

en

Service manual

Crawler dozer

Document ID

Order number: 12265215
Issued: 01.04.2021
Version: 03
Author: LWT / Technical Documentation Department

Product ID

Manufacturer: Liebherr-Werk Telfs GmbH
Valid for: PR 726-1793_05_G8.0 18370
PR 726-1793_4F_G8.0 18370

Conformity:



Contact

Liebherr-Werk Telfs GmbH
Hans Liebherr-Straße 35
A – 6410 Telfs

LWT/12265215/03/215-20210330_143606/en

Foreword

Notes for the user

This Service manual is intended for trained specialist staff in the Liebherr organization and its dealers.

The Service manual provides specific knowledge for the maintenance of Liebherr construction machinery. Basic technical knowledge of electrics, hydraulics, mechanics and Diesel engine technology are not detailed in this Service manual. A subject-based, qualified training is therefore necessary. Liebherr recommends participation on the Liebherr Training program for construction machinery.

In this Service manual you find information about:


- Special tools
- Technical data
- Maintenance intervals and maintenance tasks
- Adjustment procedure
- Design and functional descriptions
- Removal and installation tasks
- Wiring diagrams, hydraulic schematics and technical drawings

For information relating to control and operation refer to the operator's manual. For information relating to spare parts refer to the Spare parts catalog. Observe the locally applicable accident prevention regulations.

This document - even in part - may only be reproduced with approval from Liebherr.



Subject to technical changes.


Designation of safety advice

	This is a warning sign. Warns of possible danger of injury. Follow all measures, which are marked with this warning sign to avoid injuries or death.
---	--

The warning sign always appears in connection with the signal words

DANGER
WARNING
CAUTION

	DANGER	indicates an immediate dangerous situation which will lead to death or serious bodily injury if it is not prevented.
	WARNING	indicates a dangerous situation which could result in fatal or serious bodily injury if it is not prevented.

	CAUTION	indicates a dangerous situation, which could result in slight or medium-grade bodily injuries if it is not prevented.
	NOTICE	indicates a dangerous situation which could result in material damage if it is not prevented.

Structure of warning notes

Warning notes in this document are structured as follows:







WARNING

Here you find information about the type and source of the danger. Here you are information about possible consequences, if you ignore the warning note.









► Here you are asked to take measures to avoid the dangerous situation.

Additional designations





Symbol	Meaning
	Note indicates useful information and tips.
	This symbol means: perform task.
	This symbol means: prerequisite must be met.
	This symbol means: result of a task.
-	This symbol identifies a listing.

Symbols

Colour legend for the hydraulic schematics

Colour	Line thickness	Name
 	Thick or thin	High pressure
 	Thick	Tank line
 	Thin	Leak oil line
 	Thin	Supply pressure or pilot pressure to the pilot control unit

LWT/122652/15/03/Z15-20210330_143606/en

Colour	Line thickness	Name
	Thin	Control pressure or pilot pressure from the pilot control unit
	Thick	Enclosed oil
	Thick	Operating pressure
	Thin	Load sensing pressure

LWT/12265215/03/215-20210330_143606/en

Contents

010	Introduction	010-1
010.1	Safety instructions	010-4
010.1.1	General safety instructions	010-4
010.1.2	Safety instructions for crushing and burn prevention	010-5
010.1.3	Safety guidelines for fire and explosion prevention	010-5
010.1.4	Safety instructions for machine start up	010-6
010.1.5	Safety instruction for start up	010-6
010.1.6	Safety guidelines for working	010-6
010.1.7	Safety instructions for parking the machine	010-8
010.1.8	Safety instructions for transporting machine	010-8
010.1.9	Safety instructions for towing machine	010-8
010.1.10	Safety instructions for maintenance	010-9
010.1.11	Safety guidelines for welding work on machine	010-11
010.1.12	Safety guidelines for working on attachment	010-11
010.1.13	Safety guidelines for loading machine with a crane	010-12
010.1.14	Safety notes for maintenance of hydraulic hoses and hose lines	010-12
010.1.15	Safety guidelines for maintenance work on machines with hydro accumulators	010-13
010.1.16	Roll over protection (ROPS) and falling object protection (FOPS)	010-13
	010.1.16.1 Avoid accidents	010-13
	010.1.16.2 Avoid injuries	010-14
010.1.17	Equipment and attachment parts	010-14
010.1.18	Protection from vibrations	010-14
010.1.19	See and be seen	010-15
	010.1.19.1 Field of vision	010-16
	010.1.19.2 Measures before and during operation	010-16
010.1.20	Safety notes for Diesel engines with electronic control units	010-17
010.1.21	Safety notes for working on Common Rail System of Diesel engines	010-17
010.2	Special tools for maintenance and repair work	010-19
010.2.1	Tools - Diesel engine	010-19

010.2.2	Tools - Hydraulic system	010-21
010.2.3	Tools - Hydraulic cylinder	010-25
010.2.4	Tools - Electrical system	010-26
010.2.5	Tools - Travel gearbox	010-29
010.2.6	Tools - Undercarriage	010-30
010.2.7	Tension unit tools	010-31
010.2.8	Tools - Oscillating axle frame	010-31
010.2.9	Tools – Operator's cab	010-32
010.2.10	Tools - Diesel exhaust fluid system	010-32
010.2.11	Assistance system tools	010-33
010.3	Standards and specifications	010-35
010.3.1	Preload values and tightening torques for screws with standard and fine metric thread according to DIN ISO 261	010-35
010.3.1.1	Scope of application and purpose	010-35
010.3.1.2	Further applicable documentation	010-35
010.3.1.3	Changes and descriptions	010-36
010.3.1.4	Tightening values	010-36
010.3.1.5	Flanges and half flanges for high pressure (standard 62)	010-42
010.3.1.6	Half flange for low pressure (standard 61)	010-42
010.3.1.7	Tightening torques for cutting edges, end bits and adapters	010-42
010.3.2	Installation specifications	010-43
010.3.2.1	Duo cone slipping seals	010-43
010.3.3	Tapping bores	010-45
010.3.3.1	Tapping bores of metric ISO standard threads	010-45
010.3.3.2	Tapping bores of metric ISO fine threads	010-47
010.3.4	Conversion tables	010-50
010.4	Conservation guidelines	010-51
010.4.1	General	010-51
010.4.2	Taking the machine out of service for an unknown duration	010-51
010.4.3	Shut down of the machine	010-52
010.4.3.1	Shut down for up to 2 months	010-52
010.4.3.2	Shut down for up to 12 months	010-53
010.4.3.3	Shut down for longer than 12 months	010-54
010.4.4	Return to operation	010-54

	010.4.4.1	After a shut down of 2 months	010-54
	010.4.4.2	After a shut down of 12 months	010-54
	010.4.4.3	After shut down of longer than 12 months	010-55
010.5	Repair welding		010-56
	010.5.1	Preparation of cracked part	010-56
	010.5.1	Preparation of a weld	010-57
	010.5.1	Treatment of electrodes	010-57
	010.5.1	Welding technique	010-57
	010.5.1	Reinforcement of welding seam	010-58
	010.5.1	General use of reinforcement sheeting	010-58
	010.5.1.1	Form of sheeting	010-58
	010.5.1.1	Thickness of sheeting	010-58
	010.5.1.1	Material quality of sheeting	010-59
	010.5.1.1	Application of reinforcement sheeting	010-59
	010.5.1.1	Welding the reinforcement sheeting	010-59
	010.5.1.1	Selection of correct welding electrodes	010-60
	010.5.1.2	Electrode selection	010-60
	010.5.1.2	Steel chart	010-61
	010.5.1.2	Welding additives chart	010-62
010.6	Hydraulic symbols		010-66
010.7	Electrical symbols		010-76
010.8	Material weights		010-80
020	Technical data		020-1
	020.1	Drive group	020-3
	020.1.1	Diesel engine <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	020-3
	020.2	Cooling system	020-5
	020.2.1	Gear pump for cooling circuit <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	020-5
	020.2.2	Fan drive gear motor for water, charge air and hydraulic oil cooler <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	020-5
	020.3	Working hydraulics	020-6
	020.3.1	Working hydraulics regulating pump <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	020-6
	020.3.2	Proportional control valve block <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	020-6

