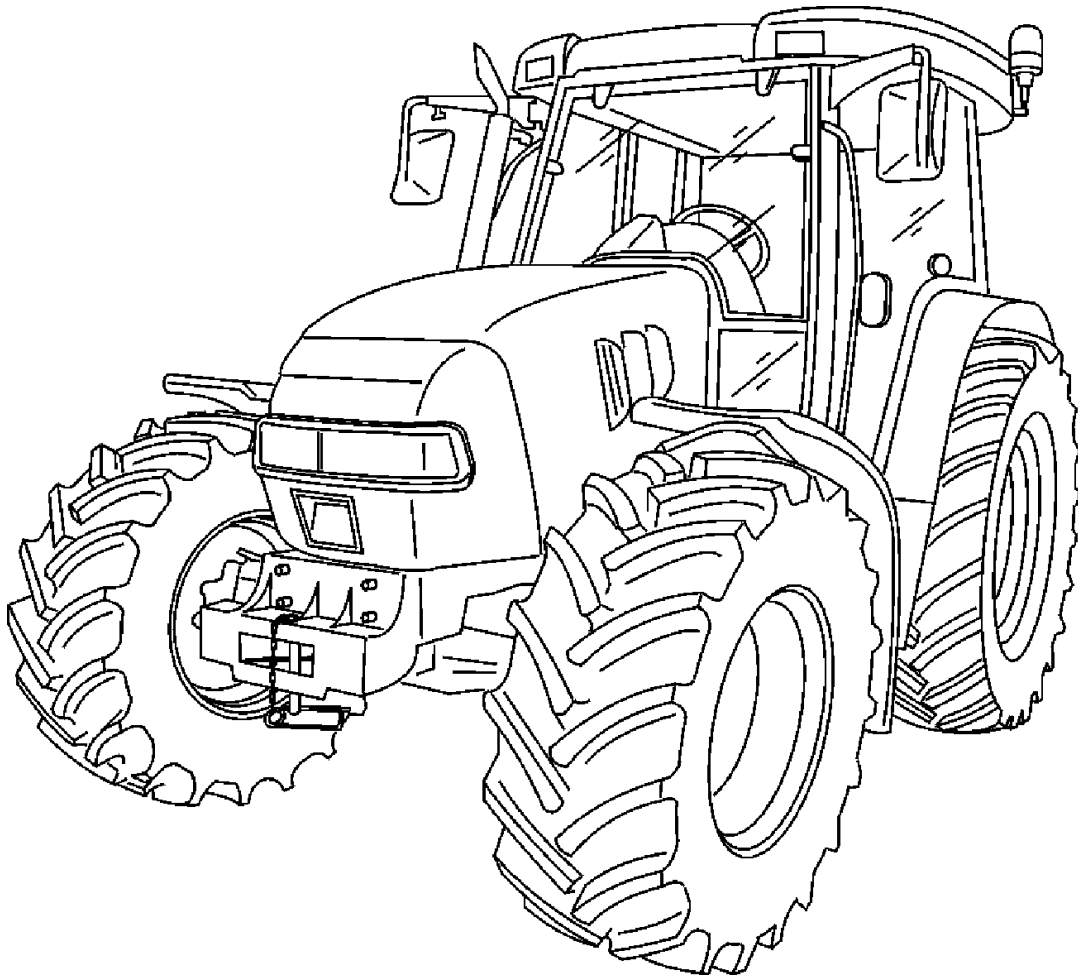




REPAIR MANUAL



CS100 Pro , CS105 Pro , CS80 Pro , CS85 Pro , CS90 Pro , CS95 Pro

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INTRODUCTION

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INTRODUCTION

Foreword – How to use this manual

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Foreword – How to use this manual

The information in this manual is organized using the Integrated Coding Environment (ICE). ICE is a shorthand system for pointing to Sections, Chapters and sub-Chapters in the manual without using the words. ICE also identifies the type of information at that location.

A search for information on an engine component will likely begin at the Table of Contents (TOC) or the Index: for example, a search for information on the rear seal of the crankshaft. When you locate “crankshaft - rear seal” in the TOC with the indicated page number, this Foreword explains:

- how to proceed to the correct location in the manual based on the ICE code,
- how to identify the type of information you may expect at that location.

