Static data en

Foundation loadings

LN 303

630 EC-H 40 Litronic, Tower system 500HC/630EC-H Crane stationary, without climbing equipment, without crane driver elevator

base tower section 630EC-H 12.42m

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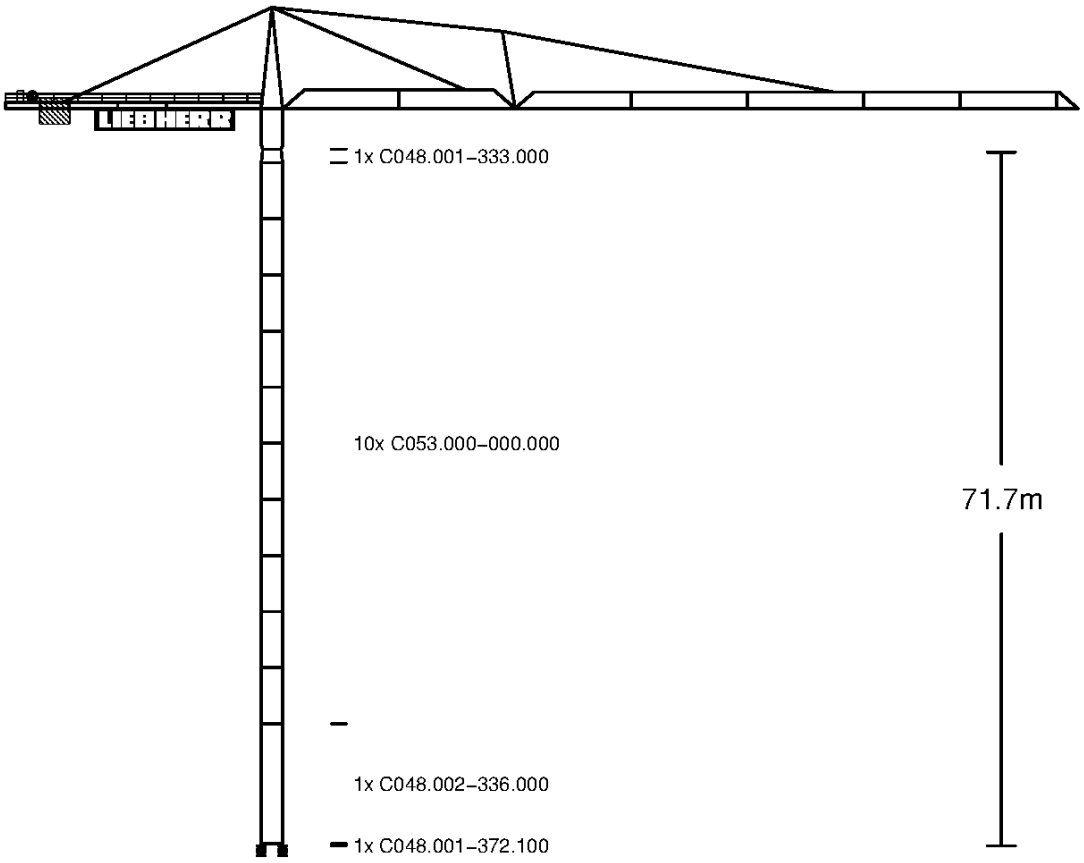

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EN22000194/00272381 2016.03

1 General safety indications

1.1 Safety indications for corner pressure tables and foundation loading tables

WARNING

Danger of accident if the component compatibility list is ignored!

The static data may only be used if the crane erection corresponds with the configuration described, and if the components being used have been selected in observation of the component compatability list.

► For further information see “Component compatability list”.

WARNING

Risk of instability!

The foundation or central ballast must correspond with the erection height and the configuration of the crane (with or without climbing equipment). Subsequent installation or removal of the climbing equipment for erection or dismantling of the crane will alter the stability of the crane and the resulting corner pressures or foundation reaction forces.

► During applications engineering, observe both corner pressure tables “with climbing equipment” and “without climbing equipment” and take the most unfavourable values into account.

