LIEBHERR

Service Manual

Property of Liebherr-Werk Telfs GmbH

Pipe Layers SERIES 4 Litronic

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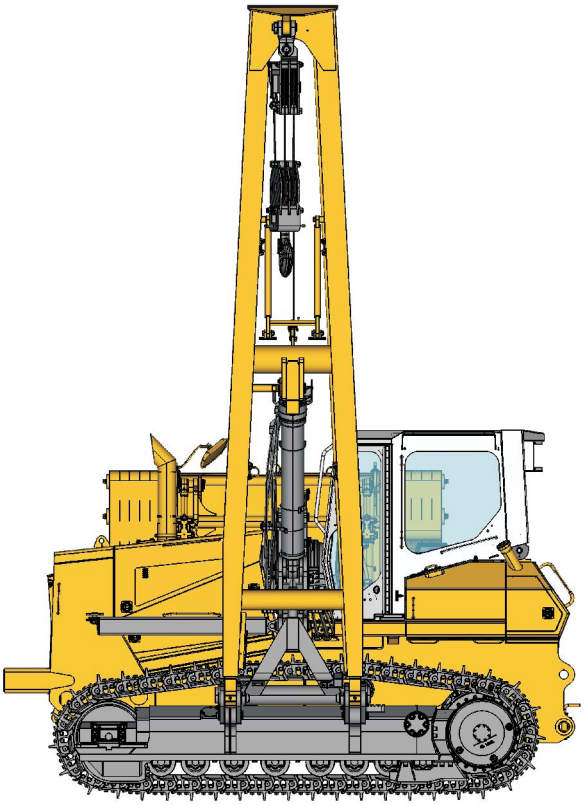

Book Nr.: _ _ _ _ _ _ _ _ _ _ _ _ _ _

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0.1.00 Index

Section Title

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1 General

1.0.00 Sub group index - General

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1.1.00 Foreword and explanation

1 For information

This manual contains technical data, design and functional descriptions, work and adjustment instructions as well as numerous drawings, functional views and illustrations for the

LIEBHERR – Pipe layers (RL) of Series 4.

This manual should simplify competent customer service of our products, however, it does not replace expert and qualified user training and attendance of our factory training classes.

Generally valid technical basic information is not listed. Refer to separate documentation for operational and spare parts information.

The manual will be updated and expanded as necessary when changes occur in series.

For all tasks on the machine, accident prevention guidelines and safety guidelines must be strictly observed.

We reserve the right to make changes of technical details on the machine in comparison to the information and illustrations in this manual.

Written and published by
LIEBHERR-Werk Telfs GmbH., Technical Documentation Dept.

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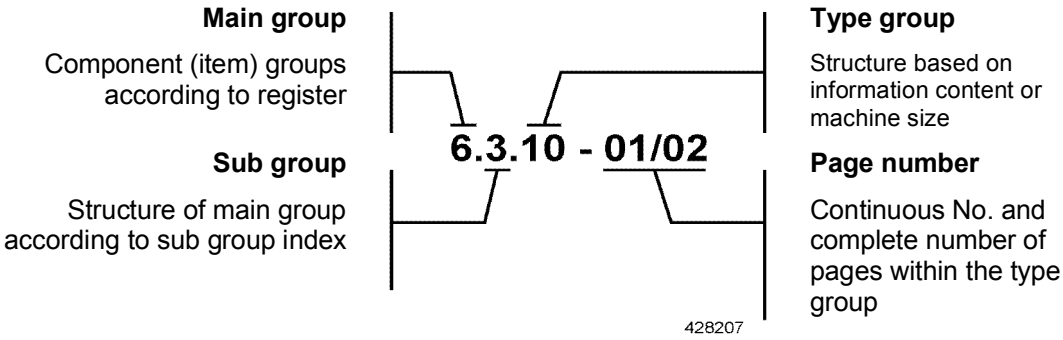
2 Explanation of layout

To simplify finding certain information and filing of updates, we set up the following layout:



It is possible that other continuous numbers are listed after the continuous number, for example 9.4.20 - 13/15 - **02**. This number is for supplements, especially for electrical schematics, where only one page is supplemented.

Changes are supplied with the same number, but with a later date, supplements are assigned a new number. If only one page is valid for a certain machine group, then this is noted in the header.