Crankshaft	
Crankshaft - Remove (B.10.A.43 - F.10.A.10)	139
Crankshaft - Install (B.10.A.43 - F.10.A.15)	140
Crankshaft - End play (B.10.A.43 - F.40.E.10)	141
Crankshaft - Front seal - Remove (B.10.A.43.01 - F.10.A.10)	142
Crankshaft - Front seal - Visual inspection (B.10.A.43.01 - F.40.A.10)	144
Crankshaft - Front seal - Install (B.10.A.43.01 - F.10.A.15)	145
Crankshaft - Rear seal - Remove (B.10.A.43.02 - F.10.A.10)	148
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Crankshaft - Rear seal - Install (B.10.A.43.02 - F.10.A.15)	150

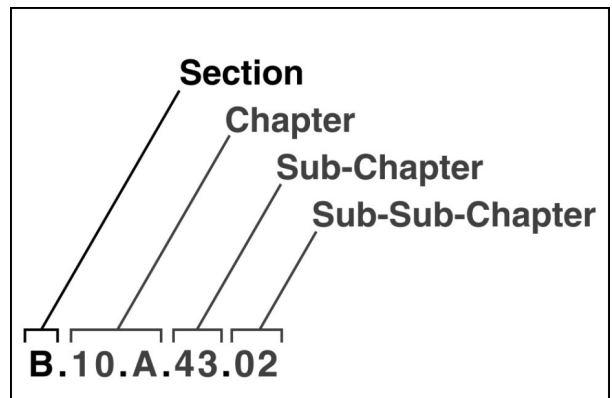
RCPH05CDC414ABA 1

NOTE: Due to differences in languages and models, the page number indicated in the illustration may not be applicable to your manual. Refer to the table of contents in your repair manual.

Location

The first half of an ICE code describes the location of the information.

(The ICE code has two parts separated by a hyphen. The first part describes the location. The periods break up the ICE code into its parts.)



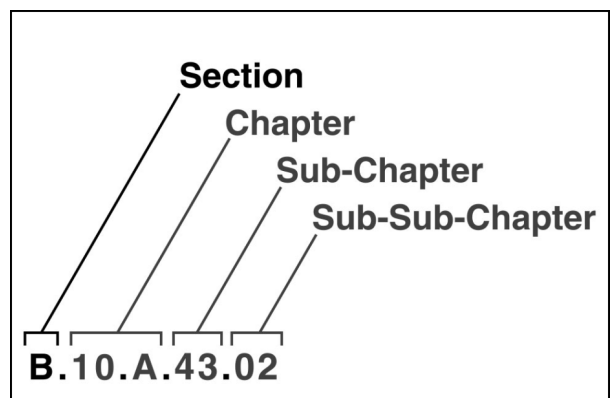
RCPH05CDC476ABA 2

The first letter identifies the section.

Sections are arranged alphabetically in a manual. This engine repair manual is contained within one section – the Power Production Section – signified by the letter “B,” and all ICE references in the manual begin with the letter “B.”

Do NOT confuse a section with a bound book. Because of its size, a section may require more than one bound book, sometimes a book for each chapter within a section.

This repair manual, although contained within one section, requires more than one bound book. The book cover always lists both the section(s) and chapter(s) contained inside the bound book.



RCPH05CDC476ABA 3

The second number and letter identify the chapter within the section.

Chapters are arranged numerically within the section.

The chapters used in this manual are listed below:

- ENGINE (B.10.A)
- FUEL AND INJECTION SYSTEM (B.20.A)
- AIR INTAKE SYSTEM (B.30.A)
- EXHAUST SYSTEM (B.40.A)
- ENGINE COOLANT SYSTEM (B.50.A)
- LUBRICATION SYSTEM (B.60.A)
- STARTING SYSTEM (B.70.A)

The coding indicates that the rear seal is located in Chapter 10.A (Engine), of Section B (Power Production).

