

端梁用户手册

End Carriage

Owner's Manual

安装和使用端梁之前，请仔细阅读配套的使用说明书。请妥善保管说明书，以备后用。
Please read this Manual carefully prior to erection and use, and put it in a safe place.

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1 前言 Foreword

1.1 概要 General

为了保证起重机在安装、操作和维护过程中的安全性和有效性，起重机销售中包括提供使用说明书。此外，起重机机身本身也有相应的文字说明和指示标记。说明书以文字或 CD-ROM 的形式发行。数字化的 CD-ROM 的使用说明被印制在包装上。在安装和使用前请仔细阅读该说明书，并将其存放在一个安全的地方以备后用。

The end carriages are accompanied with the User Manual in view of ensuring safety and effectiveness of its operation, installation and maintenance. In addition, a crane itself is engraved with descriptions and signs. The Manual will be released in print or CD-ROM, including the print version on the packaging. Please read this Manual carefully prior to installation and use, and put it in a safe place.

1.2 使用环境 Environmental conditions

- 使用场合：室内
Operating conditions: Indoor
- 海拔：≤1000m
Altitude: ≤1000m
- 工作温度：-10℃~40℃
Working temperature: -10℃~40℃
- 相对湿度：最大 90%
Relative humidity: Max. 90%

1.3 版权 Copyright

这些操作说明只允许特定的人员使用，需要对外保密。所有的文件都受到版权法的保护。


These operating instructions must be treated confidentially. They should only be used by authorized personnel. All documents are protected within the sense of copyright law.

1.4 象征符号 Symbols

说明书中将出现以下的象征符号：

This Manual includes the following symbols:

 警告! Warning!

 小心! Be Careful!

2 技术概要 Brief technical description

2.1 产品编号说明 Type designation (example) for end carriage

端梁总成参数									端梁体参数			连接梁参数	油漆颜色	特殊选项
DN32	B	20	95	D	C7	2066	C	0763	76.5	510	850	473	N	N
1-4	5	6,7	8-9	10	11,12	13-16	17	18-21	22-25	26-28	29-31	32-35	36	37

序号	代码	代号	代码含义	可选项及备注
1-4	DN32		端梁型号及轮踏面直径 (×10mm)	DN11, DN14, DN20, DN25, DN32, DN40, DN50 轮踏面直径 32=320mm, 等等
5	B		-	-=标准 B=带台车 (用于 DN20, -25, -32, -40, -50)
6,7	20	WB	轮距 (×100mm)	多种可选, 见 2.3
8-9	95		轮槽宽度 (mm)	多种可选, 见 2.3
10	D		主动轮数量	- = 每根端梁一个主动轮 D = 每根端梁两个主动轮
11,12	C7		连接板代号	多种可选, 见 2.3
13-16	2066	Y1	内侧定位销距离 (mm)	双梁时, 两连接板内侧定位销间距. 单梁时, 此尺寸为 0
17	C		缓冲器型号	多种可选, 见 2.3
18-21	0763	S	台车内侧轮距(mm)	无台车的端梁, 此尺寸为 0
22-25	76.5	L4	连接板中心距端梁中心的距离	单梁时, 此尺寸为 0
26-28	510	L5	隔板内侧间距	用于 DN25, DN32, DN40, DN50
29-31	850	L6	手孔间距	
32-35	473	M	连接轴孔距	
36	N		颜色代号	N=仅喷底漆 E=其他喷涂要求
37	N		特殊配置	N=标准端梁 E=其他特殊配置

Parameter of end carriage									Parameter of structure			Parameter of connection beam	Color code	Special properties
DN32	B	20	95	D	C7	2066	C	0763	76.5	510	850	473	N	N
1-4	5	6 7	8 9	10	11 12	13 16	17	18 21	22 25	26 28	29 31	32-35	36	37

Pos.	Code	Feature code	Feature	Available properties
1-4	DN32		End carriage type & wheel diameter(×10mm)	DN11, DN14, DN20, DN25, DN32, DN40, DN50 Wheel diameter 32=320mm, etc.
5	B		-	--Standard B=Bogie (with DN20, -25, -32, -40, -50)
6,7	20	WB	Wheel base (×100mm)	Reference 2.3
8-9	95		Groove width (mm)	Reference 2.3
10	D		Number of drive wheels	--One drive wheel/end carriage D=Two drive wheels/end carriage
11,12	C7		Joint type	Reference 2.3
13-16	2066	Y1	Bolt joint distance (mm)	Joint plates distance from alignment pin centers with double girder. 0000 (zero) with single girder.
17	C		Buffer type	
18-21	0763	S	Bogie inner wheel distance (mm)	0000 (zero) = No bogie type end carriage
22-25	76.5	L4	Distance of the center of the joint plate to the center of the structure	0000 (zero) with single girder
26-28	510	L5	Distance between diaphragms	With DN25, DN32, DN40, DN50
29-31	850	L6	Distance between hand-holes	
32-35	473	M	Distance between shafts of connection beam	
36	N		Color code	N=Just primer paint E=Other paint
37	N		Special properties	N=Standard end carriage without any options E=Special end carriage

2.2 主端梁连接方式 End carriage and main girder connection

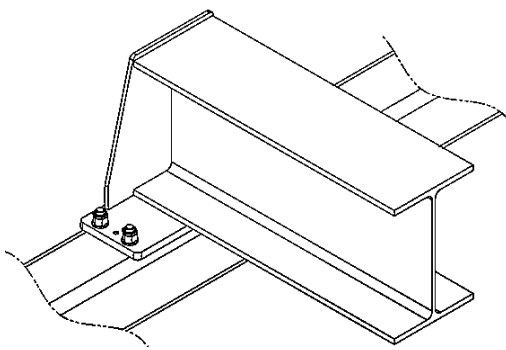
主梁与连接板之间的连接必须按情况计算，并且连接板自身也需要相应的尺寸。下方将举例说明。

Main girder connection to the joint plate has to be calculated case by case and joint plate itself needs to be sized. Here under you can see few examples about joints.