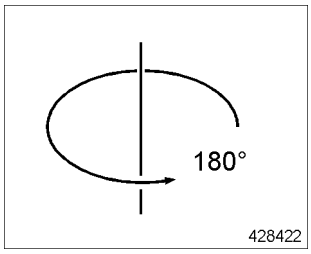
Note!
This symbol is used in the manual for very important safety notes.

- This symbol identifies a standard listing.

❑ This symbol signifies the following: “The prerequisite must be met”.
The maintenance personnel must first fulfil the precondition described, i.e. the machine must be brought into a particular work position in order to be able to carry out the actions subsequently described.

▶ This symbol identifies an action.
The maintenance personnel should be active at this location and carry out the action described.

▷ This symbol identifies a result.
The maintenance personnel is notified that a result will occur after a working step, for example, after the test knob is pressed, the LED light lights up.



This note shows that a detail view of an illustration is shown rotated by a given angle, as compared to the actual installation position. (In this case 180°)

We hope that with the supplied information we have taken yet another step to improve service on the LIEBHERR crawler dozers, crawler loaders, pipe layers and telescopic handlers.

LIEBHERR-Werk Telfs GmbH.
Technical documentation

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1.2.00 Safety regulations

1 Introduction

Prior and during the performance of tests / inspections, adjustments and repairs, it is imperative that the following safety guidelines are observed:

- Any type of work may only be carried out by **qualified expert personnel** or under their guidance and supervision.

  Qualified expert personnel are persons, who, based on their specialized training and experience, have sufficient knowledge in the area of earthmoving equipment and the specific technology of our machines in particular and who are familiar with all applicable laws and general work protection regulations, accident prevention guidelines, regulations, guidelines and generally approved rules concerning technology so that they are able to evaluate if the earthmoving equipment is safe to operate and if the necessary work can be performed without endangering themselves or third persons.

- Machines with raised operator's platform may not be driven! The machine may only be operated from a lowered and secured operator's platform!

- Always adhere to the adjustment values noted in the **LIEBHERR documentation** when performing adjustment work.

- At the delivery of a machine, the operating personnel must be trained using the current operating instructions. The safety guidelines noted in the instructions must be particularly observed.

- These safety guidelines must also be observed during inspection, adjustment or repair work. However, there are special repair and / or inspection work which require qualified personnel to follow another procedure than that noted in the safety guidelines. In such cases, qualified personnel or individuals performing the work under the supervision of such personnel should assure that additional safety precautions necessary to insure the safety of those involved in the repair are taken. The decision to carry out this measure can only be made by qualified expertly trained personnel. Such items of repair and/ or inspection work include, but are not limited to the following:
  - Opening the side doors while the Diesel engine running to carry out tests and / or adjustments.
    In these cases, care should be taken that the side engine compartment doors are properly secured during the entire duration of the work to prevent them from closing unexpectedly and / or inadvertently. Care should be exercised to assure that there will be no inadvertent or unintended contact of any part of the body with any moving and / or heated parts of the engine. Wear only tightly fitted clothing (no scarves, no tie, no wide sleeves, etc.)
  - Starting the Diesel engine with tilted operator's platform, as well as actuating the travel drive with properly raised machine for adjustment, repair or diagnostics purposes. In these cases, before starting the engine, the support of the operator's platform support as well as the support for the machine and the required ground clearance for the track chains must be checked again.

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2 Danger notes in this manual

For description of work, which can pose a danger for man or machine, the required safety precautions are described in this manual.

They are marked by the following notes:

Danger!
Warns that certain working procedures without appropriate precautionary measures can result in fatal injuries.

Warning!
Warns that certain working procedures without appropriate precautionary measures can result in severe bodily injuries.

Caution!
Warns that certain working procedures without appropriate precautionary measures can result in bodily injuries or damage to the machine.

Following these notes does not relieve you of the responsibility for following additional rules and guidelines!

Additional points that should be noted are:

- the safety regulations which apply on the jobsite,
- statutory “road traffic regulations”,
- the guidelines provided by professional associations.

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3 Safety guidelines in the operating instructions

The detailed descriptions for the following safety guidelines are noted in the operating instructions of the machine and must be strictly observed.

