

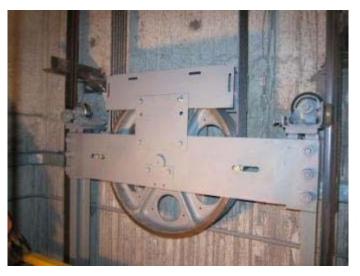
Lift Suspension System

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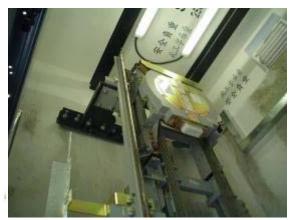
Visual Inspection for Lift Suspension System

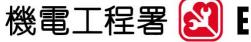
Suspension System:

- 1. Confirm the ratio between the pitch diameter of sheaves, or pulleys and diameter of suspension ropes shall be at least **40**
- 2. Confirm effective guard is provided to prevent ropes leaving the pulleys if there is(are) moving sheave(s) at car top and shall be designed such that it will not hinder the inspection of rope & sheave as well as it can avoid trapping of foreign objects.









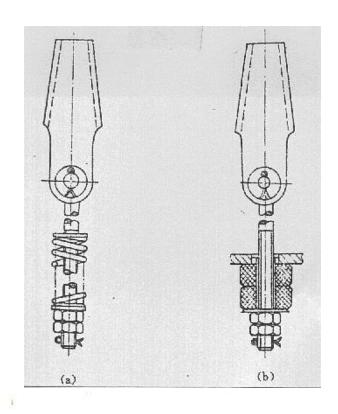


Lift Suspension System - Termination

Termination of Ropes

Rope Equalizing Gear

- For equalizing the tension of suspension ropes, at least at one of their ends, an automatic device shall be provided.
- Rope equalizing gear can also act as damping device to reduce car vibration.
- ➤ If springs are used to equalize the tension, they shall work in compression.
- Following shows 2 common types of equalizing gear, namely the spring type tension equalizer Fig.(a) and rubber type tension equalizer Fig.(b).





Lift Suspension System - Sheaves

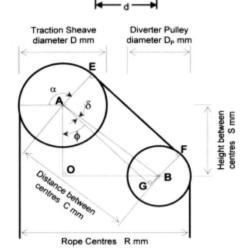
Determining factors for rope traction

Specific <u>pressure</u> between groove and rope is related to <u>the load</u> and <u>area of contact</u>, dependent upon the <u>groove shape</u> and the extent of any <u>undercut</u>

Fraction of rope/groove diameter

- > d= groove diameter
- ➤ w = undercut in the groove

Angle of wrap of the rope



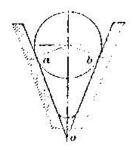


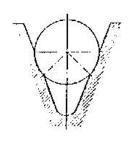
Undercut U-groove

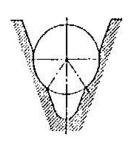
Plain U-groove

Undercut V-groove

Lift Suspension System – Sheave in V Groove



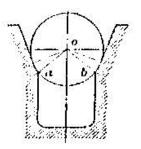


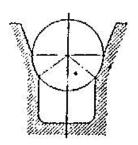


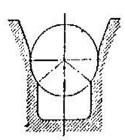
- Advantage :
 - Lesser the angle of $\,\mathrm{V}\,$, higher the traction force
- Disadvantage:
 - Higher vibration and noise as suspension ropes entering to and departing from the traction sheave
- Application :
 - Suitable for low speed lift with rated speed at or below 1.75 m/s



Lift Suspension System – Sheave Undercut U Groove







• Advantage :

- Suitable for higher rated load
- Vibration and noise can be reduced as suspension ropes entering to and departing from the traction sheave

