



Maintenance manual

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C Preventive maintenance

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3 Driveline/axle

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Foreword

About the Maintenance Manual

General

Thank you for choosing Kalmar Industries as your machine supplier. We hope that we'll meet your expectations.

This maintenance manual contains information about how the machine should be maintained for maximal operating reliability and service life as well as troubleshooting information for fast correction of any malfunctions.

Conditions

The instructions are based on the use of generally available standard tools. All lifting devices, for example, slings, straps, ratchet blocks, etc., must meet governing national standards and regulations for lifting devices.

Kalmar Industries will not accept any responsibility for modifications performed without permission from Kalmar Industries or if other lifting devices, tools or work methods are used other than those described in this manual.

Storage

NOTE

The maintenance manual shall be accessible to service personnel.

About the machine version

The information in this publication corresponds to the machine's design and appearance at the time of delivery from Kalmar Industries. Due to customizations, there may be variations and/or deviations.

Kalmar Industries reserves the right to modify specifications and equipment without prior notice. All information and data in this manual are valid at the time of publication.

Copyright

Kalmar Industries AB

Duplication of the content in this manual, in whole or in part, is strictly prohibited without written permission from Kalmar Industries AB.

Duplication by any means such as copying, printing, etc., is prohibited.

Reading instructions

Warning information

Warnings inform on potential dangers which can, if the warnings are not heeded, result in personal injury or product damage.

DANGER

Situation that may result in serious personal injury, possible death, if the instruction is not followed.

WARNING

Situation that may result in serious personal injury if the instruction is not followed.

CAUTION

Situation that may result in damage to the product if the instruction is not followed.

Important information

Important information marked with NOTE facilitates the work process, operation/handling or increases understanding of the information.

NOTE

Information that is important without being safety related.

Read operator's manual

The symbol to the left is used in certain cases on the machine and refers to important information in the operator's manual.



Read the operator's manual

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Read maintenance manual

The symbol to the left is used in certain cases on the machine and refers to important information in the maintenance manual.



Read the maintenance manual

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Maintenance manual's content

The information in the maintenance manual is divided in function groups (0-12) to facilitate information searches. The manual is divided in 20 sections A-C, 0-12, D-G. The sections with letters contain specific information that applies to several function groups and is not bound to a function, e.g., section "F Technical data". This is described in greater detail in the table below.

For more information on function groups, see *Function group structure page 6*. The function group is intended to function together with references as search key between different types of information, see *References between different information types page 7*.

A	Foreword	General information about the maintenance manual's purpose, content and reading instructions as well as survey for feedback of views and eventual inaccuracies.
B	Safety	Keep in mind for your safety.
C	Preventive maintenance	General information about preventive maintenance of the machine.
0	Complete machine	<p>Technical description, description of the machine's functions with schematic drawings and explanatory texts for the included components.</p> <p>Overviews with the components' position on the machine.</p> <p>Work instructions for preventive maintenance.</p> <p>Work instructions for checking and adjusting.</p>
1	Engine	
2	Transmission	
3	Driveline/axle	
4	Brakes	
5	Steering	
6	Suspension	
7	Load handling	
8	Control system	
9	Frame, body, cab and accessories	
10	Common hydraulics	
11	Common electrics	
12	Common pneumatics	
D	Error codes	Error code information and instructions for reading error code information.
E	Schematics	Wiring and hydraulic diagrams
F	Technical data	Technical data, conversion tables, information for conversion of units.
G	Terminology and index	General terminology and abbreviations, explanations of terms and abbreviations that may appear in the manual, index for headings in the manual.

Function group structure

The information in the manual is divided in a structure of functions at different levels, based on the machine's design and use, called function groups.

The upper level (called main group) determines area, e.g., group 7 Load handling. The second level (called two-digit) determines function, e.g., 7.2 Lift and lower. The third and fourth levels are used to break down functions in smaller parts (components).

The function groups' structure for main group and two-digit group level are common for all machines from Kalmar Industries, e.g., 4.3 Servo brake system. Machine-unique adaptations of functions are done at the third and fourth group level, e.g., 4.3.9 Wheel brake and 4.3.9.1 Disc pack. This means that certain function groups (headings) will be left out in the documentation for certain machines since the machine is missing that specific function or component. In turn, this means that there may be skips in the function groups' numbering (e.g., the three-digit heading level 4.8.7 Oil cooler may be included for some machines, but is missing for others).