1 Introduction

2 Destined use

3 Signs on the machine

4 Safety regulations

4.1 General safety guidelines

4.2 Crushing and burn prevention

4.3 Fire and explosion prevention

4.4 Machine start up safety

4.5 Engine start up safety

4.6 Machine operating safety

4.7 Safety notes for working with the machine

4.8 Working in the vicinity of electricity transmission lines

4.9 Machine parking safety

4.10 Machine transporting safety

4.11 Machine towing safety

4.12 Machine maintenance safety

4.13 Safety guidelines for welding work on the machine

4.14 Safety guidelines for working on the attachment

4.15 Safety guidelines when loading the machine with a crane

4.16 Safe maintenance of hydraulic hoses and hose lines

4.17 Safety guidelines for maintenance work on machines with hydro accumulators

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

4.19 Equipment and accessory items

4.20 Protection from vibrations

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1.3.01 Tightening torques

1 General information

The preload values and the tightening torques noted in the chart have been taken from the VDI (Association of German Engineers) guidelines 2230 of July 1986.

Installation preload values F_M and tightening torques M_A for shoulder studs with standard metric or fine thread per DIN ISO 262 and DIN ISO 965 T2 (replacement for DIN 13 part 13) and wrench sizes for hex head screws with shaft DIN EN 24014 (replacement for DIN 931 part 1) or socket head screws DIN EN ISO 4762 (replacement for DIN 912)

The chart values are valid for screws with surface:

- black or phosphated – oiled
- zinc plated – oiled
- flZn according to LH standard 10021432 - dry (replaces DACROMET 500).

Medium friction value $\mu_G = 0.12$

Note!
Any tightening torque values and/ or tightening procedures noted in drawings / parts lists, instructions or component descriptions must be adhered to and given preference over factory standards.

Beginning with grade 10.9, no additional safety effect is provided when using lock washers

Always use correctly sized torque wrenches – the torque value according to the chart should be within the upper third of the existing range.

When using impact wrenches, care must be taken so that the torque values are not exceeded. Check before and intermediately with a torque wrench.

Note!
The tightening torques for the following components are noted in the following sections in detail:
Hydraulic cylinder – see section 8.9.
Track pad and sprocket segment screws – see section 12.1.
Rope winch – see section 14.2.

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2 Preload values and tightening torques for screws with standard metric thread according to factory standard WN 4037 I

Metric standard thread	**Preload value Fm based on grades in N**			**Tightening torques Ma based on grades in Nm**			**Wrench size** (x) = according to DIN931, for			
							Hex head screw		**Socket head screw**	
	8.8	**10.9**	**12.9**	**8.8**	**10.9**	**12.9**	**mm**	**Inch**	**mm**	**Inch**
M 4 x 0.7	4050	6000	7000	2,8	4,1	4,8	7	9/32	3	- -
M 5 x 0.8	6600	9700	11400	5,5	8,1	9,5	8	5/16	4	5/32
M 6 x 1	9400	13700	16100	9,5	14	16,5	10	- -	5	- -
M 7 x 1	13700	20100	23500	15,5	23	27	11	- -	- -	- -
M 8 x 1.25	17200	25000	29500	23	34	40	13	1/2	6	- -
M 10 x 1.5	27500	40000	47000	46	68	79	(17) 16	(11/16)--	8	5/16
M 12 x 1.75	40000	59000	69000	79	117	135	(19) 18	(3/4) - -	10	- -
M 14 x 2	55000	80000	94000	125	185	215	(22) 21	(7/8) - -	12	- -
M 16 x 2	75000	111000	130000	195	280	330	24	- -	14	9/16
M 18 x 2.5	94000	135000	157000	280	390	460	27	1-1/16	14	9/16
M 20 x 2.5	121000	173000	202000	390	560	650	30	1-3/16	17	- -
M 22 x 2.5	152000	216000	250000	530	750	880	(32) 34	- -	17	- -
M 24 x 3	175000	249000	290000	670	960	1120	36	1-7/16	19	3/4
M 27 x 3	230000	330000	385000	1000	1400	1650	41	1-5/8	19	3/4
M 30 x 3.5	280000	400000	465000	1350	1900	2250	46	1-13/16	22	7/8
M 33 x 3.5	350000	495000	580000	1850	2600	3000	50	2	24	- -
M 36 x 4	410000	580000	680000	2350	3300	3900	55	2-3/16	27	1-1/16
M 39 x 4	490000	700000	820000	3000	4300	5100	60	2-3/8	27	1-1/16

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3 Preload values and tightening torques for screws with fine metric thread according to factory standard WN 4037 I

