THE HONG KONG INSTITUTION OF ENGINEERS
香港工程師學會

建築工地塔式起重機的驗收及檢測技術要求

Technical requirements for thorough examination and testing of tower cranes on construction sites, and their certification

參考指引

法例 Legislation	**工廠及工業經營(起重機械及起重裝置)規例 Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations LALGR**
工作守則 Code of Practice	安全使用塔式起重機工作守則 Code of Practice for Safe Use of Tower Cranes
指南 Guidance Notes	起重機械及起重裝置的檢查、檢驗和測試 指南 Guidance Notes on Inspection, Thorough Examination and Testing of Lifting Appliances and Lifting Gear

工廠及工業經營(起重機械及起重裝置)規例
Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

2nd June 1993, a passenger hoist plunged 17 floors in a construction site at North Point, killing 12 workers



8th July 1993, amendment to LALGR

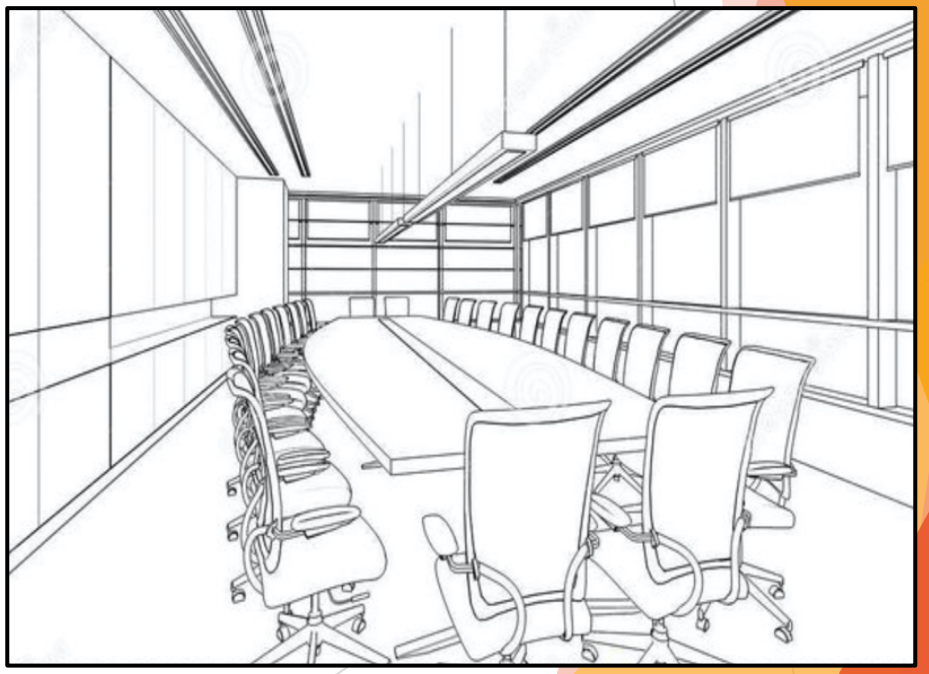
Competent Examiner (合資格檢驗員) = Registered Professional Engineer In Mechanical Engineering (機械工程) / Marine & Naval Architecture (輪機暨造船學)

安全使用塔式起重機工作守則
Code of Practice for Safe Use of Tower Cranes

- 10th July 2007, fatal tower crane accident at Hennessy Centre site, Causeway Bay
- Task force soon formed under the Committee on Construction Site Safety of the CIC
- Thorough study of all issues related tower cranes
- Made recommendations on how to improve on the safe use and operation of tower cranes

Chairman – Thomas Ho, Construction Industry Council

- Labour Department
- Buildings Department
- Hong Kong Construction Association
- The Hong Kong Institute of Architects
- HK Construction Industry Employees General Union
- Construction Site Workers General Union
- HK Const Ind Professional Plant-Operators and Mechanics' Association
- HK Professional Hoisting Engineering Association Limited
- Members of the HKIE
- Tower crane rental companies
- Tower crane specialist contractors
- Plant Department of Main Contractors



Involvement of Registered Professional Engineer

- Design and construction of foundation and temporary supporting Structures(COP For Safe Use of Tower Crane clause 9.2.3 & 9.2.6)

✓ Technically Competent Person of Grade T5" (TCP T5)



- Pre-delivery checking of tower crane critical parts

(COP For Safe Use of Tower Crane clause 10.7.1)