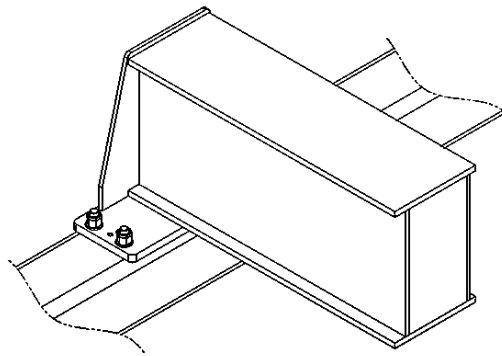
2.2.1 高连接 Top connection

主梁下翼缘板直接焊接在连接板上，连接板用螺栓固定在端梁上。这种连接方式适用于型钢或箱型主梁。

The bottom flange is welded directly on the joint plate and the joint plate is locked on the end carriage with bolts. This connection is suitable for profile or box girder.



高连接 型钢主梁
Top connection Profile

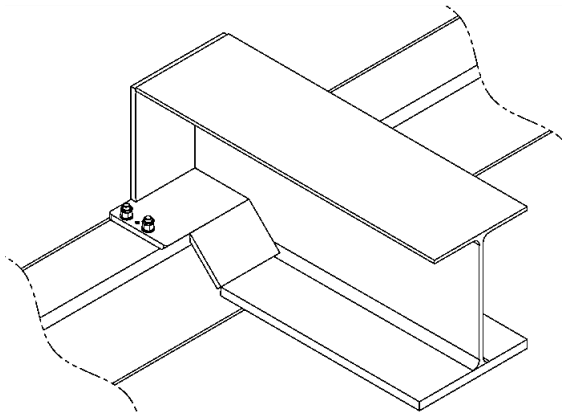


高连接 箱型主梁
Top connection Box

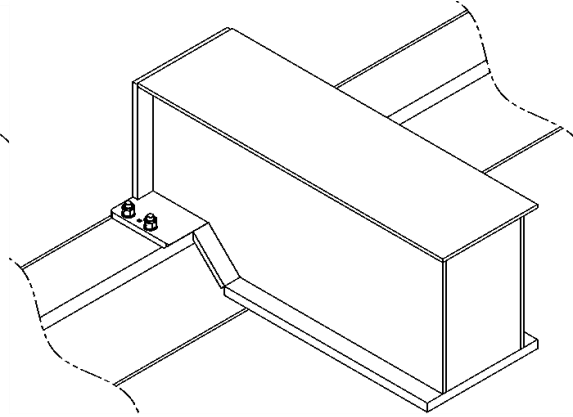
2.2.2 中连接 Medium connection

主梁焊接在连接板上，连接板用螺栓固定在端梁上。这种连接方式适用于型钢或箱型主梁。

The main girder is welded directly on the joint plate and the joint plate is locked on the end carriage with bolts. This connection is suitable for profile or box girder.



中连接 型钢主梁
Medium connection Profile

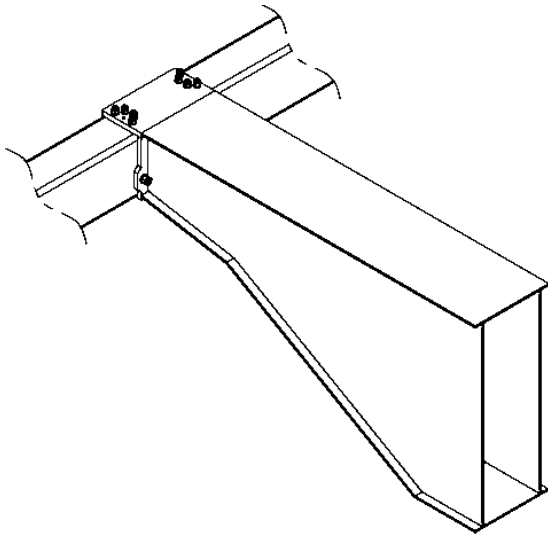


中连接 箱型主梁
Medium connection Box

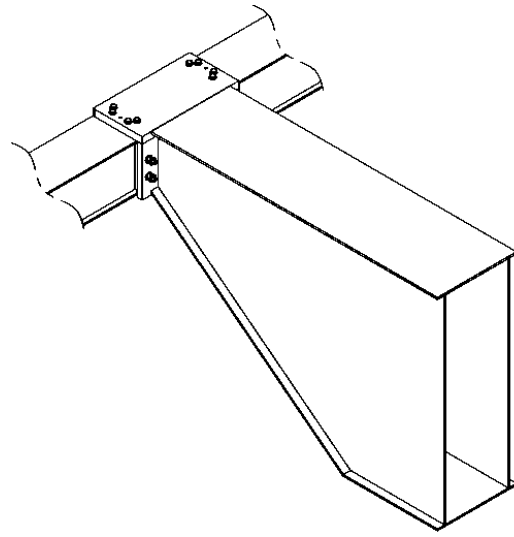
2.2.3 侧连接 Side connection

主梁焊接在连接板上，连接板用螺栓固定在端梁上。这种连接方式多用于箱型主梁。

The main girder is welded to joint plate and the joint plate is locked to the end carriage with bolts. This connection is suitable for box girder.



侧连接 D 型连接
Side connection D-joint



侧连接 E 型连接
Side connection E-joint

2.3 端梁基本参数 Data information of end carriage

- DN11, DN14, DN20, DN25B 端梁是由矩形管焊接而成。

The DN11, DN14, DN20, DN25B end carriages are made of rectangular hollow section.

- DN25, DN32, DN40, DN50 是焊接而成的箱型结构。

The DN25, DN32, DN40, DN50 end carriages are a welded box type construction.