Metric standard thread	**Preload value Fm based on grades in N**			**Tightening torques Ma based on grades in Nm**			**Wrench size** (x) = according to DIN931, for			
							Hex head screw		**Socket head screw**	
	8.8	**10.9**	**12.9**	**8.8**	**10.9**	**12.9**	**mm**	**Inch**	**mm**	**Inch**
M 8 x 1	18800	27500	32500	24,5	36	43	13	1/2	6	- -
M 9 x 1	24800	36500	42500	36	53	62	- -	- -	- -	- -
M 10 x 1	31500	46500	54000	52	76	89	17	11/16	8	5/16
M 10 x 1.25	29500	43000	51000	49	72	84	17	11/16	8	5/16
M 12 x 1.25	45000	66000	77000	87	125	150	19	3/4	10	- -
M 12 x 1.5	42500	62000	73000	83	122	145	19	3/4	10	- -
M 14 x 1.5	61000	89000	104000	135	200	235	22	7/8	12	- -
M 16 x 1.5	82000	121000	141000	205	300	360	24	- -	14	9/16
M 18 x 1.5	110000	157000	184000	310	440	520	27	1-1/16	14	9/16
M 18 x 2	102000	146000	170000	290	420	490	27	1-1/16	14	9/16
M 20 x 1.5	139000	199000	232000	430	620	720	30	1-3/16	17	- -
M 22 x 1.5	171000	245000	285000	580	820	960	32	- -	17	- -
M 24 x 1.5	207000	295000	346000	760	1090	1270	36	1-7/16	19	3/4
M 24 x 2	196000	280000	325000	730	1040	1220	36	1-7/16	19	3/4
M 27 x 1.5	267000	381000	445000	1110	1580	1850	41	1-5/8	19	3/4
M 27 x 2	255000	365000	425000	1070	1500	1800	41	1-5/8	19	3/4
M 30 x 1.5	335000	477000	558000	1540	2190	2560	46	1-13/16	22	7/8
M 30 x 2	321000	457000	534000	1490	2120	2480	46	1-13/16	22	7/8
M 33 x 1.5	410000	584000	683000	2050	2920	3420	50	2	24	- -
M 33 x 2	395000	560000	660000	2000	2800	3300	50	2	24	- -
M 36 x 1.5	492000	701000	820000	2680	3820	4470	55	2-3/16	27	1-1/16
M 36 x 3	440000	630000	740000	2500	3500	4100	55	2-3/16	27	1-1/16
M 39 x 1.5	582000	830000	971000	3430	4890	5720	60	2-3/8	27	1-1/16
M 39 x 3	530000	750000	880000	3200	4600	5300	60	2-3/8	27	1-1/16

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4 Tightening torques for screws to mount SAE flange

Note!
Not part of factory standard WN 4037 I
Listing according to LFR – Quality service 2QA 6 051 00 as of Oct. 2001

4.1 Flanges and half flanges for high pressure (Norm 62)

Flange nominal size	Screw size	Tightening torques in Nm for screw grade 10.9		
		Half flange	Flat flange without reinforcement rim	Flange with reinforcement rim
½"	M 8	31	--	--
¾"	M 10	62	45	65
1"	M 12	108	70	110
1 ¼"	M 14	172	120	180
1 ½"	M 16	264	170	250
2"	M 20	350	250	450

4.2 Half flange for low pressure (Norm 61)

Flange nominal size	Screw size	Tightening torques in Nm for	
		Screw grade 8.8	Screw grade 10.9
½"	M 8	22	31
¾"	M 10	44	62
1"	M 10	44	62
1 ¼"	M 10	44	62
1 ½"	M 12	76	108
2"	M 12	76	108
2 ½"	M 12	76	108
3"	M 14	122	172
3 ½"	M 16	187	264
4"	M 16	187	264
5"	M 16	187	264

5 Tightening torques for oil drain plugs on travel drives

Note!
Not part of factory standard WN 4037 I Listing according to LBC – Quality service as of Oct. 2003

Screw plug Thread size	Tightening torque in Nm
M 14x1.5	40
M 16x1.5	40
M 18x1.5	40
M 22x1.5	80
M 33x1.5	160