020.3.3	Lift cylinder <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-6
020.3.4	Tilt cylinder <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-7
020.4	Travel hydraulics	020-9
020.4.1	Variable displacement motor <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-9
020.5	Electrical system	020-10
020.5.1	Batteries - Installation <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-10
020.6	Travel gearbox	020-11
020.6.1	Travel gearbox <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-11
020.6.2	Brake system <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-12
020.7	Travel gear, axles, tyres, drive shafts	020-13
020.7.1	Undercarriage frame <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-13
020.7.2	Idler <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-13
020.7.3	Tension unit <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-13
020.7.4	Track roller <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-13
020.7.5	Carrier roller <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-14
020.7.6	Track chain <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-14
020.7.7	Sprocket <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-15
020.8	Working attachment	020-16
020.8.1	Ripper <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	020-16
030	Maintenance	030-1
030.1	Maintenance and inspection schedule	030-10
030.2	Fill quantities and lubrication chart	030-15
030.2.1	Recommended lubricants <i>PR26-1793-05-G8.0/18370;</i>	030-15
030.2.2	Recommended fuel and operating fluids <i>PR26-1793-05-G8.0/18370;</i>	030-16
030.2.3	Lubrication schedule <i>PR26-1793-4F-G8.0/18370; PR26-1793-05-G8.0/18370;</i>	030-16

030.3	Lubricants and fuels	030-19
030.3.1	General information about lubricants and fuels	030-19
030.3.1.1	General Information	030-19
030.3.1.2	General questions	030-19
030.3.1.3	Safety data sheets	030-19
030.3.1.4	Technical data sheets	030-19
030.3.1.5	Specific Liebherr standards	030-19
030.3.2	Diesel fuels <i>PR726-1793-05-G8.0/18370;</i>	030-20
030.3.2.1	Liebherr recommendation	030-20
030.3.3	Engine oils <i>PR726-1793-05-G8.0/18370;</i>	030-21
030.3.3.1	Liebherr recommendations for stage IV/tier 4f and stage V diesel engines	030-21
030.3.3.2	Liebherr recommendation for other emission stages	030-21
030.3.3.3	Minimum quality requirement	030-22
030.3.3.4	Aggravating circumstances	030-22
030.3.4	Coolant <i>PR726-1793-05-G8.0/18370;</i>	030-23
030.3.4.1	Requirements for water used	030-23
030.3.4.2	Corrosion inhibitor	030-23
030.3.4.2	Liebherr recommendation	030-23
030.3.4.2	Anti-freeze and corrosion protection agent	030-23
030.3.4.2	Liebherr recommendation	030-23
030.3.4.2	Minimum quality requirement	030-24
030.3.5	Diesel exhaust fluids <i>PR726-1793-05-G8.0/18370;</i>	030-24
030.3.5.1	Liebherr recommendation	030-24
030.3.5.2	Minimum quality requirement	030-24
030.3.6	Hydraulic oils <i>PR726-1793-05-G8.0/18370;</i>	030-24
030.3.6.1	Liebherr recommendation	030-24
030.3.6.2	Minimum quality requirement	030-25
030.3.6.3	Oil analysis	030-25
030.3.6.4	Filter change	030-25
030.3.6.5	Oil change	030-26
030.3.7	Lube oils for travel gearbox <i>PR726-1793-05-G8.0/18370;</i>	030-26

	030.3.7.1	Quality	030-26
	030.3.7.2	Viscosity	030-27
	030.3.7.3	Oil change	030-27
030.3.8	Oil for duo cone (slipping) seal Travel gear <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		030-27
030.3.9	Grease and other lubricants <i>PR726-1793-05-G8.0/18370;</i>		030-28
030.3.10	Oil for hinges and joints <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		030-29
030.3.11	Oil for axle bearing <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		030-30
030.4	Maintenance tasks		030-31
030.4.1	Safety instructions for maintenance <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		030-31
030.4.2	Maintenance – Preparatory activities		030-31
	030.4.2.1	Maintenance position <i>PR726-1793-05-G8.0/18370;</i>	030-31
	030.4.2.2	Lifting operator's cab <i>PR726-1793-05-G8.0/18370;</i>	030-34
	030.4.2.3	Lowering the operator's cab <i>PR726-1793-05-G8.0/18370;</i>	030-38
030.4.3	Complete machine		030-41
	030.4.3.1	Checking the machine for external damage, correct maintenance and proper condition <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-41
	030.4.3.2	Lubricating the machine <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-41
	030.4.3.3	Central lubrication system (optional): Check the fill level of the grease container <i>PR726-1793-05-G8.0/18370;</i>	030-42
	030.4.3.4	Checking and changing windscreen wiper blade <i>PR726-1793-05-G8.0/18370;</i>	030-43
	030.4.3.5	Carrying out the maintenance and inspection for the optional equipment in the scope of delivery according to the manufacturer's operator's manual or manufacturer's data <i>PR726-1793-05-G8.0/18370;</i>	030-44
	030.4.3.6	Oil samples and oil analysis <i>PR726-1793-05-G8.0/18370;</i>	030-44
	030.4.3.7	Wet cleaning machine <i>PR726-1793-05-G8.0/18370;</i>	030-48

030.4.3.8	Protecting the piston rods <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-49
030.4.3.9	Taking the machine out of service <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-50
030.4.4	Drive group	030-50
030.4.4.1	Diesel engine: checking oil level <i>PR726-1793-05-G8.0/18370;</i>	030-50
030.4.4.2	Changing engine oil <i>PR726-1793-05-G8.0/18370;</i>	030-51
030.4.4.3	Changing oil filter <i>PR726-1793-05-G8.0/18370;</i>	030-55
030.4.4.4	Checking the diesel engine configuration and the belly pan for contamination and cleaning them <i>PR726-1793-05-G8.0/18370;</i>	030-56
030.4.4.5	Checking the ribbed V-belt and adjusting it if necessary <i>PR726-1793-05-G8.0/18370;</i>	030-57
030.4.4.6	Checking and replacing belt drive <i>PR726-1793-05-G8.0/18370;</i>	030-60
030.4.4.7	Checking diesel engine configuration for leaks and condition <i>PR726-1793-05-G8.0/18370;</i>	030-62
030.4.4.8	Checking intake system and exhaust system <i>PR726-1793-05-G8.0/18370;</i>	030-63
030.4.4.9	Diesel engine: checking electrical system <i>PR726-1793-05-G8.0/18370;</i>	030-65
030.4.4.10	Alternator seal (option): changing filter cartridge <i>PR726-1793-05-G8.0/18370;</i>	030-66
030.4.4.11	Changing oil separator filter cartridge <i>PR726-1793-05-G8.0/18370;</i>	030-67
030.4.4.12	Checking and changing the heater flange <i>PR726-1793-05-G8.0/18370;</i>	030-68
030.4.4.13	Checking the engine mount, oil pan and engine brackets for tight seating <i>PR726-1793-05-G8.0/18370;</i>	030-72
030.4.4.14	Checking speed according to adjustment checklist <i>PR726-1793-05-G8.0/18370;</i>	030-72
030.4.4.15	Checking valve clearance <i>PR726-1793-05-G8.0/18370;</i>	030-72
030.4.4.16	Checking the tightening torque of profile clamp <i>PR726-1793-05-G8.0/18370;</i>	030-74
030.4.4.17	Notes for working on the fuel system <i>PR726-1793-05-G8.0/18370;</i>	030-75

030.4.4.18	Draining fuel pre-filter condensation <i>PR726-1793-05-G8.0/18370;</i>	030-75
030.4.4.19	Fuel tank: draining condensation and sediment <i>PR726-1793-05-G8.0/18370;</i>	030-76
030.4.4.20	Changing the fuel pre-filter <i>PR726-1793-05-G8.0/18370;</i>	030-77
030.4.4.21	Changing fuel fine filter <i>PR726-1793-05-G8.0/18370;</i>	030-80
030.4.4.22	Checking fuel system for leaks and condition <i>PR726-1793-05-G8.0/18370;</i>	030-82
030.4.4.23	Emptying and cleaning the fuel tank <i>PR726-1793-05-G8.0/18370;</i>	030-82
030.4.4.24	Venting fuel pre-filter and fuel system <i>PR726-1793-05-G8.0/18370;</i>	030-85
030.4.4.25	Replacing the air filter <i>PR726-1793-05-G8.0/18370;</i>	030-88
030.4.4.26	Air filter: checking dust discharge <i>PR726-1793-05-G8.0/18370;</i>	030-91
030.4.4.27	Diesel particle filter: changing filter module <i>PR726-1793-05-G8.0/18370;</i>	030-91
030.4.5	Cooling system	030-100
030.4.5.1	Checking the coolant level <i>PR726-1793-05-G8.0/18370;</i>	030-100
030.4.5.2	Cleaning the cooling system <i>PR726-1793-05-G8.0/18370;</i>	030-103
030.4.5.3	Checking cooling system for leaks and damage <i>PR726-1793-05-G8.0/18370;</i>	030-103
030.4.5.4	Checking anti-freeze concentration of the coolant <i>PR726-1793-05-G8.0/18370;</i>	030-104
030.4.5.5	Changing coolant <i>PR726-1793-05-G8.0/18370;</i>	030-111
030.4.6	Travel hydraulics	030-114
030.4.6.1	Changing supply circuit filter cartridge <i>PR726-1793-05-G8.0/18370;</i>	030-114
030.4.7	Hydraulic components	030-118
030.4.7.1	Checking oil level in the hydraulic tank and topping up oil <i>PR726-1793-05-G8.0/18370;</i>	030-118
030.4.7.2	Cleaning magnetic rod of the hydraulic tank <i>PR726-1793-05-G8.0/18370;</i>	030-121
030.4.7.3	Checking hydraulic system for function and leaks <i>PR726-1793-05-G8.0/18370;</i>	030-123
030.4.7.4	Changing hydraulic oil <i>PR726-1793-05-G8.0/18370;</i>	030-123