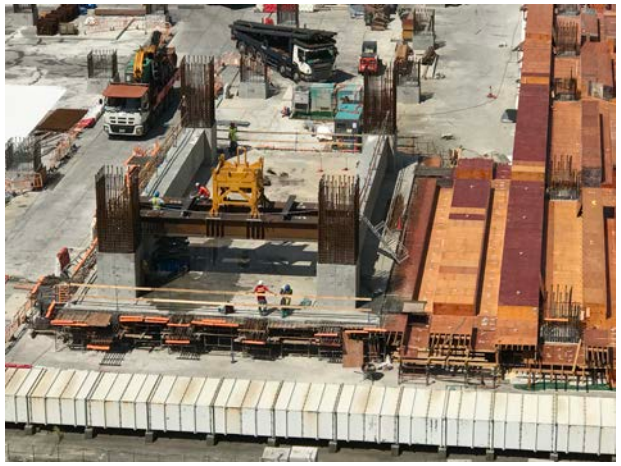
✓ Competent Examiner

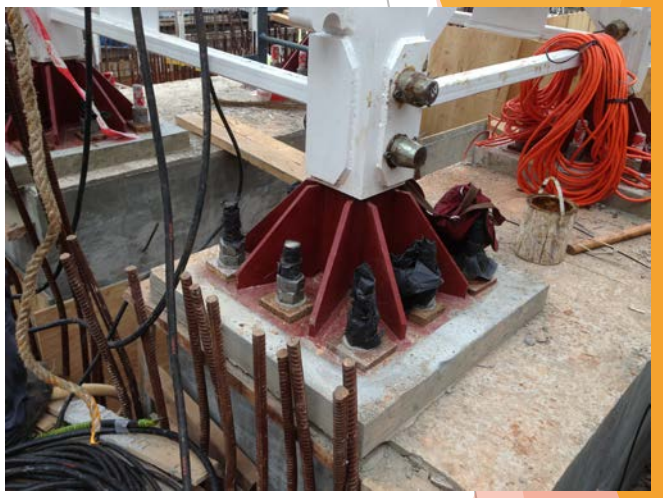
Qualification:

Registered Professional Engineer **(Mechanical / Marine)**

Design and construction of foundation and temporary supporting structures by T5 grade Engineer













Non-destructive test report



Pullout test for holding down bolts



Non-destructive test by qualified person

Pre-delivery checking of tower crane critical parts by RPE (Mechanical / Marine)

Inspection of critical parts











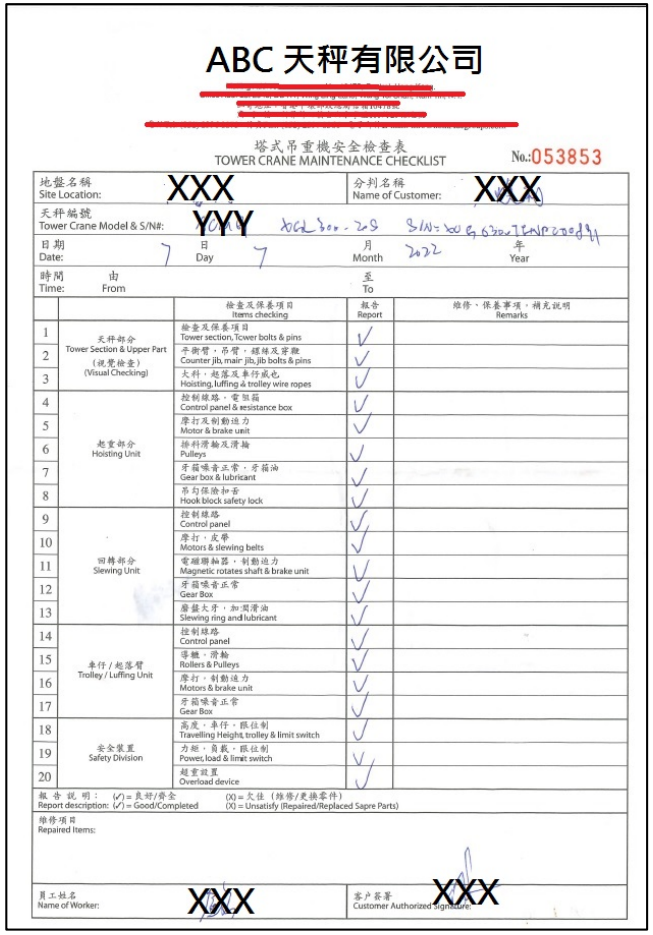






Review maintenance logbook

- Repair and maintenance record
- Replacement of major parts



ABC 天秤有限公司

塔式吊重機安全檢查表
TOWER CRANE MAINTENANCE CHECKLIST

No.:053853

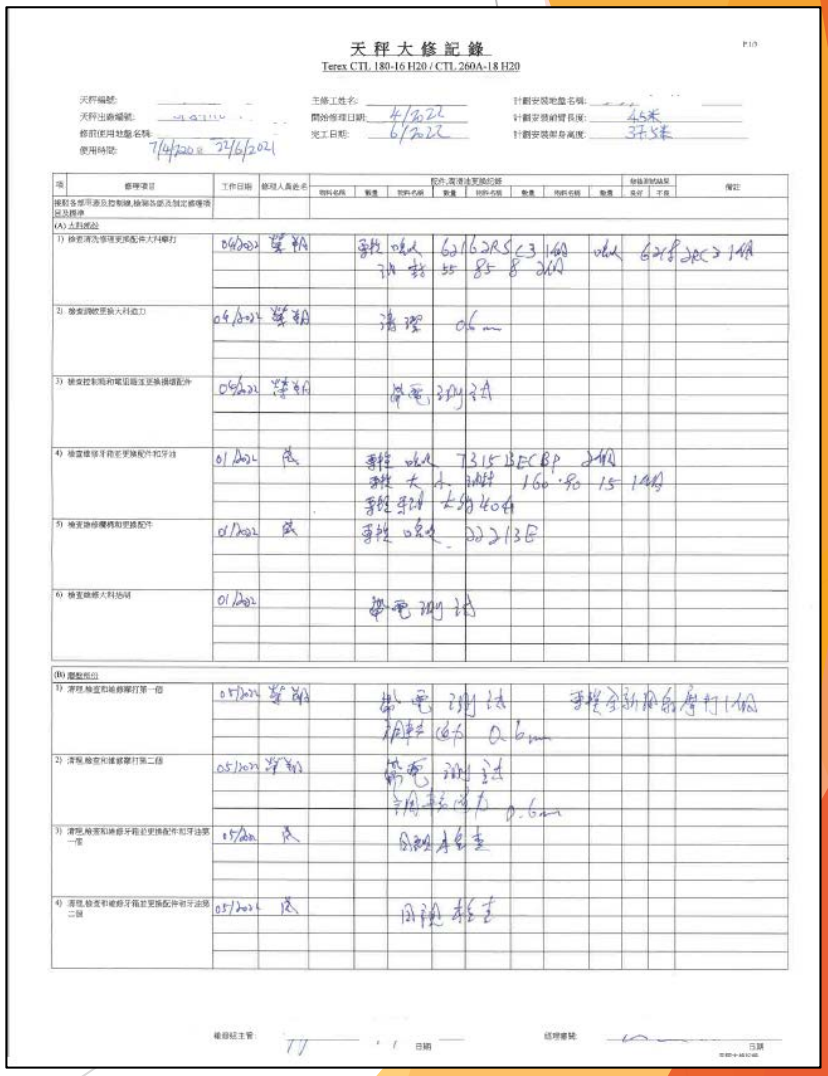
地盤名稱 Site Location:	XXX		分判名稱 Name of Customer:	XXX
天秤編號 Tower Crane Model & S/N#:	YYY			
日期 Date:	7 日 Day	7 月 Month	2022 年 Year	
時間 Time:	由 From		至 To	