- 端梁体材质为 Q345B。

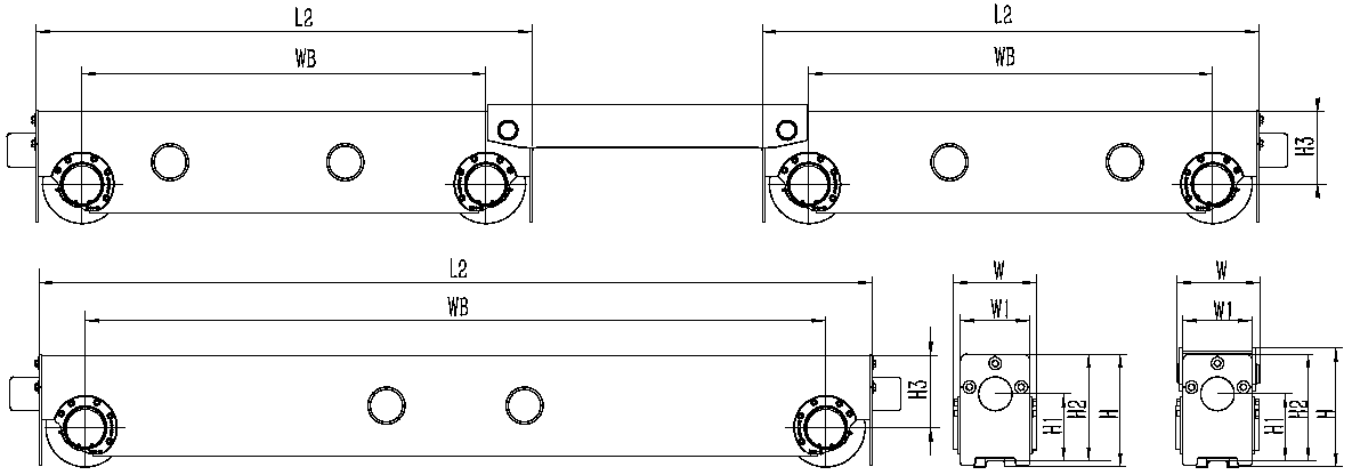
The material of the steel structure is Q345B.

- 车轮材质为 QT700。

The material of the wheel is QT700.

端梁基本参数 Data info of end carriage					
型号 Type	轮距 Wheel base (x100mm)	轮距(带台车) Wheel base (bogie) (x100mm)	轮槽宽度 Groove width (mm)	大车运行速度(m/min) Bridge traveling speed(m/min)	减速箱型号 Machinery type
DN11	14,18,22,27	-	75	25,32,40,50	T3
DN14	14,18,22,27,31,38	-	75	32,40,50,63	T3
DN20	18,22,27,31,38	12,14,16,18,20	75,95	16,20,25,32,40,56,70,90	T3,T4
DN25	22,27,31,38,45,50,55	14,16,18,20	75,95,120	20,25,32,40	T4,T5
DN32	22,27,31,38,45,50,55	14,16,18,20	75,95	20,25,32,40,50	T4,T5
DN40	22,27,31,38,45,50,55	16,18,20	75,95	32,40,50,63,80,100	T5
DN50	22,27,31,38,45,50,55	16,18,20	95,120,140	40,50,63,80,100,125	T5

2.4 端梁外形尺寸 Dimensions of end carriages



型号 Type	WB(×100mm)	L2	H	H1	H2	H3	W	W1
DN11-	14	1612	180	100	165	110	200	150
	18	2012						
	22	2412						
	27	2912						
DN14-	14	1652	280	100	268	198	198	150
	18	2052						
	22	2452						
	27	2952						
	31	3352						
DN20-	18	2076	335	200	315	215	247	200
	22	2476						
	27	2976						
	31	3376						
DN20B	18	2076	353	200	315	215	247	200
	14	1676						
	16	1876						
	18	2076						
	20	2276						
DN25-	22	2546	327	200	310	185	270	270
	27	3046	327		310	185		
	31	3446	329		312	187		
	38	4146	333		316	191		
	45	4846	431		416	291		
	50	5346	431		416	291		
	55	5846	431		416	291		

DN25B	14	1722	406	200	370	245	270	270
	16	1922						
	18	2122						
	20	2322						
DN32-	22	2620	380.5	200	364	204	278	270
	27	3120	380.5		364	204		
	31	3520	380.5		364	204		
	38	4220	382.5		366	206		
	45	4920	550.5		534	374		
	50	5420	554.5		538	378		
	55	5920	554.5		538	378		
DN32B	14	1817	380.5	200	364	204	288	270
	16	2017						
	18	2217						
	20	2417						
DN40-	22	2818	581	200	540	340	290	290
	27	3318	585		544	344		
	31	3718	585		544	344		
	38	4418	589		548	348		
	45	5118	705		664	464		
	50	5618	709		668	468		
	55	6118	709		668	468		
DN40B	16	2215	581	200	540	340	311	270
	18	2415						
	20	2615						
DN50-	22	2818	581	200	540	290	290	290
	27	3318	585		544	294		
	31	3718	585		544	294		
	38	4418	589		548	298		
	45	5118	705		664	414		
	50	5618	709		668	418		
	55	6118	709		668	418		
DN50B	16	2215	581	200	540	290	311	270
	18	2415						
	20	2615						

3 收货及存储 Receiving and storage

3.1 货物验收 Checking goods on receiving

- 装箱单即为货物清单。

The scope of delivery is specified in the packing papers.

- 到货后检查轴承是否已加注润滑剂。

Ensure that the bearing has been filled with lubricant.

- 到货后请立即检查货物，确定货物数量及检查运输过程中是否有损坏。

Check the delivery immediately on receipt to ensure that it is complete and examine it for damage caused in transit.

- 如果货物有损坏，不要破坏货物和包装材料。更不要使用！

In any case, leave the goods and packaging material unchanged. Do not use the goods !

- 请及时联系供应商！

Then contact the supplier!

3.2 存储 Storage

- 端梁必须储存在干燥的地方，避免受到温度变化的影响。例如，放在托架上。

The end carriages must be stored in dry places which are not subject to extreme temperature fluctuations, e.g. on a wooden support.

- 不要直接堆叠放在一起。

Unpacked end carriages must not be stacked on top of each other.



端梁仅喷了底漆，面漆由客户喷涂。

Primary painting as delivery, coating paint should be done by customer.



轴承已加注润滑剂。

The bearings have been filled with lubricant.



在交货时，螺栓仅为预装配，安装起重机时必须进行最后的紧固。

On delivery the bolts are just pre-assembled, final tightening has to be done when assembled on the crane.

3.3 制造商的联系方式 Manufacturer's contact information

制造商的名称及住址:

华德起重机（天津）股份有限公司

天津市京滨工业园民丰道 1 号

电话号码: +86 (022) 2219-9090, 2946-7189

Contact:

Manufacturer name: WORLDHOISTS (Tianjin) Co., Ltd.