030.4.7.5	Checking and adjusting hydraulic pressures as per adjustment checklist <i>PR726-1793-05-G8.0/18370;</i>	030-126
030.4.7.6	Changing return filter cartridge <i>PR726-1793-05-G8.0/18370;</i>	030-126
030.4.8	Electrical system	030-127
030.4.8.1	Lighting: checking for correct function <i>PR726-1793-05-G8.0/18370;</i>	030-127
030.4.8.2	Checking the batteries <i>PR726-1793-05-G8.0/18370;</i>	030-128
030.4.8.3	Checking cable routings and connections <i>PR726-1793-05-G8.0/18370;</i>	030-131
030.4.8.4	Checking and adjusting travel drive control system as per adjustment checklist <i>PR726-1793-05-G8.0/18370;</i>	030-131
030.4.9	Travel gearbox	030-131
030.4.9.1	Travel gearbox: checking the condition <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-131
030.4.9.2	Checking oil level and cleaning magnetic plug <i>PR726-1793-05-G8.0/18370;</i>	030-131
030.4.9.3	Travel gearbox: changing oil and cleaning magnetic plugs <i>PR726-1793-05-G8.0/18370;</i>	030-132
030.4.9.4	Checking oil level in duo cone (slip ring) area <i>PR726-1793-05-G8.0/18370;</i>	030-134
030.4.9.5	Flushing duo cone (slip ring) area and replacing oil in this area <i>PR726-1793-05-G8.0/18370;</i>	030-136
030.4.10	Travel gear, axles, tyres, drive shafts	030-141
030.4.10.1	Checking that the nuts and bolts of the undercarriage components are firmly seated <i>PR726-1793-05-G8.0/18370;</i>	030-141
030.4.10.2	Checking the carrier rollers, track rollers and idlers for tightness <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-143
030.4.10.3	Checking idler guides and adjusting, if necessary <i>PR726-1793-05-G8.0/18370;</i>	030-143
030.4.10.4	Checking the track tension and adjusting, if necessary <i>PR726-1793-05-G8.0/18370;</i>	030-147
030.4.10.5	Checking the travel gear wear <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-153

	030.4.10.6	Axle bearing: checking oil level and topping up <i>PR726-1793-05-G8.0/18370;</i>	030-153
030.4.11	Working attachment		030-154
	030.4.11.1	Checking the cutting edges, corners and ripper teeth for wear <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-154
	030.4.11.2	6-way blade: checking the blade linkage for play <i>PR726-1793-05-G8.0/18370;</i>	030-155
	030.4.11.3	Checking the bearing points of the working attachment for play and wear <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-158
	030.4.11.4	Checking the mounting screws and pin retainers of the working attachment for tight seating <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-160
	030.4.11.5	Removing and installing the ripper tooth tips <i>PR726-1793-05-G8.0/18370;</i>	030-160
030.4.12	Operator's cab, heating and air conditioning		030-164
	030.4.12.1	Checking heating and air conditioning for function and leaks <i>PR726-1793-05-G8.0/18370;</i>	030-164
	030.4.12.2	Cleaning recirculated air fresh air filter and changing it if necessary <i>PR726-1793-05-G8.0/18370;</i>	030-165
	030.4.12.3	Inspection of the air conditioning system by HVAC specialist staff <i>PR726-1793-05-G8.0/18370;</i>	030-166
	030.4.12.4	Checking the condenser <i>PR726-1793-05-G8.0/18370;</i>	030-166
	030.4.12.5	Hydromount: checking that screws are tightly fitted <i>PR726-1793-05-G8.0/18370;</i>	030-166
030.5	Adjustment checklist <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		030-169
	030.5.1	Adjustment checklist	030-169
	030.5.2	Travel gear check list	030-180
	030.5.2.1	Test report	030-180
	030.5.2.2	Wear data	030-184
030.6	Adjustment procedure		030-189
	030.6.1	Safety instructions <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-189
	030.6.2	Complete machine	030-190

030.6.2.1	Preparations for adjustment procedures <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-190
030.6.2.2	Visual inspection and maintenance <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-192
030.6.2.3	Bringing machine to operating temperature <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-193
030.6.2.3	Various procedures can be selected for reaching the operating temperature: <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-193
030.6.3	Drive group	030-195
030.6.3.1	Engine speed controller of diesel engine — determining adjustment range <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-195
030.6.4	Cooling system	030-198
030.6.4.1	Checking the stand-by pressure for the fan control <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-198
030.6.4.2	Checking pressure relief valve – fan motor and fan control <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-199
030.6.5	Working hydraulics	030-206
030.6.5.1	Checking the standby pressure <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-206
030.6.5.2	Checking operating pressure for working hydraulics <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-207
030.6.5.3	Checking the primary pressure relief valve on the control valve block <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-208
030.6.5.4	Checking LS pressure relief valve on the control valve block <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-210
030.6.5.5	Checking the secondary pressure relief valves on the control valve block <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-211
030.6.5.6	Checking pressure cut off at working hydraulics regulating pump <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-213

030.6.5.7	Checking nitrogen fill in the hydro accumulator <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-214
030.6.6	Travel hydraulics	030-215
030.6.6.1	Checking supply pressure of variable displacement pump <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-215
030.6.6.2	Checking hydraulic neutral position of variable displacement pump <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-217
030.6.6.3	Checking the pressure limitation for high pressure <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-219
030.6.6.4	Checking the pressure regulator <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-221
030.6.7	Electrical system	030-224
030.6.7.1	Calibrating the hydrostat <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-224
030.6.7.2	Checking travel joystick <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-234
030.6.7.3	Calibrating inching brake pedal <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-236
030.6.7.4	Brake test <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-244
030.6.7.5	Parameter adjustment options <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-248
030.6.7.6	Addressing CAN modules <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-250
030.6.7.7	Central control (Master5): connecting the Sculi diagnostics software <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-255
030.6.7.8	Central control (Master5): connecting the LiFT function <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-258
030.6.7.9	Central control (Master5): software update <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-259

030.6.7.10	Central control (Master5): resetting to factory settings <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-262
030.6.7.11	Free Grade and Definition Grade — calibration <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-264
030.6.7.12	Entry and exit lighting - setting the lighting duration <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-268
030.6.7.13	LiDAT: Establishing the connection with the LiDAT module <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-270
030.6.7.14	LiDAT: LiDAT module software update <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-272
030.6.7.15	LiDAT: Creating a report and snapshot <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	030-274
040	Drive group	040-1
040.1	Diesel engine	040-2
040.1.1	Diesel engine – Full overview <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-2
040.1.2	Fuel system	040-8
040.1.2.1	Fuel system <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-8
040.1.2.2	Fuel quantity sensor <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-10
040.1.2.3	Fuel filter <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-11
040.1.2.4	Fuel tank <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-12
040.1.3	Air filter system	040-13
040.1.3.1	Air filter system <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-14
040.1.4	Exhaust system	040-15
040.1.4.1	Exhaust system - Full overview <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-16

