SHIP CRANES / WIRES PROBLEMS AND THEIR PREVENTION

Presented by

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INTRODUCTION

- Types of Crane – Offshore / Marine
- Statutory Requirements – LOLER / Chain Register
- Qualification of Crane Drivers
- Typical Problems with Crane Wires
- Typical Problems with Control Systems
- Typical Problems with Mechanical Components
- Structural Damage
- Maintenance & Inspection
- Bulk Carrier Grabs
- Summary

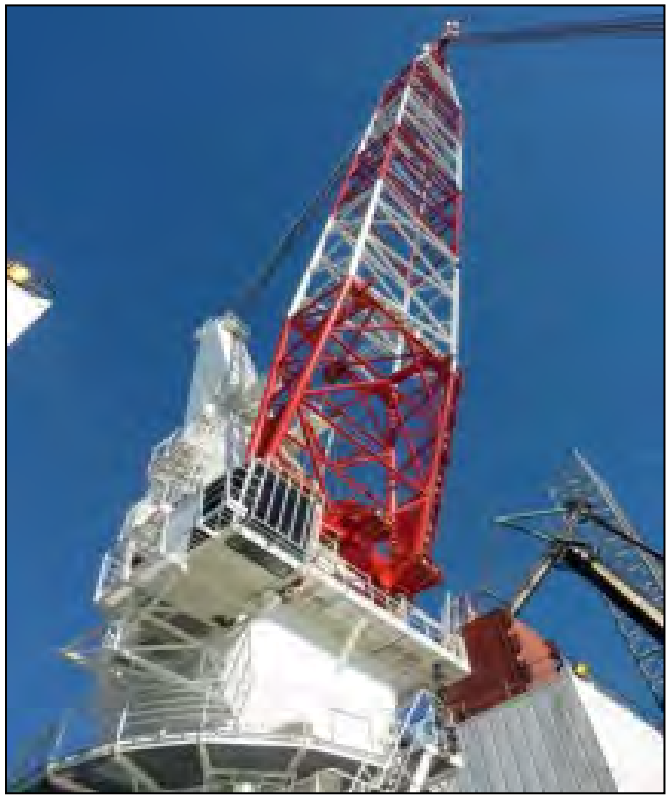
TYPES OF CRANES - OFFSHORE

Knuckle Boom Cranes

Shear Leg / Floating Crane

TYPES OF CRANES - OFFSHORE

Boom Hoist Crane



Pedestal Mounted Crane

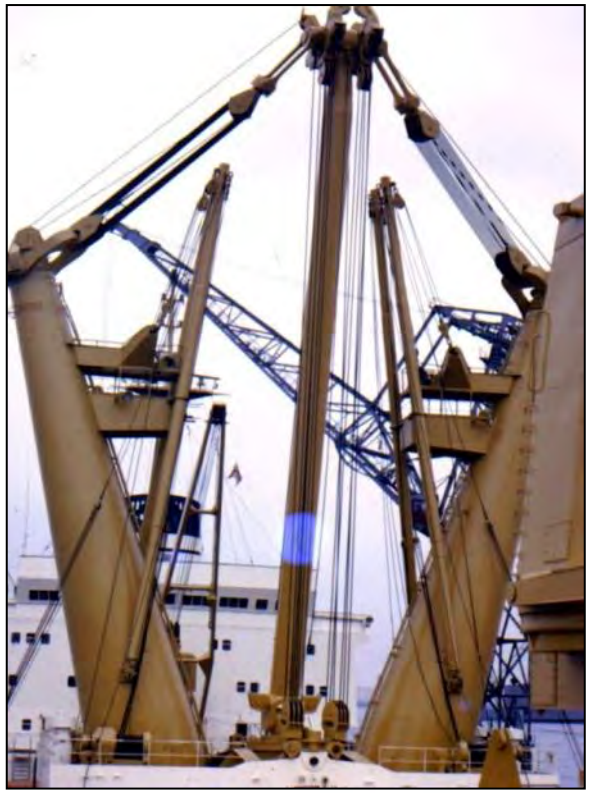
TYPES OF CRANES - MARINE

Older systems but still around

Union Purchase Derricks

Hallen/Velles Derrick

Stulken Derrick



TYPES OF CRANES - MARINE

Common crane systems

Pedestal Crane

Pedestal Cranes operating in tandem

TYPES OF CRANES - MARINE

Pedestal Heavy Lift Cranes

Gantry Crane

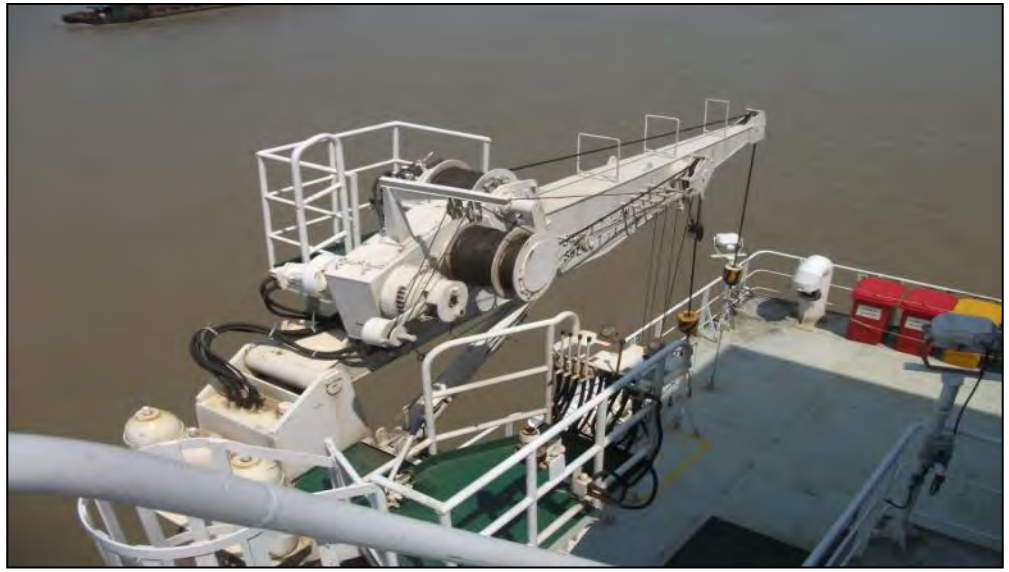
TYPES OF CRANES - MARINE

Geared container ships

Gantry Cranes

TYPES OF CRANES - MARINE

Stores / Provisions Cranes



Engine Room Gantry Crane

STATUTORY REQUIREMENTS – LOLER / Chain Register

- **No Internationally agreed Statutory Requirements**
- **IMO will soon introduce a SOLAS Convention for lifting appliances, loose gear and winches etc.**
- **International ISO Standards within the Industry:-**

ISO 12480-1 - General Safe Use of Cranes

STATUTORY REQUIREMENTS – LOLER / Chain Register

- **For Test & Inspection Requirements:-**