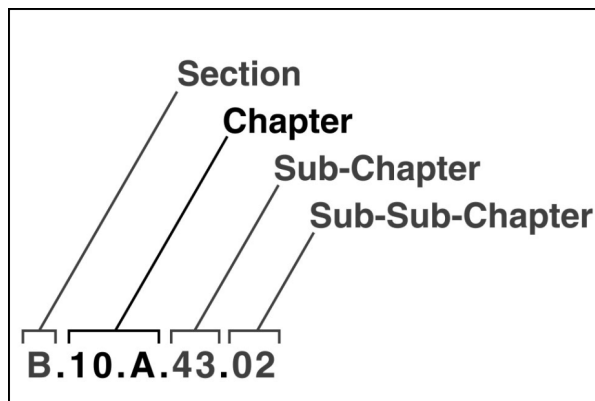
The section and chapter titles (**A**) are displayed at the top of each page in the body of the manual.

The ICE code for the section, chapter and page number (for example, B.10.A/149) (**B**) are displayed at the bottom of each page in the body of the manual.

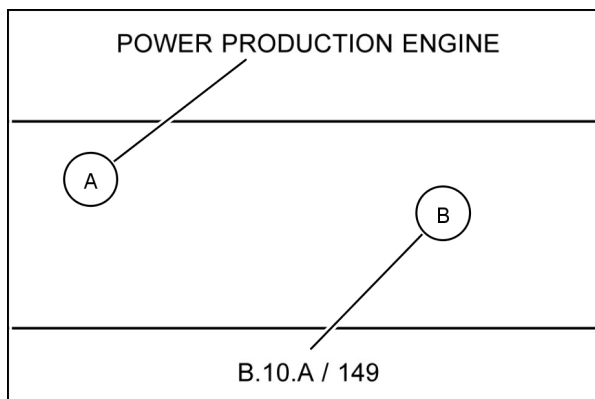
The last two positions in the location code always form the title of the document – in this example, crankshaft - rear seal.

The third number identifies a sub-chapter within the chapter.

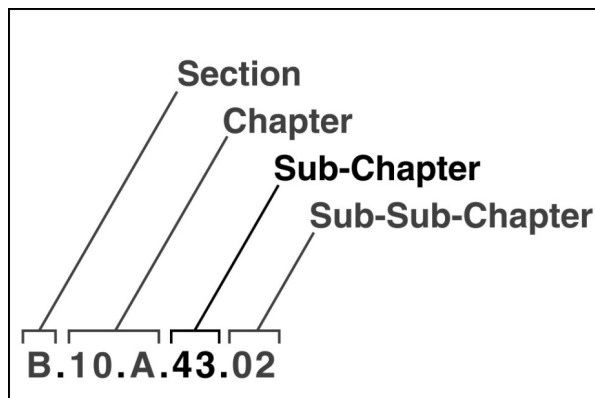
The number “43” represents the crankshaft and indicates that rear seal information is located under crankshaft in Chapter 10.A of Section B.



RCPH05CDC483ABA 4



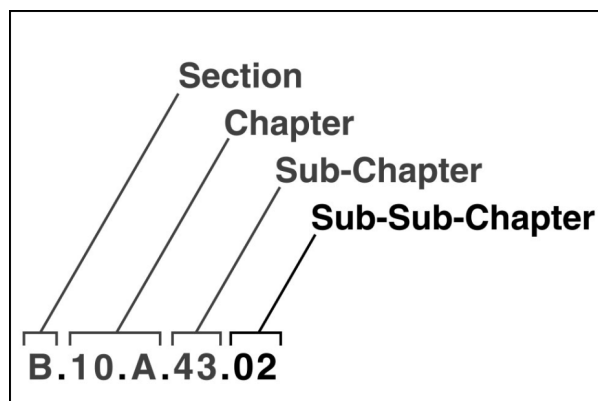
RCPH05CDC407ABA 5



RCPH05CDC490ABA 6

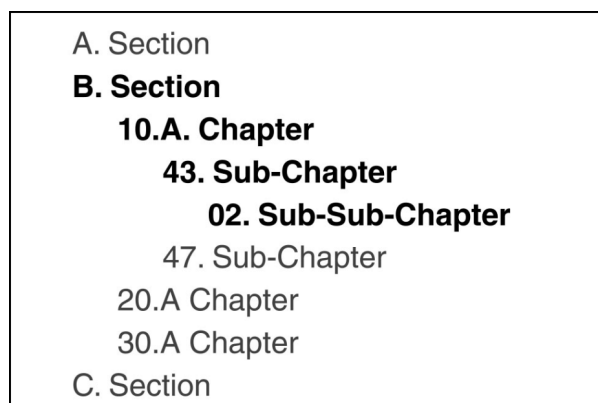
The fourth number identifies the rear seal itself, a sub-topic (or sub-sub-chapter) of crankshaft. This is not any rear seal; this is the rear seal for the crankshaft.