040.1.5	Diesel engine mounting <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-22
040.2	Clutch <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	040-23
050	Cooling system	050-1
050.1	Complete cooling system <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	050-2
050.2	Cooler arrangement	050-5
050.2.1	Combi cooler <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	050-5
050.3	Hydraulic	050-11
050.3.1	Gear pump <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	050-11
050.3.2	Gear motor <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	050-13
060	Working hydraulics	060-1
060.1	6-way blade <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	060-2
060.2	Regulating pump	060-14
060.2.1	Regulating pump - Full overview <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	060-14
070	Travel hydraulics	070-1
070.1	Complete travel hydraulics <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	070-2
070.2	Variable displacement pump <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	070-13
070.3	Variable displacement motors	070-19
070.3.1	Variable displacement motors - full overview <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	070-19
080	Hydraulic components	080-1
080.1	Hydraulic cylinder	080-2
080.1.1	Lift cylinder <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	080-2
080.1.2	Tilt cylinder <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	080-4
080.1.3	Swing cylinder <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	080-6

080.1.4	Ripper cylinder <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	080-8
080.2	Hydraulic tank	080-11
080.2.1	Hydraulic tank <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	080-11
100	Brake system	100-1
100.1	Inching brake pedal	100-2
100.1.1	Speed reduction pedal <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	100-2
110	Electrical system	110-1
110.1	Electrical system - Full overview <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-3
110.2	Lighting system <i>PR726-1793-4F-G8.0/18370;</i>	110-5
110.3	Circuit diagrams <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-8
110.4	Electrical components of operator's cab	110-9
110.4.1	Electrical components in operator's cab <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-9
110.4.2	Central control (Master 105) <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-16
110.4.3	Compact control (A120) <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-17
110.4.4	Travel joystick <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-18
110.4.5	Speed control <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-20
110.5	Electrical components - Diesel engine <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-22
110.6	Electrical components - Main frame <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-28
110.7	Electrical components Compartments	110-34
110.7.1	Battery compartment <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-34
110.7.2	Fuel tank compartment <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-35
110.7.3	Central electrical system compartment <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-37
110.7.4	Hydraulic tank <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-43

110.8	Display unit <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-45
110.9	Electrical components LiTU3 (option) <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-46
110.10	Electrical components - Assistance systems	110-48
110.10.1	Free Grade and Definition Grade <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-48
110.11	Electrical components of machine control	110-50
110.11.1	Electrical components of machine control Trimble <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-50
110.11.2	Electrical components of machine control Leica <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-57
110.11.3	Electrical components of machine control Topcon <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	110-61
120	Travel gearbox	120-1
120.1	Travel gearbox, overall <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	120-2
120.2	Brake system <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	120-8
120.3	Duo cone slipping seal <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	120-9
120.4	External oil supply <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	120-10
130	Travel gear, axles, tyres, drive shafts	130-1
130.1	Undercarriage frame	130-3
130.1.1	Support frame <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	130-3
130.2	Idler <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	130-5
130.3	Tension unit <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	130-7
130.4	Tension unit – removal <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	130-9
130.4.1.1	Remove the cover on the track roller frame	130-10
130.4.1.2	Position of tension unit grease nipple	130-11
130.4.1.3	Push the pin in	130-11
130.4.1.4	Removal of cover	130-12
130.4.1.5	Grease nipple with twist guard	130-12
130.4.1.6	Place a mark	130-13
130.4.1.7	Installation of the assembly tool	130-13

	130.4.1.8	Adjust the assembly tool	130-14
	130.4.1.9	Clamp on the assembly tool	130-14
	130.4.1.10	Press in the tension unit	130-16
	130.4.1.11	Removal of the tension unit	130-17
130.5	Tension unit - installation <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		130-18
	130.5.1.1	Installation	130-18
	130.5.1.2	Positioning of left and right travel gear	130-18
	130.5.1.3	Press in the tension unit	130-20
	130.5.1.4	Venting the tension unit	130-21
	130.5.1.5	Installation of cover	130-21
	130.5.1.6	Install the cover on the track roller frame	130-22
130.6	Track roller <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		130-23
130.7	Carrier roller <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		130-24
130.8	Function, wear and evaluation <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>		130-25
140	Steel components Basic machine		140-1
	140.1	Lift cylinder suspension <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	140-2
	140.2	Equaliser bar <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	140-4
	140.3	Push frame (inside) <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	140-6
150	Working attachment		150-1
	150.1	Ripper <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	150-2
	150.2	Ripper for front equipment, 6-way blade <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	150-3
160	Operator's cab, heating and air conditioning		160-1
	160.1	Operator's platform	160-2
	160.1.1	Operator's platform installations <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	160-2
	160.1.2	Operator's platform bearing <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	160-3
	160.1.3	Support cylinder <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	160-6

160.2	Operator's cab	160-11
160.2.1	Operator's seat with pneumatic comfort suspension <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	160-11
160.3	Heating, ventilation, air conditioning	160-12
160.3.1	Heating and air conditioning unit	160-12
160.3.1.1	Heating, air conditioning and ventilation <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	160-12
190	Options	190-1
190.1	Refuelling pump <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	190-2
190.2	Reversible fan drive <i>PR726-1793-4F-G8.0/18370; PR726-1793-05-G8.0/18370;</i>	190-9
200	Service codes, diagnosis	200-1
200.2	Test and adjustment software	200-2
200.2.1	Wizard test and adjustment software	200-2
200.2.1.1	General	200-2
200.2.1.2	Symbols	200-3

010 Introduction

Contents

010.1	Safety instructions	010-4	
010.1.1	General safety instructions	010-4	
010.1.2	Safety instructions for crushing and burn prevention	010-5	
010.1.3	Safety guidelines for fire and explosion prevention	010-5	
010.1.4	Safety instructions for machine start up	010-6	
010.1.5	Safety instruction for start up	010-6	
010.1.6	Safety guidelines for working	010-6	
010.1.7	Safety instructions for parking the machine	010-8	
010.1.8	Safety instructions for transporting machine	010-8	
010.1.9	Safety instructions for towing machine	010-8	
010.1.10	Safety instructions for maintenance	010-9	
010.1.11	Safety guidelines for welding work on machine	010-11	
010.1.12	Safety guidelines for working on attachment	010-11	
010.1.13	Safety guidelines for loading machine with a crane	010-12	
010.1.14	Safety notes for maintenance of hydraulic hoses and hose lines	010-12	
010.1.15	Safety guidelines for maintenance work on machines with hydro accumulators	010-13	
010.1.16	Roll over protection (ROPS) and falling object protection (FOPS)	010-13	
	010.1.16.1	Avoid accidents	010-13
	010.1.16.2	Avoid injuries	010-14
010.1.17	Equipment and attachment parts	010-14	
010.1.18	Protection from vibrations	010-14	
010.1.19	See and be seen	010-15	
	010.1.19.1	Field of vision	010-16
	010.1.19.2	Measures before and during operation	010-16
010.1.20	Safety notes for Diesel engines with electronic control units	010-17	
010.1.21	Safety notes for working on Common Rail System of Diesel engines	010-17	
010.2	Special tools for maintenance and repair work	010-19	

010.2.1	Tools - Diesel engine	010-19
010.2.2	Tools - Hydraulic system	010-21
010.2.3	Tools - Hydraulic cylinder	010-25
010.2.4	Tools - Electrical system	010-26
010.2.5	Tools - Travel gearbox	010-29
010.2.6	Tools - Undercarriage	010-30
010.2.7	Tension unit tools	010-31
010.2.8	Tools - Oscillating axle frame	010-31
010.2.9	Tools – Operator's cab	010-32
010.2.10	Tools - Diesel exhaust fluid system	010-32
010.2.11	Assistance system tools	010-33
010.3	Standards and specifications	010-35
010.3.1	Preload values and tightening torques for screws with standard and fine metric thread according to DIN ISO 261	010-35
010.3.1.1	Scope of application and purpose	010-35
010.3.1.2	Further applicable documentation	010-35
010.3.1.3	Changes and descriptions	010-36
010.3.1.4	Tightening values	010-36
010.3.1.5	Flanges and half flanges for high pressure (standard 62)	010-42
010.3.1.6	Half flange for low pressure (standard 61)	010-42
010.3.1.7	Tightening torques for cutting edges, end bits and adapters	010-42
010.3.2	Installation specifications	010-43
010.3.2.1	Duo cone slipping seals	010-43
010.3.3	Tapping bores	010-45
010.3.3.1	Tapping bores of metric ISO standard threads	010-45
010.3.3.2	Tapping bores of metric ISO fine threads	010-47
010.3.4	Conversion tables	010-50
010.4	Conservation guidelines	010-51
010.4.1	General	010-51
010.4.2	Taking the machine out of service for an unknown duration	010-51
010.4.3	Shut down of the machine	010-52
010.4.3.1	Shut down for up to 2 months	010-52
010.4.3.2	Shut down for up to 12 months	010-53
010.4.3.3	Shut down for longer than 12 months	010-54

