the block are classed 1,2,or 3 and are located on the rear of the block lower right hand side. If the classifications are not found, the crankshaft must be measured and classified for each journal.



CRANKIDENTIFY 18

Standard crankshaft connecting rod bearing selection

Standard crankshaft connecting rod journals	Connecting rod bore		
	Class (1) Yellow paint	**Class (2) Green paint**	**Class (3) Blue paint**
Class (1) 81.915 to 81.925 mm	Green	Green	Yellow
	Green	Yellow	Yellow
Class (2) 81.925 to 81.935 mm	Red	Green	Green
	Green	Green	Yellow
Class (3) 81.935 to 81.945 mm	Red	Red	Green
	Red	Green	Green

NOTE: *It may be necessary to mix two bearing shells in one journal.*

0.127 mm under-size crankshaft connecting rod bearing selection

- **0.127 mm** Standard crankshaft connecting rod journals	Connecting rod bore		
	Class (1) Yellow paint	Class (2) Green paint	Class (3) Blue paint
Class (1) 81.789 to 81.799 mm	Green/Black	Green/Black	Yellow/Black
	Green/Black	Yellow/Black	Yellow/Black
Class (2) 81.799 to 81.809 mm	Red/Black	Green/Black	Green/Black
	Green/Black	Green/Black	Yellow/Black
Class (3) 81.809 to 81.819 mm	Red/Black	Red/Black	Green/Black
	Red/Black	Green/Black	Green/Black

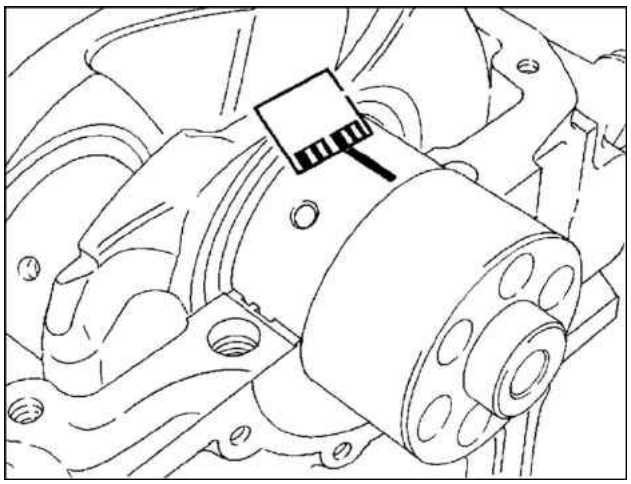
Standard crankshaft main bearing selection

Standard crankshaft journals	Main bearing bore fit class		
	Class (1)	Class (2)	Class (3)
Class (1) 92.970 to 92.980 mm	Green	Green	Yellow
	Green	Yellow	Yellow
Class (2) 92.980 to 92.990 mm	Red	Green	Green
	Green	Green	Yellow
Class (3) 92.990 to 93.000 mm	Red	Red	Green
	Red	Green	Green

0.127 mm under-size crankshaft main bearing selection

Standard crankshaft journals	Main bearing bore fit class		
	Class (1)	Class (2)	Class (3)
Class (1) 92.843 to 92.853 mm	Green/Black	Green/Black	Yellow/Black
	Green/Black	Yellow/Black	Yellow/Black
Class (2) 92.853 to 92.863 mm	Red/Black	Green/Black	Green/Black
	Green/Black	Green/Black	Yellow/Black
Class (3) 92.863 to 93.872 mm	Red/Black	Red/Black	Green/Black
	Red/Black	Green/Black	Green/Black

With the variables in the bearing selection process, it is always a good idea to use a plastic gauge to test each journal for proper clearance.



RAIL15TR00392BA 19

Camshaft installation and timing

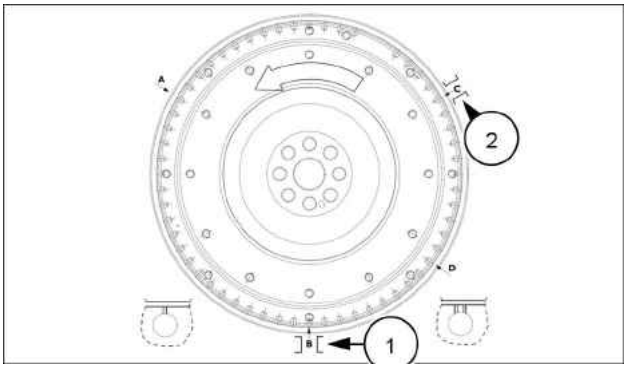
When timing or adjusting valves it is critical to position the A, B, C or D holes in the center of the view hole **(1)** at the bottom of the bell housing. Serious engine damage can occur if procedures are not followed carefully.

A. TDC 3 and 4

B. TDC 1 and 6

C. TDC 2 and 5

D. **54 °** before TDC 1 and 6



RAIL15TR00406FA 20

When timing or adjusting valves it is critical to position the A, B, C or D holes in the center of the view hole **(1)** at the bottom of the bell housing. Serious engine damage can occur if procedures are not followed carefully.

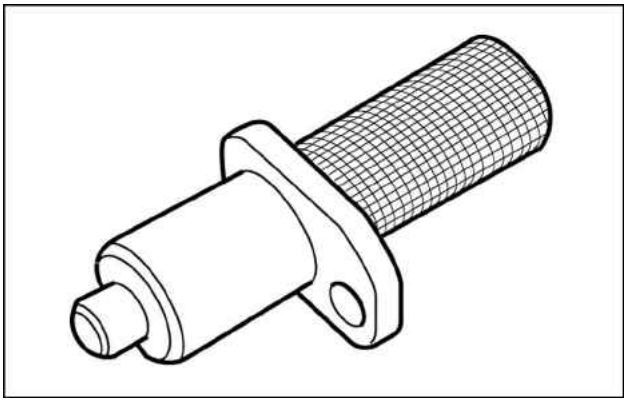
NOTE: *All references to flywheel rotation will be made as viewed from the rear of the engine.*

NOTE: *The A, B and C holes are marked with one hash mark (I) and the D' hole with two hash marks (II).*

Position the flywheel at TDC 1 and 6, the B hole at the bottom. This can be done by locating the D hole at the bottom view hole in the bell housing, and then turning the flywheel counterclockwise until the B hole appears.

Once the flywheel is in this position, it should be pinned in position with the flywheel pinning tool **380000150** in the sensor hole.

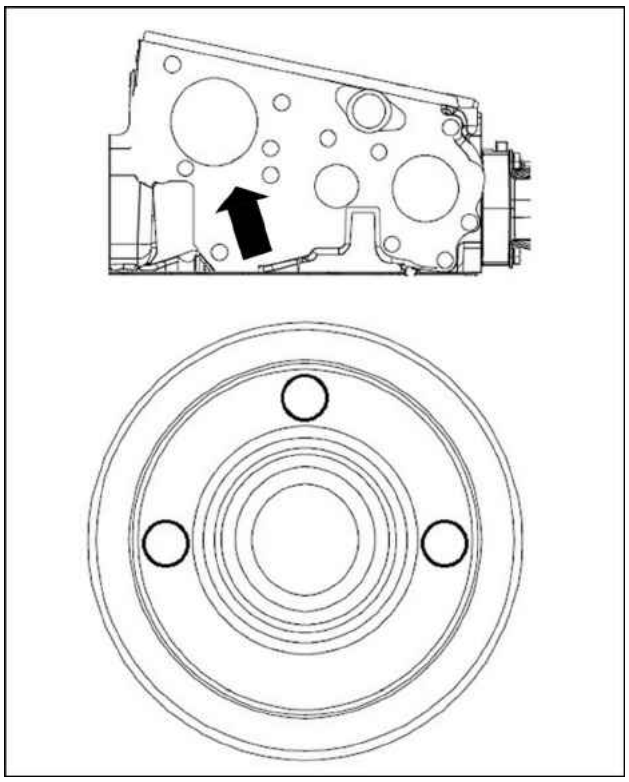
The engine is now ready to have the camshaft installed.



21

Install the camshaft with the three holes (viewed from the front) in the 9, 12 and 3 o'clock position.

NOTE: *Do not trust the back of the cam for positioning.*



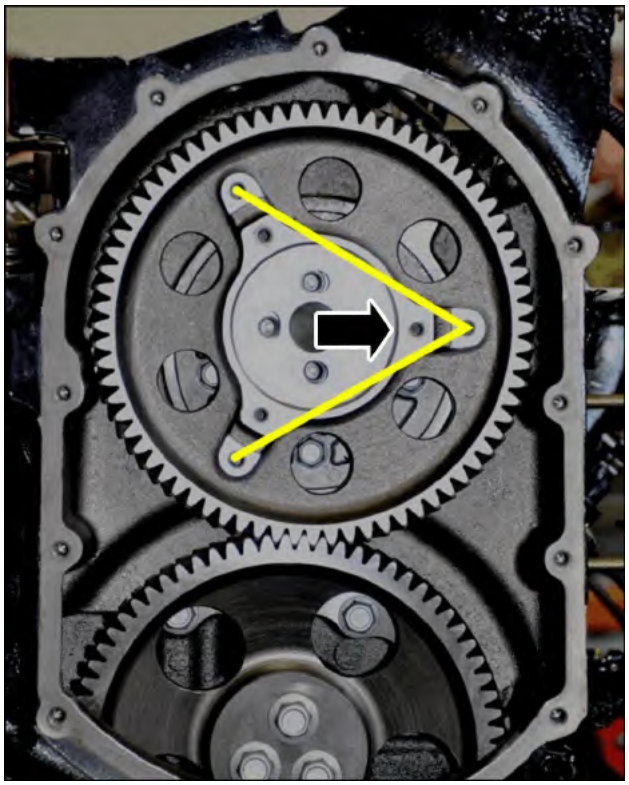
RAIL15TR00380BA 22

Install the camshaft gear as shown.

In T8. tractors, the cam drive must be installed with the three phonic wheel mounting holes making an arrow pointing to the right. If this is not done, the phonic wheel will not be able to be timed.

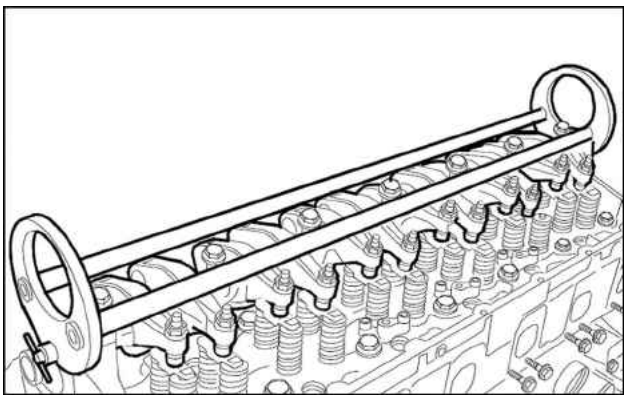
The slotted holes must be centered on the camshaft bolt holes to make fine adjustments to the cam later in this process.

Install the bolts and tighten, but do not torque yet; they will be loosened later in this procedure.



RAIL15TR00378BA 23

Install the rocker arm shaft assembly using tool number: **380000149**.



RAIL15TR00374AA 24

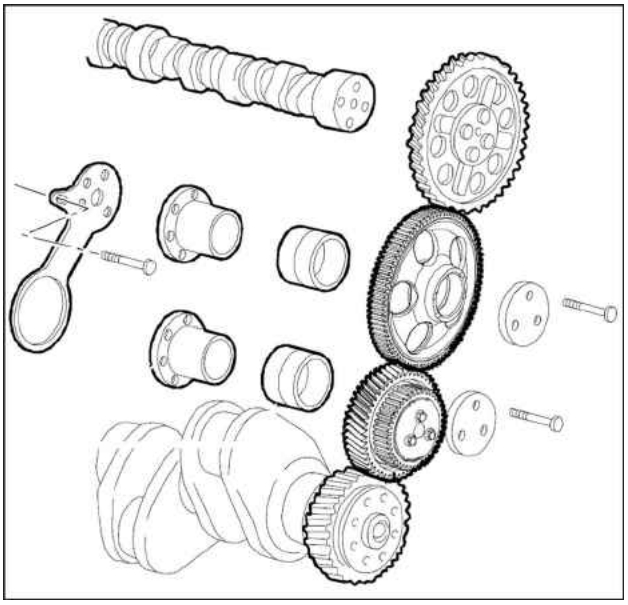
Camshaft timing

The double idler gear location is fixed. The upper single idler gear location can be adjusted and is used to set the back lash between the idler gear and the camshaft gear.

This back lash has to be checked and set since this is an overhead camshaft engine. All for the gear train is mounted to the block except the camshaft gear which is mounted to the cylinder head. Set the back lash before the rocker arm assembly is installed.

Use a dial indicator to measure the camshaft gear to idler back lash. Only measure the back lash between the upper idler gear and the camshaft gear. Install the dial indicator tangential to a camshaft gear tooth. Hold the idler so that it does not move and rock the camshaft gear.

Correct back lash is **0.080 - 0.180 mm** (**0.003 - 0.007 in**).

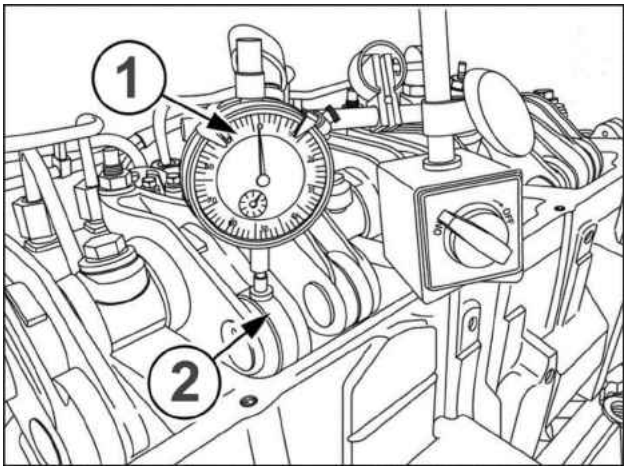


RAIL15TR01370BA 25

Rotate the flywheel clockwise until the D hole appears in the bottom view hole. Install a dial indicator **(1)** on the number 3 exhaust valve rocker arm camshaft roller **(2)** as shown.

Preload the dial indicator **6.00 mm** (**0.24 in**).

Rotate the engine clockwise until the dial indicator stops moving: lift up on the valve end of the rocker arm to take any clearance or play out and to verify that you are on the inner base circle of the camshaft, the lowest point.



RAIL15TR01371BA 26

Zero the dial indicator at this point.

On Tier III and later **Cursor®** 9 engines, rotate the engine counterclockwise until the dial indicator reads **5.29 mm** (**0.21 in**) ± **0.05 mm** (**0.002 in**). Check to see if the D hole is in the window and that the timing pin will lock the flywheel.

If the D hole is not centered in the window and the flywheel cannot be locked:

1. Loosen the four bolts that retain the camshaft gear.
2. Rotate the flywheel until the D hole is in the timing window and the flywheel can be locked.
3. Tighten the four bolts that hold the camshaft gear to the camshaft.

Now, verify the timing by turning the engine clockwise **10 - 20 °** and then back counterclockwise until the D hole is in the timing window and the timing pin will lock the flywheel. Verify the reading on the dial indicator is **5.29 mm** (**0.21 in**) ± **0.05 mm** (**0.002 in**).