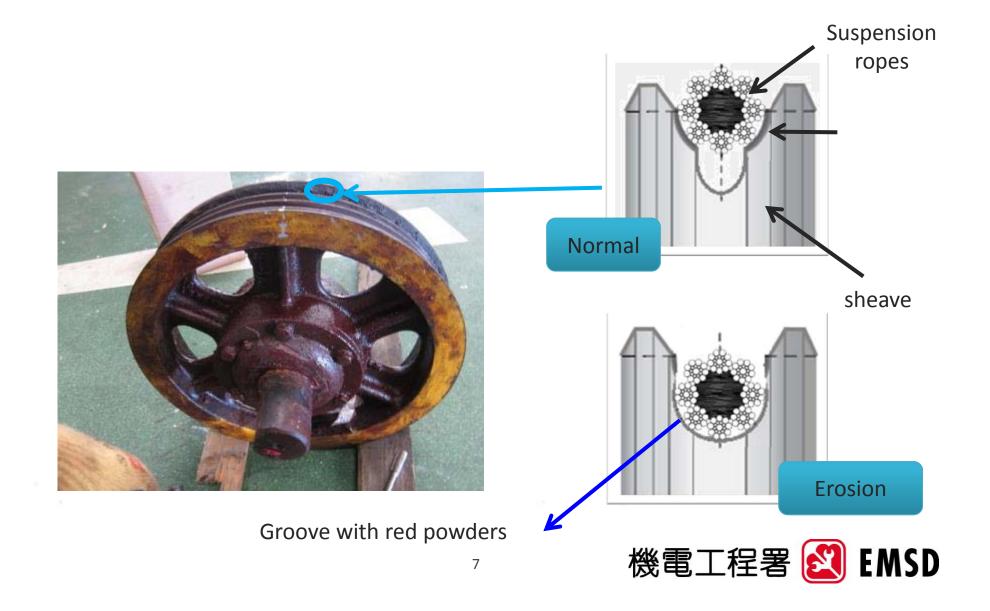
• Disadvantage:

Lower traction force

• Application :

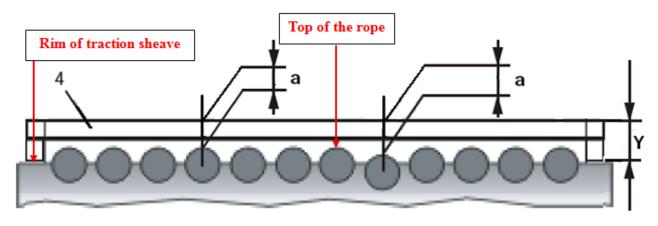
- Application for rated speed at or above 2.0 m/s

Lift Suspension System - Sheave



Lift Suspension System - Sheave





Lift Suspension System - Sheave

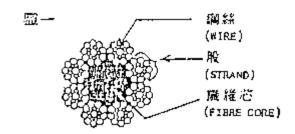
檢查纜轆坑槽高低 △a:

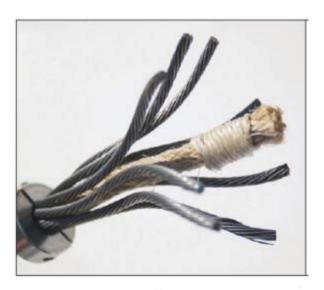
| 行車纜轆坑全部的數目,包括不被使用的在其編號之下劃上「X」。 | |
|--|---|
| agraightarrow $ agraightarrow$ $ ag$ |) |

Y = 20 mm

| 纜轆坑槽 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---------------|------|------|------|------|---|---|---|---|---|
| a (mm) | 25.4 | 25.3 | 25.6 | 25.3 | | | | | |
| Y-a(mm) | 5.4 | 5.3 | 5.6 | 5.3 | | | | | |
| 行車纜直徑 | 12.0 | 11.9 | 12.0 | 11.8 | | | | | |
| 纜生銹程度 | No | No | No | No | | | | | |
| 纜斷支程度 | 0 | 0 | 0 | 0 | | | | | |