Add.: No. 1, Minfeng Road, Jingbin Industrial Park, Tianjin City

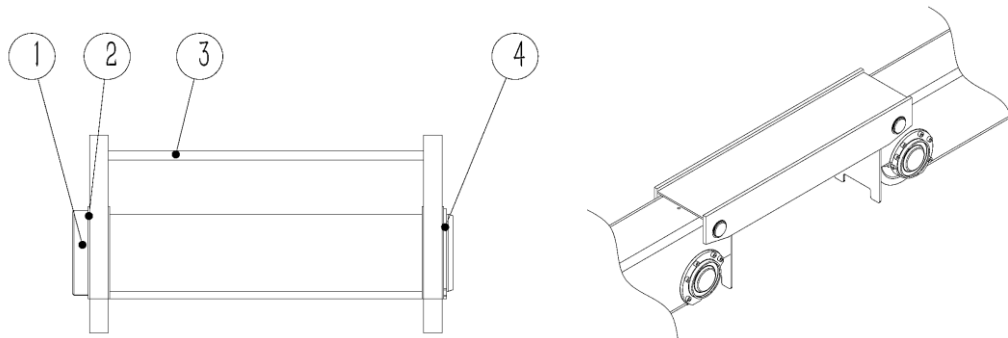
Tel.: +86(022)2219-9090, 2946-7189

4 装配指南 Assembly instructions

4.1 组装连接梁 Connection beam assembly

到货时，连接梁与端梁未组装，需组装。

The connection beam and the end carriage are not assembled and need to be assembled.



① 台车轴 Shaft ② 垫板 Sleeve ③ 连接梁 connection beam ④ 轴用弹性挡圈 Circlip

4.2 主端梁预组装 Main girder and end carriage preassembly

4.2.1 胎架及端梁调整 Assembly stands and end carriage adjustment

4.2.1.1 依据起重机主梁的跨度调整胎架。

Adjust the assembly stands according to the crane span.

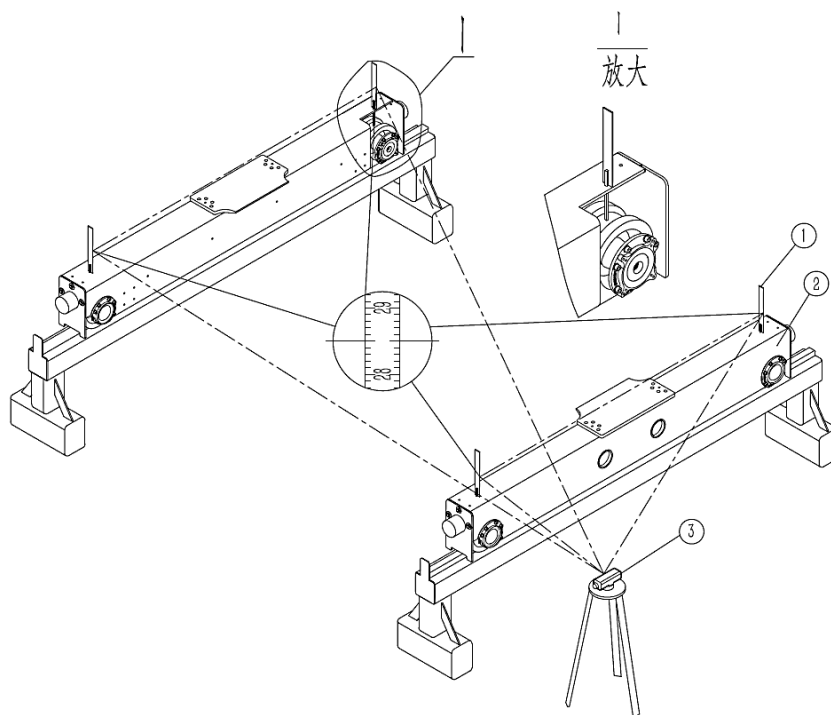
4.2.1.2 将组装好的端梁放到胎架上，把特制的直尺分别插入车轮观察孔，直尺末端顶紧轮踏面上面。用水平仪测量直尺高度。将端梁找平，满足GB/T 10183.1 / ISO 12488-1的要求。示意图如下。

Put the end carriage on the stands, insert a measuring ruler into the measuring hole, pressed against the wheel tread. Use a levelling instrument to measure the height of the ruler. And level the end carriages, meet GB/T 10183.1 / ISO 12488-1 requirements. The details are shown below.



车轮观察孔为端梁上盖板上的一个 M12 螺纹孔，正对车轮中心的上方。

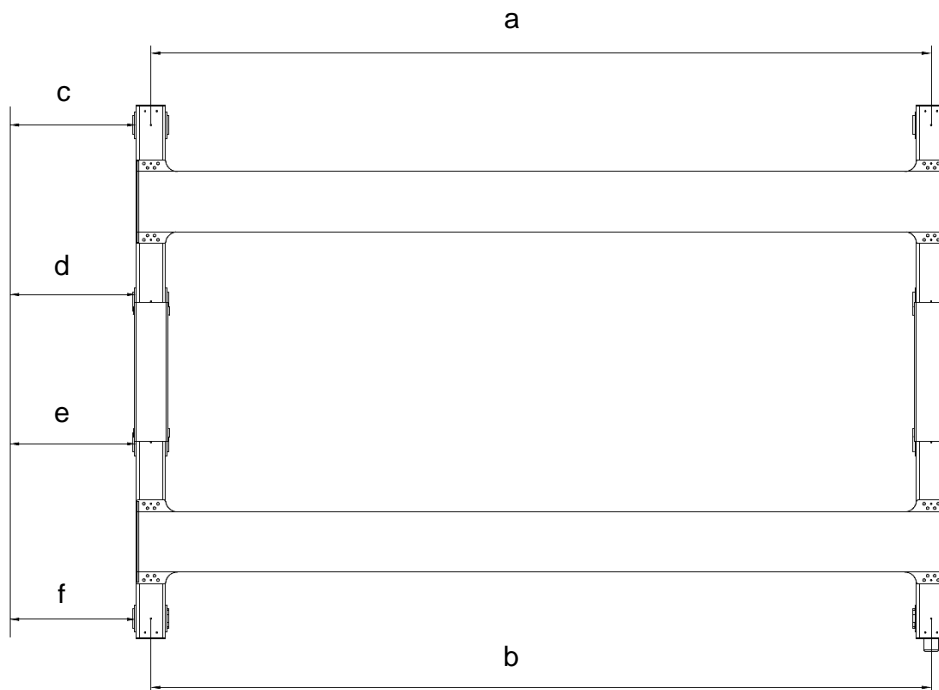
The measuring hole is on the top plate of the end carriage, one M12 threaded hole, above the wheel center.