► Check central ballast.

WARNING

Risk of instability!

For certain jib lengths, the crane cannot turn freely in the wind without the installation of an additional wind sail.

► Mount wind sail as required. For more information, please see: Instruction manual, erection chapter.

WARNING

Risk of instability!

If tower sections with built-up guide rails for the crane driver elevator are integrated with the tower configuration, the deviating static data shall apply. Guide rails that are installed can result in a decrease to the maximum erection height and an increase in foundation reaction forces, corner forces and the central ballast required.

Crane configurations in which the guide rails remain in the tower section must be considered to be the same as crane configurations with a crane driver elevator installed!

► Request special static data from the Structural Analysis department at Liebherr-Werk Biberach GmbH.

► Use the special static data to check the reliability of the crane configuration.

► If in doubts, remove the guide rails and the interior fittings for entering and exiting from the entire tower configuration.

EN22000194/00272381 2016.03

The corner pressures are characteristic loads and do not include the dead load and hoist load factor.

In case of cranes with multiple rope types, observe the minimum and maximum radius.

In case of stationary configuration of the crane with an undercarriage or cruciform base, the hook heights specified in the corner pressure tables may decrease, depending on the crane configuration.

1.2 Notes on conformity

Based on the number of possible variants and influence parameters during erection of tower cranes, it's important to determine if the selected crane configuration and/or available documentation meet local safety requirements and if conformity is therefore ensured.

In European Economic Area (EEA) countries, corner pressure tables and foundation loading tables help to ensure adherence to the required level of safety as per EN 14439.

In countries outside of the EE, there are often no binding regulations. The Liebherr works standard LN 303 defines the minimum requirements for these countries. The data sheets and the static forces tables that this specification has been applied to are marked with the abbreviation LN 303.

In some cases, safety requirements and/or wind force assumptions based on other standards and guidelines may not represent a suitable protection level for crane attachments.

The applicability of the documents provided must be checked the operator. In this case, we recommend creating a site-related hazard analysis that takes special consideration of the wind exposure.

1.3 Notes for cranes with climbing tower section

On cranes which require a climbing tower section for the application of a climbing equipment, observe the following:

– The indicated hook height in the corner pressure tables and foundation loading tables always includes climbing tower section.
– When erecting the crane without climbing equipment, the climbing tower section can be replaced with a standard tower section.

1.4 Symbols used in the corner pressure tables and foundation loading tables

Symbol	Meaning
*	At this hook height, the climbing equipment must be lowered after assembly!
xx	At this hook height, switching to the LM2 load diagram is not permissible! For more information, please see: “Operating manual for the crane driver”, “control desk”.
&	For this hook height, raising and lowering the load and slewing and trolley travelling is not permissible while crane travelling!
+	At this hook height, the use of travelling undercarriages or a cruciform base is not permissible! Only stationary and without travel gears is possible.
°	At this hook height, attachment of a cabin is not permissible! Only possible “without cabin".

EN22000194/00272381 2016.03

Symbol	Meaning
@	At this hook height, use with a climbing tower section is not permissible! The climbing tower section must be replaced with a standard tower section.

Tab. 1: Symbols used in the corner pressure tables and foundation loading tables

1.5 Symbols used in the component compatibility list

Symbol	Meaning
*	not for climbing
+	only use once

Tab. 2: Symbols used in the component compatibility list

EN22000194/00272381 2016.03

EN22000194/00272381 2016.03

2 Explanations concerning stability calculation in accordance with LN 303

2.1 Global calculation standards

The most essential requirements for tower cranes globally are for their structures to be as high and as safe as possible. The possible hook heights are not only specified based on the construction or configuration of the crane, but they depend, in particular, on legislation and rules. Considering the different calculation standards, this results in significantly different hook heights.

In crane manufacture, there is no calculation standard that is globally binding. In countries within the European Economic Area (EEA), the EN 14439 Product Standard is the binding framework for tower cranes. In this standard, the safety level which must be complied with, together with the out-of-operation wind load, is clearly defined.