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1.3.02 Conversion chart

Size	from unit	Multiplier	to unit from	Multiplier	to unit
Length	mm	0,039	inch	25,4	mm
	m	3,281	feet	0,305	m
	m	1,093	yard	0,914	m
	km	0,621	mile	1,609	km
Area	cm²	0,155	sq. inch	6,452	cm²
	m²	10,764	sq. feet	0,093	m²
	m²	1,196	sq. yard	0,0863	m²
	km²	0,386	sq. mile	2,59	km²
Volume	cm³	0,061	cu. inch	16,387	cm³
	m³	35,314	cu. feet	0,028	m³
	m³	1,308	cu. yard	0,764	m³
	l	61,025	cu. inch		l
	l	0,035	cu. feet	28,316	l
	l	0,264	gallon	3,785	l
	l	1,057	quart	0,946	l
Mass	g	0,035	oz.	28,349	g
	kg	2,204	lbs.	0,453	kg
	t	1,102	short t	0,907	t
Force	N	0,225	lbs.	4,449	N
	kN	224,732	lbs.	0,0044	kN
Torque	Nm	0,737	ft. lbs.	1,356	Nm
Performance	kW	1,342	HP	0,745	kW
	PS	0,736	kW	1,358	PS
Pressure	bar	14,5	PSI	0,069	bar
(hydraulic)	kpa	0,145	PSI	6,896	kpa
Ground pressure	kg/cm²	14,223	lbs.inch^2	0,0703	kg/cm²
	kg/m²	0,205	lbs. ft.^{2}	4,878	kg/m²
Density	g/cm³	0,036	lbs. inch^3	27,78	g/cm³
	kg/m³	0,062	lbs. ft.^{3}	16,13	kg/m³
Speed	km/h	0,621	Mph	1,609	km/h
	m/min	3,281	ft. / min	0,305	m/min
Temperature	°C	(°Cx1,8) + 32	°F	(°F-32)/1,8	°C
	°C	°C+273	°K	°K-273	°C

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1.3.03 Tapping holes

1 Tapping holes for metric ISO standard threads

Thread	Hole diameter Ø Diameter dimensions max.	min.	Drill bit Ø
M 1	0,785	0,729	0,75
M 1,1	0,885	0,829	0,85
M 1,2	0,985	0,929	0,95
M 1,4	1,160	1,075	1,1
M 1,6	1,321	1,221	1,25
M 1,7	1,346	1,258	1,30
M 1,8	1,521	1,421	1,45
M 2	1,679	1,567	1,6
M 2,2	1,838	1,713	1,75
M 2,3	1,920	1,795	1,9
M 2,5	2,138	2,013	2,05
M 2,6	2,176	2,036	2,10
M 3	2,599	2,459	2,5
M 3,5	3,010	2,850	2,9
M 4	3,422	3,242	3,3
M 4,5	3,878	3,688	3,7
M 5	4,334	4,134	4,2
M 6	5,153	4,917	5
M 7	6,153	5,917	6
M 8	6,912	6,647	6,8
M 9	7,912	7,647	7,8
M 10	8,676	8,376	8,5
M 11	9,676	9,376	9,6
M 12	10,441	10,106	10,2
M 14	12,210	11,835	12
M 16	14,210	13,835	14
M 18	15,744	15,294	15,5
M 20	17,744	17,294	17,5
M 22	19,744	19,294	19,5
M 24	21,252	20,752	21
M 27	24,252	23,752	24
M 30	26,771	26,211	26,5
M 33	29,771	29,211	29,5
M 36	32,270	31,650	32
M 39	35,270	34,670	35
M 42	37,799	39,129	37,5
M 45	40,799	40,129	40,5
M 48	43,297	42,587	43,0
M 52	47,297	46,587	47,0
M 56	50,796	50,046	50,5
M 60	54,796	54,046	54,1
M 64	58,305	57,505	57,6
M 68	62,305	61,505	61,6

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2 Tapping holes for metric ISO fine threads