NOTE: *For engines without an engine brake engine serial numbers 25342 and after, set backlash to use* ***4.70 mm*** *(****0.19 in****).*

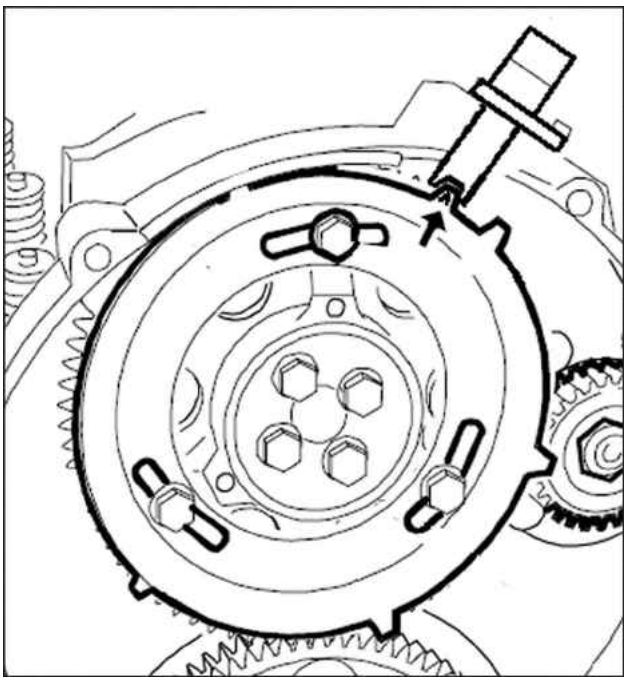
NOTE: *For engines with or without an engine brake prior to engine serial number 25342, set backlash to use* ***5.29 mm*** *(****0.21 in****).*

Repeat the above procedure if necessary to obtain the specified timing. Once timing is within the specified range tighten the camshaft gear retaining bolt to specified torque.

Ultimately timing for the cam on a T8. TIER 4 engine is: **5.29 mm** (**0.21 in**) lift on number 3 exhaust rocker arm at **54 °** before Top Dead Center (TDC) 1 and 6, which is the D hole on the flywheel, visible through the hole in the bottom of the bell housing.

Phonic wheel adjustment

Using the phonic wheel timing fork (special tool **380000151**) with the flywheel locked in the D position, install the phonic wheel so the timing fork engages the phonic wheel tooth with the “^” mark. Tighten the phonic wheel retaining bolts to the specified torque.



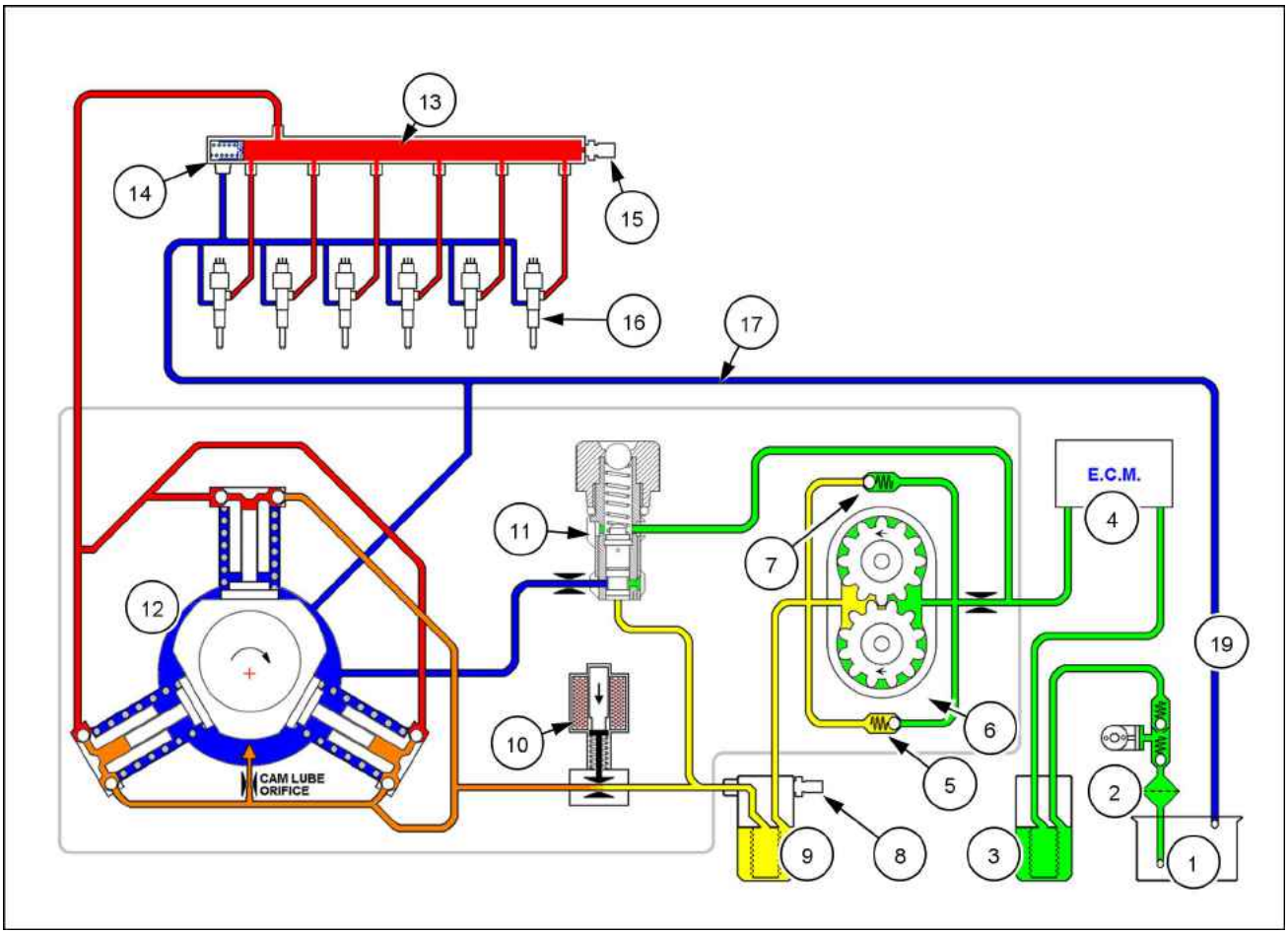
RAIL15TR01372BA 27

Adjusting the valve lash

Flywheel	Cylinder
B	1
A	4
C	2
B	6
A	3
C	5

- The valves can only be adjusted when the piston is at TDC firing.
- Rotate the engine counterclockwise to the B hole (the first hole after the hole with the double mark). Use the timing pin to lock the flywheel.
- Now adjust the valves on cylinder number 1.
- Use the chart to the left to determine which hole to use to adjust the valves.

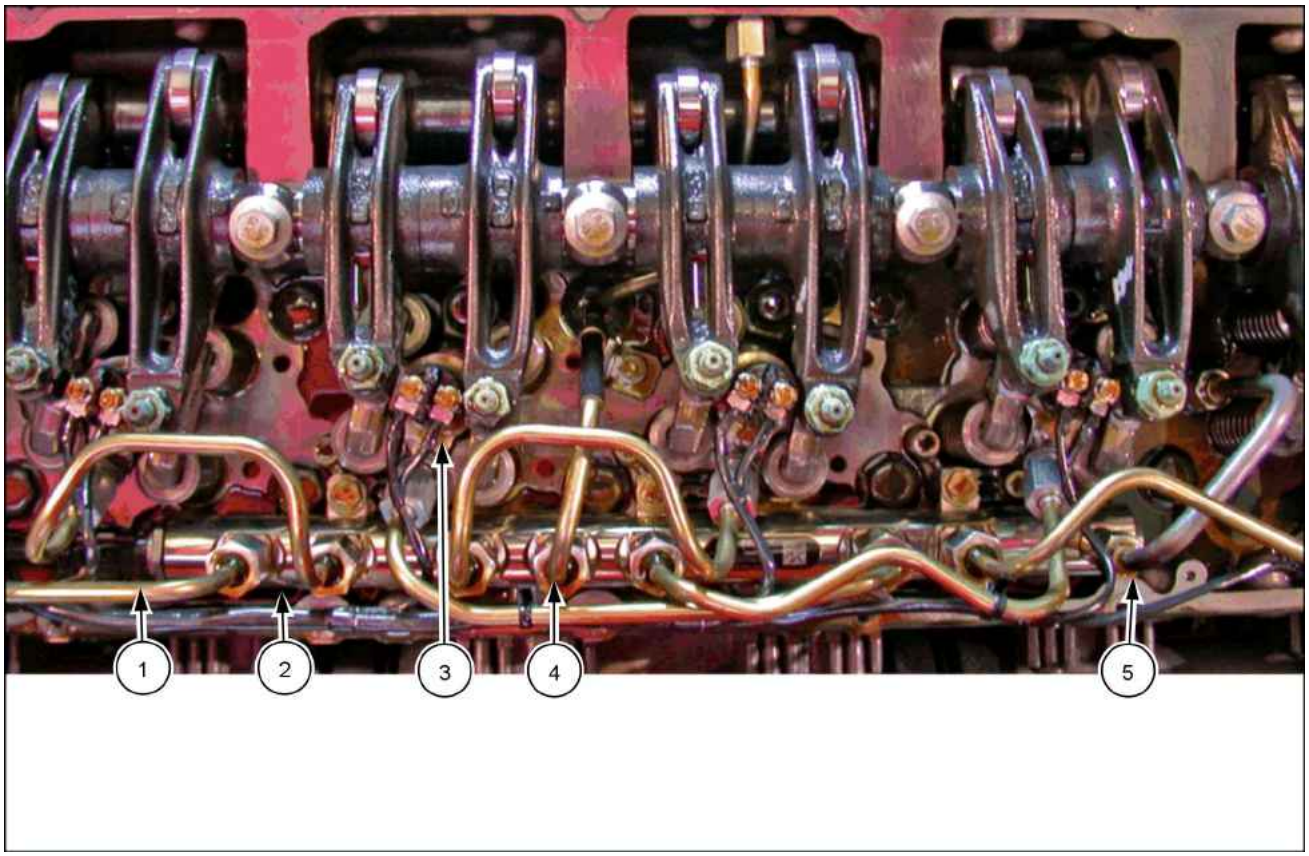
Fuel system



RAIL15TR00414GA 28

1) Inlet from tank
2) Lift pump
3) Primary fuel filter
4) Engine control module
5) **13.8 - 34.5 kPa** (**2.0 - 5.0 psi**) 2-5 psi check valve
6) Gear pump
7) **5.0 bar** (**72.5 psi**) relief valve
8) Fuel temp sender
9) Secondary fuel filter
10) Regulator (Mprop) valve
11) **5.0 bar** (**72.5 psi**) relief valve
12) High pressure pump
13) Common rail
14) High pressure relief
15) Rail pressure sensor
16) Injector
17) Return line
18) Cooler
19) Filter/separator(option)

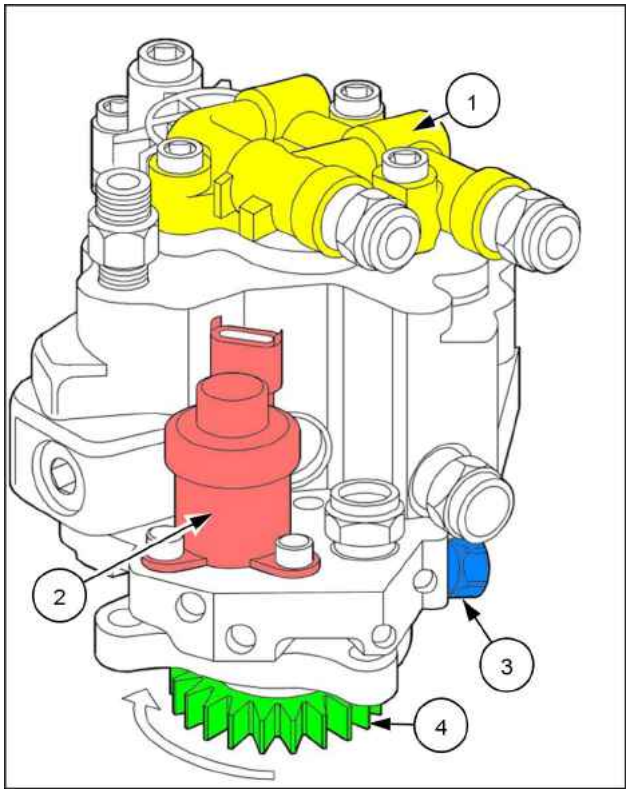
High Pressure Common Rail (HPCR)



RAIL15TR00407FA 29

1. Pressure sensor
2. Common rail
3. Injector
4. Supply from high pressure pump
5. Relief valve

Fuel pump assembly



RAIL15TR00384BA 30

These are the components of the fuel pump that are available separately through parts

1. Low pressure gear pump.
2. Regulator valve (Mprop). 3.2Ω PWM. Controls low pressure supply to high pressure pump, therefore, the common rail pressure.
3. **5.0 bar** (**72.5 psi**) low pressure control valve.

   NOTE: *There are two **5.0 bar** (**72.5 psi**) pressure valves: one in the gear pump and this one in the pump body.*
4. Drive gear.

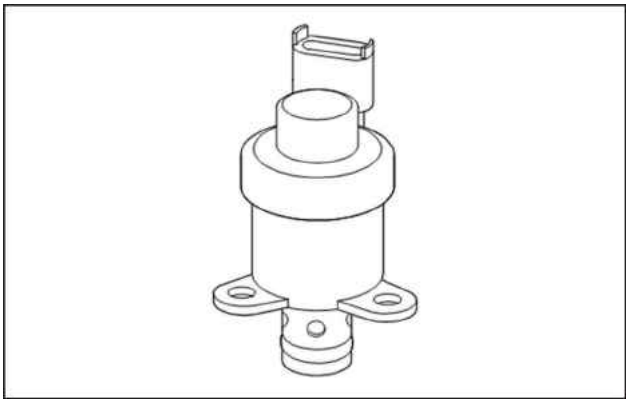
Fuel system Components

Pressure regulator

Located on the high pressure pump, it regulates the amount of fuel supplied to the high pressure pump on the basis of signals received from the Engine Control Unit (ECU) by modulating the duty-cycle. This allows pressure variation inside the common rail.

The pressure regulator is normally open. The high pressure pump is therefore in maximum delivery mode if no signal is sent by the ECU unit.

The regulator is Pulse Width Modulated (PWM); it receives **12 V** (battery voltage) from the ECU. The ECU completes and varies the current by controlling the ground. The regulator is not polarity sensitive. Resistance if checked should be about **3.2 Ω**.

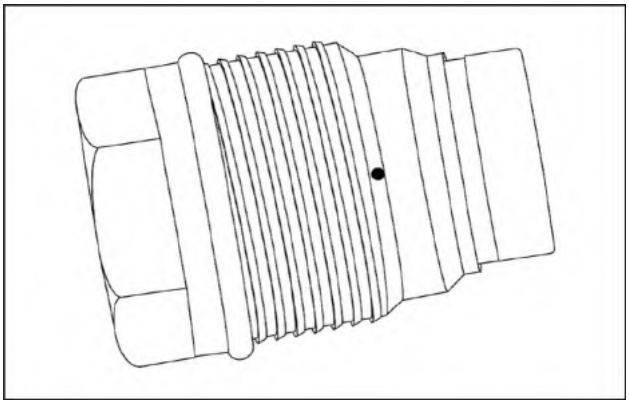


RAIL15TR00373AA 31

Common rail relief valve

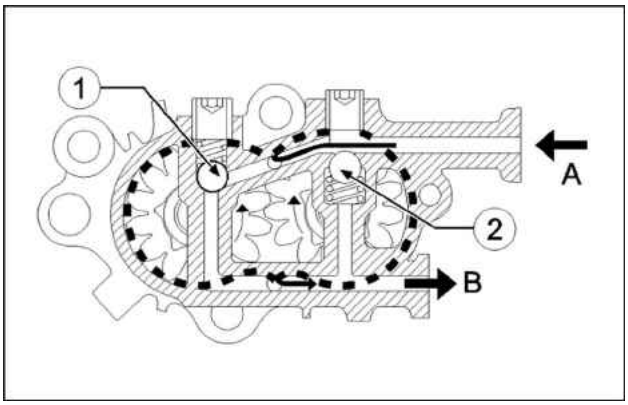
The common rail relief valve is mounted on the end of the common rail. It functions to protect the system's components in case of a failure of the rail pressure sensor or the pressure regulator that could cause the high pressure pump to provide more fuel than the system can safely handle.

The common rail relief valve is a two stage valve. When the rail pressure reaches **2000 bar** (**29000 psi**), the valve opens and will drop the common rail pressure to approximately **1000 bar** (**14500 psi**). This allows the engine to be operated but at reduced power.