010.4.4	Return to operation	010-54
010.4.4.1	After a shut down of 2 months	010-54
010.4.4.2	After a shut down of 12 months	010-54
010.4.4.3	After shut down of longer than 12 months	010-55
010.5	Repair welding	010-56
010.5.1	Preparation of cracked part	010-56
010.5.1	Preparation of a weld	010-57
010.5.1	Treatment of electrodes	010-57
010.5.1	Welding technique	010-57
010.5.1	Reinforcement of welding seam	010-58
010.5.1	General use of reinforcement sheeting	010-58
010.5.1.1	Form of sheeting	010-58
010.5.1.1	Thickness of sheeting	010-58
010.5.1.1	Material quality of sheeting	010-59
010.5.1.1	Application of reinforcement sheeting	010-59
010.5.1.1	Welding the reinforcement sheeting	010-59
010.5.1.1	Selection of correct welding electrodes	010-60
010.5.1.2	Electrode selection	010-60
010.5.1.2	Steel chart	010-61
010.5.1.2	Welding additives chart	010-62
010.6	Hydraulic symbols	010-66
010.7	Electrical symbols	010-76
010.8	Material weights	010-80

010.1 Safety instructions

010.1.1 General safety instructions

1. Please familiarize yourself with **operator's manual** before putting machine into service.
Make sure that you have obtained, read and understand any additional instructions relating to special accessories for machine.
2. Only explicitly authorized personnel may operate, maintain or repair the machine.
Observe the permissible minimum legal age limit!
3. Use only trained or instructed personnel, clearly determine the responsibility of the personnel for operation, set up, maintenance and repairs.
4. Determine machine operator responsibility (also in regards to traffic regulations) and allow him to refuse unsafe instructions from third persons.
5. Do not allow any person either still to be trained or already in training to operate or work on machine unless under constant supervision and guidance of an experienced instructor or operator.
6. Check and observe any person working or operating machine at least periodically if they observe safety instructions and guidelines given in **operator's manual**.
7. Always wear proper work clothing when operating or working on machine. Avoid wearing rings, watches, ties, scarves, open jackets, loose clothing, etc. There is a danger of injury, as they can get stuck or be pulled in.
Prescribed for specific tasks: safety glasses, safety shoes, safety helmet, work gloves, reflective vest, ear protection, ...
8. Consult supervisor at jobsite for special safety instructions and regulations.
9. When entering and exiting the machine, maintain three-point contact.
10. When entering or exiting, never use joysticks as handholds.
This could trigger inadvertent movement of machine and cause serious accidents.
11. Never jump off the machine. When climbing on or off machine, use intended steps, ladders and catwalks and handles. Use both hands for support and face machine.
12. Keep steps, ladders and handles free of oil, grease, mud, snow and ice. These precautions will minimize the danger of slipping, stumbling or falling.
13. Make yourself familiar with emergency exit.
14. If no other instructions are given, proceed as follows for maintenance and repair work.

Procedure:

- Park the machine on solid and level ground.
 - Bring all control levers to neutral position.
 - Switch parking switch to park position.
 - Turn engine off and pull ignition key.
 - Actuate control levers several times to relieve pressure in servo lines.
 - Bring all control levers to neutral position.
15. Before working on hydraulic circuit, with engine turned off and with ignition key in contact position, move all pilot controls (joysticks and pedals) in both directions to relieve servo pressure and remaining back pressures in working circuits. Then release internal hydraulic tank pressure.
 16. Before leaving operator's seat, switch parking switch to Park position.
 17. Secure all loose parts on machine.
 18. Never operate a machine without a complete walk around inspection. Check if all warning signs are on the machine and if they are all legible.
 19. Observe all signs with danger and safety instructions.

20. For special applications, this machine must be equipped with specific safety devices. In this case, use the machine only if they are installed and functioning.
21. Never make any changes or additions and modifications on machine, which could affect safety, without obtaining explicit approval from manufacturer / supplier. This also applies to installation and adjustment of safety devices and safety valves as well as to any welding on load carrying parts.
22. Avoid staying near running Diesel engine. Persons with a pacemaker may not stay near a running Diesel engine (minimum distance 50 cm).
23. Do not touch current carrying components on electrical connection of solenoid valve controlled injection pumps (Unit Pumps) when Diesel engine is running.

010.1.2 Safety instructions for crushing and burn prevention

1. Never work underneath attachment as long as it is not safely resting on ground or properly supported.
2. Never use damaged or insufficient tackle (such as cables, chains, ..). Always wear work gloves when handling wire cables.
3. When working on attachment, never align bores with your fingers, always use a suitable alignment tool.
4. When engine is running, make sure that no objects touch fan. Any objects falling or protruding into fan will be thrown out or destroyed and can damage fan.
5. Avoid skin contact with hot surfaces and fluids. There is a danger of burns.
6. Check coolant level only after cap of expansion tank is cool enough to touch. Turn cap carefully to relieve pressure.
7. At or near operating temperature, engine and hydraulic oil are hot. Do not allow hot oil or oil-bearing parts to touch skin.
8. Always wear safety glasses and work gloves when handling batteries. Avoid sparks and open flames.
9. Never permit anyone to hand guide attachment into proper position.
10. Check if open door position of engine compartment door is ensured by gas cylinder.
If function is not ensured, then problem must be remedied immediately.
11. Before operating machine, close and lock all engine compartment doors and covers.
12. Never lay underneath machine unless machine is properly and safely supported.

010.1.3 Safety guidelines for fire and explosion prevention

1. Engine must be turned off when refueling.
In addition, heater must also be turned off before refueling.
2. Do not smoke and avoid open flames when refueling and where batteries are charged.
3. Always start engine as described in "**operator's manual**"
4. Check electrical system. Correct any defects, such as loose connections, chafed wiring or burnt out fuses and bulbs immediately.
5. Never store flammable fluids on machine except in appropriate storage tanks.
6. Regularly inspect all lines, hoses and fittings for leaks and damage. Repair any leaks immediately and replace damaged components.
Any oil escaping from leaks can easily cause a fire.
7. Be certain that all clamps and protective guards are properly installed to prevent vibration, rubbing and heat build up.

8. Starter fluid (ether) is especially flammable! Never use cold start ether near heat sources, open flames (for example cigarettes) or in insufficiently ventilated areas.
9. Never use flame glow system or preheat systems when using cold start ether! (Danger of explosion)
10. Know location of fire extinguishers, make sure you know how to use them properly and check out location of where to report a fire and inform yourself about fire fighting capabilities before you start to work.

010.1.4 Safety instructions for machine start up

1. Before starting the machine, always perform a thorough walk-around inspection.
2. Visually check the machine for loose bolts, cracks, wear, leaks and intentional damage.
3. Never start or operate a damaged machine.
4. Make sure to correct any problems immediately.
5. Make sure that all hoods and covers are closed and locked. Check if all warning and reference signs are on the machine.
6. Clean all windows and mirrors, secure all doors and windows to prevent inadvertent movements.
7. Always enter and leave the machine using the ascending aids provided.
8. Make sure that no one works on or under the machine. Warn all persons in the surrounding area before operating the machine.
9. After entering the cab, adjust the operator's seat, the mirrors, the arm rests and the safety belt so that you can work comfortably.
10. The noise protection devices on the machine must be in protective position during operation.
11. Never operate the machine without the operator's cab or canopy.

010.1.5 Safety instruction for start up

1. Before starting machine, check all indicator lights and instrument for proper function. Bring all control levers into neutral position.
2. Before starting engine, alert any nearby personnel that machine is being started by sounding horn.
3. Start machine only from operator's seat.
4. If no other instructions were issued, start engine according to guidelines in **operator's manual**.
5. Start engine and check all indicators, gauges, instruments and controls.
6. When operating in enclosed spaces, run engine only if there is sufficient ventilation. If necessary, open doors and windows to ensure sufficient fresh air supply.
7. Bring engine and hydraulic oil to operating temperature, low oil temperatures cause controls to be sluggish.
8. Check that control for attachment functions properly.
9. Move machine carefully into an open area and check all travel functions, check travel brake, steering function as well as turn signals and lights.