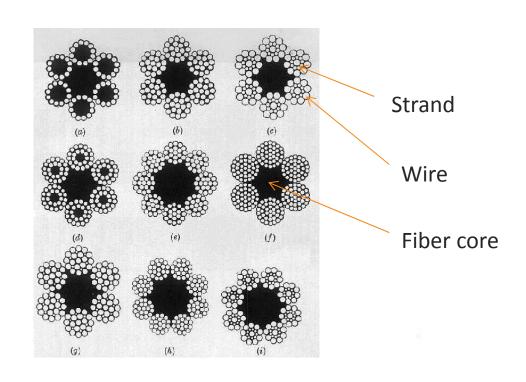
- Stranded Steel Wire Rope:
 - An assembly of strands laid helically in one layer around a core





Rope Types and Specification

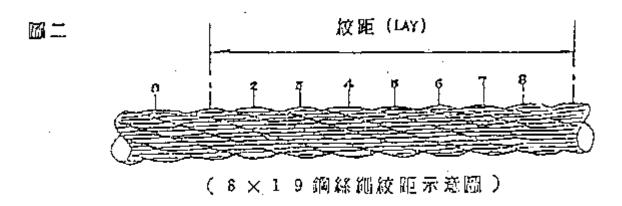
- Popular lift rope constructions They are round stranded with 6 or 8 strands. The most popular suspension ropes are 6x19 Filler, 6x19 and 8x19 Seale.
- Some round stranded rope sections for lifts are illustrated in the figures below:
 - (a) 6 x 12 and fibre
 - (b) 6 x 19
 - (c) 6 x 19 Seale (9/9/1)
 - (d) 6 x 24
 - (e) 8 x 19
 - (f) 6 x 37
 - (g) 6×19 with fillers (12/6/1)
 - (h) 8×19 with fillers (12/6/1)
 - (i) 8 x 19 Seale (9/9/1)





• Strand lay length:

 To measure one rope lay, mark a spot on one strand, then with a finger, trace that strand along one complete wrap around the rope, then make another mark on the same strand. This distance between the marks is one rope lay (normally 6.5 times of rope diameter)



• Ordinary lay:

 Stranded rope in which the direction of lay of the wires in the outer strands is in the <u>opposition</u> direction to the lay of the outer strands in the rope.



• Lang's lay:

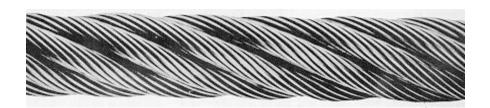
 Stranded rope in which the direction of lay of the wires in the outer strands is the <u>same</u> direction as that of the outer strands in the rope.

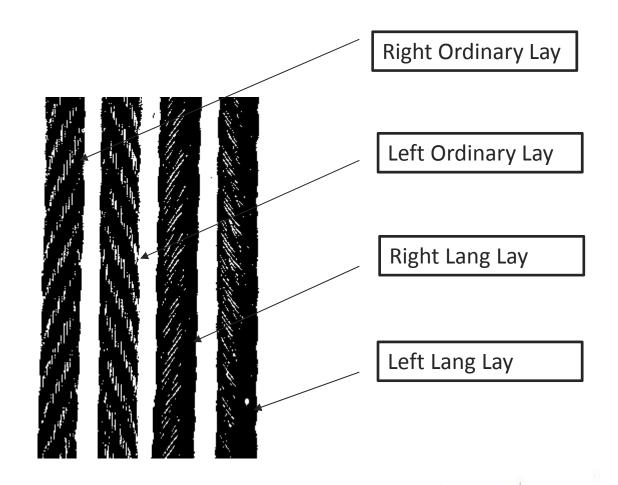


- Advantages for Ordinary lay:
 - Relatively high flexibility and long service life
- Disadvantages for Ordinary lay:
 - Wires easily loose out from the strands and cause unexpected nodes
 - Use small diameter of sheave if 12 mm rope is used



- Advantages for Lang lay:
 - Tight construction and avoid unexpected node
- Disadvantages for Lang lay:
 - Relatively low flexibility, easily cause broken wires and relatively short service life
 - Require larger diameter of sheave if 12 mm rope is used



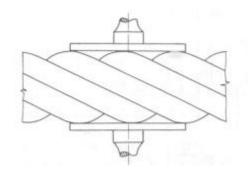


■ Measure the rope diameter



Rope Types and Specification

- Material High quality steel with:
 - Carbon contents 0.4% 1%
 - ➤ Phosphorus and sulphur contents less than 0.035% to restrict rope brittleness
- Size Usually ¼" (6mm) 7/8" (22mm) in terms of nominal diameter. The max. variation between any of the 4 measurements is less than 3% of the nominal rope diameter.