RAIL15TR00368AA 32

Low pressure gear pump

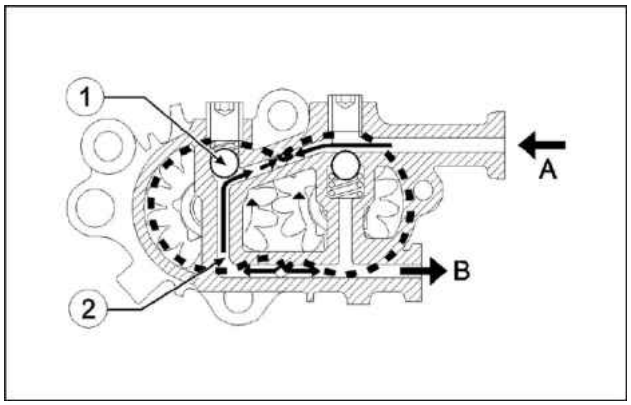


RAIL15TR00372AA 33

(A) Supply fuel drawn from pre-filter
(B) Supply fuel to final filter
(1) Fuel supply relief valve **5.0 bar** (**72.5 psi**)
(2) Supply pump bypass valve (for bleeding)

The fuel supply transfer pump is a gear pump located on the back of the CP3 high pressure pump. The transfer pump is shaft driven off the CP3 high pressure pump shaft.

Pressure control mode

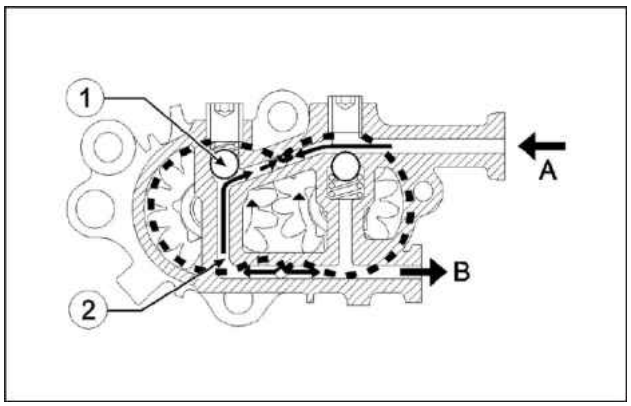


RAIL15TR00370AA 34

When the fuel Pressure exceeds **5.0 bar** (**72.5 psi**), the supply pump relief valve open opens and fuel is routed to the inlet side of the pump.

(A) Supply fuel drawn from pre-filter
(B) Supply fuel to final filter
(1) Fuel supply relief valve **5.0 bar** (**72.5 psi**)
(2) Supply pump bypass valve (for bleeding)

Bypass mode



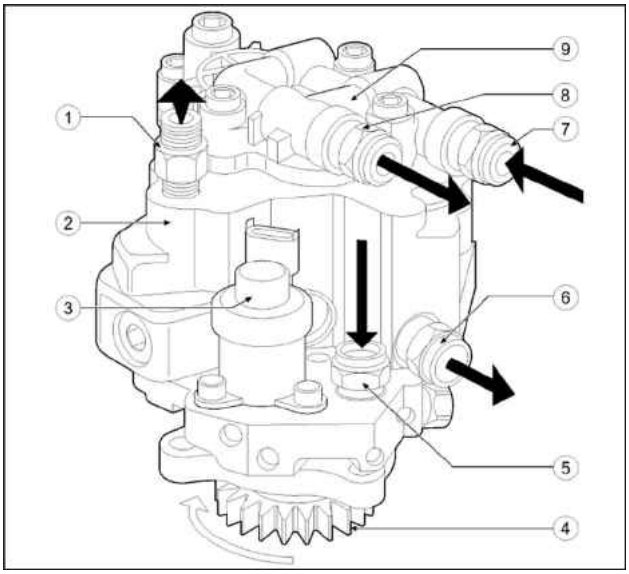
RAIL15TR00370AA 35

During lift pump operation, fuel will bypass the gear pump through a check valve that opens at about **0.138 - 0.345 bar** (**2.0 - 5.0 psi**).

(A) Supply fuel drawn from pre-filter
(B) Supply fuel to final filter
(1) Fuel supply relief valve **5.0 bar** (**72.5 psi**)
(2) Supply pump bypass valve (for bleeding)

High Pressure Pump

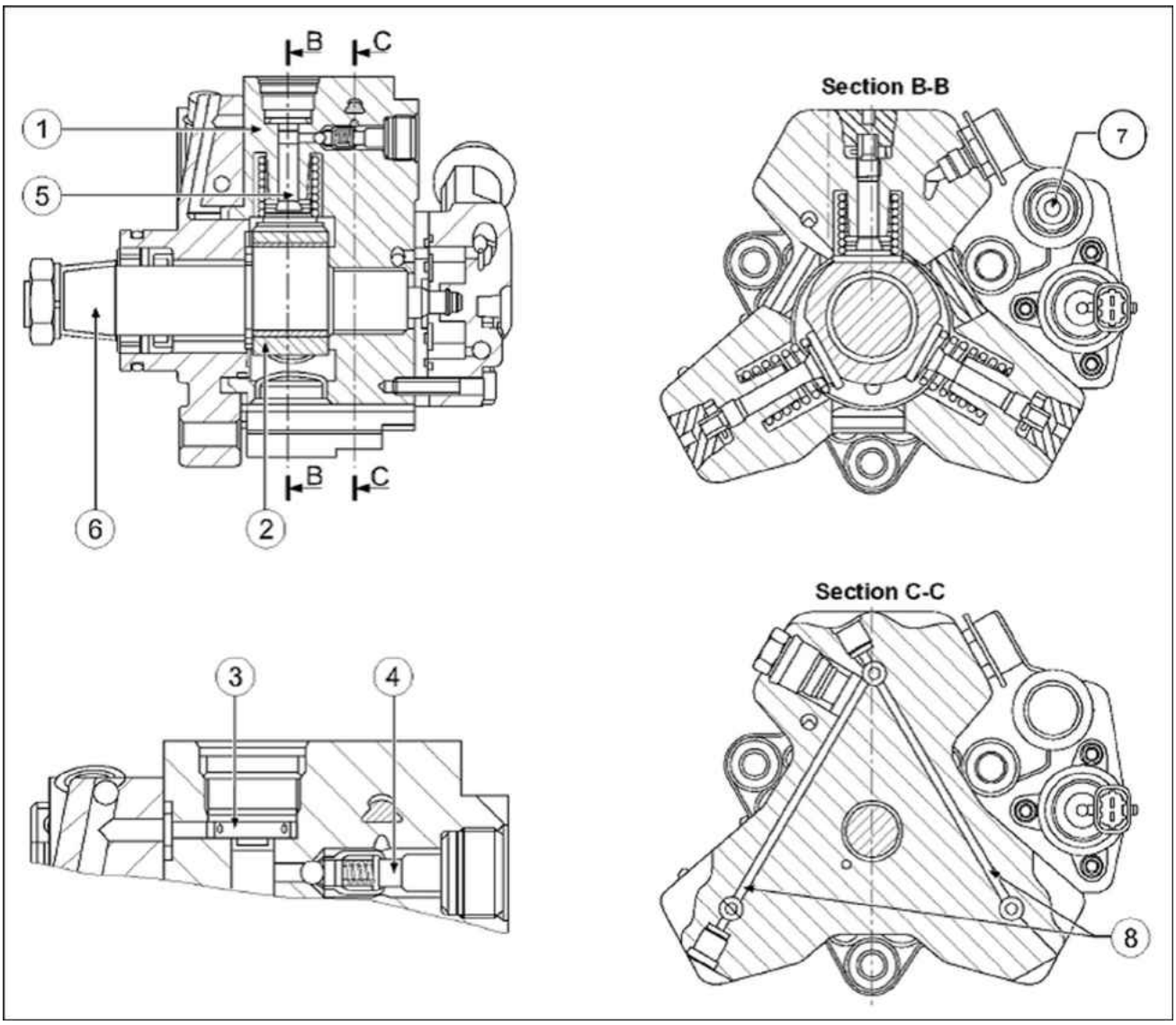
(1) Outlet to common rail
(2) High pressure pump
(3) Pressure regulator valve (Mprop)
(4). Drive gear
(5) Inlet supply from final filter
(6) Return to tank
(7) Inlet from ECU cooling plate
(8) Outlet to final filter
(9) Gear low pressure pump



RAIL15TR00386BA 36

The CP3 pump is a radial piston pump. It has three pistons that are spring loaded against a common eccentric shaft. In one revolution of the pump shaft each piston has completed a pumping cycle. Each piston is spring loaded to push the piston against the rotary coupling on the eccentric shaft.

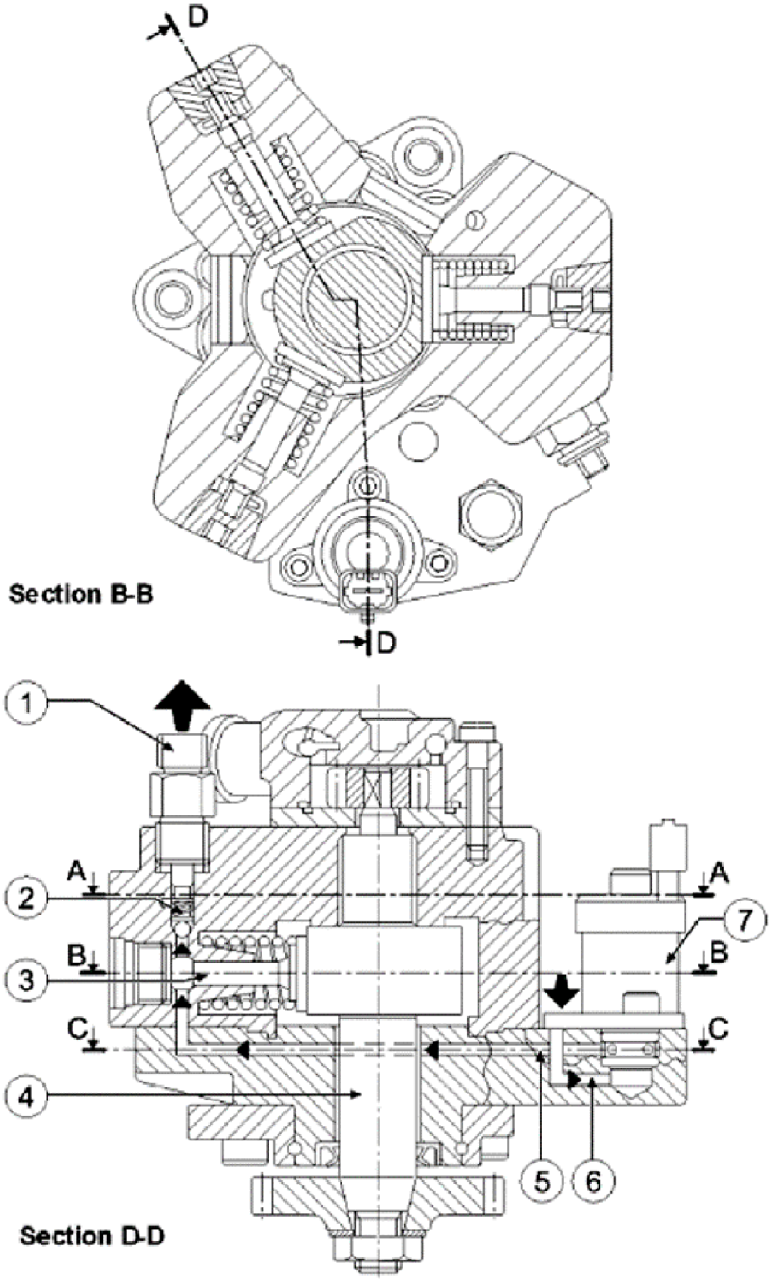
Each pumping element has an inlet valve and an outlet valve. The valves act as check valves; the inlet valve allows low pressure fuel that is metered by the regulator valve to inter the pumping chamber while the outlet valve only allows the fuel to exit the pumping chamber and go to the common rail.



RAIL15TR00413GA 37

(1) Pumping element
(2) Rotary coupling
(3) Inlet valve
(4) Outlet valve
(5) Piston
(6) Eccentric pump shaft
(7) Low pressure fuel inlet
(8) Supply fuel ducts to pumping elements

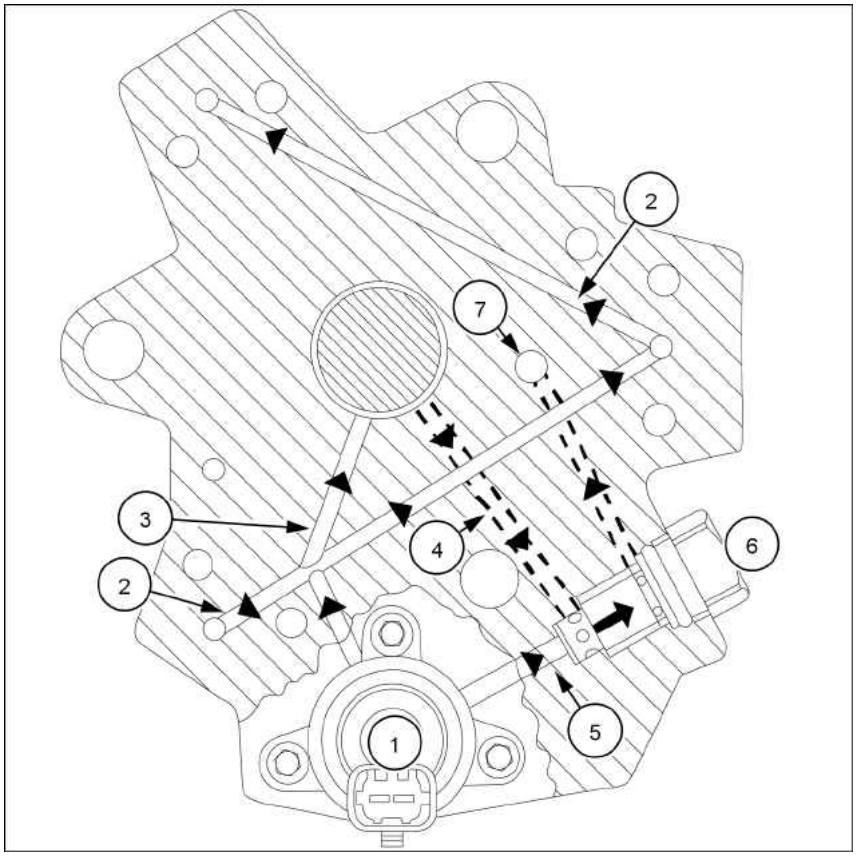
During the inlet phase, the quantity of fuel flow to the pumping element is determined by the regulating valve. The regulating valve, dependent on the PWM command sent from the ECU, meters the fuel to the pumping elements. When the pumping element starts decreasing the volume the inlet valve will close. The fuel is now trapped in the pumping chamber and the pressure will start to build. When the pressure in the pumping chamber becomes higher than the pressure in the common rail the outlet valve will open the fuel will flow to the common rail.



RAIL15TR01379GA 38

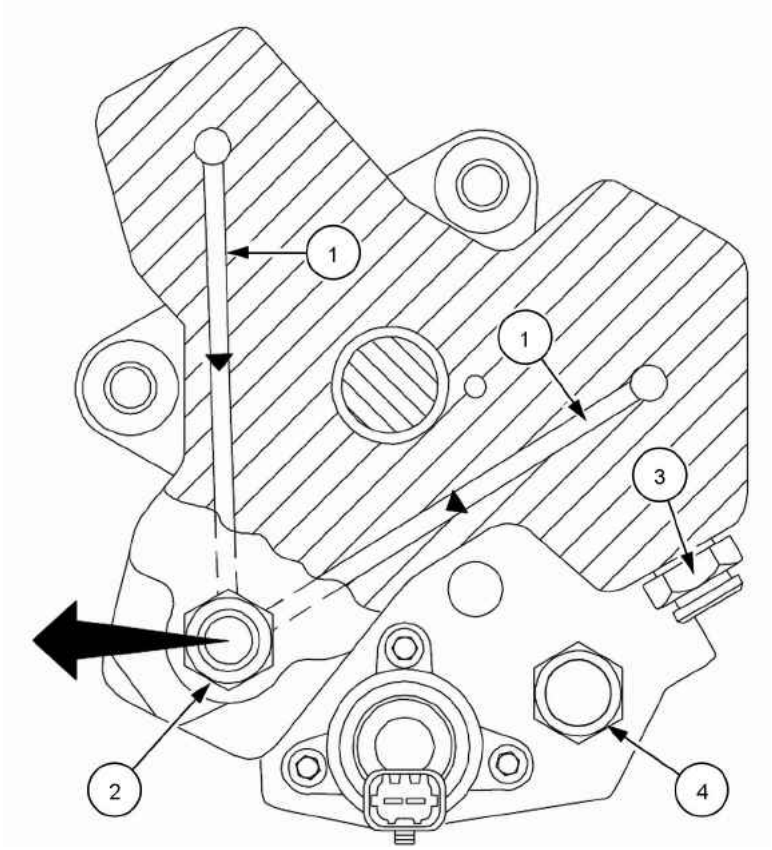
(1) Fuel to common rail
(2) Outlet valve
(3) Pumping element
(4) Eccentric pump shaft
(5) PWM metered fuel
(6) Low pressure supply fuel
(7) Regulator valve (PWM)

This figure shows the low pressure supply passages in the CP3 pump. The pump shaft and pumping elements are lubricated with diesel fuel. The relief valve maintains a **5.0 bar** (**72.5 psi**) supply pressure to charge the pumping elements.