010.1.6 Safety guidelines for working

1. Before starting to work, familiarize yourself with the peculiarities of the job site, as well as the special regulations and warning signals. Part of the surrounding area includes, for example, the obstacles in the working or traffic area, the load bearing capacity of the ground and special protection required to secure the job site from public highway traffic.

2. Always keep a safe distance to overhangs, edges, embankments and unstable ground.
3. Be particularly cautious of changing ground conditions, unfavourable visibility and changing weather.
4. Familiarize yourself with location of power lines on jobsite and work particularly careful in their vicinity. If necessary, inform the responsible authorities.
5. Maintain a safe distance from electrical overhead lines. When working near electrical overhead lines, do not allow attachment too come close to wires.
Risk of fatal injury!
Inform yourself about required safety distances.
6. **If you do touch a high voltage power line, proceed as follows:**
 - Do not leave the machine!
 - If possible, move the machine a sufficient distance away from the danger zone.
 - Warn all personnel in the surrounding area not to come close to the machine and not to touch the machine.
 - Instruct someone to turn the electric power off.
 - Do not leave machine until you are assured that electric wire, which has been touched or damaged is no longer energized and power has been turned off!
7. Before moving machine or working with machine, always make sure that equipment is safely secured.
8. When travelling on public roads, highways or properties, always observe valid traffic regulations and, if necessary, first bring machine into proper condition to meet federal and local highway standards.
9. Always turn on lights if visibility is poor or as dusk approaches.
10. It is strictly prohibited for anyone to ride along on machine.
11. Operate machine only when seated and with safety belt fastened.
12. In even that machine should tip over, remain seated with seatbelt secured. Experience has shown that it is safer to remain in cab in event of an overturn.
13. Report any functional problems or defects, make sure that all necessary repairs are completed immediately.
14. Personally make sure that no one is endangered by moving the machine.
15. Never leave the operator's seat as long as the machine is still moving.
16. Never leave machine unattended while engine is running.
17. When moving loads, keep load as close as possible to ground.
18. Maximum permissible incline and side slope of machine depends on installed attachment as well as on ground conditions!
19. Avoid any working movements which could cause machine to tip over. However, if machine does begin to tip or slide, lower attachment immediately and turn machine downhill. If possible, always work downhill or uphill, never sideways on a slope.
20. Always move slowly and carefully on rocky or slippery ground or on a slope.
21. Always adapt the travel speed to the working conditions.
22. Never travel on slopes which exceed the maximum permissible gradeability.
23. Travel downhill only at low travel speed, maximum 4 km/h, to prevent loss of control over machine. Engine must run at high idle speed and speed must be reduced by selecting lower speed range. Never switch into lower travel speed range while already driving downhill, always switch before approaching slope.
24. For terrain which is difficult to gain an overview of and whenever necessary, ask for assistance of a guide. Have only one person signal you.
25. Danger of accidents due to restriction of vision for large machines! Take suitable measures to ensure a safe working application of machine on construction site.
26. Exclusively permit experienced personnel to secure loads and signal crane operator. Signaller must position himself within view of operator or be in voice contact with him.

010.1.7 Safety instructions for parking the machine

1. Park machine only on firm and level ground. If it becomes necessary to park the machine on a grade, it must be properly blocked and secured with wedges to prevent any unintentional movement.
2. Lower working attachment and lightly anchor working attachment on ground.
3. Bring all control levers to neutral position, switch parking switch to park position and turn engine off according to Operating instructions before leaving operator's seat.
4. Lock the machine, remove all keys and secure the machine to prevent unauthorized use and vandalism.
5. Never park machine in such a way as to block access to entrances, dock ladders, fire hydrants, etc.

010.1.8 Safety instructions for transporting machine

1. Use only suitable transport devices and lifting devices with sufficient load carrying capacity.
2. Park the machine on level ground and block the chains or wheels with wedges.
3. If necessary, remove parts of working attachment for duration of transport.
4. When loading a machine on a transport vehicle, be sure that the stipulated ramp incline angle is not exceeded and the ramp is covered with wooden planks to prevent slipping.
5. Before moving onto ramp, clean chains or wheels of machine, remove any snow, ice or mud.
6. Align machine with loading ramp.
7. Use a guide to signal machine operator. Drive onto ramp and onto transport vehicle very carefully.
8. Secure machine and remaining parts with chains and wedges to prevent them from slipping.
9. Relieve pressure from hydraulic lines and hoses, remove ignition key, lock cab and all covers before leaving machine.
10. Carefully check out transport route beforehand, especially in regards to width, height and weight limitations.
11. Check that there is enough clearance underneath all electrical lines, bridges, underpasses and in tunnels.
12. During unloading procedure, proceed with same caution as during loading procedure.
Procedure:
 - Remove all chains and wedges. Start engine as outlined in operator's manual.
 - Carefully drive off loading platform down ramp.
 - Have another person guide and signal you.

010.1.9 Safety instructions for towing machine

1. Always follow the correct procedure according to the instructions in the **operator's manual**, refer to section "Towing the machine".
2. The machine may only be towed in exceptional circumstances, for example to move the machine from a dangerous area for repair.
3. If the sun gears are removed, the machine starts to roll by itself from an incline of 2°. Before removing and installing the sun gears, secure the machine to prevent it from rolling off.
4. If the sun gears are removed, the service brake and parking brake are without function.

5. Before pulling or towing, check all towing and pull devices for safety and stability.
6. The rod, which is used to tow the machine must be adequate to pull the machine and must be connected to the appropriate bores and towing devices. Damage or accidents which occur when towing machine cannot be covered by manufacturer's guarantee under any circumstances.
7. During towing procedure, keep within required transport position, permissible speed and distance.
8. When returning machine to operation, proceed only as outlined in operator's manual.
9. After the towing procedure, re-establish the series condition of the machine.

010.1.10 Safety instructions for maintenance

1. Never perform any maintenance or repairs for which you are not qualified or you do not understand.
2. Observe stated intervals or time periods for repeat checks and inspections as outlined in operator's manual. Always use appropriate tools to carry out maintenance work.
3. Chart in this operator's manual defines exactly who must or can carry out which type of work. Operator can exclusively carry out work marked in maintenance and inspection schedule with by "maintenance staff". Remaining tasks can exclusively be carried out by specialist staff with appropriate training.
4. Spare parts must meet technical requirements set forth by manufacturer. This is always ensured by using original spare parts. Spare parts, which do not meet technical requirements of manufacturer can impact safety and function of machine.
5. Always wear safe work clothing when performing maintenance. For certain work, safety glasses and work gloves are required, in addition to a hard hat and safety shoes.
6. Keep unauthorized personnel away from machine during maintenance.
7. Secure a wide-ranging area for service, as necessary.
8. Inform operator before carrying out any special task or maintenance work. Appoint one supervisory person.
9. If not otherwise noted in this operator's manual, carry out all maintenance work on machine on firm and level ground, with engine turned off.
10. Operator's platform can exclusively be tilted when machine is at a standstill and engine is turned off! When tilting operator's platform forward or backward, there can be no personnel within tilt range. Work under tilted operator's platform may only be carried out if machine is at a standstill and after placing safety support bar. Machine can **NOT** be started or driven with a tilted operator's platform. Leave parking switch in park position!
11. During maintenance and repairs, make sure you always tighten any loosened screw connections.
12. If it becomes necessary to remove any safety devices during set up, maintenance and repairs, safety devices which were removed must be reinstalled immediately after completion of maintenance and repair work and then be inspected for proper function.
13. Before any maintenance and repair work, especially when working under machine, attach an easily visible "**DO NOT TURN ON**" warning sign to ignition switch. Pull ignition key off.
14. Before any maintenance and repairs, clean machine, especially connections and fittings to remove oil, fuel or cleaning substances. Never use aggressive cleaning substances. Use exclusively lint-free cleaning cloths.
15. To clean machine, never use flammable cleaning fluids.
16. Before any welding, cutting and grinding, clean machine and surrounding area of dust and flammable substances and assure adequate ventilation.

- Otherwise there is a **DANGER OF EXPLOSION!**
17. Before cleaning machine with water, steam (high pressure cleaner) or other cleaning fluids, cover / tape off all openings whose safety and function could be affected by infiltration of water, steam or cleaning fluid.
Electric motors, switch boxes and battery compartments are especially endangered.