		檢查及保養項目 Items checking	報告 Report	維修、保養事項、補充說明 Remarks
1	天秤部分 Tower Section & Upper Part (視覺檢查) (Visual Checking)	檢查及保養項目 Tower section, Tower bolts & pins	√	
2		平衡臂、吊臂、螺栓及窗銷 Counter jib, main jib, jib bolts & pins	√	
3		支料、起落及車行鋼也 Hoisting, luffing & trolley wire ropes	√	
4	起重部分 Hoisting Unit	控制線路、電阻箱 Control panel & resistance box	√	
5		摩打及制動迫力 Motor & brake unit	√	
6		排科滑輪及滑輪 Pulleys	√	
7		牙箱噪音正常、牙箱油 Gear box & lubricant	√	
8		吊勾保油扣吾 Hook block safety lock	√	
9	回轉部分 Slewing Unit	控制線路 Control panel	√	
10		摩打、皮帶 Motors & slewing belts	√	
11		電磁聯軸器、制動迫力 Magnetic rotates shaft & brake unit	√	
12		牙箱噪音正常 Gear Box	√	
13		磨盤大牙、加潤滑油 Slewing ring and lubricant	√	
14	車仔 / 起落臂 Trolley / Luffing Unit	控制線路 Control panel	√	
15		導輪、滑輪 Rollers & Pulleys	√	
16		摩打、制動迫力 Motors & brake unit	√	
17		牙箱噪音正常 Gear Box	√	
18	安全裝置 Safety Division	高度、車仔、限往制 Travelling Height, trolley & limit switch	√	
19		力矩、負載、限位制 Power, load & limit switch	√	
20		超重裝置 Overload device	√	

報告說明： (√) = 良好/齊全 (X) = 欠佳 (維修/更換零件)
Report description: (√) = Good/Completed (X) = Unsatisfy (Repaired/Replaced Sapre Parts)

維修項目 Repaired Items:

員工姓名 Name of Worker:	XXX
客戶簽署 Customer Authorized Signature:	XXX



天秤大修記錄
Terex CTL 180-16 H20 / CTL 260A-18 H20

| | | | |

Non-destructive test report issued by laboratory



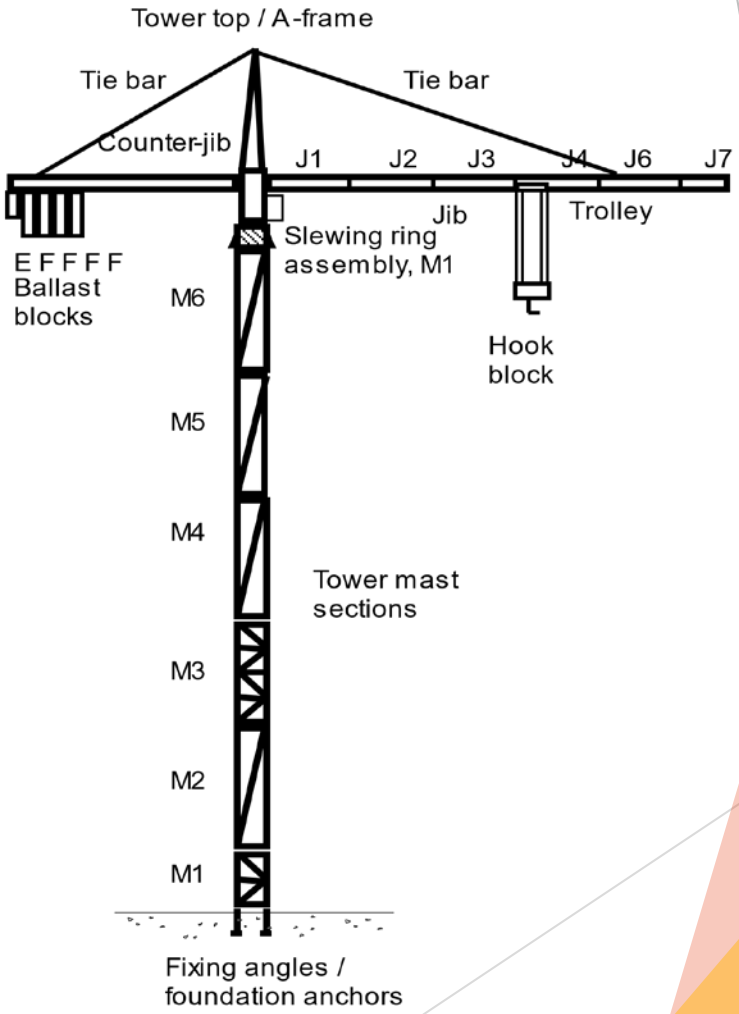
Connection pins



Fixing angles / foundation anchors

Verification of tower crane configuration

Check configuration report against information from manufacturer manual, to ensure compliance



Thorough Examination

- Perform a visual examination of the foundation and temporary supporting structures, e.g., concrete footing for cracks, steel support frame for visible damage including the structural beams, welded joints and bolted connections

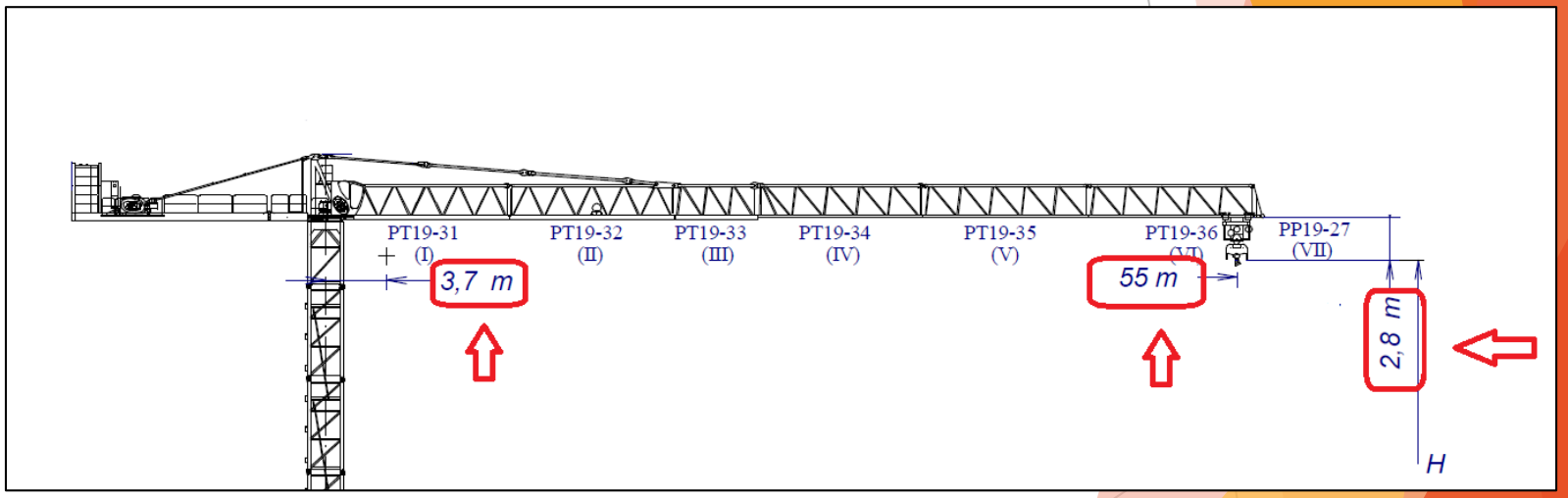
- Perform visual examination of tower crane parts, including anchorage - refer to Labour Department's Guidance Notes for details.

- Some requirements stipulated in the Guidance Notes performed during the pre-delivery checking stage by the Mechanical RPE engaged by the crane owner (機主).

Functional test at no load

Check movements

- Hoisting hook lifting and lowering mechanism
- Trolley travelling mechanism
- Slewing mechanism



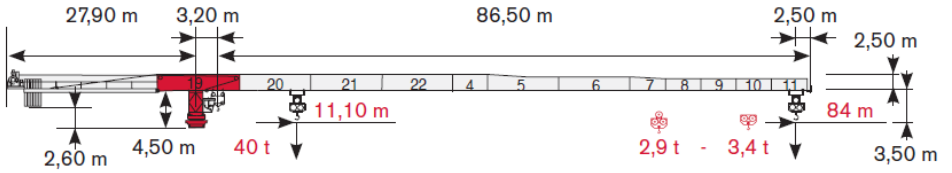
Check limit switches

- Hook height limit switch (maximum height)
- Trolley travel limit switches (maximum out or in positions)

Interpreting a manufacturer's load capacity chart

LOAD DIAGRAM

Lastkurven · Courbes de charges · Curvas de cargas · Diagramma di portata



	D2 (5,3 t)	A1 (3,57 t)
94 AFC 200	3	5

			19 m	24 m	29 m	34 m	39 m	44 m	49 m	54 m	59 m	64 m	69 m	74 m	79 m	84 m
20 t →	21,50 m	t	20,00	17,70	14,25	11,81	10,00	8,60	7,49	6,58	5,82	5,19	4,64	4,17	3,76	3,40
20 t →	20,90 m	t	20,00	17,08	13,65	11,24	9,44	8,05	6,95	6,05	5,30	4,67	4,13	3,67	3,26	2,90
40 t →	11,10 m	t	22,30	17,08	13,65	11,24	9,44	8,05	6,95	6,05	5,30	4,67	4,13	3,67	3,26	2,90