① 测量尺 Measuring ruler ②端梁 End carriage ③水平仪 Levelling instrument

4.2.1.3 测量a,b,c,d,e,f尺寸，各尺寸满足GB/T 10183.1 / ISO 12488-1的要求，具体见下图。

Measure a,b,c,d,e,f dimensions need to meet the requirements of GB/T 10183.1 / ISO 12488-1.The details are show below .



4.2.1.4 检查端梁主动车轮组放置方向。

Check the drive wheel group placement of the end carriage.



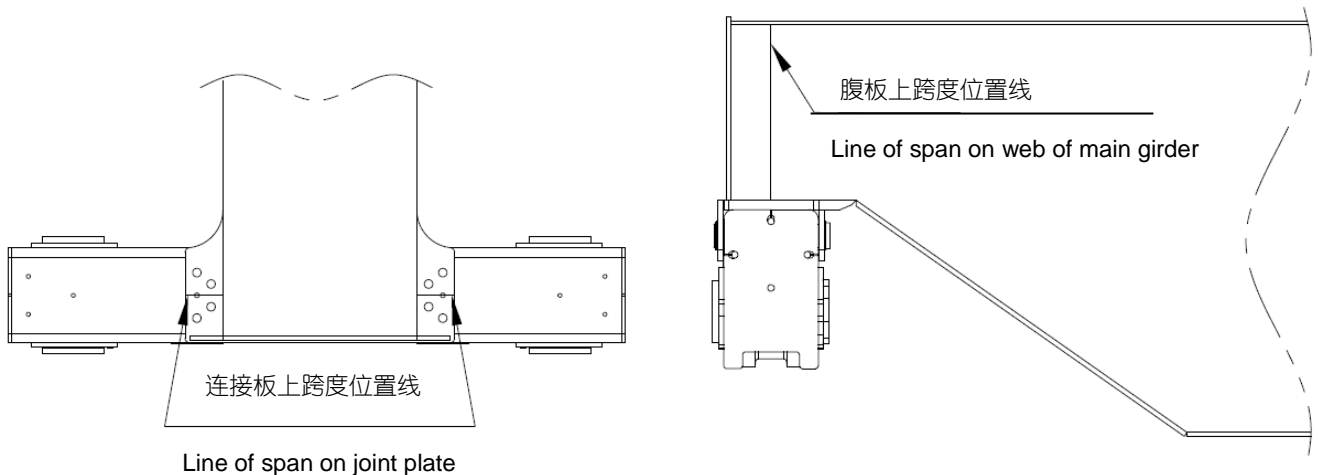
调整端梁位置前，将主端梁螺栓拧紧。建议预组装时使用工艺螺栓替代本公司提供的高强度螺栓。

Tighten the joint plate bolts before adjusting the end carriage position. It is recommended to use temporary bolts to replace the high strength bolts delivery by our company.

4.2.2 与主梁焊接 Connection with main girders

4.2.2.1 在连接板及主梁腹板上分别画出主梁跨度位置线，将主梁放到连接板上，保证三条跨度位置线对齐。调整主梁使其与端梁垂直，具体如下图所示。

Mark out the span on joint plate and web plates, place the main girder on the joint plate, make sure that the three span lines are aligned. Adjust the main girder and make it perpendicular to the end carriage, the details are shown in the figure below.



4.2.2.2 复核小车轨距及大车跨度，确认无误后焊接主梁。

Re-check trolley rail gauge and span, then fixing the main girder to the end carriage.

4.3 起重机端梁现场组装 Assemble end carriage onsite

4.3.1 主端梁螺栓紧定 Tighten the bolts

在交货时，螺栓仅为预装配，安装起重机时必须进行最后的紧固。拧紧力矩参照附录A。

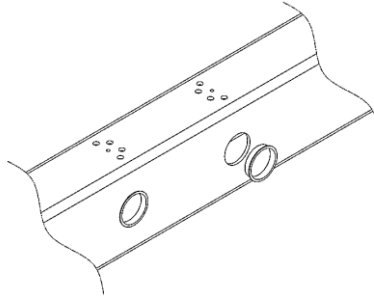
On delivery the bolts are just pre-assembled, final tightening has to be done when assembly crane. See Annex A for more details.



螺栓打紧力矩后不能重复使用，建议每拆卸一次均更换新螺栓。

Bolts can't be reused after tightened torque, it is recommended to replace used bolts with new bolts.

4.3.2 手孔盖安装 Hand-covers assembly



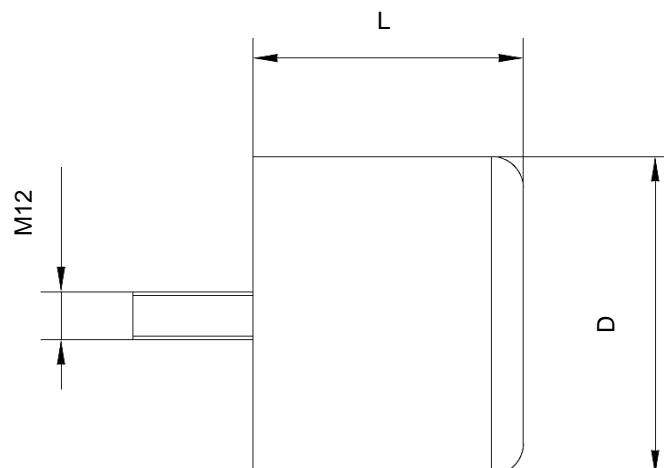
手孔盖塞入端梁手孔处，贴紧梁体。

Plug the hand-cover into the hole.