The page numbers for rear seal information within Chapter 10.A are also given.



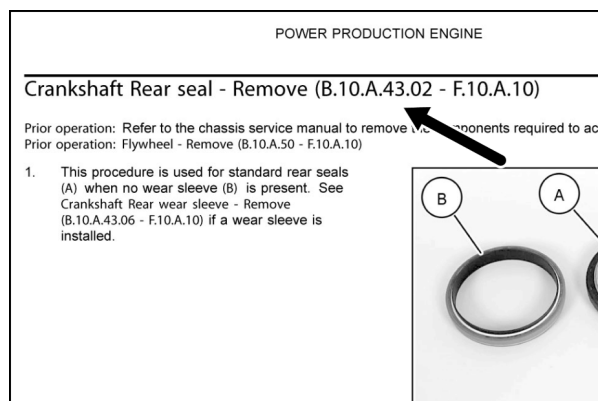
RCPH05CDC497ABA 7

If the same location is viewed as part of a manual outline, the uniqueness of the location is apparent. Rear seal information is the only information that will be found at B.10.A.43.02 within the entire manual.



RCPH05CDC506ABA 8

When you locate the information at the given page number, the page heading confirms the location.



RCPH05CDC393ABA 9

Information type (Infotype)

The information in each chapter, and therefore the table of contents, is separated into four broad categories:

- Technical Data
- Functional Data
- Service Data
- Diagnostic Data

NOTE: The information in the Index for a chapter is organized alphabetically. The locations are listed alphabetically, and then information from the different categories is listed alphabetically for the location.

This is the order of the information in the chapter and the table of contents. These are the exact headings used in the table of contents to separate the information.

There may be information on any component, like the rear seal of the crankshaft, in any of the four categories.

The location is the same – B.A.10.43.02 for all four categories. The second part of the code which identifies the type of information, or infotype, is different.

B.10.A.43.02 – D.20.A.40

B.10.A.43.02 – F.10.A.10
– F.40.A.10
– F.10.A.15

RCPH05CDC421ABA 10

In fact, there are only two types of information offered on the crankshaft rear seal in this manual:

- technical data which describes a special tool needed for installation (**A**),
- and service data, which describes seal removal, inspection and installation (**B**).

The first grouping in the illustration is located under the Technical Data heading in the TOC. The second grouping is located under the Service Data heading in the TOC.

Crankshaft	
Crankshaft - Service limits (B.10.A.43 - D.20.A.20)	29
Crankshaft - Special tools (B.10.A.43 - D.20.A.40)	29
Crankshaft - Front seal - Torque (B.10.A.43.01 - D.20.A.10)	30
Crankshaft - Front seal - Special tools (B.10.A.43.01 - D.20.A.40)	30
Crankshaft - Rear seal - Special tools (B.10.A.43.02 - D.20.A.40)	31
Crankshaft	
Crankshaft - Remove (B.10.A.43 - F.10.A.10)	139
Crankshaft - Install (B.10.A.43 - F.10.A.15)	140
Crankshaft - End play (B.10.A.43 - F.40.E.10)	141
Crankshaft - Front seal - Remove (B.10.A.43.01 - F.10.A.10)	142
Crankshaft - Front seal - Visual inspection (B.10.A.43.01 - F.40.A.10)	144
Crankshaft - Front seal - Install (B.10.A.43.01 - F.10.A.15)	145
Crankshaft - Rear seal - Remove (B.10.A.43.02 - F.10.A.10)	148
Crankshaft - Rear seal - Visual inspection (B.10.A.43.02 - F.40.A.10)	149
Crankshaft - Rear seal - Install (B.10.A.43.02 - F.10.A.15)	150

RCPH05CDC406ABA 11

The coding for technical information always begins with the letter “D.” The coding for the service information always begins with the letter “F.”

The first letter of the infotype code always explains the category of the information:

- D = technical data,
- C = functional data,
- F = service data,
- G = diagnostic data.