Example:
84m jib length (4 Falls)
2.9Ton@84m radius
40Ton@3.2m-11.1m radius

84m jib length (2 Falls)
3.4Ton@84m radius
20Ton@3.2m-21.5m radius





Testing

According to the **First Schedule** of the LALGR :

SWL	Proof load
Less than 20 tonnes	Exceeds SWL by at least 25%
20 to 50 tonnes	Exceeds SWL by 5 tonnes
Over 50 tonnes	Exceeds SWL by at least 10%

84m jib length (2 Falls)
3.4Ton@84m radius ➔ testing 4.25Ton@84m radius
20Ton@3.2m-21.5m radius ➔ testing 25Ton@3.2m-21.5m radius

- The proof load shall be hoisted and then swung as far as is practicable first in one direction and then in the other.
- Apply a proof load at both the maximum radius and the minimum radius of the jib

Testing

Lifting test load just off the ground to height of about 200mm for safety









Proof load at minimum radius:
Check the adequacy of hoisting mechanism, including the brake.
Ensure no slippage

Proof load at maximum radius:
Check integrity of all the structural parts,
including the support structure, fixing angles, mast tower and jib

Testing

With the test load still suspended, swing the load as far as is practicable first in one direction and then in the other direction.







Re-examination

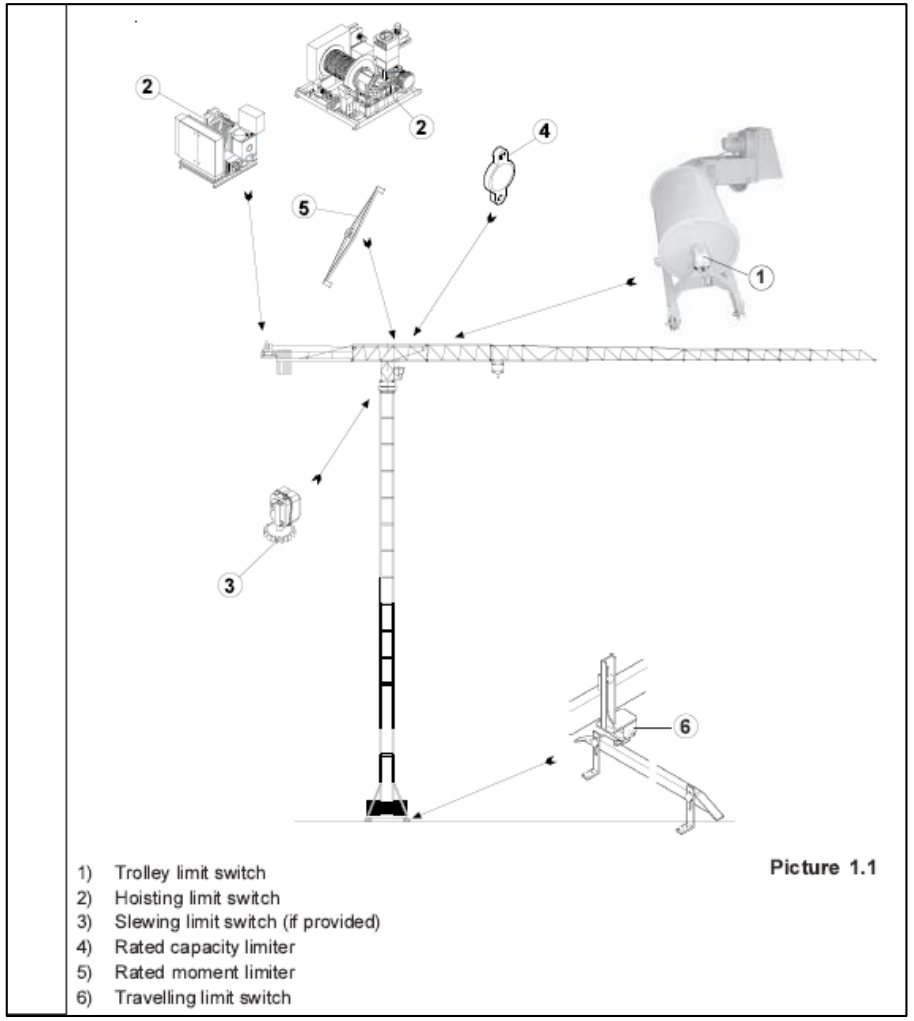
Carry out a visual examination after the proof load test to check whether there are any cracking, deformation or loosening of or damage to structural connections developed during the test.

This applies to both the tower crane structure and to the foundation or temporary supporting structures.