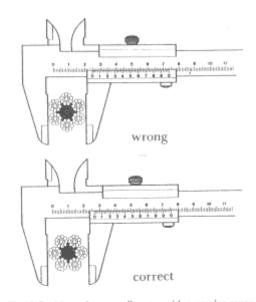
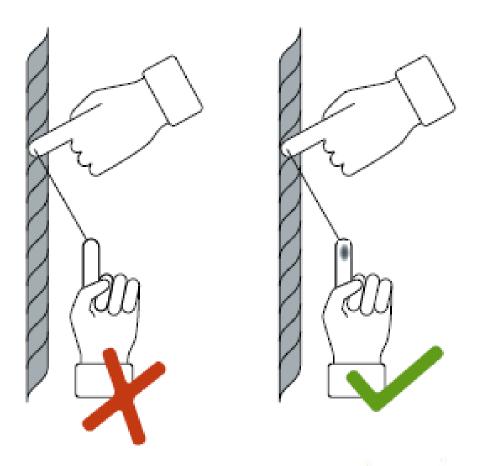


Fig. 2.7 - Measuring rope diameter with a vernier gauge.



Rope Types and Specification



Ropes Lubrication



Broken wires









Rusting





Lift Suspension System

Rusting





| | Rope Replacement Criteria | | | | | | |
|---|---|---|--|--|--|--|--|
| Rope Conditions | 6-strand x 19 rope | 8- or 9-strand x19 rope | | | | | |
| | 6-strand x 25 rope | 8- or 9-strand x 25 rope | | | | | |
| Reduction in diameter | 10% | 10% | | | | | |
| No. of broken wires randomly distributed among the outer strands | >24 per rope lay | >32 per rope lay | | | | | |
| No. of broken wires randomly distributed among the outer strands when severe rusting or extensive rouging of the rope is observed | >12 per rope lay | >16 per rope lay | | | | | |
| No. of broken wires concentrating in one or two outer strands | >12 per rope lay | >16 per rope lay | | | | | |
| No. of broken wires concentrating in one or two outer strands when severe rusting or extensive rouging of the rope is observed | >6 per rope lay | >8 per rope lay | | | | | |
| No. of adjacent broken wires in one outer strand | >4 and the no. of broken wires per rope lay >12 | >4 and the no. of broken wires per rope lay >16 | | | | | |
| No. of adjacent broken wires in one outer strand when severe rusting or extensive rouging of the rope is observed | >2 and the no. of broken wires per rope lay >6 | >2 and the no. of broken wires per rope lay >8 | | | | | |



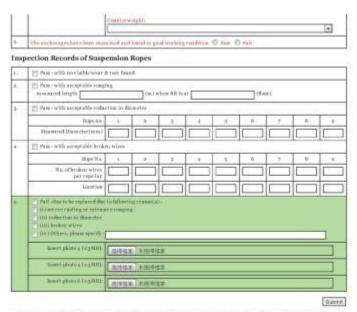


➤ Screening and sample checking are also arranged. Photos will be sample checked each month and site inspection will be arranged to verify the submission