NHIL13ENG1039GA 39

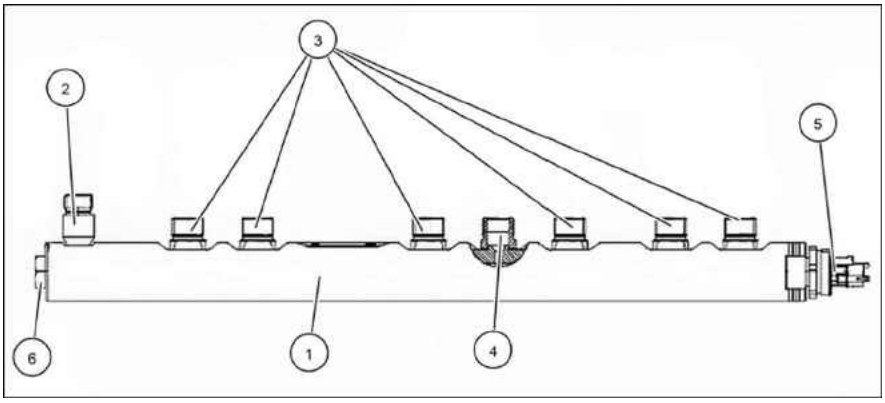
(1) Pumping element inlet pressure
(2) Pump lubrication passage
(3) Pumping element inlet pressure
(4) Main supply passage
(5) Pressure regulator
(6) Pumping element inlet pressure
(7) Relief valve outlet passage
(8) Fuel supply inlet from final filter passage to relief valve and regulator



HPFUELPUMP5 40

(1) High pressure fuel passage to common rail
(2) High pressure fuel passage to common rail
(3) Outlet to common rail

Common Rail



RAIL15TR00399EA 41

1) Common rail
2) Fuel return
3) Connector to injectors
4) Fuel supply
5) Fuel pressure sensor
6) Relief valve

The volume of the common rail is relative small to allow quick pressure build up at cranking and start up, at idle, and in case of high flow rates.

The rail has enough volume to minimize pressure spikes caused by the opening and closing of the injectors and the operation of the high pressure pump.

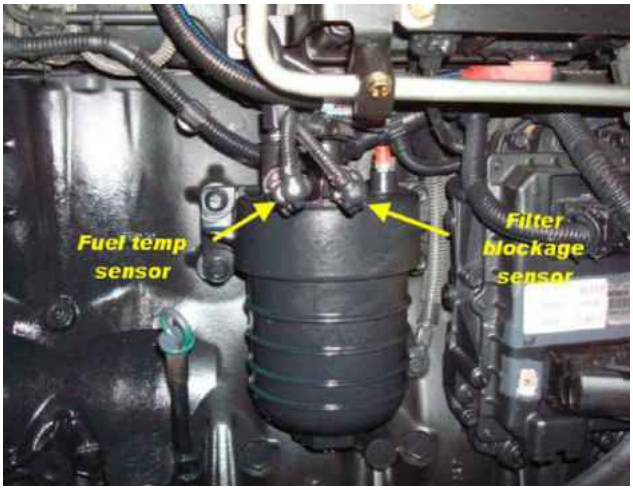
The fuel pressure sensor (5) sends a signal to the ECU; this is feedback information in the calculation of the PWM signal sent to the regulator valve.

The relief valve (6) open at 1850 - 1950 bar (29825 - 28275 psi)

Fuel system testing

Always use the fuel temperature sensor port when checking fuel pressure.

Using the fuel blockage sensor will open the dirty side of the filter to the clean and contaminate the fuel system.



RAIL15TR01377PA 42

To test the fuel supply pressure you will to procure a MC5315 x 4 x 12 fitting locally.

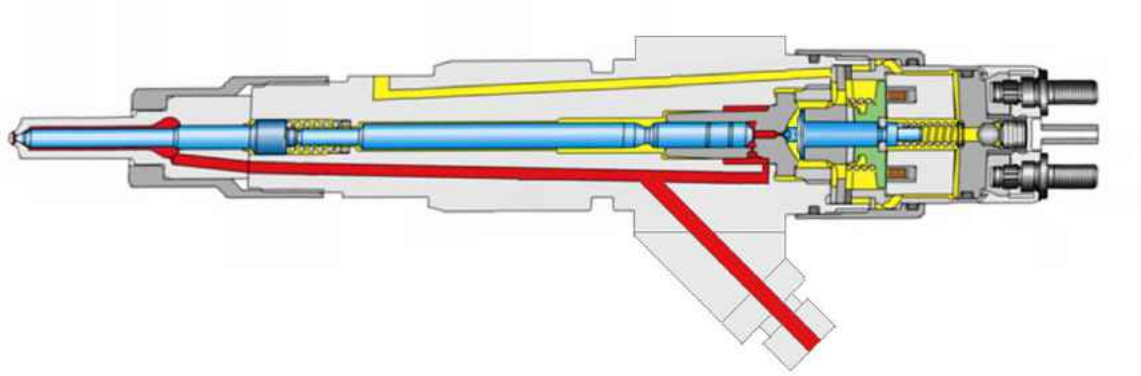
Pressure at filter with lift pump running . **0.34 bar** (**5.00 psi**)

Pressure while cranking **1.0 bar** (**14.5 psi**)

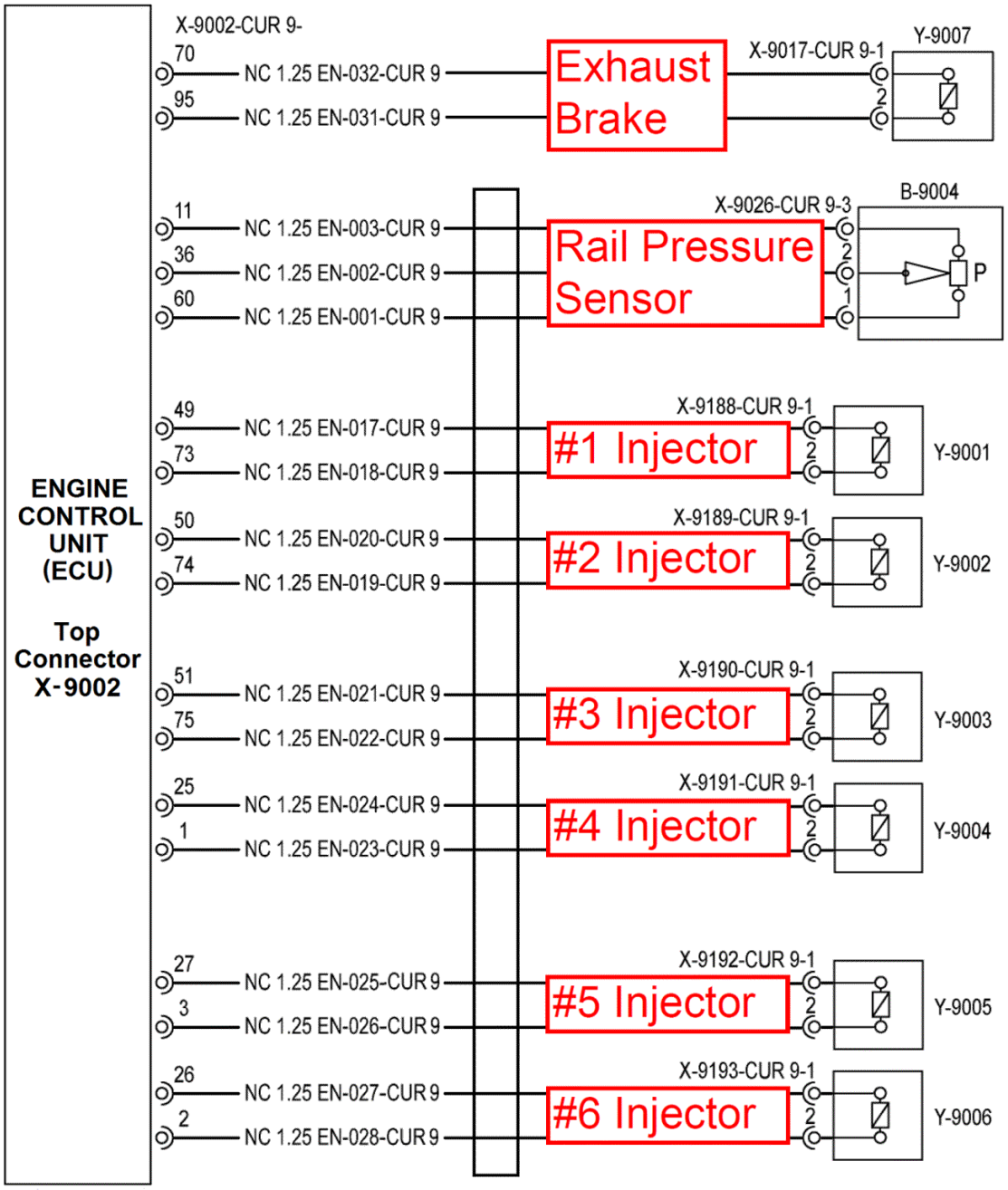
Engine running **5.0 bar** (**72.5 psi**)

RAIL15TR01378PA 43

EDC17CV41 Injector to ECU Connections



RAIL15TR01375SA 44



RAIL15TR01376UA 45

Engine - Overview - Special Tools

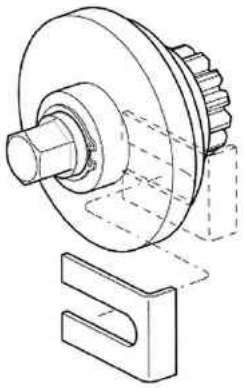
Turning tool

380003118 - **Cursor®** 9

Mandatory

Level 1 - One at every dealer location

Included in Kits:



RAIL15TR01298AA 1

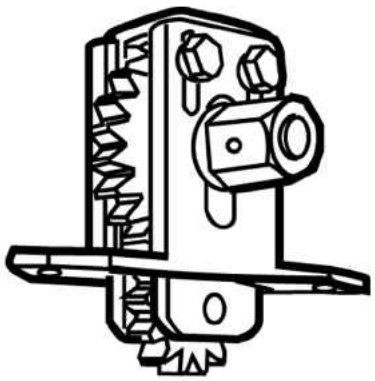
Turning tool

380000137 - **Cursor®** 8, 10, and 13

Mandatory

Level 2 - Internal Repair: one set by dealer

Included in Kits: 380040121 and 380040128



2

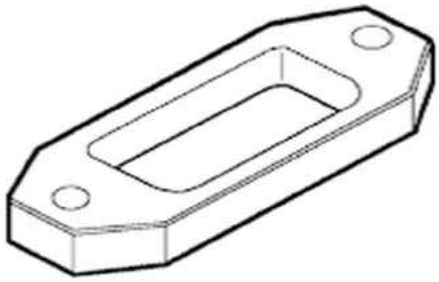
Spacer

To be used with **380000137** and **380000138** - **Cursor®** 10 and 13

Mandatory

Level 1 - One at every dealer location

Included in Kits: 380040127, and 380040129



RAIL15TR01299AA 3

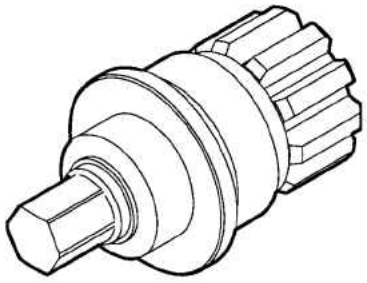
Engine turning tool

380002822 - **Cursor®** 9 (Except for T8. series tractors)

Mandatory

Level 2 - Internal repair: one set by dealer

Included in Kits:



380002822 4

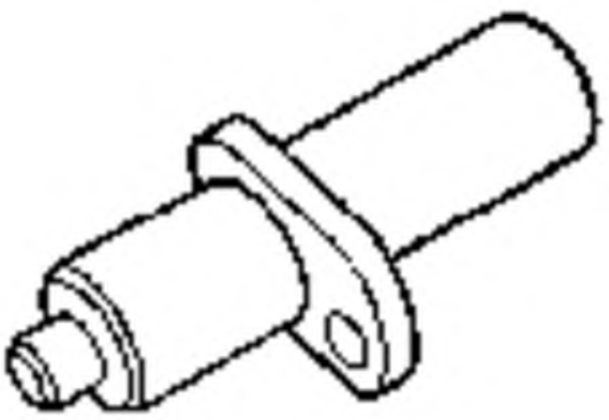
Flywheel pinning tool

380000150 - **Cursor®** 8, 9, 10, and 13

Mandatory

Level 1 - One at every dealer location

Included in Kits: 380040121, and 380040128



380000150 5

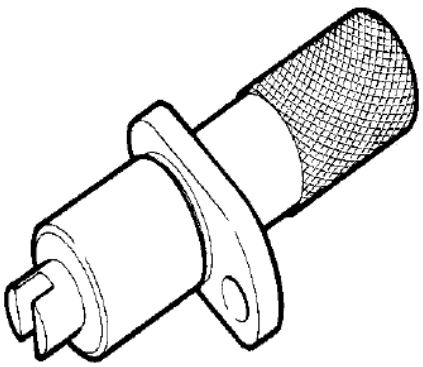
Phonic wheel position tool

380000151 - **Cursor®** 8, 9, 10, and 13

Mandatory

Level 1 - One at every dealer location

Included in Kit: 380040121



380000151 6

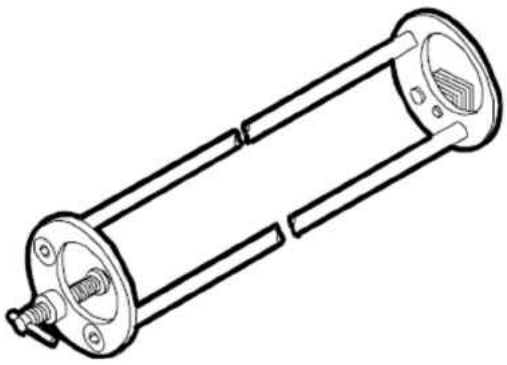
Rocker arm shaft tool

380000148 - **Cursor®** 10 and 13
380000149 - **Cursor®** 8 and 9

Level 2 - Internal repair: one set by dealer

380000148 (**Cursor®** 10 and 13) included in kits: 380040127, 380040129, and 380040199

380000149 (**Cursor®** 9) included in kit: 38040126



380000148 7

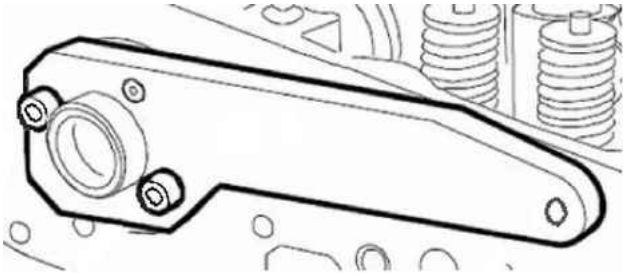
Camshaft timing tool

380002818 - **Cursor®** 9

Recommended

Level 2 - Internal repair: one set by dealer

Included in kit:



RAIL15TR01300AA 8

Rear seal removal tool

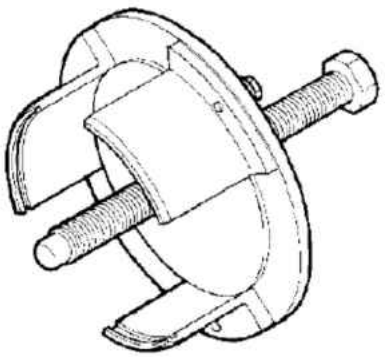
380000119 - **Cursor®** 8
380000121 - **Cursor®** 9, 10, and 13

Mandatory

Level 2 - Internal repair: one set by dealer

Included in Kit:

* Also available in kit 380040121 per eTIM



380000121 9

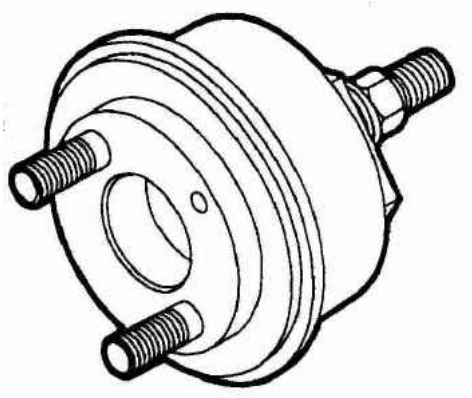
Rear seal installation tool

380000125 - **Cursor®** 8
380002815 - **Cursor®** 9, 10, and 13

Mandatory

Level 2 - Internal repair: one set by dealer

Included in kit: 380040121



380000127 10

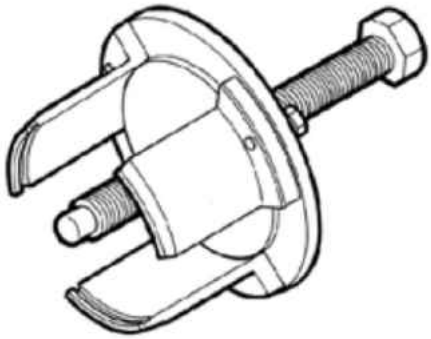
Front seal removal tool

380000118 - **Cursor®** 8 and 9
380000120 - **Cursor®** 10 and 13

Level 2 - Internal repair: one set by dealer

380000118 included in kit:

380000120 included in kit: 380040121



380000120 11

Front seal installation tool

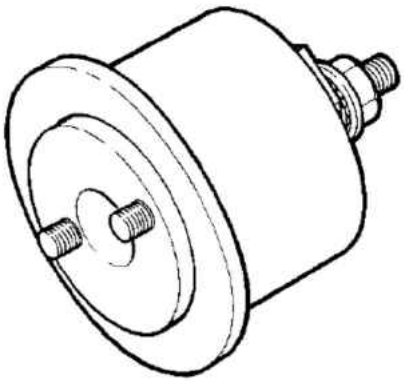
00409463 - **Cursor®** 8 and 9
380000126 - **Cursor®** 10 and 13

Mandatory

Level 2 - Internal repair: one set by dealer

380000124 included in kit:

380000126 included in kit: 380040121



380000126 12

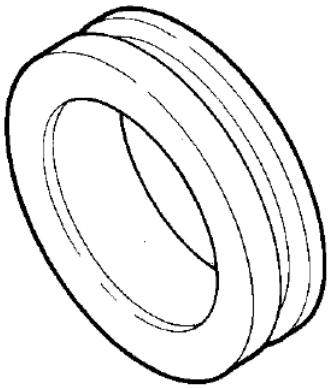
Centering ring for front crankshaft seal

380000168 - **Cursor®** 8
380000169 - **Cursor®** 10 and 13

Mandatory

Level 2 - Internal repair: one set by dealer

380000169 included in kit: 380040121



380000169 13

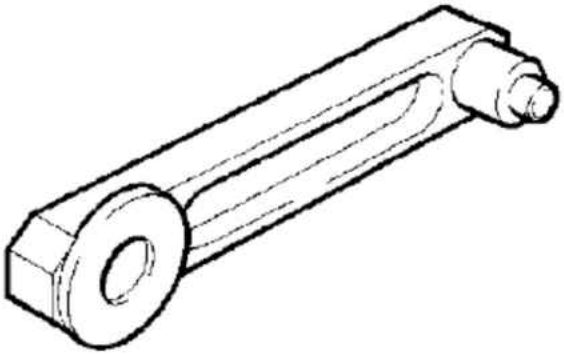
Gauge for setting camshaft to idler gear backlash

380000165 - **Cursor®** 8
380002823 - **Cursor®** 9
380000167 - **Cursor®** 10
380000117 - **Cursor®** 13

Mandatory

Level 2 - Internal repair: one set by dealer

Included in kits:



380000117 14

Crankshaft lifting tool

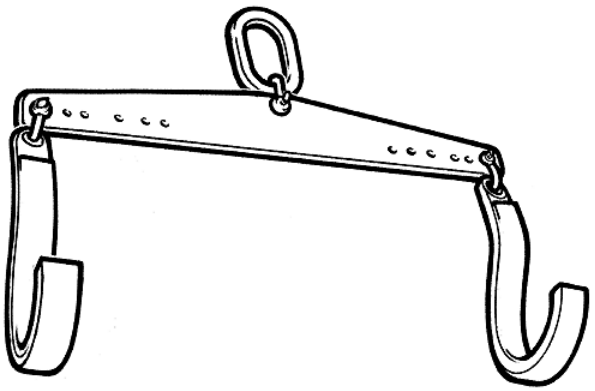
380000362 - Generic

Mandatory

Level 3 - Safety related tool

Included in kit:

Purchase locally



380000362 15

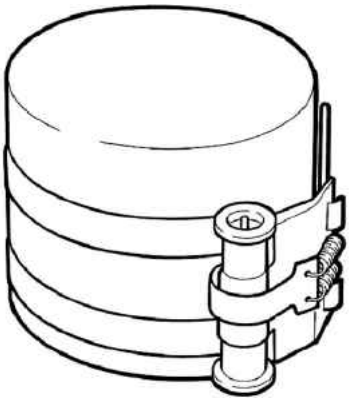
Ring compressor

380000220 - Generic **60.0 - 125.0 mm** (**2.4 - 4.9 in**)

Recommended

Level 2 - Internal repair: one set by dealer

Included in kits:



380000220 16

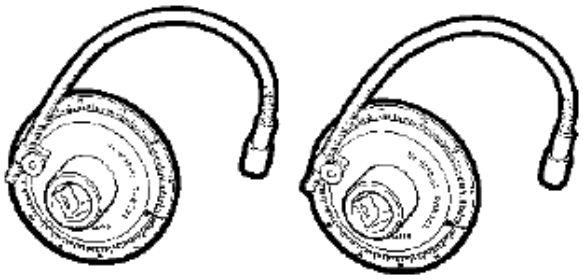
Torque turn tool

380001001 - Generic **0.5 in** and **0.75 in** drive

Recommended

Level 1 - One at every dealer location

Included in kits:



380001001 17

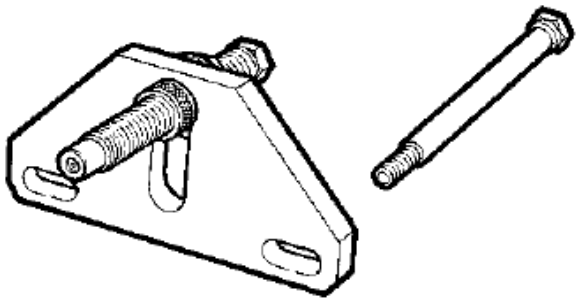
Flywheel stop tool

380000144 - **Cursor®** 9, 10, and 13

Mandatory

Level 2 - Internal repair: one set by dealer

Included in kits:



380000144 18

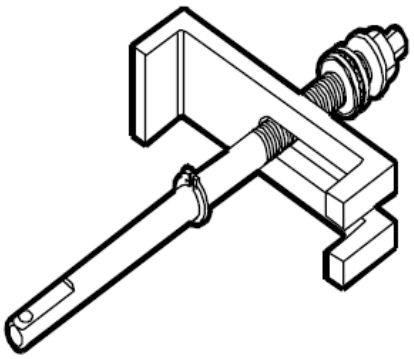
Cylinder sleeve removal tool

380000366 - **Cursor®** 8, 9, 10, and 13
(Tool works with specific rings)

Mandatory

Level 2 - Internal repair: one set by dealer

Included in kits:



380000366 19

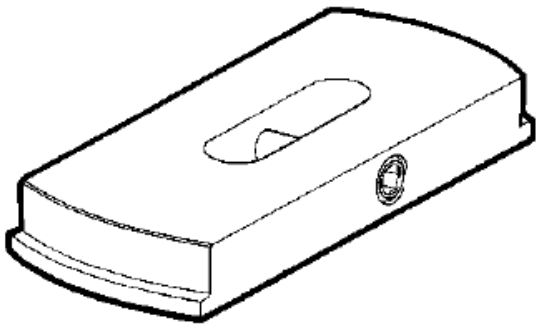
Cylinder sleeve removal rings

380000152 - **Cursor®** 8 and 9 (**115 mm**)
380000153 - **Cursor®** 10 (**125 mm**)
380000116 - **Cursor®** 13 (**135 mm**)
(Used with the 380000366 sleeve pulling tool)

Recommended

Level 2 - Internal repair: one set by dealer

Included in kits:



380000116 20

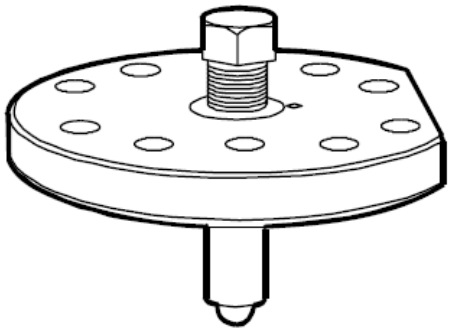
Sleeve protrusion compression tool

380000140 - **Cursor®** 8, 9, 10, and 13

Mandatory

Level 2 - Internal repair: one set by dealer

Included in kits:



380000140 21

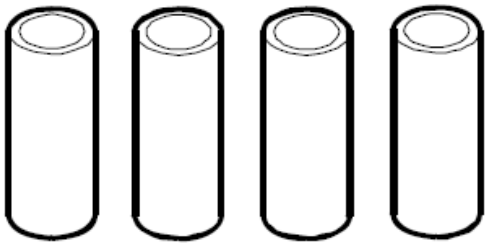
Spacers used with sleeve compression tool

380000142 - **Cursor®** 10 and 13
(Used with **380000140**)

Recommended

Level 2 - Internal repair: one set by dealer

Included in kits:



380000142 22

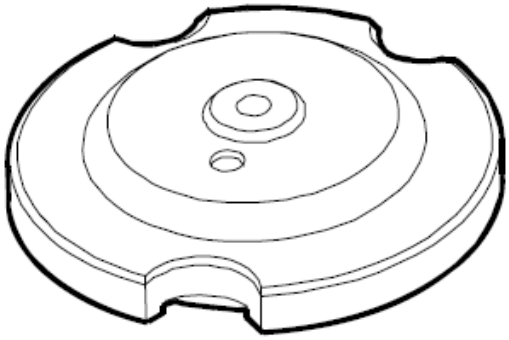
Sleeve compression plate

380000143 - **Cursor®** 10
380000115 - **Cursor®** 13
(Used with **380000140** and **380000142**)

Recommended

Level 2 - Internal repair: one set by dealer

Included in kits:



380000115 23

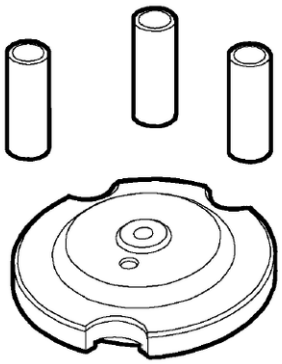
Sleeve compression plate and spacers

380000141 - **Cursor®** 8, and 9
(Tool to be used with **380000140**)

Mandatory

Level 2 - Internal repair: one set by dealer

Included in kits:



RAIL15TR01301AA 24

Fuel pump alignment tool

380002817 - **Cursor®** 9

Mandatory

Level 2 - Internal repair: one set by dealer

Included in kits:

RAIL15TR01302AA 25

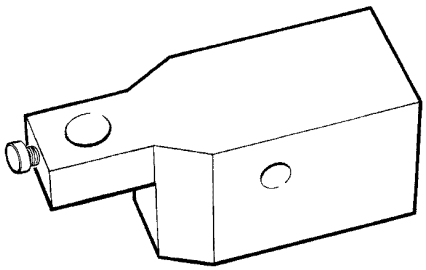
Dial indicator base

380000364 - **Cursor®** 8, 9, 10, and 13
(Used with **380000228**)

Recommended

Level 2 - Internal repair: one set by dealer

Included in kits:



380000364_3A 26

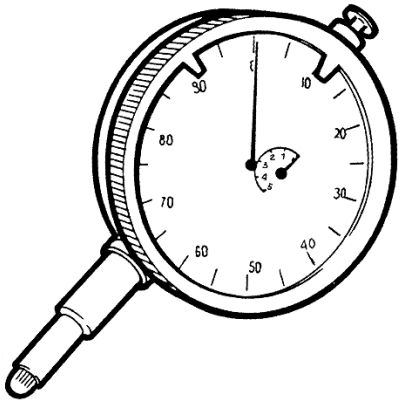
Dial indicator

380000225 - **Cursor®** 8, 9, 10, and 13
(Used with **380000364**)

Recommended

Level 2 - Internal repair: one set by dealer

Included in kits: 380000229



380000228 27

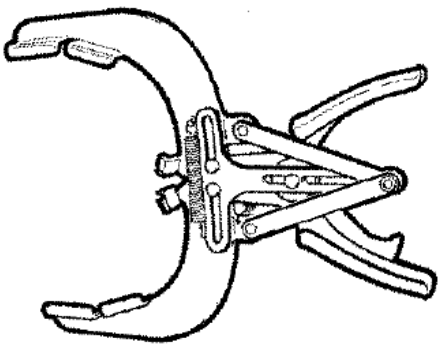
Piston ring extender

380000324 - Generic **110.00 - 150.00 mm** (**4.33 - 5.91 in**)

Recommended

Level 2 - Internal repair: one set by dealer

Included in kits:



380000324 28

Camshaft bushing removal and installation tool

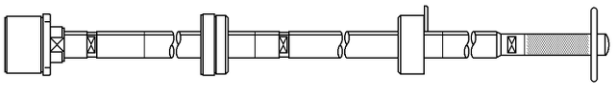
380000145 - **Cursor®** 8
380000146 - **Cursor®** 10, and 13

Mandatory

Level 2 - Internal repair: one set by dealer

380000145 (**Cursor®** 8) Included in kit: 380040127

380000146 (**Cursor®** 10 and 13) included in kits: 380040127, 380040129, and 380040199



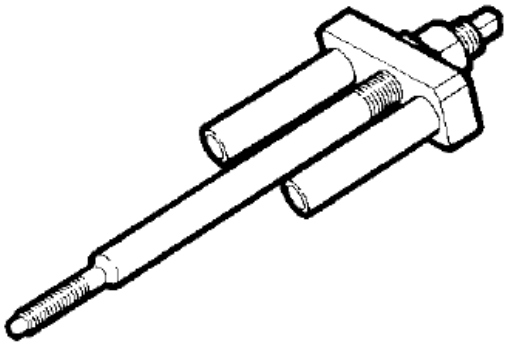
RAIL15TR01303AA 29

Injector cup extractor

380000123 - **Cursor®** 8, 9, 10, and 13

Mandatory

Level 2 - Internal repair: one set by dealer



380000123 30

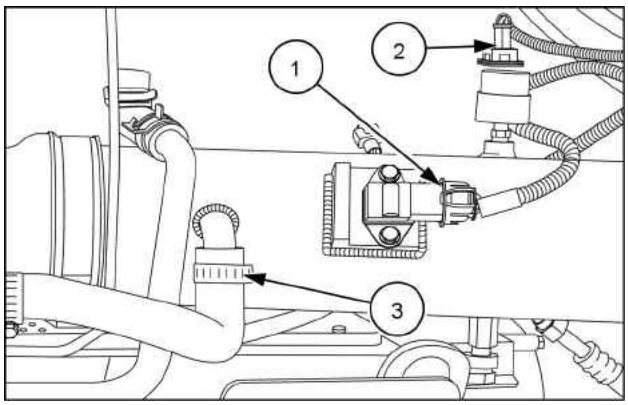
Engine - Remove

Prior operation:
Disconnect the batteries — **Battery - Disconnect (55.302)**
Prior operation:
Remove the hood — **Hood - Remove (90.100)**
Prior operation:
Side shield - Remove (90.102)
Prior operation:
Recover the refrigerant — **Air conditioning - Recover (50.200)**
Prior operation:
Drain the coolant — **Engine cooling system - Emptying (10.400)**
Prior operation:
Engine cooling system - Remove (10.400)
Prior operation:
Diesel Oxidation Catalyst (DOC) - Remove (10.500)

NOTE: *Clean all fittings before disconnecting.*

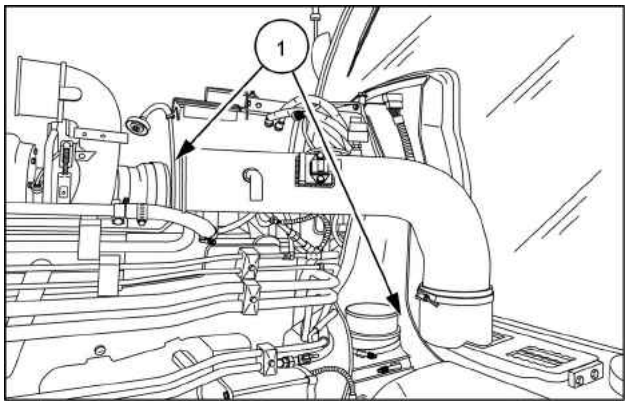
NOTE: *Cap or plug all lines and ports when disconnecting hydraulic components.*

1. Disconnect the harness connector to the humidity sensor **(1)** and the air restriction sensor **(2)**. Disengage the hose clamp **(3)** and disconnect the hose from the air intake tube.