Thread size	Hole Ø diameter limits max.	min.	Drill bit Ø	Thread size	Hole Ø diameter limits max.	min.	Drill bit Ø
M 1 x 0,2	0,821	0,783	0,8	M 25 x 1	24,153	23,917	24
M 1,1 x 0,2	0,921	0,833	0,9	M 25 x 1,5	23,676	23,376	23,5
M 1,2 x 0,2	1,021	0,983	1	M 25 x 2	23,210	22,835	23
M 1,4 x 0,2	1,221	1,183	1,2	M 26 x 1,5	24,676	24,376	24,5
M 1,4 x 0,25	1,185	1,129	1,15	M 27 x 1	26,153	25,917	26
M 1,6 x 0,2	1,421	1,383	1,4	M 27 x 1,5	25,676	25,376	25,5
M 1,8 x 0,2	1,621	1,583	1,6	M 27 x 2	25,210	24,835	25
M 2 x 0,25	1,785	1,729	1,75	M 28 x 1	27,153	26,917	27
M 2,2 x 0,25	1,985	1,929	1,95	M 28 x 1,5	26,676	26,376	26,5
M 2,5 x 0,35	2,201	1,121	2,15	M 28 x 2	26,210	25,835	26
M 3 x 0,35	2,721	2,621	2,65	M 30 x 1	29,153	28,917	29
M 3,5 x 0,35	3,221	3,121	3,15	M 30 x 1,5	28,676	28,376	28,5
M 4 x 0,5	3,599	3,459	3,5	M 30 x 2	28,210	27,835	28
M 4,5 x 0,5	4,099	3,959	4	M 30 x 3	27,252	26,752	27
M 5 x 0,5	4,599	4,459	4,5	M 32 x 1,5	30,676	30,376	30,5
M 5,5 x 0,5	5,099	4,959	5	M 32 x 2	30,210	29,835	30
M 6 x 0,75	5,378	5,188	5,2	M 33 x 1,5	31,676	31,376	31,5
M 7 x 0,75	6,378	6,188	6,2	M 33 x 2	31,210	30,835	31
M 8 x 0,75	7,378	7,188	7,2	M 33 x 3	30,252	29,752	30
M 8 x 1	7,153	6,917	7	M 35 x 1,5	33,676	33,376	33,5
M 9 x 0,75	8,378	8,188	8,2	M 36 x 1,5	34,676	34,376	34,5
M 9 x 1	8,153	7,917	8	M 36 x 2	34,210	33,835	34
M 10 x 0,75	9,378	9,188	9,2	M 36 x 3	33,252	32,752	33
M 10 x 1	9,153	8,917	9	M 38 x 1,5	36,676	36,376	36,5
M 10 x 1,25	8,912	8,647	8,8	M 39 x 1,5	37,676	37,376	37,5
M 11 x 0,75	10,378	10,188	10,2	M 39 x 2	37,210	36,835	37
M 11 x 1	10,153	9,917	10	M 39 x 3	36,252	35,752	36
M 12 x 1	11,153	10,917	11,1	M 40 x 1,5	38,676	38,376	38,5
M 12 x 1,25	10,912	10,647	10,8	M 40 x 2	38,210	37,835	38
M 12 x 1,5	10,676	10,376	10,5	M 40 x 3	37,252	36,752	37
M 14 x 1	13,153	12,917	13	M 42 x 1,5	40,676	40,376	40,5
M 14 x 1,25	12,912	112,647	12,8	M 42 x 2	40,210	39,835	40
M 14 x 1,5	12,676	12,376	12,5	M 42 x 3	39,252	38,752	39
M 15 x 1	14,153	13,917	14	M 42 x 4	38,270	37,670	38
M 15 x 1,5	13,676	13,376	13,5	M 45 x 1,5	43,676	43,376	43,5
M 16 x 1	15,153	14,917	15	M 43 x 2	43,210	42,835	43
M 16 x 1,5	14,676	14,376	14,5	M 45 x 3	42,252	41,752	42
M 17 x 1	16,153	15,917	16	M 45 x 4	41,270	40,670	41
M 17 x 1,5	15,676	15,376	15,5	M 48 x 1,5	46,676	46,376	46,5
M 18 x 1	17,153	16,917	17	M 48 x 2	46,210	45,835	46
M 18 x 1,5	16,676	16,376	16,5	M 48 x 3	45,252	44,752	45
M 18 x 2	16,210	15,835	16	M 48 x 4	44,270	43,670	44
M 20 x 1	19,153	18,917	19	M 50 x 1,5	48,676	48,376	48,5
M 20 x 1,5	18,676	18,376	18,5	M 50 x 2	48,210	47,835	48
M 20 x 2	18,210	17,835	18	M 50 x 3	47,252	46,752	47
M 22 x 1	21,153	20,917	21	M 52 x 1,5	50,676	50,376	50,5
M 22 x 1,5	20,676	20,376	20,5	M 52 x 2	50,210	49,835	50
M 22 x 2	20,210	19,835	20	M 52 x 3	49,252	48,752	49
M 24 x 1	23,153	22,917	23	M 52 x 4	48,270	47,670	48
M 24 x 1,5	22,676	22,376	22,5				
M 24 x 2	22,210	21,835	22				

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1.4.00 Conservation guidelines

1 General

All parts of a construction machine are exposed to corrosion, especially when the machine is taken out of service. Corrosion can be compared to wear. However, the effects of corrosion can greatly exceed that of mechanical wear and shorten the service life of the affected parts significantly. For that reason, for longer shut down, the machines and its components must be preserved according to certain guidelines.