Crankshaft	
Crankshaft - Service limits (B.10.A.43 - D.20.A.20)	29
Crankshaft - Special tools (B.10.A.43 - D.20.A.40)	29
Crankshaft - Front seal - Torque (B.10.A.43.01 - D.20.A.10)	30
Crankshaft - Front seal - Special tools (B.10.A.43.01 - D.20.A.40)	30
Crankshaft - Rear seal - Special tools (B.10.A.43.02 - D.20.A.40)	31
Crankshaft	
Crankshaft - Remove (B.10.A.43 - F.10.A.10)	139
Crankshaft - Install (B.10.A.43 - F.10.A.15)	140
Crankshaft - End play (B.10.A.43 - F.40.E.10)	141
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Crankshaft - Rear seal - Visual inspection (B.10.A.43.02 - F.40.A.10)	149
Crankshaft - Rear seal - Install (B.10.A.43.02 - F.10.A.15)	150

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Technical data may be:

- a specification for the engine, the fuel system, the air intake system, etc.,
- a special tool, whether recommended or required, to perform a service procedure on the component,
- a torque value for installing a component,
- a service limit criterion, for determining when a component must be replaced or the pass/fail criterion for a test.

POWER PRODUCTION ENGINE

Crankshaft Rear seal - Special tools (B.10.A.43.02 - D.20.A.40)

Crankshaft rear seal installer – CNH299155

This tool is used to install the rear crankshaft seal on CDC engines with or without a wear sleeve. When a dust seal is present, tool 380002456 is also needed.



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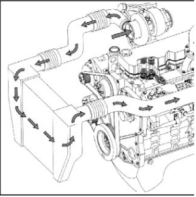
RCPH05CDC422ABA 13

Functional data may be:

- a dynamic description of how a system or sub-system works during operation,
- a static description of a system component,
- an identification illustration to show the location of components – sensor locations, fuel system components, lubrication system components, etc.

AIR INTAKE SYSTEM - Dynamic description (B.30.A - C.30.A.10)

The combustion air system consists of an air pre-cleaner and cleaner, intake air piping, turbocharger, charge air piping, air cooler and air heater.



RCS05CDC078AAB 1

Air drawn through the air pre-cleaner and cleaner and into the compression side of the turbocharger. It is forced through piping from the discharge to the air cooler, the intake air heater and into the intake manifold. From the manifold, air is forced into the cylinders and used for combustion.

RCPH05CDC429ABA 14

Service data may be:

- a basic service action like remove, disassemble, assemble or install,
- an inspection or testing procedure,
- an adjusting or measuring procedure.

ENGINE COOLANT SYSTEM - Test (B.50.A - F.40.C.01)


NOTE: Combustion produces carbon dioxide. Carbon dioxide dissolved in engine coolant for combustion gas leak tester – 3822985 (CUMMINS) – checks for the presence of carbon acid in

Combustion gas leak test

1. Remove the pressure cap, and check if the coolant level in the deaeration tank is low enough to prevent contamination of the test tool – 3822985 (CUMMINS). The instrument tests the air at the top of the deaeration tank, not the coolant. If required, drain sufficient coolant so the level is 50 - 100 mm (2.0 - 3.0 in) below the neck of the tank.

WARNING

DO NOT remove coolant system pressure cap while coolant is HOT. Wait until the coolant temperature is below 50 degrees C (120 degrees F) before removing the system pressure cap. Failure to do so will cause injury. M941



RCPH05CDC436ABA 15

Diagnostic data may be:

- guided troubleshooting to correct a problem,
- symptom-based troubleshooting to locate the source of a problem.

LUBRICATION SYSTEM - Problem solving (B.60.A - G.40.A.30)

OPERATION

Refer to LUBRICATION SYSTEM - Dynamic description (B.60.A - C.30.A.10) .

TROUBLESHOOTING

- A thorough analysis of a customer's complaint is the key to successful troubleshooting. The more known about a complaint, the faster and easier the problem can be resolved.
- The tables are organized to locate a problem by doing the easiest and most logical thing: all steps in the sequence from top to the bottom.
- It is NOT possible to list all possible solutions to all possible problems; however, these tables stimulate a thought process that will lead to the cause and correction of the problem.
- Follow these basic troubleshooting steps:
 - Get all the facts concerning the complaint.
 - Analyze the problem thoroughly.
 - Relate the symptoms to the basic engine systems and components.
 - Consider any recent maintenance or repair work that might relate to the complaint.
 - Double check before beginning any disassembly.