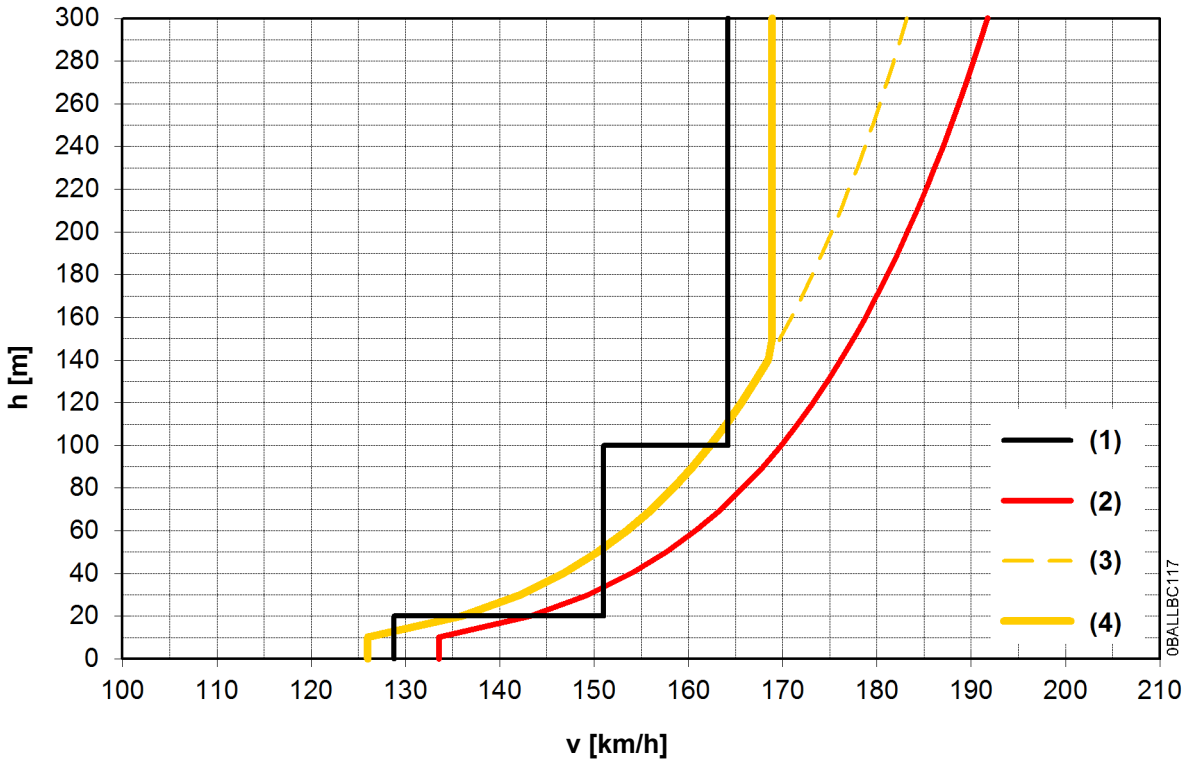
In countries outside the EEA, there are often no binding stipulations so that the specifications of the "Fédération Européenne de la Manutention (FEM)" can often be used in form of the FEM 1.001 Guideline as a substitute.

In the FEM 1.001 Guideline, the out-of-operation wind velocity is presented as a basis for the calculation in such a way that the wind velocity increases in steps with increasing height - the "step profile". In order to obtain a more realistic representation that can be compared in the current standard environment, the Liebherr Company Standard LN 303 defines a minimum wind load for all countries outside the EEA for which no exact requirements have been specified.

2.2 Details regarding the Liebherr Company Standard LN 303

In the Liebherr Company Standard LN 303, an exponential depiction of the wind velocity is used, similar to the wind load according to EN 14439. This makes wind conditions more realistic and comparable with the current standards of construction. The parameters of this wind velocity graph as well as all other necessary safety requirements in LN 303 correspond to at least FEM 1.001 in all aspects.