Generally, these guidelines are construed for the following shut down periods:

- Shut down of unknown duration (mostly unplanned)
- Shut down up to 3 months
- Shut down up to 6 months
- Shut down up to 12 months
- Return to operation

The required measures are graduated depending on the different time frames.

Note!
For conservation for sea transport, special guidelines must be observed, which are not included in these instructions.

2 Unplanned shut down of unknown duration

If a machine is taken out of service for a longer period of time without conservation, then it must be operated in intervals not to exceed 14 days, to prevent abnormal corrosion and its effects.

- ▶ Before putting the machine back into service, check all oil levels and correct them, if necessary.
- ▶ Put the machine back in service according to the operating instructions and operate it until the Diesel engine and the hydraulic system have reached the required operating temperature of at least 60° C in the hydraulic tank and at least 80° C in the coolant circuit.
- ▶ Actuate all functions of the travel and working hydraulic and alternately actuate them over a period of approx. 20 minutes. The hydraulic cylinders must be extended and retracted over their full stroke length.
- ▶ When turning the machine off, retract all hydraulic cylinders fully, if possible, and fill the fuel tank. If the machine is parked on soft ground, park the machine on wooden planks or similar and secure it to prevent it from rolling off.
- ▶ Check the batteries and remove them and recharge them, if necessary. Check the electrical contacts and spray them, if necessary.
- ▶ Anytime a machine is put back into service, carry out the daily maintenance tasks. In addition, carry out time limited maintenance work at least by the given intervals according to the inspection check list and additional Diesel engine operating instructions.

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3 Planned shut down up to 3 months

- Clean the machine well inside and outside. Remove any paint damage.
- Take care of any maintenance work which would fall within the timeframe of the planned shut down.
- Check the coolant for sufficient corrosion protection – it must contain at least 33 % antifreeze fluid or 1 % corrosion inhibitor. Check and observe the approved list of the Diesel engine manufacturer. Open the heater valves and let them run at operating temperature for at least 5 minutes.
- Park the machine on safe, dry and solid ground and secure it to prevent it from rolling off. Lower the attachment – blade / bucket and ripper – without pressure to ground level.
- Remove the batteries, correct the acid level and charge, if necessary and store in a cool and dry room. Check load current regularly every 6 weeks and recharge.
- Lubricate all bearing points, ball joints, hinges, blank parts, cable connections and exposed piston rods with acid-free, Vaseline type anticorrosion grease, such as **LIEBHERR** Anti corrosion grease CTK - Id. No. 8613 313 01, or cover with a thick film
- Observe any additional guidelines for special components, Diesel engine or special local conditions.
- Refuel the fuel tank.
- Close off the exhaust pipe with suitable material.

4 Planned shut down up to 6 months

Complete all items outlined in paragraph 3 - Planned shut down up to 3 months. In addition, the following is required:

- Open the Diesel engine intake channels and spray in corrosion inhibitor. To do so, crank the Diesel engine with the starter for approx. 15 seconds (Diesel engine should not start). Close the intake channel again.
- Remove the V-belt, rub with talcum powder and store in a protected location.
- Spray the travel gear, Diesel engine, hydraulic components, frame and working attachment with corrosion inhibitor.
- Check the machine monthly and touch up protective measures, if necessary.

5 Planned shut down up to 12 months

Complete all items outlined in paragraph 3 and 4 - Planned shut down up to 6 months. In addition, the following is required:

- Park the machine in a covered, draft free area.
- Run the Diesel engine until warm, drain the oil, and fill with engine corrosion inhibitor, which has been approved by the Diesel engine manufacturer.
- Add approx. 10% of engine oil for initial operation to the fuel in the fuel tank.
- Let the Diesel engine run at operating temperature for approx. 5 minutes at medium RPM. Then refill the fuel tank to the brim.
- Remove the intake pipe and per cylinder, add 10 to max. 15 cm^3 oil for initial operation. Then let the Diesel engine run in LinDiag fill mode (see section 10) for approx. 15 seconds.
- Close off all openings, such as air filter, exhaust pipe, vent openings on components, etc. airtight. The vent for the fuel tank must remain open for safety reasons.
- Rub the rubber seal of the operator's cab with talcum powder, close the doors. If the cab is not installed, cover the operator's platform properly. If necessary, remove the operator's seat, in any case, cover the instrument panel and protect it.