RCPH05CDC443ABA 16

When searching for information in the table of contents or the index, pay attention to the first letter of the infotype and its title (special tool, dynamic description, remove, problem-solving) so you find the type of information you are seeking.

Applicability – Does the information apply to my model?

If an entry in the table of contents or the index has no models listed immediately beneath it, the information applies to all models listed on the repair manual, section or chapter cover.

The information shown is applicable to all models.

Crankshaft		
Crankshaft - Remove (B.10.A.43 - F.10.A.10)		139
Crankshaft - Install (B.10.A.43 - F.10.A.15)		140
Crankshaft - End play (B.10.A.43 - F.40.E.10)		141
Crankshaft - Front seal - Remove (B.10.A.43.01 - F.10.A.10)		142
Crankshaft - Front seal - Visual inspection (B.10.A.43.01 - F.40.A.10)		144
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Crankshaft - Rear seal - Remove (B.10.A.43.02 - F.10.A.10)		148
Crankshaft - Rear seal - Visual inspection (B.10.A.43.02 - F.40.A.10)		149
Crankshaft - Rear seal - Install (B.10.A.43.02 - F.10.A.15)		150

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When an entry in the TOC or index has models listed below it, the information applies only to those models.

Although the location code, infotype code and title of the entry are exactly the same, the model names inform you that the content varies by model.

Go to the page number listed for your model. When you locate the information in the manual, the same models are listed below the title to confirm that you are at the right location.

Connecting rod and piston - Disassemble (B.10.A.47 - F.10.A.25)		
Magnum 225, Magnum 250, Magnum 280, STX280, 2388, 2377		
Connecting rod and piston - Disassemble (B.10.A.47 - F.10.A.25)		
Magnum 310		

RCPH05CDC450ABA 18

Prior Operation and Next Operation

This manual makes extensive use of “Prior operation” and “Next operation” lists to avoid repetition.

A “Prior operation” list always occurs at the beginning of document and points to procedures which must precede the current procedure.

A “Next operation” list always occurs at the end of a document and points to procedures which must follow the current procedure in order to restore the engine to active service.

Crankshaft - Install (B.10.A.43 - F.10.A.15)

Prior operation: Crankshaft Journal - Measure (B.10.A.43.16 - F.40.E.01)
 Prior operation: Crankshaft Gear - Install (B.10.A.43.10 - F.10.A.15)
 Prior operation: Crankshaft Speed ring - Install (B.10.A.43.20 - F.10.A.15)

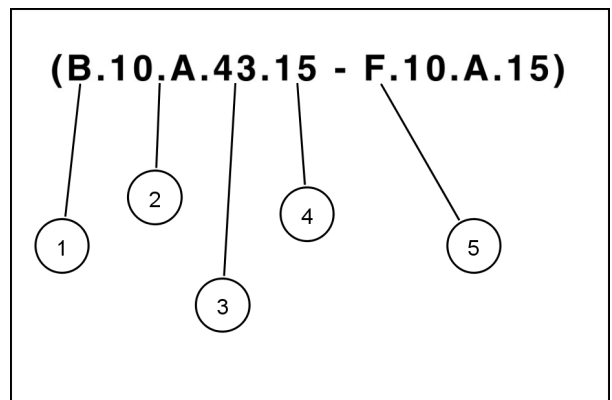
Next operation: Install the lower main bearings and bearing caps. See C (B.10.A.43.15 - F.10.A.15)
 Next operation: Crankshaft - End play (B.10.A.43 - F.40.E.10)
 Next operation: Install the lower rod bearings and rod caps. See Connect - F.10.A.15)
 Next operation: Rear cover - Install (B.10.A.76 - F.10.A.15)
 Next operation: Timing gear housing - Install (B.10.A.46 - F.10.A.15)
 Next operation: Valve drive Camshaft - Install (B.10.A.40.44 - F.10.A.15)
 Next operation: Valve drive Camshaft - End play (B.10.A.40.44 - F.40.E.10)
 Next operation: Valve drive Camshaft - Backlash (B.10.A.40.44 - F.40.E.15)
 Next operation: Oil pan - Install (B.60.A.23 - F.10.A.15)
 Next operation: LUBRICATION SYSTEM - Filling (B.60.A - F.60.A.10)
 Next operation: ENGINE COOLANT SYSTEM - Filling (B.50.A - F.60.A.10)

RCPH05CDC466ABA 19

Prior and Next operations usually contain an ICE code reference which follows the same format as previously explained. For example, installation of the lower main bearings and bearing caps is the first operation listed after the crankshaft is installed. The ICE code given is (B.10.A.43.15 - F.10.A.15) with the title, Crankshaft Main Bearing - Install.