The function groups are intended to be used as search terms to find different types of information between different sections and manuals. The information in a function group is divided in smaller sections according to the type of content, e.g., description or change.

The maintenance manual and Workshop manual contain different information. The maintenance manual contains only the information needed for preventive maintenance and simpler troubleshooting. The Workshop manual contains more in-depth information and repair instructions.

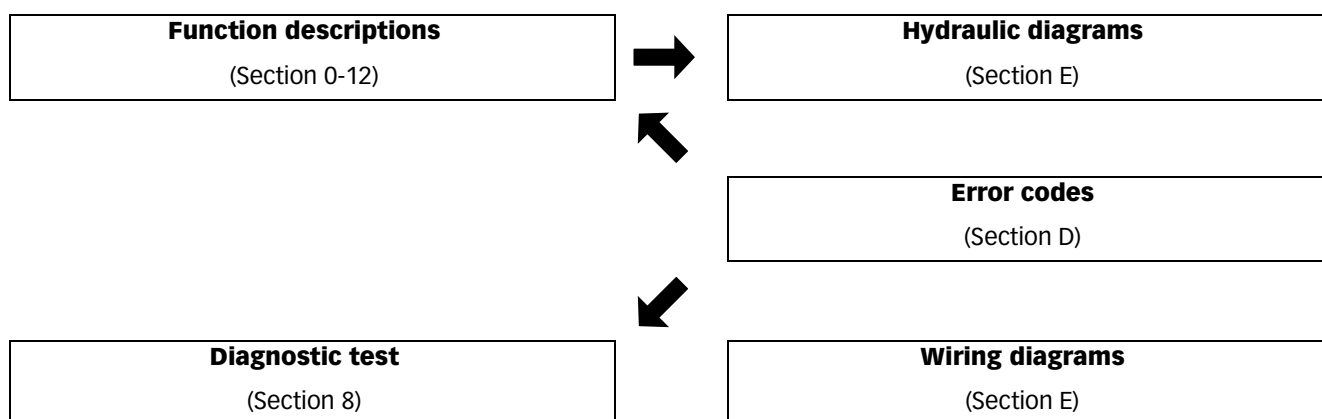
References between sections in the same manual are indicated with section and group number, e.g., see section 4 Brakes, group 4.3.9 Wheel brake". References within a section are indicated with page number, e.g., "see Sensor fuel level, description page 24".

References between Maintenance manual and Workshop manual are not given. If more information is desired for a function group, the primary recommendation is to search in the same function group in the other manual. For additional information about where different information types are found and which references are given, see *References between different information types page 7*.

References between different information types

The maintenance manual contains different types of information and is mainly divided in function groups, see section *A Foreword*.

The basic rule of searching for information is to use function groups to find different types of information regarding the function or component in question. As a complement to this, there are written references according to the below.



- From Function description to Hydraulic diagram, for hydraulic diagrams of function in question.
- From Error codes to Diagnostic test, for diagnostic menu to troubleshoot component or function in question.
- From Error codes to Function description, for further information about components or function.

Product alternatives and optional equipment

The information in the manual is divided in modules. For product alternatives and optional equipment, handling of the modules differs depending on if it is the one or the other that is described, see below.

Special equipment is not described in the manual. When uncertain about the equipment with which the machine is provided, use the machine card to decide which information applies, see *Machine card page 8*.

Product alternatives

Product alternatives are such options that exclude certain standard equipment (e.g., engine alternative).

Similar information for different product alternatives are described in separate sections following each other in the same function group. To show that there are different alternatives, the added text "Product alternative" is used in the heading, together with a simple description of which alternative is described, e.g., "(Product alternative Air conditioning ECC)". Further, alternatives that are optional equipment are marked with the symbol for optional equipment.



Symbol indicating optional equipment

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Optional equipment

Optional equipment are options that can be added to the standard equipment to obtain additional or improved functions.

Information for optional equipment is described in separate sections with standard equipment as the starting point. The description of the optional equipment describes how the standard function is affected by the option as well as which components are added.