If the shut down extends past a period 12 months, repeat all conservation measures in a timely manner.

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6 Return to operation

6.1 After shut down up to 3 months

- ▶ Install the batteries.
- ▶ Open the exhaust pipe.
- ▶ Remove the corrosion inhibitor grease where necessary.
- ▶ Put the machine back into service as outlined in the Operating instructions.

Observe any additional guidelines for special components, Diesel engine or special local conditions.

6.2 After shut down up to 6 months

- ▶ Clean the machine and components to remove corrosion inhibitor and grease, make sure that the V-belt is free of grease.
- ▶ Install the V-belt and tension it properly.

Complete all items outlined in paragraph 6.1.

6.3 After shut down up to 12 months

- ▶ Remove all covers and closures, which were installed for conservation measures.
- ▶ Turn the Diesel engine by hand, if possible.
- ▶ Complete all items outlined in paragraph 6.2 and 6.1.
- ▶ Run the Diesel engine until warm and drain the corrosion inhibitor.
- ▶ Add engine oil according to manufacturer's specifications.
- ▶ Check the entire machine for function and leaks.
- ▶ After the complete machine has been brought to operating temperature, change all oils and filters as outlined in the Operating instructions.

If necessary, carry out any required maintenance work at this time.

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1.5.00 Material weights

- **A** spec. weight [1)] in kg/m^3 solid
- **B** Loosening in %
- **C** Loosening facttor
- **D** spec. weight kg/m^3 loose

Material		A	B	C	D
Anthracite coal	- raw	1600	35	0,74	1190
	- washed	-	35	0,74	1100
Ash bituminous coal		590 - 890	8	0,93	550 - 830
Basalt		2970	52	0,66	1960
Bauxite, Kaolin		1900	33	0,75	1420
Bituminous coal	- raw	1280	35	0,74	950
	- washed	-	35	0,74	830
Carnotite, Uranium ore		2200	35	0,74	1630
Soil	- dry hardened	1900	26	0,79	1510
	- wet loosened	2020	26	0,79	1600
	- clay	1540	23	0,81	1250
Gypsum	- broken	3170	75	0,57	1810
	- ground	2790	75	0,57	1660
Granite	- broken	2730	64	0,61	1660
Hematite, iron ore		2130 - 2900	18	0,85	1810 - 2450
Limestone	- broken	2610	69	0,59	1540
	- ground	-	-	-	1540
Gravel	- damp	2170	12	0,89	1930
	- dry	1690	12	0,89	1510
	- dry 6-50mm	1900	12	0,89	1690
	- wet 6-50mm	2260	12	0,89	2020
Coke		860	54	0,65	1560
Loam, clay	- seasoned	2020	22	0,82	1660
	- dry	1840	24	0,80	1480
	- wet	2080	24	0,80	1660
Clay with gravel	- dry	1660	17	0,86	1420
	- wet	1840	19	0,84	2540
Magnetite, iron ore		3260	17	0,86	2790
Topsoil		1370	44	0,69	950
Natural stone	- ground	2670	67	0,60	1600
Pyrite, iron ore		3030	18	0,85	2580
Sand	- dry, lose	1600	12	0,89	1420
	- damp	1900	12	0,89	1690
	- wet	2080	13	0,88	1840
Sand with clay	- lose	2020	26	0,79	1600
	- compressed	-	-	-	2400
Sand with gravel	- dry	1930	12	0,89	1720
	- wet	2230	10	0,91	2020
Sandstone		2520	67	0,60	1510
Slate		1660	33	0,75	1250
Slag	- broken	2940	68	0,59	1750
Snow	- dry	-	-	-	130
	- wet	-	-	-	520
Trapp rock	- broken	2610	49	0,67	1750

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Material	A	B	C	D
Weathered rock 75% rock, 25% soil	2790	42	0,70	1960
Weathered rock 75% rock, 25% Soil	2280	33	0,75	1720
Weathered rock 75% rock, 25% Soil	1960	24	0,80	1570

The actual values depend on the moisture content, the grain size and the compression. Testing is required to determine more exact values.

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2 Tools and work instructions

2.0.00 Sub group index -Tools and work instructions

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