4.3.3 缓冲器 Buffers

缓冲器固定在端梁两侧的扫轨板上，螺栓连接。有橡胶和聚氨酯两种缓冲器可供选择。缓冲器型号在端梁代码中体现。缓冲器尺寸如下表：

The buffers are fixed to both ends of the end carriage by bolt connection. The following buffer alternatives are available; rubber and polyurethane buffers. The buffers are selected case by case and the buffer type shall be included in the end carriage ordering code. Buffer dimensions in the table below:



型号 Code	直径 [mm] Diameter[mm]	长度 [mm] Length [mm]	重量 [kg] Weight [kg]	材质 Material
A	63	53	0.3	橡胶 Rubber
B	80	68	0.6	橡胶 Rubber
C	100	85	1	橡胶 Rubber
D	125	105	2	橡胶 Rubber
G	100	100	0.7	聚氨酯 Polyurethane
H	160	160	2.5	聚氨酯 Polyurethane
I	200	200	4.5	聚氨酯 Polyurethane

5 维修与保养 Maintenance

5.1 说明 Maintenance instructions

- 润滑间隔:起重机运行 5000 小时需润滑一次, 至少每 4 年一次。
如果起重机使用频繁, 适当缩短时间间隔 (如, 每个季度润滑一次)。
Lubrication interval: 5000 hours of operation, at least every 4 years.
Under extreme operating conditions shorter intervals (every quarter) must be selected.
- 每年检查一次螺栓紧固情况。
如果起重机使用频繁(如倒班情况), 需适当缩短时间间隔 (如, 每个季度紧固一次)。
Bolted connections must be inspected annually.
Under extreme operating conditions (e.g. multiple shift operation) shorter intervals (every quarter) must be selected.

5.2 润滑剂 Lubricant

5.2.1 润滑原则 Lubrication rules

- 只能使用制造厂家建议的原装润滑剂。
Only the original lubricant is recommended by the manufacturer can be used.
- 除非顾客指定, 否则就使用工厂安置的润滑剂。
The lubricant placed by the factory shall be used unless it is specified by the client.
- 如果不得不更换润滑剂, 在加油之前要先将轴承冲洗干净。
It is required to clean up the bearings before the filling if the lubrication has to be replaced.
- 如果起重机在非常冷的环境下 (低于 -25°C) 或者在非常热的环境下 (高于 $+55^{\circ}\text{C}$) 工作较长的时间, 建议使用合成润滑剂。
If the crane operates for a long time in the very cold environment (lower than -25°C) or very hot environment (higher than $+55^{\circ}\text{C}$), it is recommended to use the synthetic lubricants.



使用劣质的或不协调的润滑剂会损坏轴承。

The use of low-grade or uncoordinated lubricant may damage the bearings.



如果必须加满润滑剂，要保证添加的润滑剂是兼容的。

It is necessary to guarantee that the adding lubricant is compatible if the conveying grease must be filled fully.

5.2.2 润滑剂的容量 Quantity of lubricant

润滑剂的容量可以通过公式计算得到：

Suitable quantity of lubricant can be calculated by using formula:

$$G_p = 0.005 * D * B$$

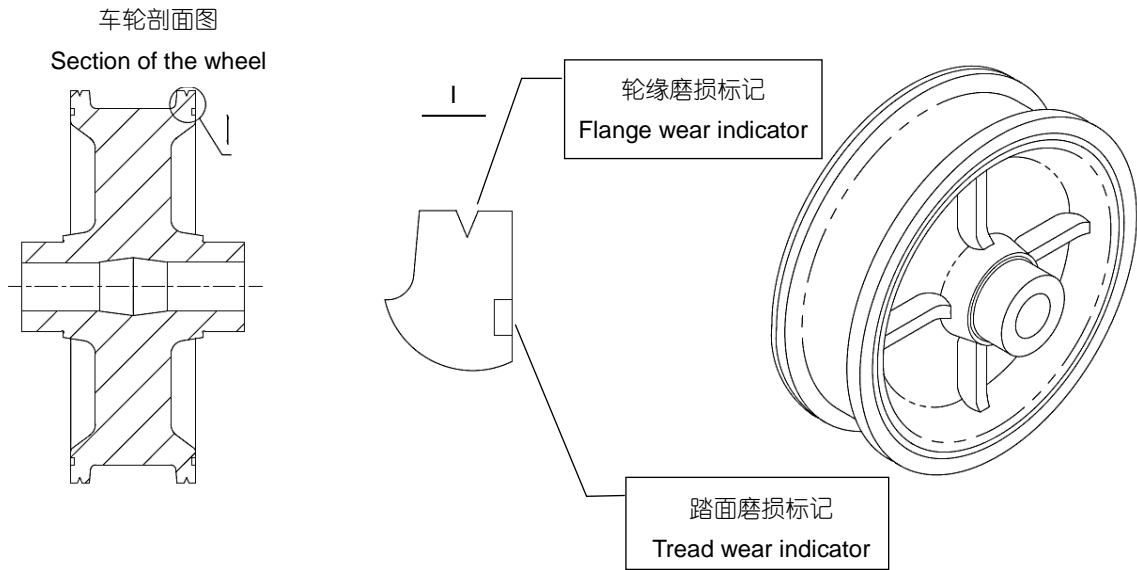
G_p = 润滑剂容量 [g] grease quantity [g]

D = 轴承外径 [mm] bearing outside diameter [mm]

B = 轴承宽度 [mm] total bearing width [mm]

车轮踏面直径 [mm] Wheel diameter [mm]	轴承 Bearing	轴承外径[mm] D [mm]	轴承宽度[mm] B [mm]	润滑剂容量[g] Grease quantity [g]
110	6308	90	23	10
140	6211	100	21	11
200	22213	120	31	19
250 320	22216	140	33	23
400 500	22220	180	46	42