ISO 4309 – Wire Ropes, Care & Maintenance

ISO 4310 – Tests, Inspections & Procedures

ISO 7363 – Technical Characteristics & Docs

ISO 9927-1 – Cranes Inspections Part 1 General

ISO 12482-1 – Cranes: Condition Monitoring

EN 13852 – Offshore Cranes: General Purpose

STATUTORY REQUIREMENTS – LOLER

- **LOLER – Lifting Operations & Lifting Equipment Regulations (UK)**

Covers cranes, wires, loose gear

Adopted worldwide for the Offshore Industry

Providing a set standard throughout

Every area of the crane operation, maintenance, test, inspection etc. captured

Correct record keeping

Qualified Competent persons / companies

Crane driver qualifications

STATUTORY REQUIREMENTS – Chain Register (or equivalent)

- **Chain Register / Certificate File / Planned Maintenance System (PMS)**

  Entries in Register of Ship's Cargo Gear and Lifting Appliances

  Wire Ropes and Loose Gear to be Certificated

  Annual Survey (Ship's staff / competent person / Class)

  Thorough Survey and Load Test Every 4 or 5 Years

  Record Repairs, Renewal of Wires etc. (PMS)

QUALIFICATION OF CRANE DRIVERS

- **Offshore Qualifications:-**

Stage 1 – Novice Operator (deck lifting ops only)

Stage 2 – Advanced Operator (dynamic lifting “over the side”) lifting

Stage 3 – Re-assessment by qualified assessor for continuing competency

QUALIFICATION OF CRANE DRIVERS

- **Offshore Qualifications**

sparrows
TRAINING

This is to certify that

has successfully completed

OFFSHORE CRANE OPERATOR STAGE 2 TRAINING
ABILITY TO CARRY OUT DECK LIFTS ONLY UNSUPERVISED
SUBJECT TO FURTHER ONBOARD CRANE FAMILIARISATION