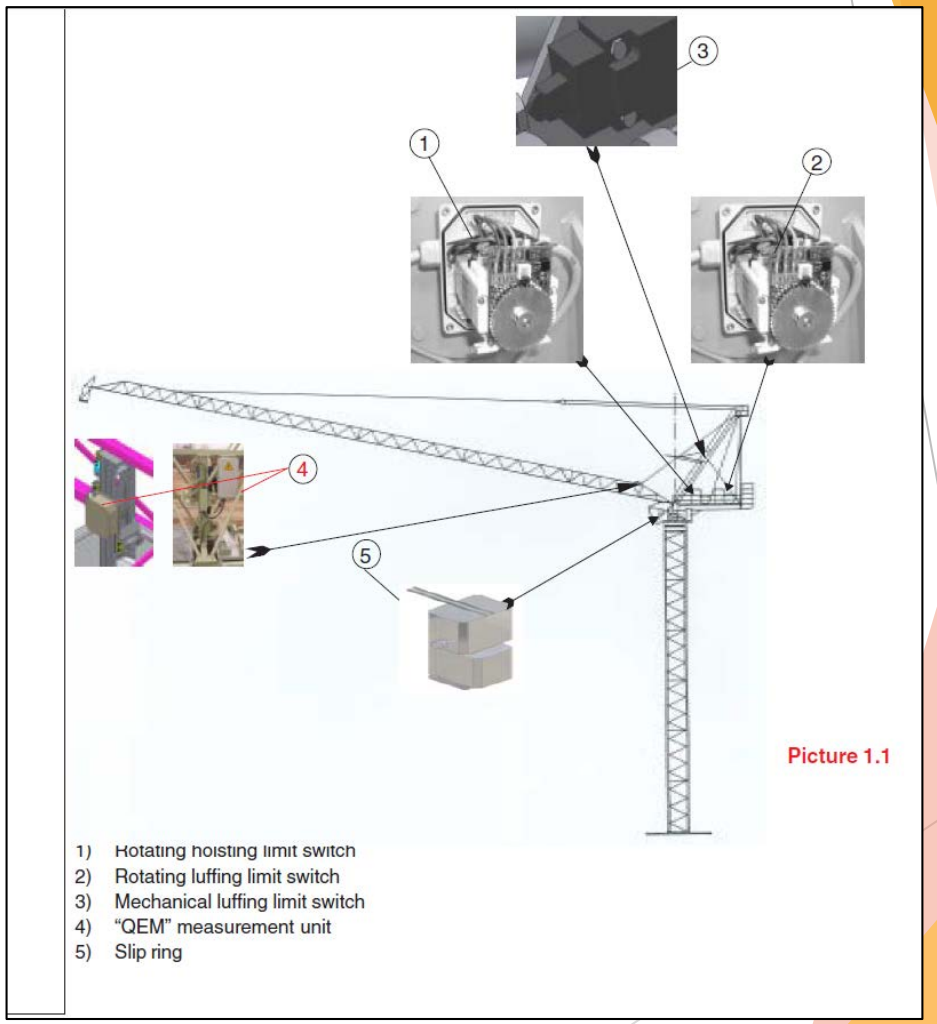




Setting Limit switch / Automatic Safe Load Indicator (ASLI)



Topless crane limit switch example

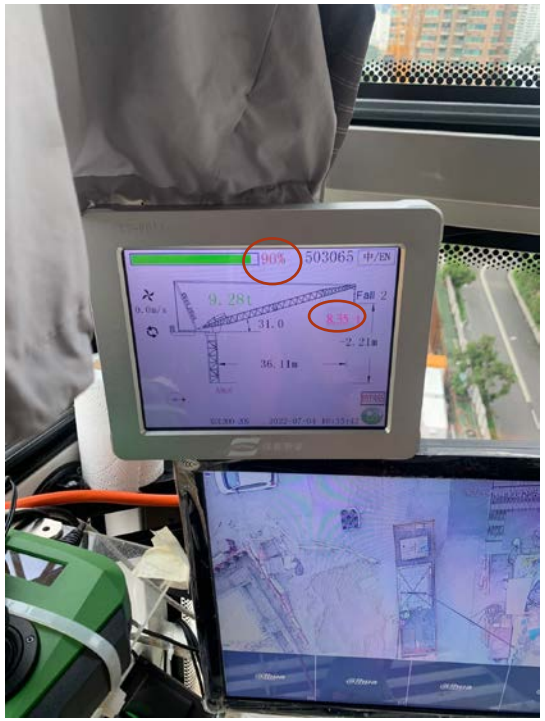


Luffing crane limit switch example

Setting the Automatic Safe Load Indicator (ASLI)

The ASLI automatically gives an audible and visible warning to the operator thereof that the crane is approaching its safe working load, and automatically gives a further audible and visible warning when the crane has exceeded its safe working load;

Amber light with an intermittent sound set at when load reaches 90% SWL



Setting the Automatic Safe Load Indicator (ASLI)