- ➤ RC and RE should inspect and take records on the suspension system upon completion of new installation (including major alteration works involving ropes/sheaves replacement) and periodic examination.
- ➤ The Inspection Record Form for Suspension System should be completed and submitted within one month after completion of examination.
- For non-compliance found on suspension ropes and/or traction/deflection sheave, photos must also be provided with the Form.
- ➤ RC and RE are also required to keep photos of traction sheave, deflection sheaves, anchorages and suspension ropes of the lift suspension system for traceable record even if conditions of these components are within the acceptable range.
- In particular, photos should be taken for the portion of suspension ropes adjacent to drive sheave inside the lift machine room as the lift car is set to main floor and highest landing floor. Depending on site situation and the type of lift, the photos can also be taken from lift car top.



| | les: | U. No. | | Location ID: | | | Examination Date (DD/WM/TYYY) |
|-------------|---|---|-----------------|-------------------|---------------------|-----------|--|
| | | | | | | | The state of the s |
| N site | illattas Address: | | | | | | 188 86: |
| majo | et Na | | | Project Name | 7 | | L |
| _ | 01/41 | | | | | | |
| nfo | ermation of the S | uspensio | n Ropes | | | | |
| 15.19 | (ropes | - 1 | 75 PT | 1 | Wort | nal Sys | metry (new) |
| U-1 | e/Model: | | Certification | No | Dogra | Satism ! | Date (DD/MM/YVYY): |
| | | | - | | | - arred t | The Constitution of the Co |
| | ormation of the Tr | | rawse:- | | | | |
| 10.00 | | See See . | | | | | |
| Mich Min | Diameter of Deflection () | Share | | | | | |
| nsp | ection Records | of Tractic | on Sheave | and Deflect | tion Sheave | Elec | tric Lift Only) |
| i. | E Pass-with nevin | hile some fict | eur found af a | il sheaves | | | |
| | Pass - Yraction 9 Measured vectical dis | | | | | | mm (for deepest grown) |
| | Past - Deflection 5 | kerejo va | thirst absorb | al noise and tree | centioner. | | |
| - | Pail Traction She (i) bottoming of a (ii) failure of star | coloreut grac tion test will and criteria | ore h load | | ы бойрыінд тион | o(d)- | |
| | (iv) Others, pleas | 4000 | | | | | |
| | | coverto be independent and criticis a | ore: | | e to following rear | erio- | |
| | (iv) Others, pleas Parl Deflection M (i) bottoming of a (ii) reaching disc. | cave to be referent government and or live in a expectity: | ore: | duer | e to following rear | wito- | |
| | (iv) Others, plans (iv) Otherton 95 (ii) bottoming of a (ii) reaching disc. (iii) Others, plans | seave to be referred good and or tire is a a specify: | or Citi namb | States States | e to following reus | MIG- | |



* If photos are provided, the photos should be taken for the portion of suspendon report indirect denser inside the life machine room as the life correct consist. Good and displaced bendon flow. Depending on the structure and the type of life, the photos can also be taken when the concentred person is unabled as and tell flow rep.







1. When shall inspection record submit?

A: Within 1 month after completion of :

- New installation (Form LE5)
- Major Alteration (Form LE7)
- Periodic Examination (Form LE11)



2. What photo shall be recorded or submitted?

A: 6 photos including:

- Ropes when car at top floor
- Ropes when car at bottom floor
- Anchorage at lift car
- Anchorage at counterweight
- Traction sheave condition
- Deflection sheave condition



3. What type of lifts shall be submitted the record?

A: Lifts with suspension ropes are required to submit the record



4. Who should submit the record if it is not under maintenance of my company (e.g. hand-over, major alteration)?

A: Pass the inspection record to maintenance RC for submission.



| Inform | nation of the Traction Sheave:- | |
|----------|--|---|
| | | |
| Pitch Di | ameter of Traction Sheave (mm) | |
| | | |
| Pitch Di | ameter of Deflection She ye (mm) | Please input 0.0 if Deflection Sheave is not available |
| | | |
| | u n n n n n n n n n n n n n n n n n n n | |
| Inspec | ction Records of Traction Stea | ve and Deflection Sheave (Electric Lift Only): |
| | | |
| 1. | Pass - with no visible wear & tea. found | d of all X yeaves |
| 2. | Pass – Traction Sheave with wear& tea | ar Aithin rang |
| | | the rope is the rim: (the Traction Sheave mm (for deepest groove) |
| 3. | Pass - Deflection Sheave(s) without abo | normal noise and unexen war |
| 4. | | |