Further procedure:
 - Make sure that temperature sensor of fire warning system and fire extinguisher do not come in contact with hot cleaning fluids when cleaning operator's cab. Otherwise they could trigger fire extinguishing system.
 - After cleaning, completely remove covers and tapes.
 - After cleaning machine, check all fuel, engine oil, hydraulic oil lines for leaks, loose connections, chafing and damage.
 - Fix any defects immediately.
 18. Adhere to product safety instructions issued for handling of oils, greases and other chemical substances.
 19. Ensure safe and environmentally friendly disposal of operating and service fluids as well as exchange parts.
 20. Be very careful when handling any hot components or service fluids on machine as there is a danger of burns and scalding.
 21. Operate combustion engines and fuel operated heaters exclusively in sufficiently ventilated areas. Before starting machine in a closed area, make sure ventilation is sufficient. Always follow all regulations valid for current job site.
 22. Perform any welding, cutting or grinding work on machine exclusively if this work has been explicitly authorized, as there can be a danger of fire or explosion.
 23. Operator's cab windows are made of safety glass. Damaged operator's cab windows must always be replaced immediately.
 - Exclusively safety glass can be used for operator's cab windows.
 - Use exclusively Original Liebherr spare parts.
 24. Do not attempt to lift heavy parts. Use suitable lifting devices with sufficient load carrying capacity.

Procedure:

- When replacing individual parts and larger components, attach and secure them carefully to lifting devices to avoid any danger.
 - Use exclusively suitable and technically sound lifting devices as well as load tackle with sufficient load carrying capacity.
 - **Do not allow anyone to work or remain underneath suspended loads.**
25. Do not use damaged or insufficiently sized ropes or cables. Always wear work gloves when handling wire cables.
 26. Exclusively permit experienced personnel to secure loads and signal crane operator. Guide must position himself within view of operator or be in voice contact with him.
 27. When working overhead during installation work, use appropriate safe access ladders and working platforms. Never use machine parts as access aids. Wear a harness / anti-fall guards when working in great heights. Keep all handles, steps, railings, platforms, ladders free of dirt, ice and snow.
 28. When working on attachment, make sure it is safely supported. Never use metal on metal support.
 29. Never lay underneath machine unless machine is properly and safely supported with wooden beams.
 30. Always support machine in such a way that any shifting weight will not endanger stability of machine and avoid metal to metal contact.
 31. Exclusively specially trained specialist staff can work on travel gears, brake and steering system.

32. If machine must be repaired while parked on a slope, track chains or wheels must be blocked with chocks to prevent any movement. Bring working attachment into maintenance position.
33. Exclusively authorized personnel with specialized training and experience in hydraulics can work on hydraulic system.
34. Wear protective gloves when checking for leaks. Fluid escaping from a small hole can have enough pressure to penetrate skin.
35. Never loosen any hydraulic oil lines or fittings before attachment has been lowered and engine has been turned off. Then, with ignition key in contact position and parking switch in operating position, actuate all pilot controls (joysticks and pedals) in both directions to relieve servo pressure and back pressures in working circuits, and relieve internal tank pressure by releasing breather screw.
36. Regularly inspect all hydraulic oil lines, hoses and fittings for leaks and externally visible damage. Fix any defects immediately. Oil spray can lead to injuries and fires.
37. Before starting repair work, depressurise system sections and pressure lines to be opened (hydraulics, compressed air) in accordance with assembly descriptions.
38. Route and install hydraulic hoses and air pressure lines properly. Do not mix up connections. All fittings, including length and quality of hose lines must match specified requirements.
Use exclusively Liebherr replacement parts.
39. Replace hydraulic hoses and lines in regular intervals, as stated, even if no safety relevant defects can be seen.
40. Exclusively qualified electricians or trained personnel under guidance and supervision of a licensed electrician can work on electrical equipment of machine, according to electro-technical rules and regulations.
41. Exclusively use Original fuses with correct amperage. In case of problems in electric energy supply, turn machine off immediately.
42. Inspect and check electronic equipment on machine regularly. Correct any defects, such as loose connections, burnt or chafed wiring or burnt out fuses and bulbs immediately.
43. If any work is necessary on energized, voltage carrying parts, a second person must be utilized to disconnect emergency off or master switch in case a problem arises. Rope off work area off with a red and white safety chain and a warning sign. Use exclusively insulated tools.
44. When working on high voltage carrying components, turn off power supply, then connect supply cable to ground and use a grounding rod to ground these parts, such as condensers.
45. Check all disconnected parts first if they are really free of voltage, ground them and then short circuit them. Insulate adjacent, voltage carrying parts.

010.1.11 Safety guidelines for welding work on machine

1. Adhere to following procedure for welding work on machine:
 - Switch off ignition.
 - Turn battery master switch off (if present).
 - Attach earth of welding unit as close as possible to welding location.
 - Only authorized expert personnel is permitted to carry out welding work.

010.1.12 Safety guidelines for working on attachment

1. Never work underneath attachment as long as it is not safely resting on ground or properly supported.

2. When replacing or changing any part of attachment (such as blade, cutting edges, teeth etc.) never use metal on metal support.
3. Do not attempt to lift heavy parts. Use suitable lifting devices with sufficient load carrying capacity.
4. When working with wire cables, always wear gloves!
5. Never loosen any hydraulic oil lines or fittings before attachment has been lowered and engine has been turned off. Then, with ignition key in contact position and parking switch in operating position, actuate all pilot controls (joysticks and pedals) in both directions to relieve servo pressure and back pressures in working circuits, and relieve internal tank pressure by releasing breather screw.
6. After completion of all maintenance and repair work, make sure that all lines, hoses and fittings are properly connected and retightened.
7. Removing and installing tempered steel bolts and pins can be dangerous, metal chips can cause severe injuries.
Always wear gloves and safety glasses.
If possible, use special tools (such as mandrels, pin pullers, etc.).

010.1.13 Safety guidelines for loading machine with a crane

1. Remove boom and counterweight or bring into transport position.
2. Bring all control levers into neutral position.
3. Turn engine off as outlined in operating instructions and switch parking switch to park position before leaving operator's seat.
4. Close all doors, covers and hoods on machine properly.
5. Exclusively permit experienced personnel to secure loads and signal crane operator. Signaller must position himself within view of operator or be in voice contact with him.
6. Install shackles and hooks for suspension to appropriate and designated brackets or bore holes on machine.
7. Make sure suspension is of sufficient length.
8. Carefully lift machine.
9. **Do not allow anyone to work or remain underneath suspended loads.**
10. When returning machine to operation, proceed only as outlined in operator's manual.

010.1.14 Safety notes for maintenance of hydraulic hoses and hose lines

1. Hydraulic lines and hoses may never be repaired! This is strictly prohibited!
2. All hoses, hose lines and fittings must be checked regularly, but at least 1 x per year for leaks and any externally visible damage! Any damaged parts must be replaced immediately. Oil spray can lead to injuries and fires.
3. Even if hoses and hose lines are properly stored and used, they undergo a natural aging process. For that reason, their service life is limited.
4. Improper storage, mechanical damage and improper use are most frequent causes of hose failures.
5. Service life of a hose line may not exceed six years, including a storage period of a maximum of two years (always check manufacturer's date on hoses).
6. Using hoses and lines close to limit ranges of permitted use can shorten service life (for example at high temperatures, frequent working cycles, extremely high impulse frequencies, multi shift operation).
7. Hoses and lines must be replaced if any of following conditions are found during an inspection:

Criteria:

- Damage to outer layer as far as intermediate layer (e.g. chafing, cuts and cracks).
 - Brittleness of outer layer (hose material cracking);
 - Deformations, which differ from natural shape of hose or hose line, when under pressure or not under pressure, or in bends, e.g. separation of layers, blisters or bubble formation;
 - Leaks;
 - Failure to follow installation instructions;
 - Damage or deformation in hose fittings, which reduce stability of fitting or connection from hose to fitting;
 - Hose slipping out of fitting;
 - Corrosion of fitting, which reduces function and strength;
 - Storage time or service life has been exceeded.
8. When replacing hoses and hose lines, use only Original spare parts.
 9. Route and install hoses and hose lines properly. Do not mix up connections.

010.1.15 Safety guidelines for maintenance work on machines with hydro accumulators

1. Only especially trained expert personnel may work on hydro accumulators.
2. Improper mounting and handling of hydro accumulators can cause severe accidents.
3. Do not operate damaged hydro accumulators.
4. Before working on hydro accumulators, relieve pressure in hydraulic system (hydraulic system including hydraulic tank), as described in these operating instructions.
5. Do not weld or solder on hydro accumulator and do not carry out any mechanical work.
Hydro accumulator can be damaged due to heat exposure and can rupture due to mechanical treatment. **THERE IS A DANGER OF EXPLOSION!**
6. Fill hydro accumulator only with nitrogen. When using oxygen or air, there is a **DANGER OF EXPLOSION!**
7. Accumulator housing can become hot during operation, there is a danger of burning.
8. New hydro accumulators must be charged to required pressure for application before use.
9. Operating data (minimum and maximum pressure) is marked permanently on hydro accumulators. Make sure that marks remain visible.