Machine card

NOTE

If the machine has been modified after delivery the information on the machine card may be lacking or incorrect.

The machine card indicates of which drawings the machine consists, in many cases these can be connected to options and product alternatives. For more information about handling of product alternatives and optional equipment, see *Product alternatives and optional equipment page 7*. The machine card is delivered with the parts catalogue and shall be kept in the cab.

The machine card is divided in the same functions groups as the parts catalogue, maintenance and Workshop manual. For practical reasons, the machine card uses only the first and second level in the function group register. The function groups are written in groups of four characters, e.g. group 0107 matches group 1.7 Cooling system in the manual.

For more information about how the machine card is used for ordering spare parts, see the parts catalogue's foreword.

If the information on the machine card does not help, contact Kalmar Industries AB.

NOTE

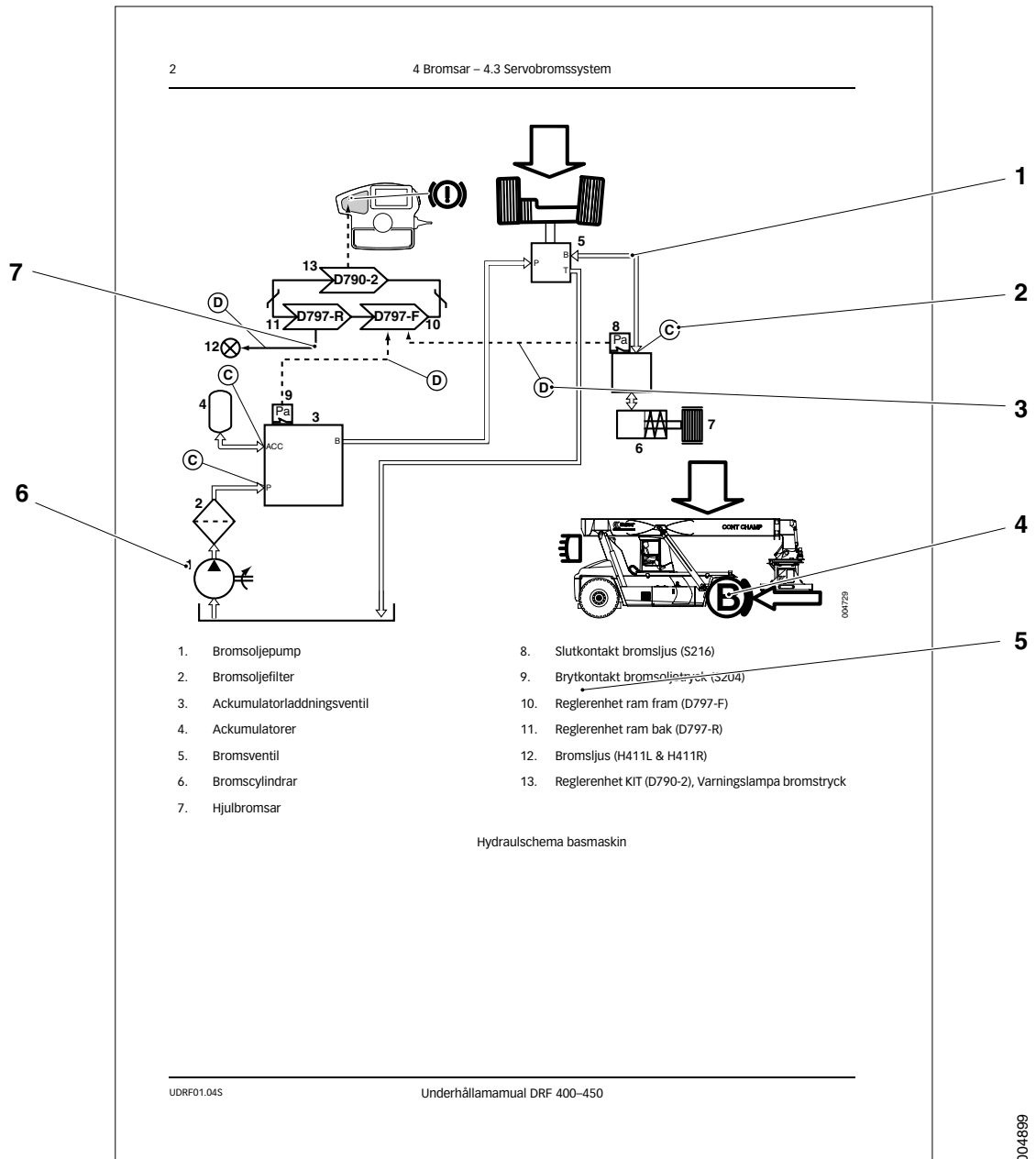
All documents that accompany the machine are non-registered documents and there will be no notification of changes.