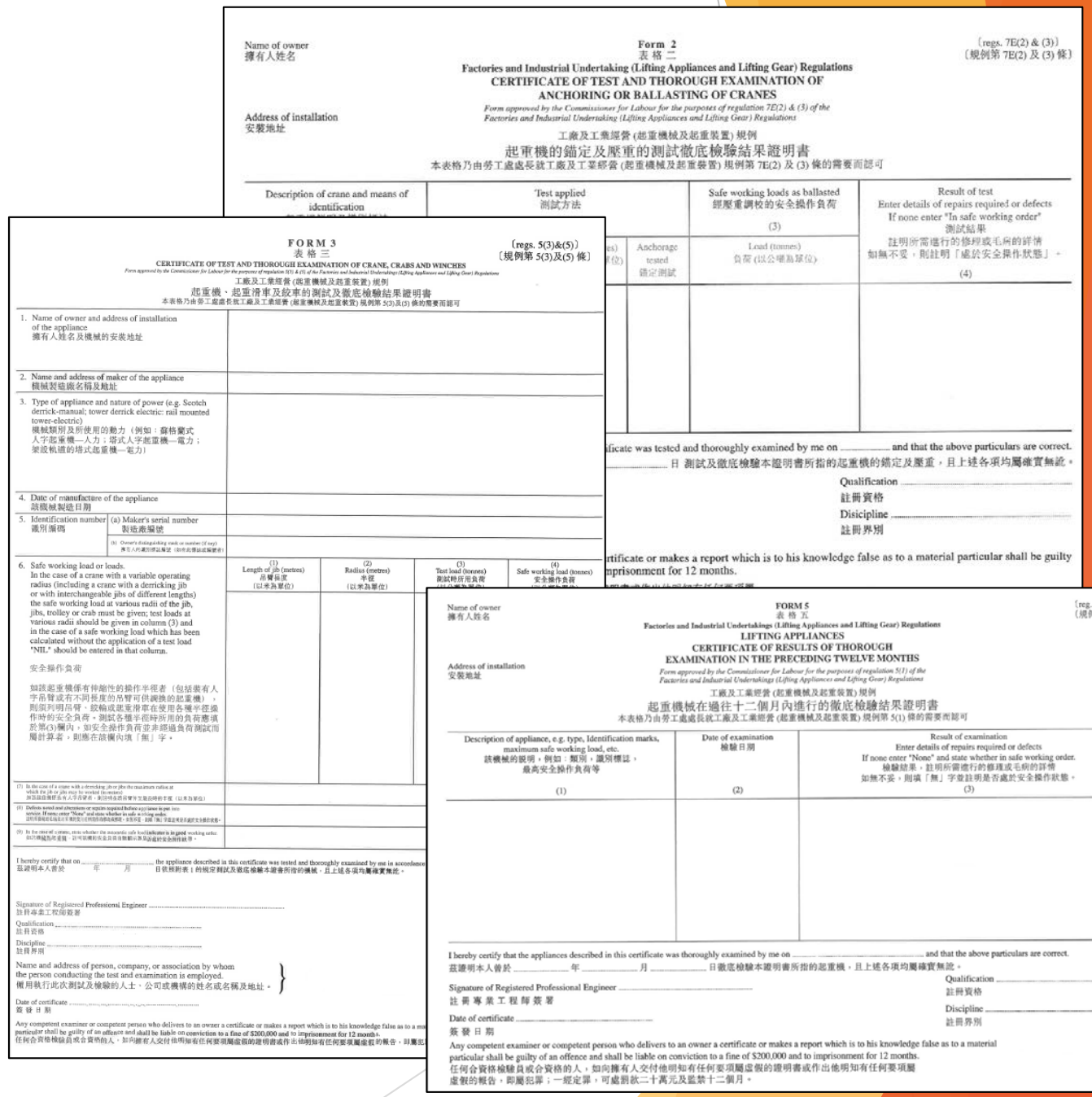
Red light with a continuous sound set at when load exceeds 100% SWL





Certification of tower crane

項目	表格編號(起重機械及裝置規例)						
	1	2	3	4	5	6	7
起重機	*		*		*		
設有錨定及壓重裝置的起重機	*	☆	☆		☆		
絞車、起重滑車	*		*		*		
滑輪組、吊重輪、腳架起重機、打樁機、拔樁機、挖掘機、架空軌道、拉索挖機等等	*			*	*		
起重裝置						*	*
纖維纜索							*
周期	7天	架設後	4年 使用前或重大修理、重新架設、失靈、翻倒或倒塌後		12個月	使用前	6個月



Name of owner 擁有人姓名

Address of installation 安裝地址

Form 2 表格二

〔regs. 7E(2) & (3)〕〔規例第7E(2)及(3)條〕

Factories and Industrial Undertaking (Lifting Appliances and Lifting Gear) Regulations
CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF ANCHORING OR BALLASTING OF CRANES

Form approved by the Commissioner for Labour for the purposes of regulation 7E(2) & (3) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及起重裝置)規例
起重機的錨定及壓重的測試徹底檢驗結果證明書
本表格乃由勞工處處長就工廠及工業經營(起重機械及起重裝置)規例第7E(2)及(3)條的需要而認可

Description of crane and means of identification	Test applied 測試方法		Safe working loads as ballasted 經壓重調校的安全操作負荷 (3)	Result of test Enter details of repairs required or defects If none enter "In safe working order" 測試結果 註明所需進行的修理或毛病的詳情 如無不妥，則註明「處於安全操作狀態」。 (4)
	Anchorage tested 錨定測試	Load (tonnes) 負荷(以噸為單位)		

...ificate was tested and thoroughly examined by me on ..... and that the above particulars are correct.
..... 日 測試及徹底檢驗本證明書所指的起重機的錨定及壓重，且上述各項均屬確實無訛。

Qualification 註冊資格
Disicipline 註冊界別

...rtificate or makes a report which is to his knowledge false as to a material particular shall be guilty ...mprisonment for 12 months.