The location code points to the sub-topic main bearings (4), in the sub-chapter on the crankshaft (3), in Chapter 10.A (2), of Section B (1).

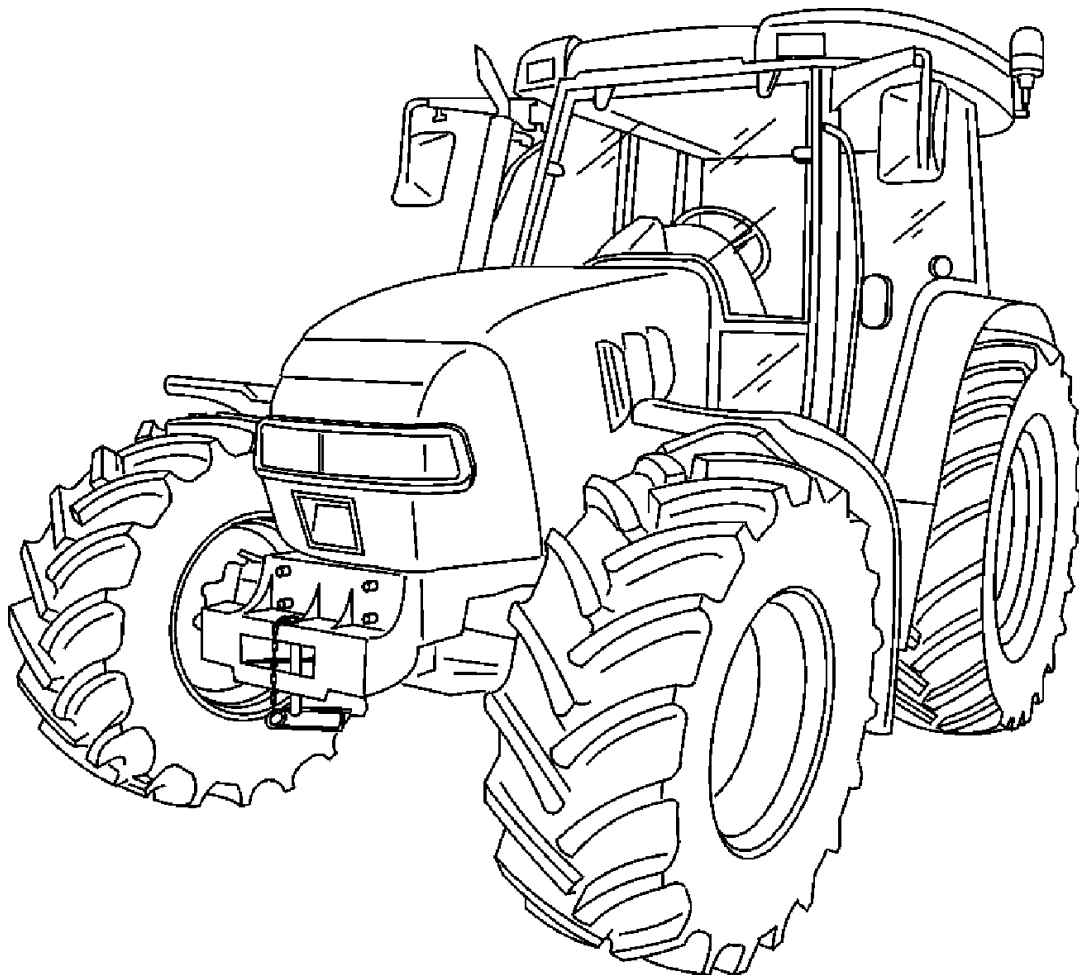
The infotype code points to a service procedure because of the initial letter “F” that is located under Service Data in the table of contents.