EN22000194/00272381 2016.03



Tab. 3: Comparison of wind velocity graphs FEM 1.001, EN 14439 - C25 and LN 303

(1) FEM 1.001
(2) EN 14439 - C25
(3) LN 303 - free-standing
(4) LN 303 - climbing

The assumption of a constant wind velocity from a tower height of approx. 140 m has been derived from a risk assessment for climbing cranes. The risk assessment assumes a lower probability of occurrence in terms of wind load. The reason for this assumption is a shorter length of stay in the specific situation, combined with the option of safety measures.

In this process, the wind velocity is reduced to approx. 92 % at a maximum height of 300 m, to which the wind velocity profile is applicable. To simplify usage planning, it is assessed consistently above this height. The factor of 92 % stems from a reduction of the recurrence period from 25 years to 10 years, assuming that the length of stay in a climbing situation is less than 3 months. This assumption is valid only for cranes climbing inside or outside with the prerequisite that these cranes - if necessary - can climb down in a safe area if there is a risk of strong wind.

2.3 Using the LN 303 specification

The LN 303 specification will be introduced with the provision of the required data sheets and static forces tables in the first quarter of 2016.

The data sheets and the static forces tables that this specification has been applied to are marked with the abbreviation LN 303.

The LN 303 specification will only be used for top-slewing cranes from the EC B, EC H, HC L and HC series. This specification will not be used for bottom-slewing cranes and mobile construction cranes because the out-of-operation situation has a lesser impact on the possible hook height of these cranes. The global marketing of bottom-slewing cranes and mobile construction cranes will continue to take place using EN 14439:2009 - C25.

Additionally, the offer continues to remain in place to separately investigate increased wind load requirements in particularly windy regions, for example in Hong Kong, Macau or New Zealand.

EN22000194/00272381 2016.03

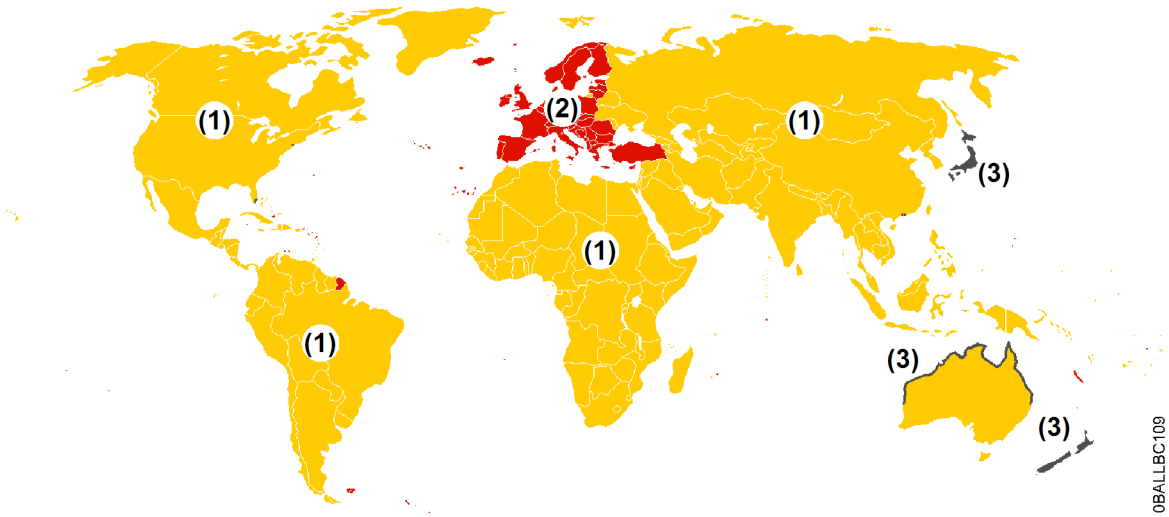


Fig. 2: Geographic overview of specifications to be used

(1) LN 303
(2) EN 14439
(3) LN 303 + special wind load zones

As in the past, the responsibility for the correct assessment and categorisation of the installation sites lies with the crane operator. During this process, it is possible that the necessary information suitable to the installation site cannot be found in the crane's instruction manual. In such cases, please consult Liebherr and request the required supplements to the instruction manual.