FORM 3 表格三

〔regs. 5(3)&(5)〕〔規例第5(3)及(5)條〕

CERTIFICATE OF TEST AND THOROUGH EXAMINATION OF CRANE, CRABS AND WINCHES

Form approved by the Commissioner for Labour for the purposes of regulation 5(3) & (5) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及起重裝置)規例
起重機、起重滑車及絞車的測試及徹底檢驗結果證明書
本表格乃由勞工處處長就工廠及工業經營(起重機械及起重裝置)規例第5(3)及(5)條的需要而認可

1. Name of owner and address of installation of the appliance 擁有人姓名及機械的安裝地址
2. Name and address of maker of the appliance 機械製造廠名稱及地址
3. Type of appliance and nature of power (e.g. Scotch derrick-manual; tower derrick electric: rail mounted tower-electric) 機械類別及所使用的動力（例如：蘇格蘭式人字起重機—人力；塔式人字起重機—電力；架設軌道的塔式起重機—電力）
4. Date of manufacture of the appliance 該機械製造日期
5. Identification number 識別編碼 (a) Maker's serial number 製造廠編號 (b) Owner's distinguishing mark or number (if any) 擁有人的識別標誌編號（如有）
6. Safe working load or loads. In the case of a crane with a variable operating radius (including a crane with a derricking jib or with interchangeable jibs of different lengths) the safe working load at various radii of the jib, jibs, trolley or crab must be given; test loads at various radii should be given in column (3) and in the case of a safe working load which has been calculated without the application of a test load "NIL" should be entered in that column.

安全操作負荷

如該起重機係有伸縮性的操作半徑者（包括裝有人字吊臂或有不同長度的吊臂可供調換的起重機），則須列明吊臂、絞輪或起重滑車在使用各種半徑操作時的安全負荷。測試各種半徑時所用的負荷應填於第(3)欄內，如安全操作負荷並非經過負荷測試而屬計算者，則應在該欄內填「無」字。

(1) Length of jib (metres) 吊臂長度 (以米為單位)	(2) Radius (metres) 半徑 (以米為單位)	(3) Test load (tonnes) 測試時所用負荷	(4) Safe working load (tonnes) 安全操作負荷

(7) In the case of a crane with a derricking jib or jibs the maximum radius at which the jib or jibs may be worked (in metres) 如該起重機裝有可人字吊臂者，則須列出該吊臂可予裝設的最大半徑（以米為單位）

(8) Defects noted and alterations or repairs required before a appliance is put into service. If none, enter "None" and state whether in safe working order. 須列明發現的缺陷以及須予進行使用前的修理或補換。如無可填「無」字，並須註明是否處於安全操作狀態。

(9) In the case of a crane, state whether the maximum safe load indicated is in gross working order. 如起重機屬為淨重值，註明裝載於安全負荷指標板上為毛重或淨重的安全操作載重。

I hereby certify that on ..... the appliance described in this certificate was tested and thoroughly examined by me in accordance
茲證明本人曾於 年 月 日依照附表1的規定測試及徹底檢驗本證書所指的機械，且上述各項均屬確實無訛。

Signature of Registered Professional Engineer .....
註冊專業工程師簽署

Qualification .....
註冊資格

Discipline .....
註冊界別

Name and address of person, company, or association by whom the person conducting the test and examination is employed.
僱用執行此次測試及檢驗的人士、公司或機構的姓名或名稱及地址。

Date of certificate .....
簽發日期

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a ma... particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 month...
任何合資格檢驗員或合資格的人，如向擁有人交付他明知有任何要項屬虛假的證明書或作出他明知有任何要項屬虛假的報告，即屬犯...

Name of owner 擁有人姓名

Address of installation 安裝地址

FORM 5 表格五

〔reg. 5(1)〕〔規例第5(1)條〕

Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations
LIFTING APPLIANCES
CERTIFICATE OF RESULTS OF THOROUGH EXAMINATION IN THE PRECEDING TWELVE MONTHS

Form approved by the Commissioner for Labour for the purposes of regulation 5(1) of the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations

工廠及工業經營(起重機械及起重裝置)規例
起重機械在過往十二個月內進行的徹底檢驗結果證明書
本表格乃由勞工處處長就工廠及工業經營(起重機械及起重裝置)規例第5(1)條的需要而認可

Description of appliance, e.g. type, Identification marks, maximum safe working load, etc. 該機械的說明，例如：類別，識別標誌，最高安全操作負荷等 (1)	Date of examination 檢驗日期 (2)	Result of examination Enter details of repairs required or defects If none enter "None" and state whether in safe working order. 檢驗結果，註明所需進行的修理或毛病的詳情 如無不妥，則填「無」字並註明是否處於安全操作狀態。 (3)

I hereby certify that the appliances described in this certificate was thoroughly examined by me on ..... and that the above particulars are correct.
茲證明本人曾於 年 月 日徹底檢驗本證明書所指的起重機，且上述各項均屬確實無訛。

Signature of Registered Professional Engineer .....
註冊專業工程師簽署

Qualification .....
註冊資格

Date of certificate .....
簽發日期

Discipline .....
註冊界別

Any competent examiner or competent person who delivers to an owner a certificate or makes a report which is to his knowledge false as to a material particular shall be guilty of an offence and shall be liable on conviction to a fine of $200,000 and to imprisonment for 12 months.
任何合資格檢驗員或合資格的人，如向擁有人交付他明知有任何要項屬虛假的證明書或作出他明知有任何要項屬虛假的報告，即屬犯罪；一經定罪，可處罰款二十萬元及監禁十二個月。

Thank you