RCPH05CDC473ABA 20



REPAIR MANUAL
DISTRIBUTION SYSTEMS



CS100 Pro , CS105 Pro , CS80 Pro , CS85 Pro , CS90 Pro , CS95 Pro

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DISTRIBUTION SYSTEMS - A

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PRIMARY HYDRAULIC POWER SYSTEM Electro-hydraulic remote valve CS100 Pro , CS105 Pro , CS80 Pro , CS85 Pro , CS90 Pro , CS95 Pro	A.10.C
ELECTRICAL POWER SYSTEM CS100 Pro , CS105 Pro , CS80 Pro , CS85 Pro , CS90 Pro , CS95 Pro	A.30.A
ELECTRONIC SYSTEM CS100 Pro , CS105 Pro , CS80 Pro , CS85 Pro , CS90 Pro , CS95 Pro	A.50.A
FAULT CODES CS100 Pro , CS105 Pro , CS80 Pro , CS85 Pro , CS90 Pro , CS95 Pro	A.50.A



DISTRIBUTION SYSTEMS - A

PRIMARY HYDRAULIC POWER SYSTEM - 10.A

CS100 Pro , CS105 Pro , CS80 Pro , CS85 Pro , CS90 Pro , CS95 Pro

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DISTRIBUTION SYSTEMS - A

PRIMARY HYDRAULIC POWER SYSTEM - 10.A

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Hydraulic pump

Fixed displacement pump - General specification 4

FUNCTIONAL DATA

PRIMARY HYDRAULIC POWER SYSTEM

Dynamic description 5

Dynamic description Connecting plate 14

Hydraulic schema 20

Wiring schema 32

PRIMARY HYDRAULIC POWER SYSTEM - General specification

Hydraulics	Constant pump Open Centre Load Sensing (OC-LS) system
Oil system	Hydraulics and steering together
Oil capacity	34 l
Oil quality	ISO VG 46 HLP DIN 51524
Removable oil volume	29 l
Max. working pressure	175 bar
Capacity with 3 pumps, at 2300 rpm	86 l/min
Capacity with 2 pumps, at 2300 rpm	50 l/min

Connecting plate with pressure compensator

Neutral circuit from p - T	Δp 4 - 6 bar
Consumer in operation	Δp 11 bar
Pressure limiting valve (PLV = pilot valve)	175 bar
p max. to R	20 bar



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Hydraulic pump Fixed displacement pump - General specification

Hydraulic pumps - construction	Geared wheel pumps
Engine ratio : Pump	i = 1:1
Engine rated speed	2300 rpm

Triple pump

Joint intake line from hydraulic tank for stage 1 and 2.	
1st stage supplies OC/LS hydraulics	V = 22.5 cm ³ /rev
2nd stage supplies primarily steering and brake valves, remainder to OC/LS hydraulics	V = 16.0 cm ³ /rev
3rd stage supplies transmission low pressure circuit (P1) and lubrication	V = 22.5 cm ³ /rev

Double pump

Separate intake line for stage 1 and 2.	
1st stage supplies steering, brake valves and OC/LS hydraulics	V = 22.5 cm ³ /rev
2nd stage supplies transmission low pressure circuit (P1) and lubrication	V = 22.5 cm ³ /rev

PRIMARY HYDRAULIC POWER SYSTEM - Dynamic description

FUNCTIONAL DESCRIPTION „LOAD SENSING (LS) SYSTEM

„Load-compensated system for minimising choke losses and load-independent volume flow control

The hydraulic system is a load-compensated system with constant pump **(1)**, known for short as an OC/LS system. In this system the oil flow is directed to the directional control valves **(5)** via a connection plate **(2)** with a pressure compensator. The pressure compensator **(3)** is arranged parallel to the supply line **(4)** of the directional control valves (consumers).

In conjunction with the choke cross sections on the directional control valves **(5)**, the pressure compensator works as a 3-way flow regulator with Δp switching (**4 bar** to **11 bar**). The load pressure (signal) needed for the pressure compensator acts on the spring side **(6)** of the pressure compensator.

This is fed from the directional control valves via the LS outlet with integrated reporting cartridge valve **(7)**, the signal line **(8)** and the LS port of the connection plate **(2)**.

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