EN22000194/00272381 2016.03

EN22000194/00272381 2016.03

3 Foundation loadings

The following hoist gears have been taken into consideration for the calculation:
– WIW280VZ402
– WIW280VZ407
– WIW280WZ403
– WIW290JX416
– WIW300VZ401
– WIW300VZ419
– WIW300VZ424
– WIW300VZ432
– WIW300WZ403

Position of trolley out of operation:

Jib	**Radius**
81.40 m	4.60 m
71.40 m	4.60 m
61.40 m	4.60 m
49.40 m	4.60 m
37.40 m	4.60 m

3.1 Component compatibility list

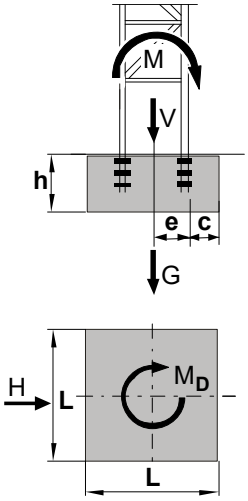
C048.001-333.000	**slewing ring support 630EC-H** – C048.001-333.000 957920901 l=1.39 m
C053.000-000.000 totalling max. l=58.00 m	**substitute tower section 500HC stand. 5.8m** – C032.004-332.000 953518501 l=5.80 m – C053.002-332.000 931684901 l=5.80 m – C053.005-332.000 932432801 l=5.80 m – C053.060-332.000 90047393 l=5.80 m – C053.061-332.000 90048547 l=5.80 m – C053.005-331.000 932434101 l=11.60 m – C053.061-331.000 90048546 l=11.60 m
C048.002-336.000	**base tower section 630EC-H 12.42m** – C048.002-336.000 958459601 l=12.42 m – C053.060-336.000 90048582 l=12.42 m
C048.001-372.100	**foundation anchor 630EC-H 6xM45** – C048.001-372.100 932131701 l=0.20 m – C048.036-372.100 90039171 l=0.20 m

EN22000194/00272381 2016.03

3.2 Jib 81.40 m

WARNING
Refer to the “General notes on safety for foundation loading tables”, as well as the instruction manual for the crane, before applying this static data.

Crane type:	630 EC-H 40 Litronic, 630 EC-H 20 Litronic Crane stationary, without climbing equipment, without crane driver elevator	**Jib:**	**81.40 m**
Tower system:	500HC/630EC-H	**Tower section length:**	5.80 m
Base tower:	base tower section 630EC-H 12.42m		
Crane base:	foundation anchor 630EC-H 6xM45 (C048.001-372.100)		



Conditions for crane stability are:
Jib must be free to weathervane when out of operation!

$$Eccentricity:\ e = \frac{M + (H \cdot h)}{V + G} \leq \frac{L}{3}$$

Ground pressure must not exceed maximum allowable soil pressure!

$$\sigma_B = \frac{2 \cdot (V + G)}{3 \cdot L \cdot c} \leq \sigma_{B\ permissible}$$