Function descriptions

Function descriptions are schematic overviews that describe how a function works as well as which components and signals work together.

Function descriptions describe the function in a logical flow from input signal to desired output signal. Most functions require that pre-set conditions are fulfilled for the function to be activated. In these cases, the conditions are listed above the illustration.

Function descriptions use symbols to illustrate components such as valves, sensors, etc.

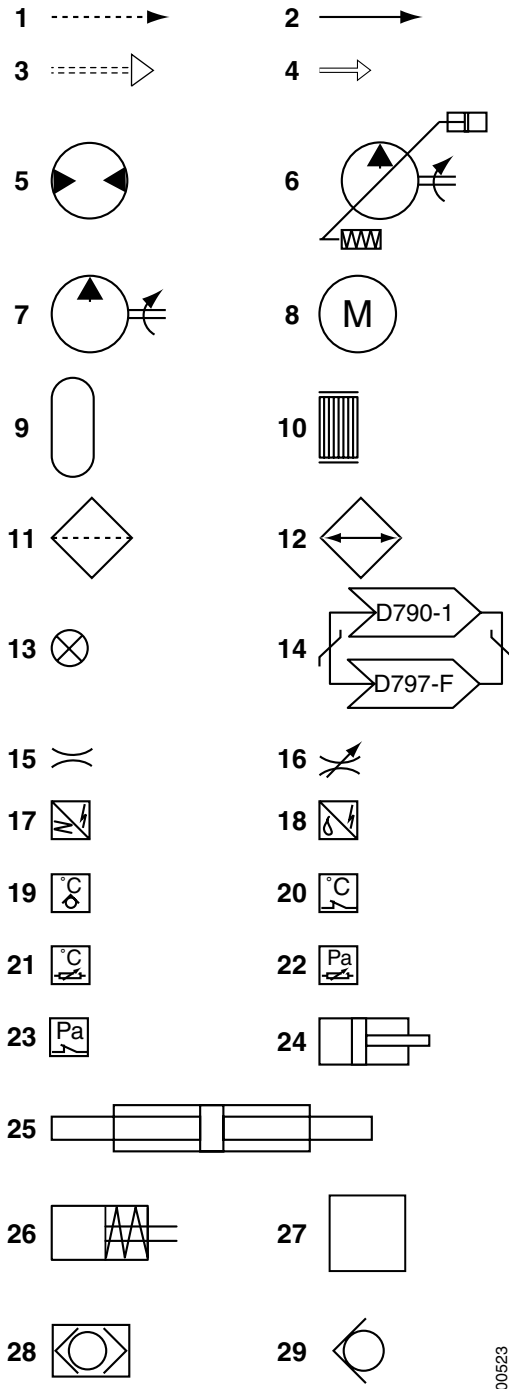


Example of function description

1. Hydraulic force (solid double line)
2. Flag pressure check connection (Check point), indicates that there is pressure check connection for checking pressure signal
3. Flag diagnostic test, indicates that signal can be checked with diagnostic test, see section 8 *Control system*, group 8.4 *Diagnostics*
4. Illustration of function, (applied brake)
5. Component list
6. Position number in illustration, reference to component list
7. Electric power (solid single line)

Symbol explanation function descriptions

The following symbols are used in function descriptions, the symbols are based on standard symbols used in wiring and hydraulic diagrams.