Measure outer diameter of sheaves



| Infor | Information of the Traction Sheave:- | | | | | | | | | |
|--|--|------------------------|--|--|--|--|--|--|--|--|
| Pitch Diameter of Traction Sheave (mm) | | neave (mm) | | | | | | | | |
| Pitch Diameter of Deflection Sheave (mm) | | | Please input o.o if Deflection Sheave is not available | | | | | | | |
| Inspe | Inspection Records of Traction Sheave and Deflection Sheave (Electric Lift Only): | | | | | | | | | |
| 1. | Pass - with no | sible wear & tear four | nd of all sheaves | | | | | | | |
| 2. Pass - Traction Sheave with wear& tear within range Measured vertical distance from the top of the rope to the rim of the Traction Sheave mm (for deepest groove) | | | | | | | | | | |
| 3. | Pass - Deflection | Sheave(s) without al | onormal noise and uneven wear | | | | | | | |
| 4. | Fail Traction Sh | ave - to be regro | oved replaced due to following reason(s):- | | | | | | | |

- For no deflection sheave → put "0.0"
- For more than 1 deflection sheave → record the sheave above the counterweight



| | Enhancement: | | | | | | | | |
|-------|--|---|--|--|--|--|--|--|--|
| Inf | ormation of the Traction She | eave:- | | | | | | | |
| Pitch | n Diameter of Traction Sheave (mm) | | | | | | | | |
| Pitch | n Diameter of Deflection Sheave (mn | Please input o.o if Deflection Sheave is not available | | | | | | | |
| Insp | nspection Records of Traction Sheave and Deflection Sheave (Electric Life Only): | | | | | | | | |
| 1. | Pass - with no visible wear & | t tear found of all sheaves | | | | | | | |
| 2. | Pass – Traction Sheave with Measured vertical distance from | n wear& tear within range in the top of the rope to the rim of the Traction Sheave mm (for deepest groove) | | | | | | | |
| 3. | Pass - Deflection Sheave(s) v | vithout abnormal noise and uneven wear | | | | | | | |
| 4. | Fail Traction Sheave - to be | regrooved replaced due to following rason(s):- | | | | | | | |
| | | Proposal: If for deflection sheave is not | | | | | | | |
| | | vailable | | | | | | | |

Inspection Records of Traction Sheave and Deflection Sheave (Electric Lift Only):

| 17 | | |
|----|---|----|
| 1. | Ass - with no visible wear & tear found of all sheaves | |
| 2. | Pals - Traction Sheave with wear& tear within range Measured vertical distance from the top of the rope to the rim of the Traction Sheave mm (for deepest groove) | |
| 3. | Pass - Deflection Sheave(s) without abnormal noise and uneven wear | |
| 4- | Fail Traction Sheave - to be regrooved replaced due to following reason(s):- (i) be toming of undercut groove (ii) failure of traction test with load reaching discard criteria of lift manufacturer (iv) Others, please specify: | |
| 5- | Fail Deflection Sheave- to be regrooved replaced due to following reason(s):- (i) bottoming of undercut groove (ii) reaching discard criteria of lift manufacturer (iii) Others, please specify: | |
| | Insert photo 1 (≤3MB): | 瀏覽 |
| | Insert photo 2 (≤3MB): | 沙莲 |
| | Insert photo 3 (≤3MB): | 瀏覽 |