$$c = \frac{L}{2} - e$$

G = Weight of foundation

Position of trolley out of operation: 4.60 m

Slewing moment in operation MD = 716 kNm

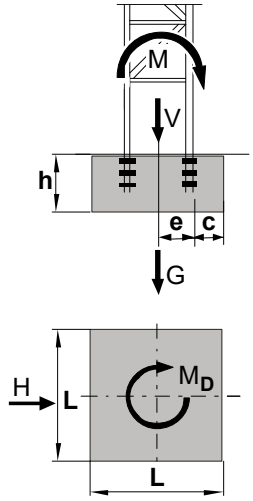
No. of tower sections	Hook height	Crane in operation			Crane out of operation						Crane during erection		
					Storm from rear			Storm from front					
	[m]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]
0	13.70	4469	80	1339	1891	73	1280	4071	69	1280	4929	19	692
1	19.50	4651	84	1397	1341	88	1338	4508	80	1338	5043	22	750
2	25.30	4978	87	1455	687	103	1396	5008	91	1396	5177	25	808
3	31.10	5336	91	1513	319	118	1451	5572	102	1454	6725	31	1147
4	36.90	5713	95	1571	1200	134	1509	6199	113	1512	6917	34	1205
5	42.70	6109	98	1629	2193	150	1567	6890	124	1570	7129	38	1263
6	48.50	6525	102	1687	3257	166	1599	7644	135	1628	7360	41	1321
7	54.30	6960	106	1745	4478	182	1657	8387	146	1657	7611	44	1379
8	60.10	7415	109	1803	5817	199	1715	9275	157	1715	7881	48	1437
9	65.90	7889	113	1861	7275	216	1773	10227	168	1773	8171	51	1495
10	71.70	8448	116	1915	8854	233	1831	11242	179	1831	8480	54	1553

EN22000194/00272381 2016.03

3.3 Jib 71.40 m

WARNING
Refer to the “General notes on safety for foundation loading tables”, as well as the instruction manual for the crane, before applying this static data.

Crane type:	630 EC-H 40 Litronic, 630 EC-H 20 Litronic Crane stationary, without climbing equipment, without crane driver elevator	**Jib:**	**71.40 m**
Tower system:	500HC/630EC-H	**Tower section length:**	5.80 m
Base tower:	base tower section 630EC-H 12.42m		
Crane base:	foundation anchor 630EC-H 6xM45 (C048.001-372.100)		



Conditions for crane stability are:
Jib must be free to weathervane when out of operation!

$$Eccentricity:\ e = \frac{M + (H \cdot h)}{V + G} \leq \frac{L}{3}$$

Ground pressure must not exceed maximum allowable soil pressure!

$$\sigma_B = \frac{2 \cdot (V + G)}{3 \cdot L \cdot c} \leq \sigma_{B\,permissible}$$

$$c = \frac{L}{2} - e$$

G = Weight of foundation

Position of trolley out of operation: 4.60 m

Slewing moment in operation MD = 648 kNm

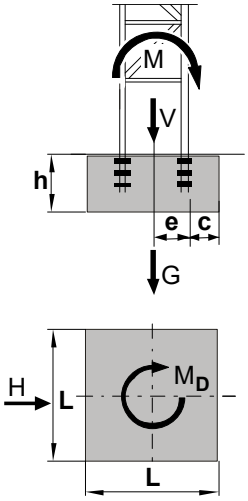
No. of tower sections	Hook height	Crane in operation			Crane out of operation						Crane during erection		
					Storm from rear			Storm from front					
	[m]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]
0	13.70	5237	55	1311	2156	73	1209	4382	69	1209	4929	19	692
1	19.50	5425	58	1369	1596	88	1267	4826	80	1267	5043	22	750
2	25.30	5717	62	1427	931	103	1325	5333	91	1325	5177	25	808
3	31.10	6076	65	1485	159	118	1383	5904	102	1383	5331	29	866
4	36.90	6454	68	1543	807	134	1476	6538	113	1441	5503	32	924
5	42.70	6852	72	1601	1771	150	1511	7236	124	1499	5696	35	982
6	48.50	7270	75	1659	2865	166	1569	7997	135	1557	5908	39	1040
7	54.30	7706	78	1717	4074	182	1627	8822	146	1615	6139	42	1098
8	60.10	8163	82	1770	5401	199	1685	9711	157	1673	6390	45	1156
9	65.90	8638	85	1828	6839	216	1731	10663	168	1731	6660	49	1214
10	71.70	9134	88	1886	8418	233	1789	11678	179	1789	6950	52	1272

EN22000194/00272381 2016.03

3.4 Jib 61.40 m

WARNING
Refer to the “General notes on safety for foundation loading tables”, as well as the instruction manual for the crane, before applying this static data.