- 1. Electric control signal
- 2. Electric force
- 3. Hydraulic control signal
- 4. Hydraulic force
- 5. Hydraulic motor
- 6. Hydraulic oil pump with variable displacement
- 7. Hydraulic oil pump with fixed displacement
- 8. Electric motor
- 9. Accumulator
- 10. Disc brake
- 11. Filter
- 12. Radiator
- 13. Bulb
- 14. Control system, two control units with CAN-buss
- 15. Restriction
- 16. Adjustable restriction
- 17. Inductive position sensor
- 18. Electrically controlled servo valve
- 19. Thermal by-pass valve
- 20. Temperature-controlled switch
- 21. Temperature sensor
- 22. Pressure sensor
- 23. Pressure-controlled switch
- 24. Hydraulic cylinder
- 25. Double-acting hydraulic cylinder
- 26. Spring brake cylinder
- 27. Valve block
- 28. Shuttle valve
- 29. Non-return valve

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About the documentation

Documentation sections

The documentation to the machine comprises the following sections:

Operator's manual

The Operator's manual is supplied with the machine in the cab.

Documentation kit

Maintenance manual and spare parts catalogue with machine card are supplied with the machine as a separate documentation kit.

Supplementary documentation

There are Supplementary documentation that can be ordered for the machine in the form of a Workshop manual. The Workshop manual includes supplier documentation for engine, transmission and drive axle.

Ordering of documentation

Extra copies and supplementary documentation is ordered from Kalmar Industries.

Kalmar Industries AB

SE-341 81 Ljungby, Sweden.

NOTE

If possible, always indicate publication number when ordering.

Feedback

Form for copying

Kalmar Industries' ambition is that you who work with maintenance of Kalmar machines shall have access to correct information.

Your feedback is important to be able to improve the information.

Copy this form, write down your views and send it to us. Thank you for your participation!

To:	<p>Kalmar Industries AB Product Support Torggatan 3 SE-340 10 Lidhult SWEDEN Fax: +46 372 263 93</p>
From:	<p>Company / Sender:</p> <p>Telephone:</p> <p>E-mail:</p> <p>Date: - -</p>
Manual information	<p>Name / Publication number:</p> <p>Section / page number:</p>
Suggestions, views, remarks, etc.	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>

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Safety

General safety information

Safety concerns everyone!

The safety information concerns everyone who works with the machine! Persons who do not follow the safety instructions given in this manual must make absolutely sure that the work is performed without risks of personal injury and without risk of damage to machine or machine property!

Remember to:

- follow the instructions in this manual
- be trained for the work in question
- follow local laws, safety rules and regulations
- use the correct equipment and tools for the job
- wear the correct clothes
- use common sense and work carefully, do not take any risks!

Kalmar Industries has in this publication documented and warned for situations and risks that may occur in connection with using as well as service/repairs of the machine during normal circumstances.

That's why it's important that all who work with the machine, or repair/service the machine read and follow the information in the manual and operator's manual.

A near-accident is a warning signal!

A near-accident is an unexpected event where neither persons, machine or property are injured or damaged. However, a near-accident indicates that there is an injury risk and actions must be taken to avoid the risk of injuries.

Safety instructions

General

Read, consider and follow the safety instructions below before starting to work in the machine:

- *Service position page 4*
- *Hydraulic and brake systems, depressurizing page 5*
- *Clothing etc. page 6*
- *Several mechanics on the same machine page 6*
- *Working under machine page 7*
- *Lifting heavy components page 7*
- *Vibrations page 8*
- *Noise page 8*
- *Solvents page 9*
- *Fire and explosion risks page 9*
- *Fluid or gas under pressure page 10*
- *Coolant page 11*
- *Refrigerant page 12*
- *Air pollution page 12*
- *Tensioned springs page 13*
- *Electric motors page 14*
- *Rotating components and tools page 14*
- *Tyre system page 15*

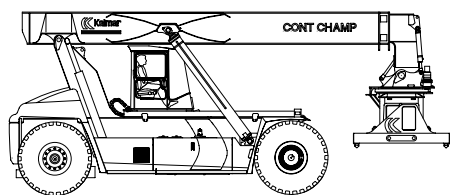
Service position

General

Service position is used for service, maintenance and other situations when the machine needs to be secured.

Service position means:

- Machine parked, that is, parking brake applied.
- Boom fully retracted and lowered to horizontal position.
- Engine off.
- Main electric power off (with battery disconnecter).



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Machine with fully retracted and lowered boom