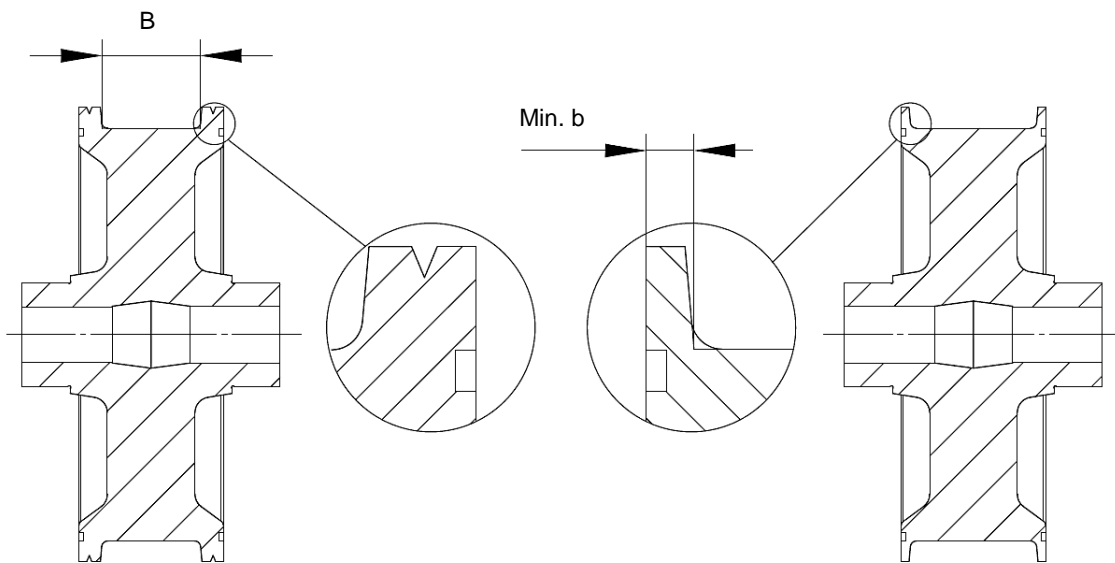
5.3 车轮磨损 Travel wheel wear



5.3.1 轮缘磨损 Flange wear

- 轮缘的磨损指示标记便于对安装进行预防性检查。

The wear indicator on the flange facilitates preventive inspections of the installation.



新车轮

New travel wheel

磨损的车轮

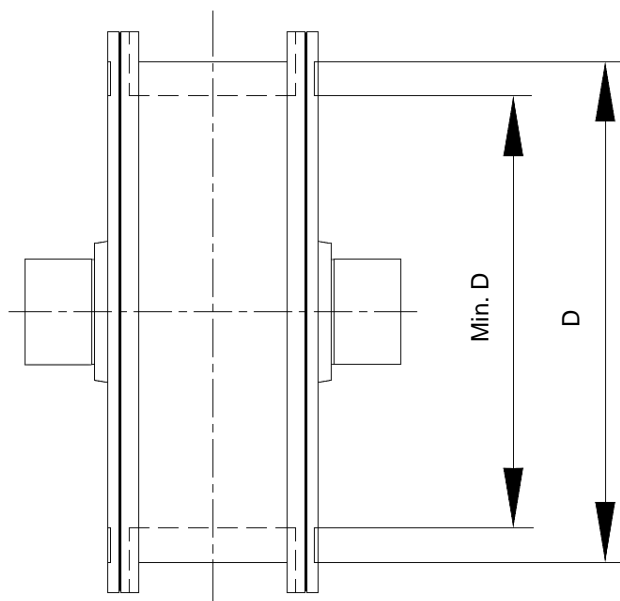
Worn travel wheel



任何一处轮缘磨损超过允许值，整个车轮就需更换。

The travel wheel must already be replaced even if only one segment of the wear indicator is disappeared.

5.3.2 踏面磨损 Tread wear



当达到下列限制值时，必须更换车轮：

Travel wheels must be replaced when the following limit values are reached:

新车轮 New wheel	磨损车轮 Worn wheel	新车轮 New wheel	磨损车轮 Worn wheel
轮踏面直径 Wheel diameter D (mm)	最小轮踏面直径 Min. wheel diameter Min. D (mm)	最大轮槽宽度 Max. groove B (mm)	最小轮缘厚度 Min. flange thickness Min. b (mm)
110	105	75	8
140	134	75	9
200	193	95	11
250	242	95	11
320	312	95	12
400	392	95	12
500	492	95	12

5.4 可能的故障源 Possible fault sources

下面的表格中列出端梁可能会发生的一些故障，以及它们的起因和校正方法。

The following table shows some faults possibly occurred in the end carriage, and their causes and the correcting behaviors needed to eliminate them.



如果使用这个表格不能识别并消除故障，就与制造厂家授权的服务代理商联系。

Please feel free to contact the service agency of the manufacturer if the faults cannot be identified and removed after complying with the contents of the following table.

故障描述 Description of fault	可能原因 Possible cause of fault	校正方法 Fault elimination
车轮磨损加剧 (踏面或轮缘) Increased travel wheel wear (tread or flange)	车轮偏斜 Wheel is misaligned	调整车轮 Re-align the wheels
	轨道有杂物 Rail is dirty	清扫轨道 Clean the rail
噪音 Running noises	车轮偏斜 Wheel is misaligned	调整车轮 Re-align the wheels
	轨道有杂物 Rail is dirty	清扫轨道 Clean the rail
	轴承磨损 Defective bearing	更换轴承 Replace the bearing

附件 A Annex A

规格 Specifications	紧固扭矩 Tightening torque on screws			
	强度等级 8.8 Strength grade 8.8		强度等级 10.9 Strength grade 10.9	
	[Nm]	[Ft lb]	[Nm]	[Ft lb]
M4	2.7	2.0	4.0	2.9
M5	5.4	4.0	7.9	5.8
M6	9.3	6.8	14	10.3
M8	23	17.0	33	24
M10	45	33.0	66	48.5
M12	77	56.6	115	84.6
M14	125	92	180	132
M16	190	140	280	206
M18	275	202	390	287
M20	385	283	550	404
M22	530	390	750	552
M24	660	485	950	699
M27	980	721	1400	1030
M30	1350	993	1900	1398