Crane type:	630 EC-H 40 Litronic, 630 EC-H 20 Litronic Crane stationary, without climbing equipment, without crane driver elevator	**Jib:**	**61.40 m**
Tower system:	500HC/630EC-H	**Tower section length:**	5.80 m
Base tower:	base tower section 630EC-H 12.42m		
Crane base:	foundation anchor 630EC-H 6xM45 (C048.001-372.100)		



Conditions for crane stability are:
Jib must be free to weathervane when out of operation!

$$Eccentricity:\ e = \frac{M + (H \cdot h)}{V + G} \leq \frac{L}{3}$$

Ground pressure must not exceed maximum allowable soil pressure!

$$\sigma_B = \frac{2 \cdot (V + G)}{3 \cdot L \cdot c} \leq \sigma_{B\ permissible}$$

$$c = \frac{L}{2} - e$$

G = Weight of foundation

Position of trolley out of operation: 4.60 m

Slewing moment in operation MD = 581 kNm

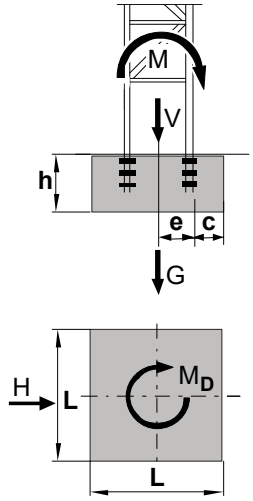
No. of tower sections	Hook height	Crane in operation			Crane out of operation						Crane during erection		
					Storm from rear			Storm from front					
	[m]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]
0	13.70	5407	55	1280	2457	73	1168	4636	69	1168	4929	19	692
1	19.50	5602	58	1338	1907	88	1226	5073	80	1226	5043	22	750
2	25.30	5855	62	1396	1252	103	1284	5573	91	1284	5177	25	808
3	31.10	6168	65	1454	491	118	1342	6137	102	1342	5331	29	866
4	36.90	6547	68	1512	656	134	1398	6764	113	1400	5503	32	924
5	42.70	6945	72	1570	1648	150	1456	7455	124	1458	5696	35	982
6	48.50	7362	75	1628	2712	166	1488	8209	135	1516	5908	39	1040
7	54.30	7799	78	1686	3934	182	1546	9027	146	1574	6139	42	1098
8	60.10	8255	82	1736	5273	199	1604	9908	157	1632	6390	45	1156
9	65.90	8731	85	1794	6731	216	1662	10771	168	1662	6660	49	1214
10	71.70	9227	89	1852	8309	233	1720	11787	179	1720	6950	52	1272

EN22000194/00272381 2016.03

3.5 Jib 49.40 m

WARNING
Refer to the “General notes on safety for foundation loading tables”, as well as the instruction manual for the crane, before applying this static data.

Crane type:	630 EC-H 40 Litronic, 630 EC-H 20 Litronic Crane stationary, without climbing equipment, without crane driver elevator	**Jib:**	**49.40 m**
Tower system:	500HC/630EC-H	**Tower section length:**	5.80 m
Base tower:	base tower section 630EC-H 12.42m		
Crane base:	foundation anchor 630EC-H 6xM45 (C048.001-372.100)		



Conditions for crane stability are:
Jib must be free to weathervane when out of operation!

$$Eccentricity:\ e = \frac{M + (H \cdot h)}{V + G} \leq \frac{L}{3}$$

Ground pressure must not exceed maximum allowable soil pressure!