010.1.16 Roll over protection (ROPS) and falling object protection (FOPS)

Machine is equipped with an operator's cab, which provides overroll (ROPS) and falling objects (FOPS) protection for machine operator.

010.1.16.1 Avoid accidents

Dangerous situations can occur depending on application and method of operation, even with intact protective devices. Avoid all unsafe methods of operation.

**Note**

Overall weight of machine!

- ▶ At installation of attached tools and attachments make sure that overall weight of machine is below weight for which overroll protection was certified. Protective function of overroll protection is not longer ensured if maximum permissible overall weight of machine is exceeded (see Data tag).

Following changes on machine can cause maximum permissible overall weight to be exceeded:

- Use of attached tools which are too heavy
- Change of working attachment
- Additions or modifications on machine

A machine with a damaged cab protective system (ROPS, FOPS) may not be placed into operation.

Damage on operator's cab can be caused by following work and occurrences:

- Welding, cutting or drilling of holes
- Attaching fittings
- Deformation after an accident
- Falling objects

Structural changes or repair of any kind are prohibited.

010.1.16.2 **Avoid injuries**

Overroll protection of operator's cab protects operator only when he is wearing seatbelt.

Any changes in interior of operator's cab, for example as a result of installation of accessories, may not restrict working area of operator.

Any objects carried in operator's cab may not protrude into working area of operator. Loose objects must be stored safely.

010.1.17 **Equipment and attachment parts**

1. Equipment and attachment parts made by other manufacturers or those which were not approved by Liebherr for installation or attachment may not be installed on machine without prior written approval by Liebherr.
2. Liebherr must be provided with required technical documentation necessary for this purpose.

010.1.18 **Protection from vibrations**

1. Vibration impact on mobile construction machinery is usually result of manner of utilization. Especially following parameters have a significant influence:
Terrain conditions: unevenness and potholes;
Operating techniques: speed, steering, braking, control of operating elements of machine during travel as well as working.
2. Machine operator determines vibration impact to a large extent, as he himself selects speed, gear ratio, working manner and travel route. This results in a wide range of various vibration impacts for same machine type.
3. Full body vibration impact for machine operator can be reduced if following recommendations are observed:
Select appropriate machine, equipment parts and auxiliary devices for corresponding tasks.

Use a machine equipped with appropriate seat (i.e. for earth moving machines, for example hydraulic excavators, a seat which meets EN ISO 7096).

4. Keep seat in good order and adjust it as follows:
Seat adjustment and suspension should be made according to weight and size of operator.
Check suspension and adjustment mechanism regularly and make sure that characteristics of seat remains as specified by seat manufacturer.
5. Check maintenance condition of machine, particularly with regard to: tyre pressure, brakes, steering, mechanical connections, etc.
6. Do not steer, brake, accelerate and shift or move and load attachment of machine in a jerky manner.
7. Match machine speed to travel route to avoid vibration impacts.
Decrease speed when driving on pathless terrain.
Drive around obstacles and avoid very impassable terrain.
8. Keep quality of terrain where machine is working and travelling in good order:
Remove large rocks and obstacles;
Fill furrows and holes.
To establish and retain suitable terrain conditions, keep machines available and allow for sufficient time.
9. Travel longer distances (i.e. on public roads) with suitable (medium) speed.
10. For machines, which are frequently used for travel, utilize special auxiliary systems for travel (if installed), which reduce vibration for this application.
If such auxiliary systems are not available, regulate speed to keep machine from "rocking".

010.1.19 See and be seen

The operator perceives most information for his work visually. Only if there is sufficient visibility while travelling and working can he minimise possible dangers for himself and others.

Since there is no direct view onto all areas in the surroundings, visual aids (such as mirrors and cameras) are installed on the machine. These visual aids must be utilised for the areas around the machine which are not directly visible.



WARNING

Restricted field of vision!
Danger to life.

- ▶ Pay attention to restrictions in the visibility field and to blind spots.
- ▶ Use visual aids.

If the field of vision is still insufficient despite the visual aids:

- ▶ Work with a guide.

Observe national regulations regarding visibility in the operator's cab. For countries within the European Economic Area, the Standard ISO 5006 describes the test and evaluation methods for the visibility field of the operator. The visibility field is tested in this case with standard equipment. Changes to the machine, such as installation or modification of components, must not impact the visibility field. When changes impact the visibility field, then a test according to ISO 5006 or the regulations valid on the job site must be carried out. Appropriate measures are to be taken, depending on the test result. The operator must be informed about the changes.

010.1.19.1 Field of vision

The field of vision is determined according to ISO 5006. The field of vision describes the visible range the operator can see from the operator's seat.

The figure below illustrates the field of vision in the near field and in the 12 m radius of the operator from the operator's seat. Not all areas of machine are located in the direct field of view. The hatched areas in the figure indicate the areas that cannot be seen from the operator's seat.

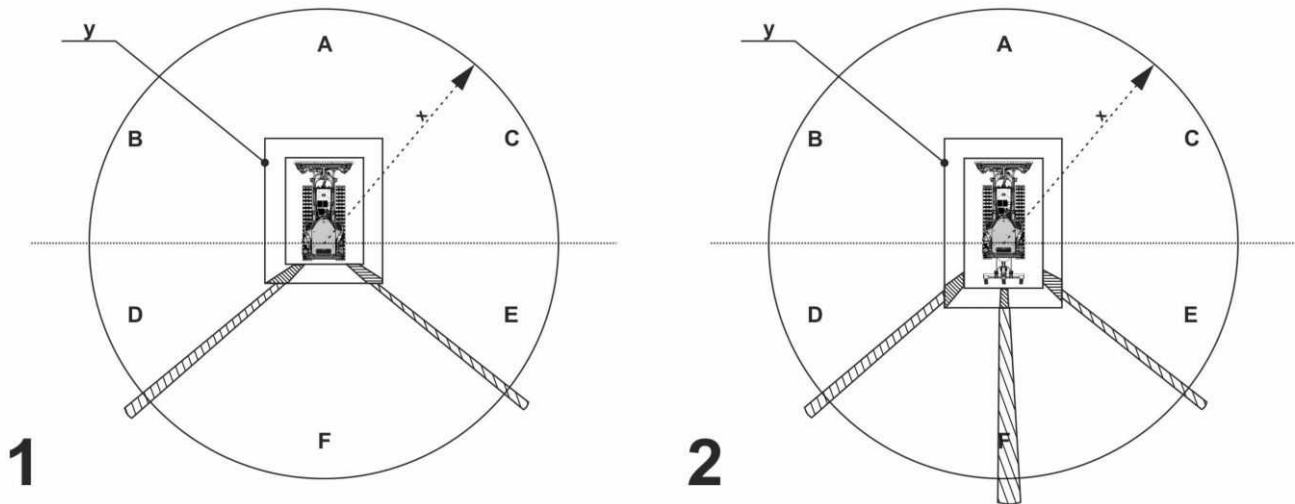


Fig. 1: Field of vision

- | | | | |
|---|--------------------------------|---|-----------------|
| 1 | Machine without rear equipment | x | Radius: 12 m |
| 2 | Machine with rear equipment | y | Near field: 1 m |

The following areas cannot be seen from the operator's seat:

- Obscured view in area **D** and **E** due to C-pillars
- Obscured view in area **F** due to rear equipment



DANGER

Restricted field of vision!
Danger to life.

Before operation of the machine:

- ▶ Adjust the visual aids.
- ▶ Make sure that no persons are within the hazard zone.
- ▶ Remove any obstacles in the work area.

The operator and construction site management must take measures to ensure that the obscured field of vision does not cause a safety hazard during operation.

010.1.19.2 Measures before and during operation

1. Make sure that persons establish contact with the operator before they approach the machine.
2. Check visibility aids for function, cleanliness and correct adjustment.
3. Adjust visibility aids in such a way that the best possible all around visibility is ensured.
4. Clean visibility aids and windows in the operator's cab immediately if dirt affects the visibility.

This as a preview PDF file from best-manuals.com



Download full PDF manual at best-manuals.com