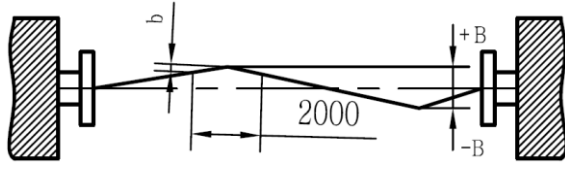
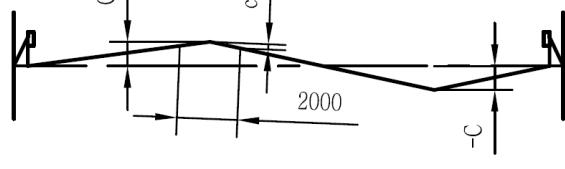
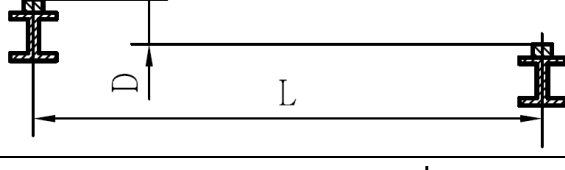
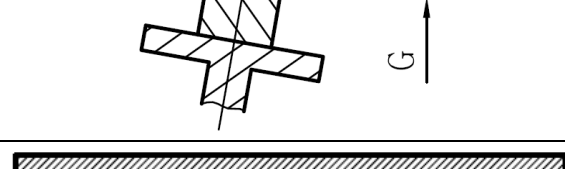
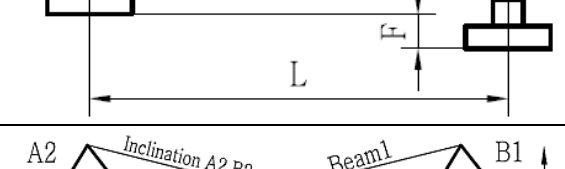
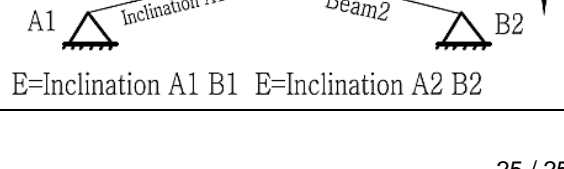
附件 B Annex B

连接板尺寸		Joint plates				
类别 Type	图纸 Drawings	代号 Code	尺寸[mm] Size[mm]			
			L	L1	L2	t
A 型 A-joint plates		A4	450	410	-	16
		A6	650	600	-	
B 型 B-joint plates		B3	460	410	300	25
		B4	570	520	410	
		B5	680	630	520	
C 型 C-joint plates		C4	570	520	410	25
		C5	680	630	520	
		C7	900	850	740	
F 型 F-joint plates		F4	630	520	470	25
		F5	740	630	580	
		F7	960	850	800	

附件 C Annex C

轨道参数 Rail technical data							
型号 Type	轨顶宽 Width (top) (mm)	轨底宽 Width (bottom) (mm)	轨高 Height (mm)	轨顶有效宽度 Effective width (mm)	重量 Weight (kg/m)	标准 Standard	材质 Material
50×30	50	50	30	38	11.8	GB/T 704	Q345B
60×40	60	60	40	48	19.1	GB/T 704	Q345B
70×40	70	70	40	58	22.2	GB/T 704	Q345B
80×60	80	80	60	68	38.6	GB/T 704	Q345B
100×60	100	100	60	88	47.1	GB/T 704	Q345B
120×80	120	120	80	108	75.4	GB/T 704	Q345B
P18	40	80	90	28.2	18.06	YB 222	55Q
P22	50.8	93.66	93.66	34.92	22.3	GB/T 11264	55Q
P24	51	92	107	26.13	24.46	YB 222	55Q
P30	60.33	107.95	107.95	44.45	30.1	GB/T 11264	55Q
P38	68	114	134	43.9	38.73	GB/T 183	U71Mn
P43	70	114	140	46	44.65	GB/T 182	U71Mn
P50	70	132	152	46	51.51	GB/T 181	U71Mn
QU70	70	120	120	58	52.8	GB 3426	U71Mn
QU80	80	130	130	64	63.69	GB 3426	U71Mn
QU100	100	150	150	84	88.96	GB 3426	U71Mn
QU120	120	170	170	104	118.1	GB 3426	U71Mn
A45	45	125	55	37	39.6	DIN 536	≥690 MPa
A55	55	150	65	45	48.3	DIN 536	≥690 MPa
A65	65	175	75	53	57	DIN 536	≥690 MPa
A75	75	200	85	59	64.3	DIN 536	≥880 MPa
A100	100	200	95	80	86.6	DIN 536	≥880 MPa
A120	120	220	105	100	106.6	DIN 536	≥880 MPa
A150	150	220	150	130	136.6	DIN 536	≥880 MPa

附件 D Annex D

轨道安装公差 Rail installation tolerances (GB/T 10183.1 / ISO 12488-1)																					
描述 Figure	公差等级 Tolerance class																				
<p>跨度 Span</p> 	<p>$L \leq 15m \quad A = \pm 3mm$ $L > 15m \quad A = (3 + 0.25(L - 15))mm$ Max 15mm</p> <table border="1"> <tr> <td>L (m)</td> <td>10</td> <td>15</td> <td>20</td> <td>25</td> <td>30</td> <td>35</td> <td>40</td> <td>50</td> <td>≥58</td> </tr> <tr> <td>A (mm)</td> <td>3</td> <td>3</td> <td>4.3</td> <td>5.5</td> <td>6.8</td> <td>8</td> <td>9.3</td> <td>11.8</td> <td>15</td> </tr> </table>	L (m)	10	15	20	25	30	35	40	50	≥58	A (mm)	3	3	4.3	5.5	6.8	8	9.3	11.8	15
L (m)	10	15	20	25	30	35	40	50	≥58												
A (mm)	3	3	4.3	5.5	6.8	8	9.3	11.8	15												
<p>直线度 Straightness</p> 	<p>$B = \pm 5mm$ $b = \pm 1.0mm$ 随机取样 (Random sampling)</p>																				
<p>高低差 Elevation</p> 	<p>$C = \pm 10mm$ $c = \pm 1.0mm$ 随机取样 (Random sampling)</p>																				
<p>相对高低差 Rail to rail elevation</p> 	<p>$D = L/5000$ Max.=10mm</p>																				
<p>倾斜度 Inclination of rail</p> 	<p>$G = \pm 0.8\%$</p>																				
<p>车挡位置 Buffer end stops</p> 	<p>$F = \pm L/1428$ Max.=20mm</p>																				
<p>相对倾斜 Tilt rail to rail</p>  <p>$E = \text{Inclination A1 B1} \quad E = \text{Inclination A2 B2}$</p>	<p>$E = 0.5\%$</p>																				