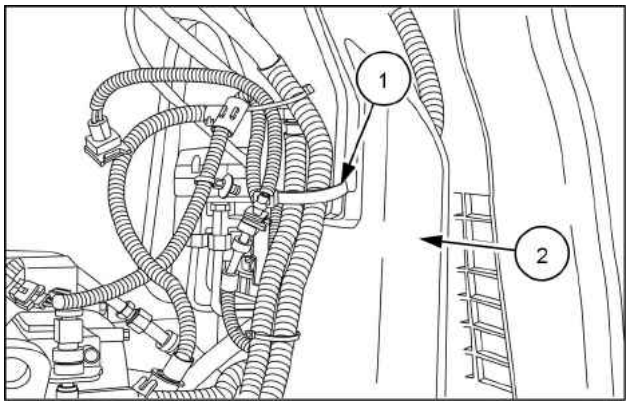
RAIL13TR04202AA 1

2. Disconnect the clamps **(1)** from each end of the air intake tube and remove the tube.



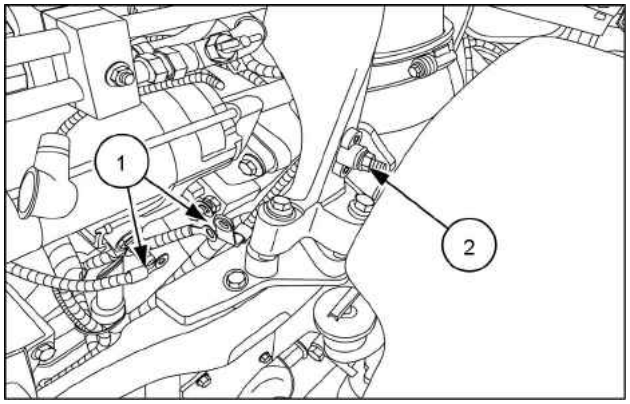
RAIL13TR04211AA 2

3. Cut the wire tie **(1)** securing the harness to the hood support **(2)**.



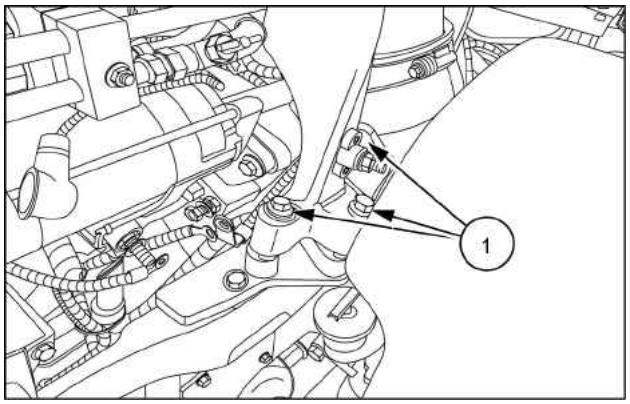
RAIL13TR04204AA 3

4. Disconnect the starter cables **(1)** and the auxiliary wire **(2)**.



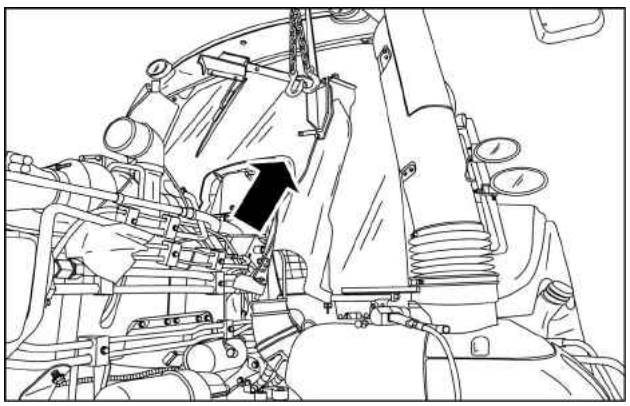
RAIL13TR04209AA 4

5. Remove the three bolts **(1)** securing the hood support to the frame.



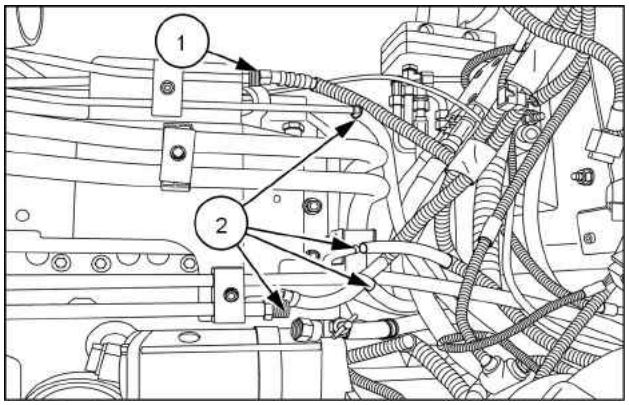
RAIL13TR04209AA 5

6. Remove the hood support.



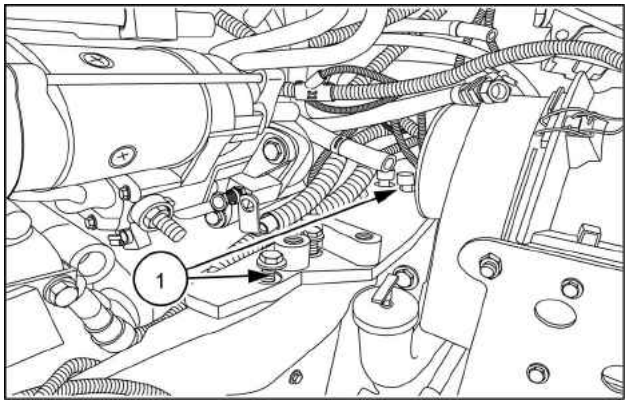
RAIL13TR04212AA 6

7. Disconnect the high pressure A/C hose **(1)** and the coolant lines **(2)**. Plug or cap all ports and lines.



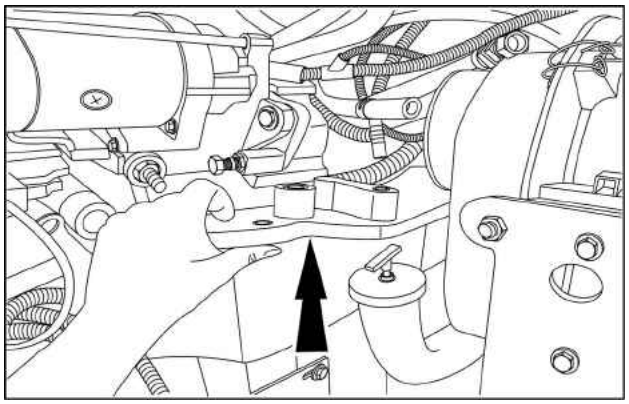
RAIL13TR04230AA 7

8. Remove the two bolts **(1)** from the rear engine mount plate.



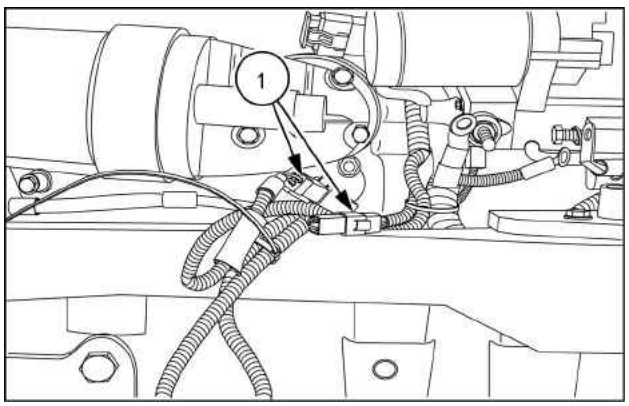
RAIL13TR04243AA 8

9. Remove the engine mount cover plate.



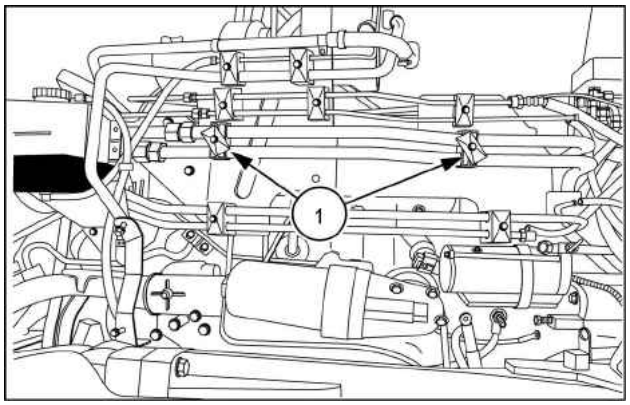
RAIL13TR04244AA 9

10. Disconnect the suspended axle electrical connectors **(1)** if equipped.



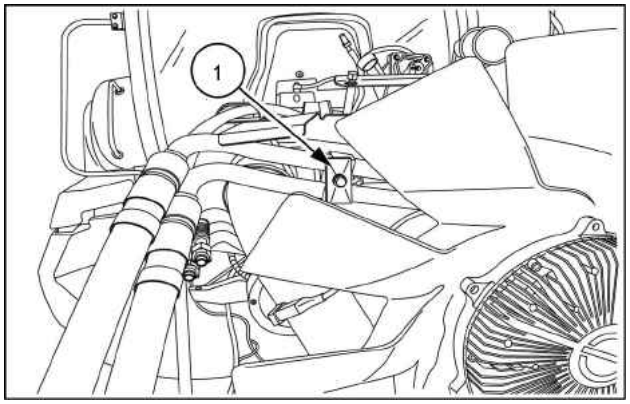
RAIL13TR04237AA 10

11. Remove the two tube clamps **(1)** securing the hydraulic cooler tubes.



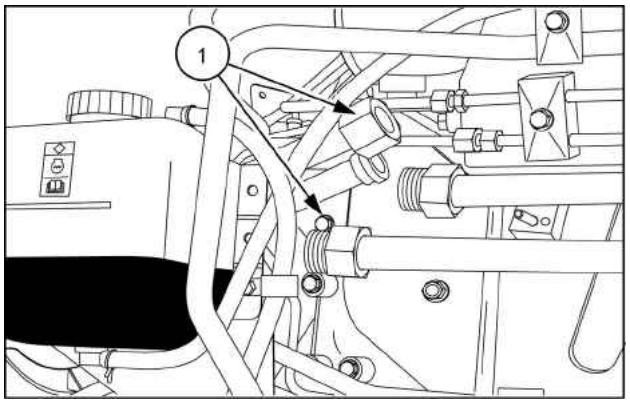
RAIL13TR04232AA 11

12. On the front of the engine, remove the tube clamp **(1)** for the oil cooler tubes.



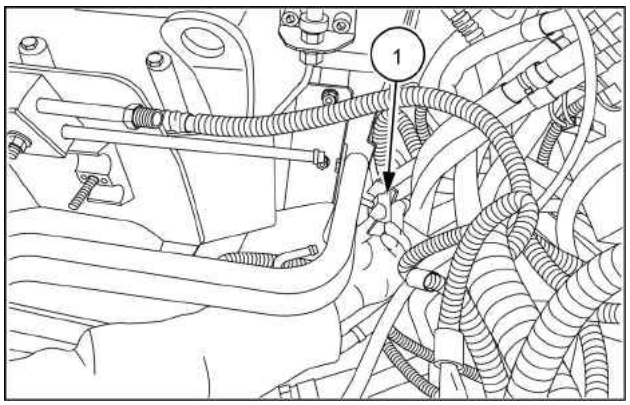
RAIL13TR04234AA 12

13. Disconnect the oil cooler tubes **(1)** and set them aside.



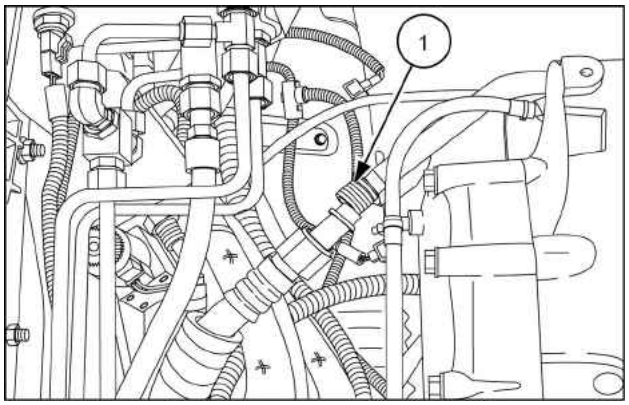
RAIL13TR04235AA 13

14. On the rear of the engine, remove the oil cooler tube clamp **(1)**.



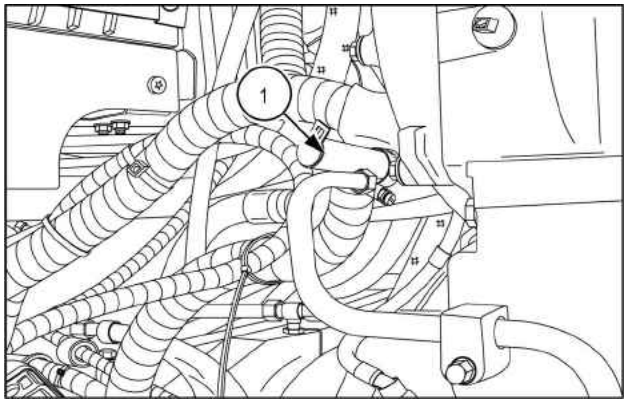
RAIL13TR04236AA 14

15. Disconnect the low pressure A/C line **(1)**. Plug or cap the fittings.



RAIL13TR04228AA 15

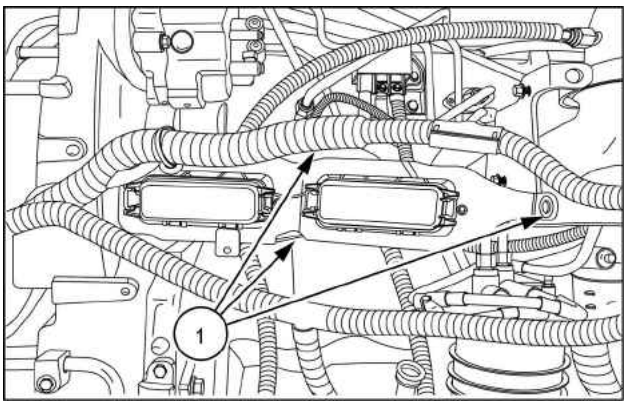
16. Disengage the hose clamp and disconnect the engine controller oil line **(1)**.