For any PASS case(s),

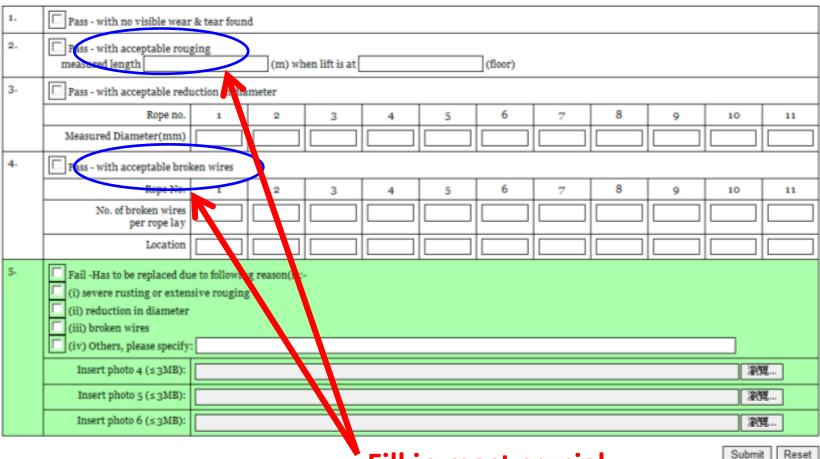
- **☑** 1. or
- ☑ both 2. & 3.

For any FAIL case,

 ■ 4. or 5. and insert
 photos



Inspection Records of Suspension Ropes:



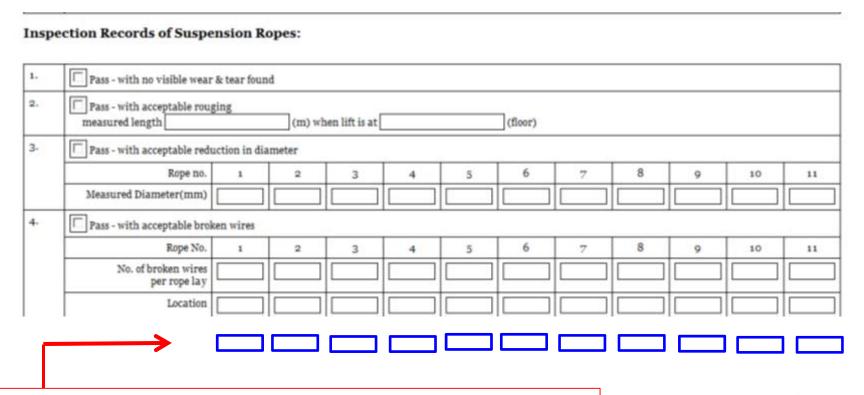
Fill in most crucial condition

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| hancement: | Proposa | | | | | | , , | | |
|--|--------------------------------------|------------------------------|--------|-----------------|----|---|-------------|-----------|-----|
| | observe | ılated mo ed at | | d len por(s) | _ | | <u>(m)</u> | <u>),</u> | |
| Inspection Records of | Suspension Ropes: | | | | | | | | |
| Pass - with no visi Pass - with accept measured length | able rouging | i) when lift is at | | (floor) | | | | | |
| 3- Pass - with accept | able reduction in diameter | 3 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 4- Pass - with accept | able broken wires | | | | | | | | |
| No. of broke per i | ope No. 1 2 n wires ope lay ocation | 3 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| | Pr M wi | oposal 2 ax. no. o res per r | f brok | | 機電 | | · 程 記 | m (| EMS |

Enhancement:



Proposal 3:

Other locations with broken wires observed



FAQ of Inspection Record Submission - Reminder

5. Who will receive a reminder?

A: The RE and RC in accordance to the last Form LE11 submitted with outstanding submission.

(Remark: All hydraulic lifts & vertical lifting platforms without suspension ropes, lifts hoisting with belts, etc., are withdrawn from the database)

Enhancement:

Add Enquiry Function

| Location ID | Lift Code | RC no. | RC name | RLE no. | RLE Name | Form LE11 submission Date | Submission of suspension rope inspection record: |
|----------------|--------------|----------|------------|----------|-------------|---------------------------|--|
| 1234567 | 001 | RLC12345 | ABC | RLC12345 | DEF | 23/04/2014 | <u>No</u> |
| | | | | | | | |
| | | | | | | | |



~ End ~

Thank You