$$\sigma_B = \frac{2 \cdot (V + G)}{3 \cdot L \cdot c} \leq \sigma_{B\,permissible}$$

$$c = \frac{L}{2} - e$$

G = Weight of foundation

Position of trolley out of operation: 4.60 m

Slewing moment in operation MD = 470 kNm

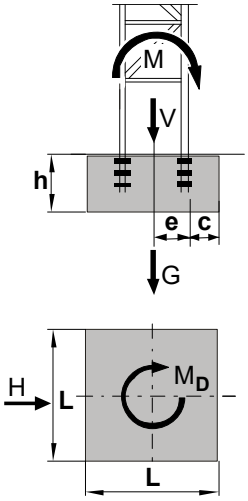
No. of tower sections	Hook height	Crane in operation			Crane out of operation						Crane during erection		
					Storm from rear			Storm from front					
	[m]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]
0	13.70	5782	55	1304	2563	73	1148	4699	69	1114	3681	19	661
1	19.50	5994	58	1362	2013	88	1206	5143	80	1172	3795	22	719
2	25.30	6246	62	1420	1358	103	1264	5650	91	1230	3929	25	777
3	31.10	6597	65	1478	597	118	1322	6221	102	1288	4083	29	835
4	36.90	6976	68	1528	460	134	1372	6855	113	1346	4256	32	893
5	42.70	7375	72	1586	1452	150	1430	7553	124	1404	4448	35	951
6	48.50	7793	75	1644	2559	166	1488	8314	135	1462	4660	39	1009
7	54.30	8231	79	1702	3726	182	1520	9139	146	1520	4891	42	1067
8	60.10	8688	82	1760	5064	199	1578	10028	157	1578	5142	45	1125
9	65.90	9165	85	1818	6522	216	1636	10980	168	1636	5412	49	1183
10	71.70	9661	89	1876	8101	233	1694	11995	179	1694	5702	52	1241

EN22000194/00272381 2016.03

3.6 Jib 37.40 m

WARNING
Refer to the “General notes on safety for foundation loading tables”, as well as the instruction manual for the crane, before applying this static data.

Crane type:	630 EC-H 40 Litronic, 630 EC-H 20 Litronic Crane stationary, without climbing equipment, without crane driver elevator	**Jib:**	**37.40 m**
Tower system:	500HC/630EC-H	**Tower section length:**	5.80 m
Base tower:	base tower section 630EC-H 12.42m		
Crane base:	foundation anchor 630EC-H 6xM45 (C048.001-372.100)		



Conditions for crane stability are:
Jib must be free to weathervane when out of operation!

$$Eccentricity:\ e = \frac{M + (H \cdot h)}{V + G} \leq \frac{L}{3}$$

Ground pressure must not exceed maximum allowable soil pressure!

$$\sigma_B = \frac{2 \cdot (V + G)}{3 \cdot L \cdot c} \leq \sigma_{B\,permissible}$$

$$c = \frac{L}{2} - e$$

G = Weight of foundation

Position of trolley out of operation: 4.60 m

Slewing moment in operation MD = 403 kNm

No. of tower sections	Hook height	Crane in operation			Crane out of operation						Crane during erection		
					Storm from rear			Storm from front					
	[m]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]	M [kNm]	H [kN]	V [kN]
0	13.70	5847	55	1389	2778	71	1170	4884	67	1170	2592	19	633
1	19.50	6055	58	1397	2243	85	1228	5310	78	1228	2706	22	691
2	25.30	6393	61	1455	1605	100	1286	5799	89	1286	2840	25	749
3	31.10	6749	65	1513	861	115	1344	6351	100	1344	2993	29	807
4	36.90	7125	68	1571	234	131	1384	6886	111	1358	3165	32	865
5	42.70	7521	71	1629	1207	147	1442	7571	122	1416	3357	35	923
6	48.50	7936	75	1687	2292	163	1500	8320	133	1474	3568	39	981
7	54.30	8370	78	1745	3492	179	1558	9132	144	1532	3799	42	1039
8	60.10	8824	81	1803	4809	196	1616	10008	155	1590	4050	45	1097
9	65.90	9297	85	1861	6177	213	1648	10947	166	1648	4319	49	1155
10	71.70	9790	88	1919	7800	230	1732	11950	177	1706	4609	52	1213

EN22000194/00272381 2016.03