RAIL13TR04227AA 16

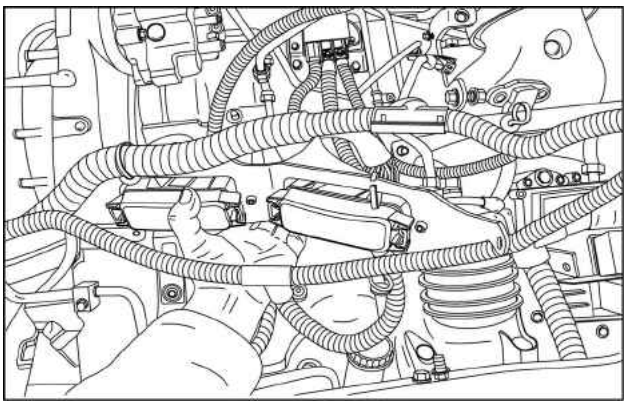
17. Remove the three mounting bolts **(1)** securing the fuse panel bracket.

NOTE: *Cut any wire ties securing the harness.*



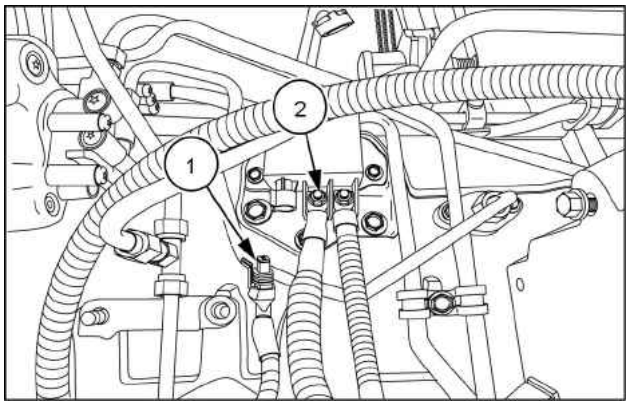
RAIL13TR04216AA 17

18. Remove the fuse panel.



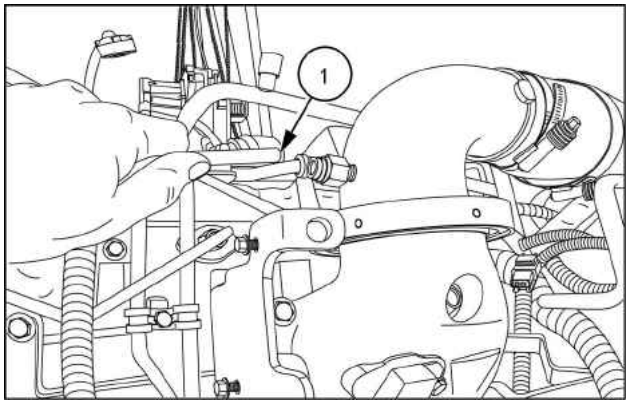
RAIL13TR04214AA 18

19. Disconnect the harness connector **(1)** for the engine grid heater and the power supply cable **(2)**.



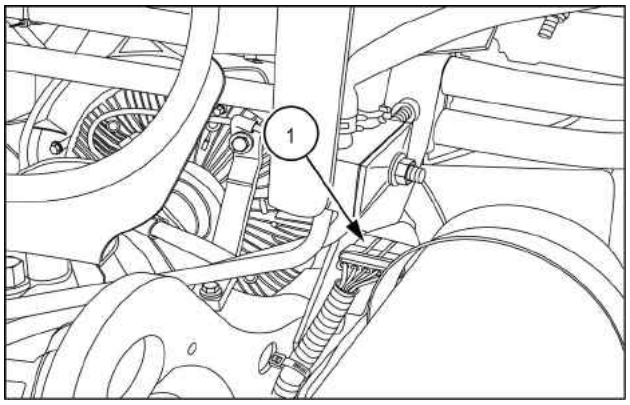
RAIL13TR04219AA 19

20. Disconnect the vent hose **(1)** from the intake manifold.



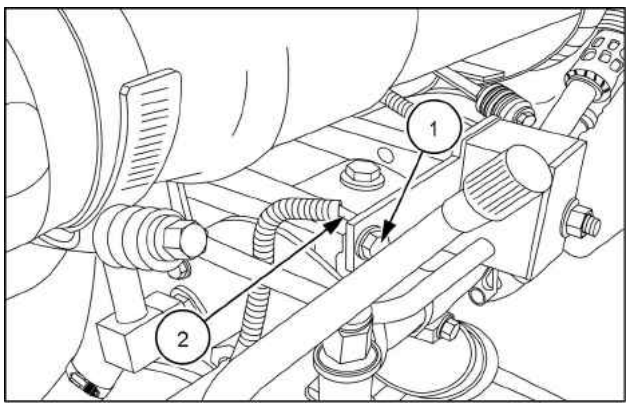
RAIL13TR04218AA 20

21. Disconnect the harness connector **(1)** for the fan drive.



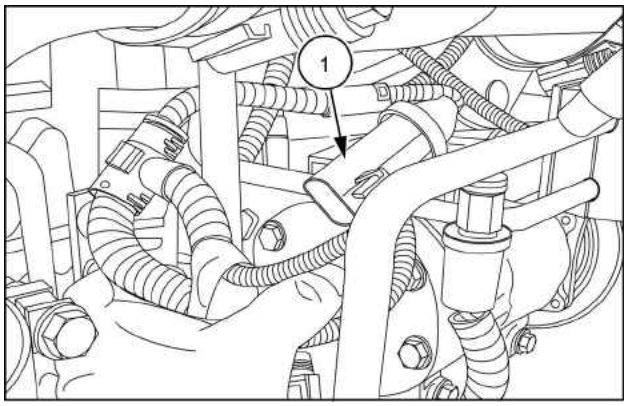
RAIL13TR04220AA 21

22. Remove the A/C compressor mounting bolt **(1)** and disconnect the ground wire **(2)**.



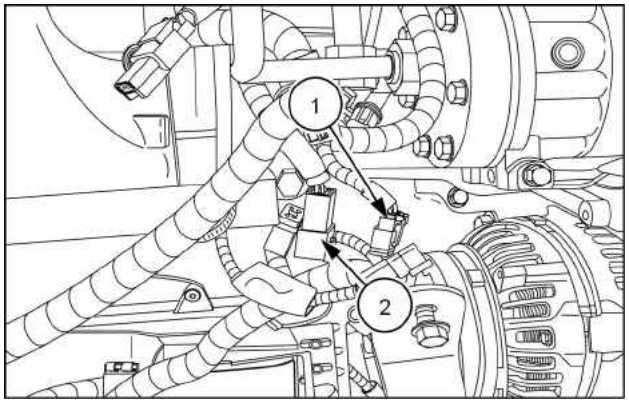
RAIL13TR04224AA 22

23. Disconnect the harness connector to the high pressure switch **(1)**.



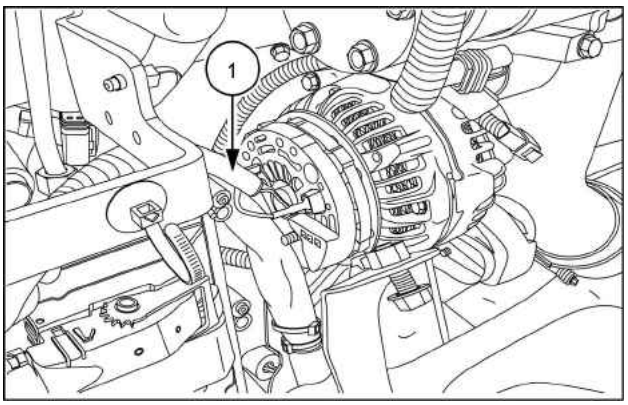
RAIL13TR04223AA 23

24. Disconnect the alternator excite wire connector **(1)** and the CAN bus connector **(2)**.



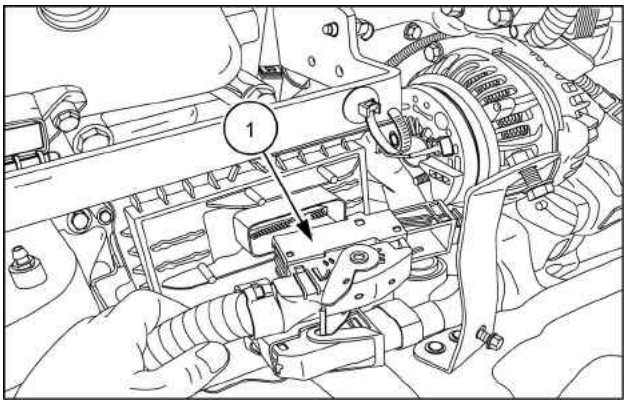
RAIL13TR04221AA 24

25. Remove the nut and disengage the alternator output cable **(1)**.



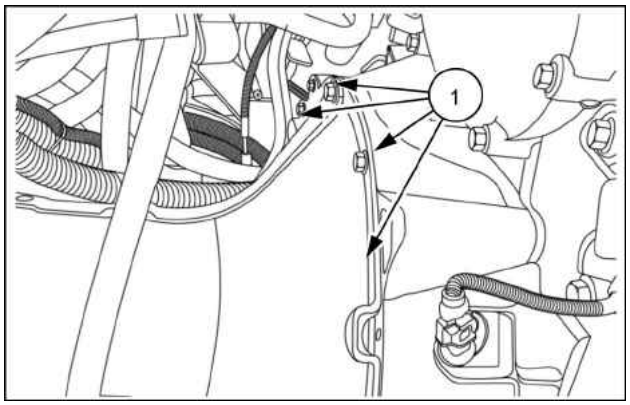
RAIL13TR04231AA 25

26. Disconnect the harness connector **(1)** to the engine controller.



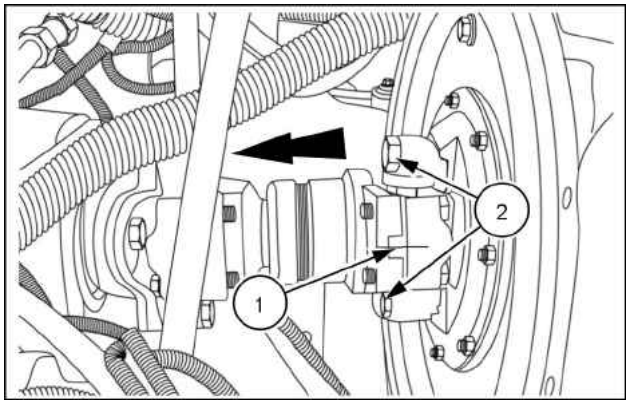
RAIL13TR04226AA 26

27. Remove the bolts **(1)** and the cover for the drop box drive shaft. Set the cover aside.



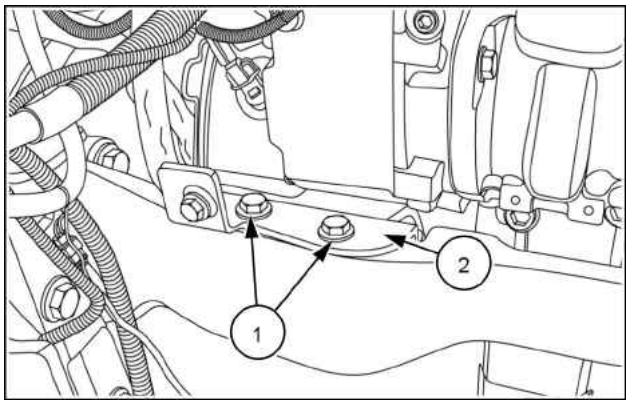
RCPH10CCH813AAB 27

28. Mark the alignment of the drive shaft **(1)**. Remove the four bolts and disengage the drive shaft from the flywheel.



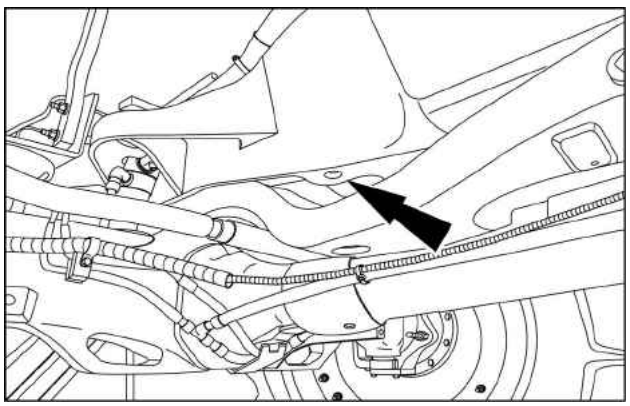
RCPH10CCH817AAB 28

29. Remove the bolts **(1)** from the plate **(2)** for the right hand rear engine mount.



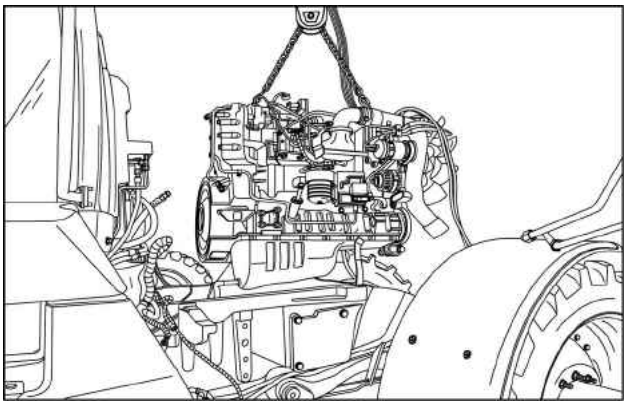
RCPH10CCH925AAB 29

30. Under the front frame, remove the front engine mount nut.



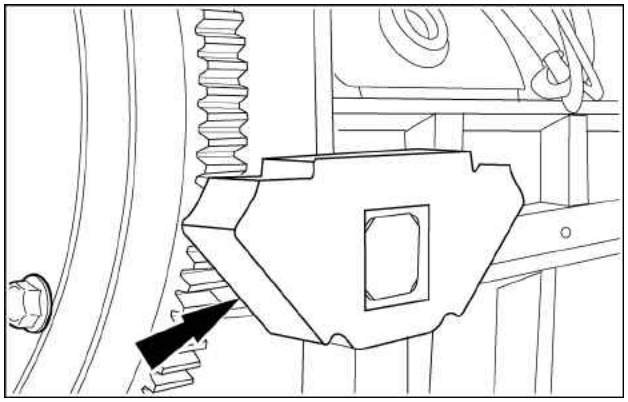
RAIL13TR04246AA 30

31. Attach appropriately rated lifting equipment to the lifting brackets on the engine. Carefully remove the engine while making certain all harnesses, lines and hoses have been disconnected.



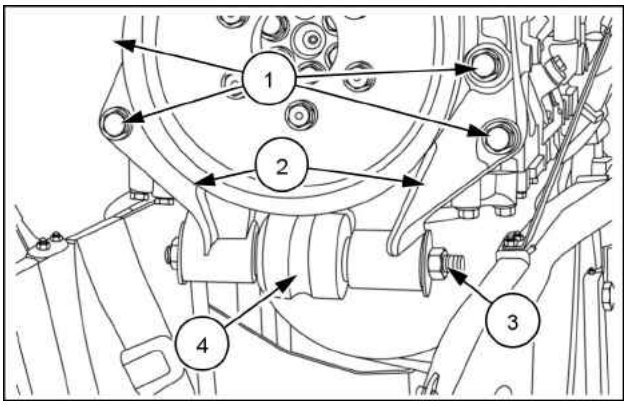
RAIL13TR04247AA 31

32. Remove the right hand ear engine mount. Inspect for wear and/or damage. Replace as required. Repeat for the left side.



RCPH07CCH166AAB 32

33. Remove the four bolts **(1)** securing the brackets **(2)** for the front engine mount.
34. Remove the bolt **(3)** securing the front engine mount **(4)**.
35. Inspect the mount for wear and/or damage. Replace as required.



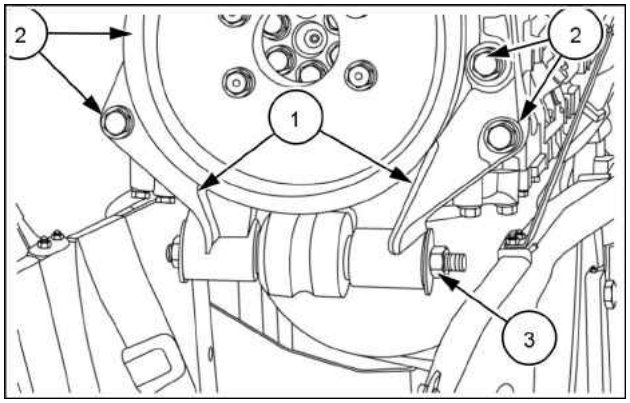
RCPH10CCH833AAB 33

Next operation:
Engine - Install (10.001)

Engine - Install

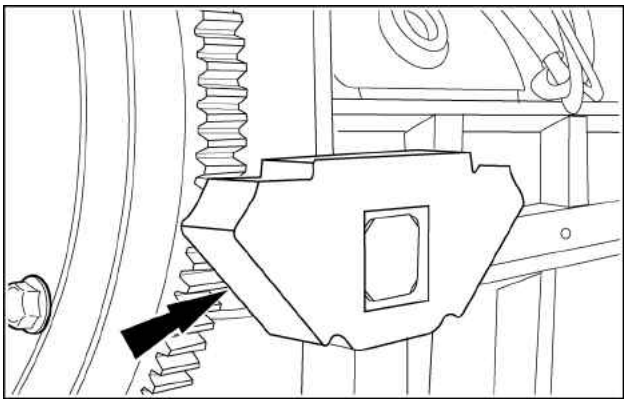
Prior operation:
Engine - Remove (10.001)

1. If removed, install the front engine mounting brackets **(1)**.
2. Torque the four mounting bolts **(2)** to **101 - 113 N·m** (**75 - 83 lb ft**).
3. Torque the ISO mount support bolt nut **(3)** to **160 - 220 N·m** (**118 - 162 lb ft**).



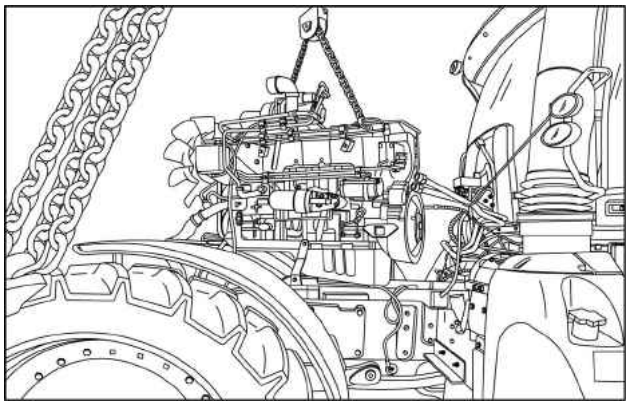
RCPH10CCH833AAB 1

4. Install the right (shown) and left rear engine ISO mounts.



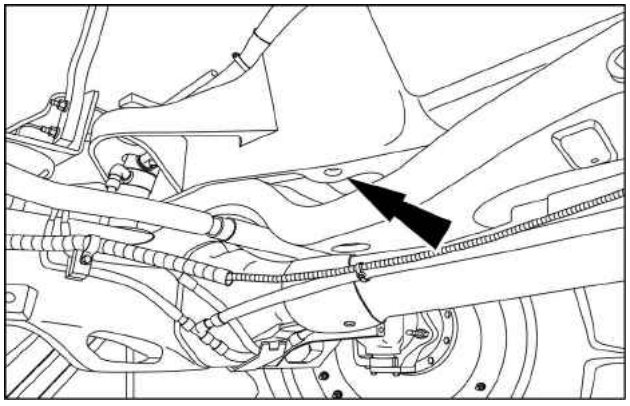
RCPH07CCH166AAB 2

5. Properly support the engine. Raise and move the engine into the front support frame.



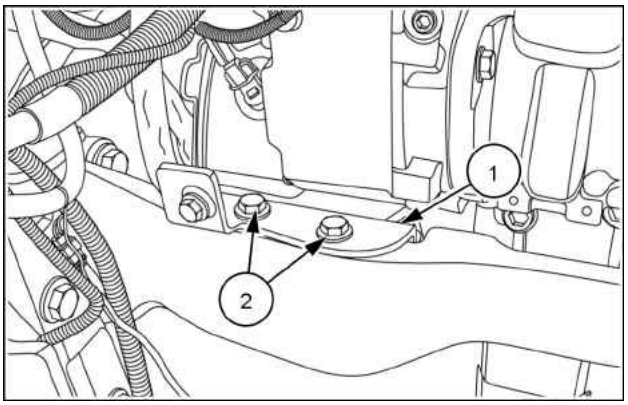
RAIL13TR04248AA 3

6. Install the front engine mounting nut.



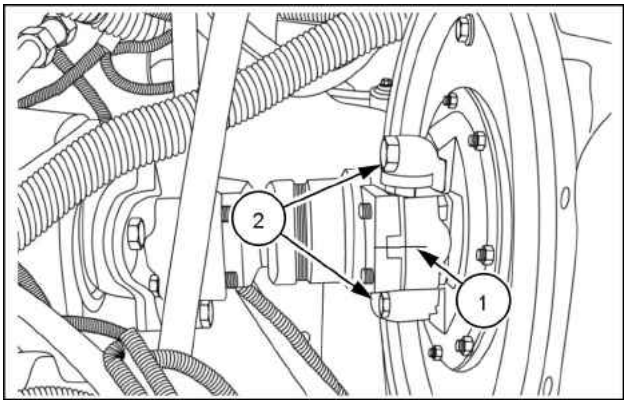
RAIL13TR04246AA 4

7. Install the plate **(1)** for the right hand rear engine mount with the bolts **(2)** removed earlier.
8. Torque the bolts to **125 - 150 N·m** (**92.2 - 110.6 lb ft**).
9. Install the bolts **(3)** removed earlier, and torque to **125 - 150 N·m** (**92 - 111 lb ft**).
10. Install the hood support bolt and washer **(4)** and torque to **125 - 150 N·m** (**92 - 111 lb ft**).



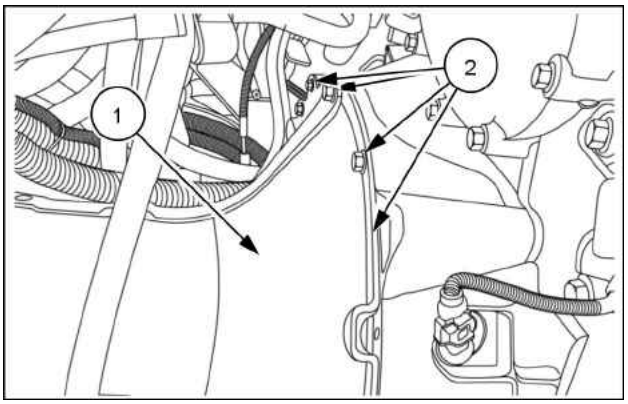
RCPH10CCH925AAB 5

11. Using the alignment marks **(1)** made earlier, attach the engine output drive shaft to the engine flywheel.
12. Using the four bolts **(2)** removed earlier to secure the drive shaft to the flywheel.
13. Torque the bolts to **101 - 113 N·m** (**75 - 83 lb ft**).



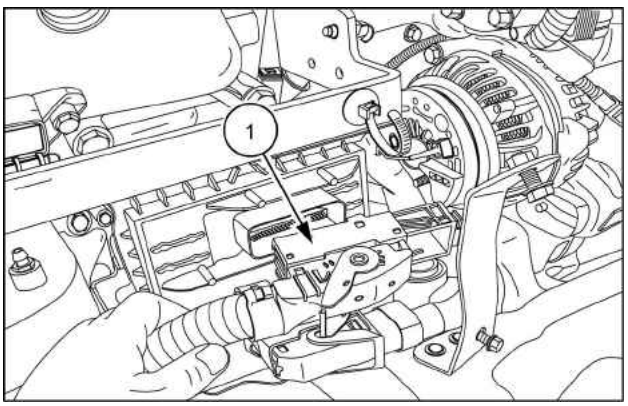
RCPH10CCH817AAB 6

14. Install the engine output drive shaft cover **(1)**. Use the bolts **(2)** removed earlier to secure the cover to the flywheel housing.



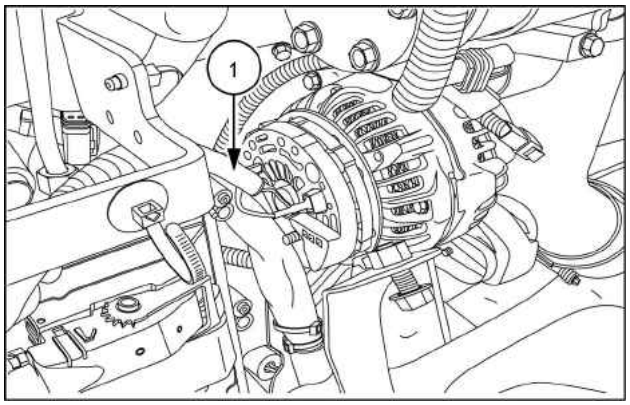
RCPH10CCH813AAB 7

15. Connect the harness connector to the engine controller **(1)**.



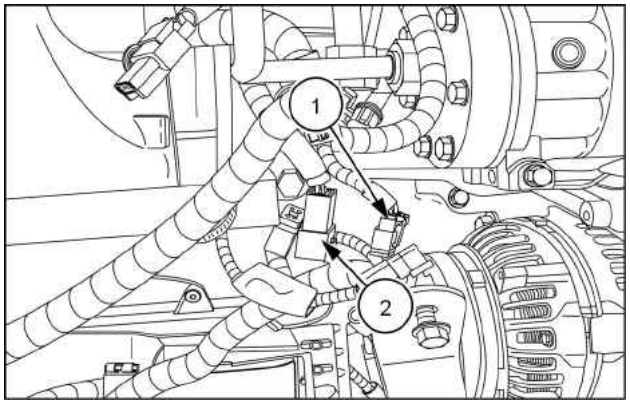
RAIL13TR04226AA 8

16. Connect the alternator output cable **(1)** and secure with the nut previously removed..



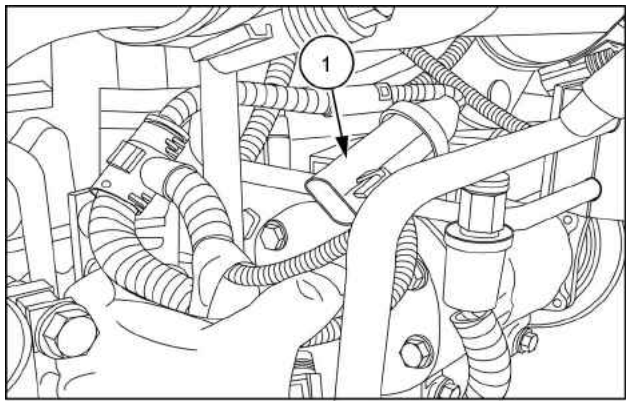
RAIL13TR04231AA 9

17. Connect the alternator excite wire connector **(1)** and the CAN bus connector **(2)**.



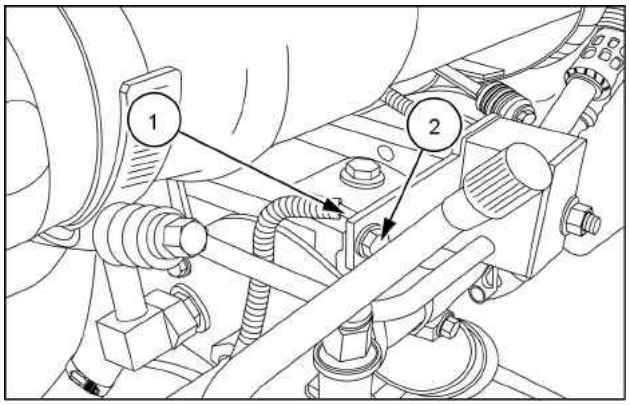
RAIL13TR04221AA 10

18. Connect the harness connector to the high pressure switch **(1)**.



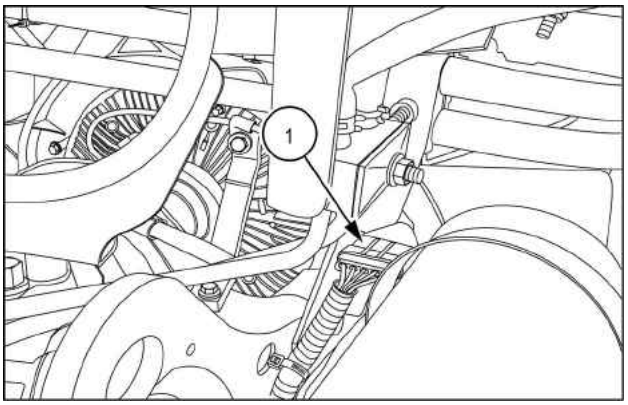
RAIL13TR04223AA 11

19. Connect the ground wire **(1)** and secure the wire with the A/C compressor mounting bolt **(2)**.



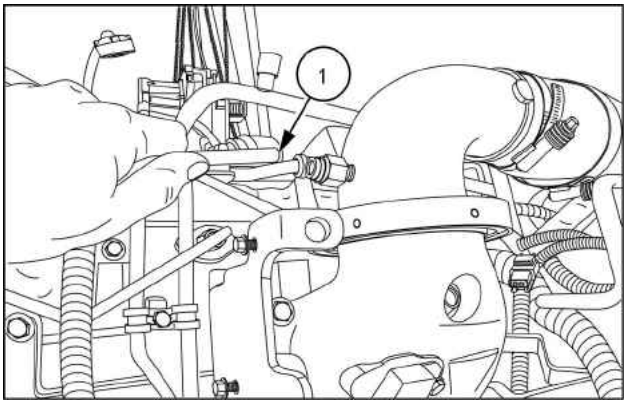
RAIL13TR04224AA 12

20. Connect the harness connector **(1)** for the fan drive.



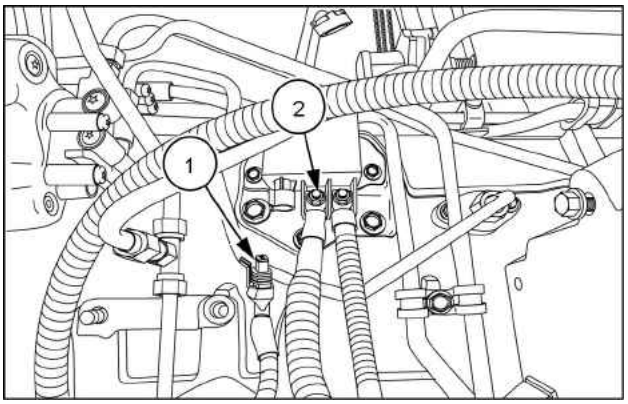
RAIL13TR04220AA 13

21. Connect the vent hose **(1)** to the intake manifold.



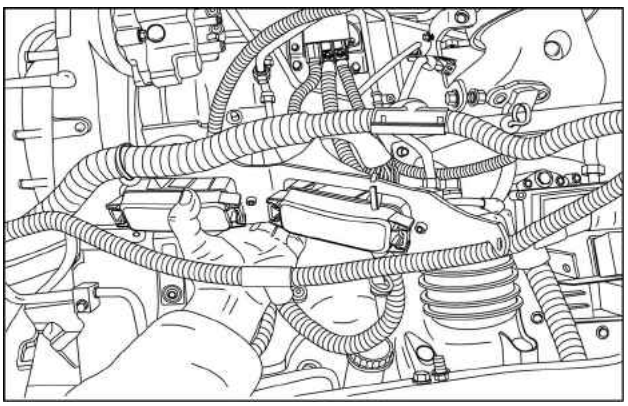
RAIL13TR04218AA 14

22. Connect the harness connector **(1)** for the engine grid heater and the power supply cable **(2)**.



RAIL13TR04219AA 15

23. Install the fuse panel.



RAIL13TR04214AA 16