JIM DAVIDSON	28.11.11 – 02.12.11	18169
INSTRUCTOR & or ASSESSOR	DATE	CERTIFICATE NUMBER

AUTHORISED SIGNATORY
ISSUED BY SPARROWS TRAINING

IN ACCORDANCE WITH BS.7121 PART 11 RE-ASSESSMENT DUE BY 27.11.13 UNLESS SUPERCEDED BY STAGE 3 ASSESSMENT IN THE INTERIM PERIOD

SQA Approved Centre

BSI
IMR 506024

sparrows raising standards

QUALIFICATION OF CRANE DRIVERS

- **Marine Qualifications:-**

  Training is dependent on the financial ability of a Port

  Bulk Carriers often load / discharge in remote locations:-

  Surigao, Philippines

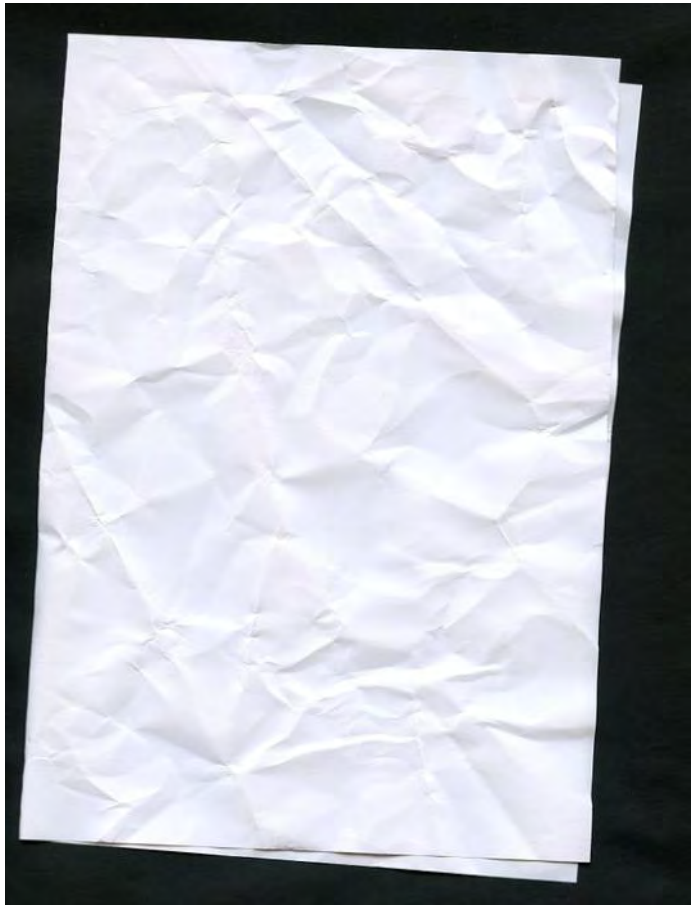
  Manaus, Brazil (Amazon)

  Haiphong, Vietnam

  Surabaya, Indonesia

QUALIFICATION OF CRANE DRIVERS

- Marine Qualifications



TYPICAL PROBLEMS WITH CRANE WIRES

Wire Rope Failure or Damage

- Distortion of Strands
- Flattening of Some of the Outer wires by Abrasion
- Broken Wires
- Corrosion
- Lack of lubrication

TYPICAL PROBLEMS WITH CRANE WIRES

Discarding Wire Ropes (ISO 4309 – Wire Ropes, Care & Maintenance)

- In general a wire rope should be discarded when the following characteristic are present:-

- Wear & tear beyond 10% of the original diameter
- Significant build-up of corrosion
- Abrasion
- Fatigue Breaks / Valley Breaks
- Crushing & Crossover Damage
- Waviness
- Bird Cage – Basket Deformation Develops

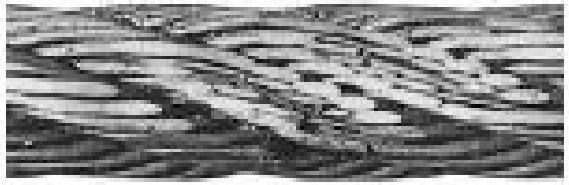
TYPICAL PROBLEMS WITH CRANE WIRES

Discarding Wire Ropes (ISO 4309 – Wire Ropes, Care & Maintenance)

- In general a wire rope should be discarded when the following characteristic are present:-

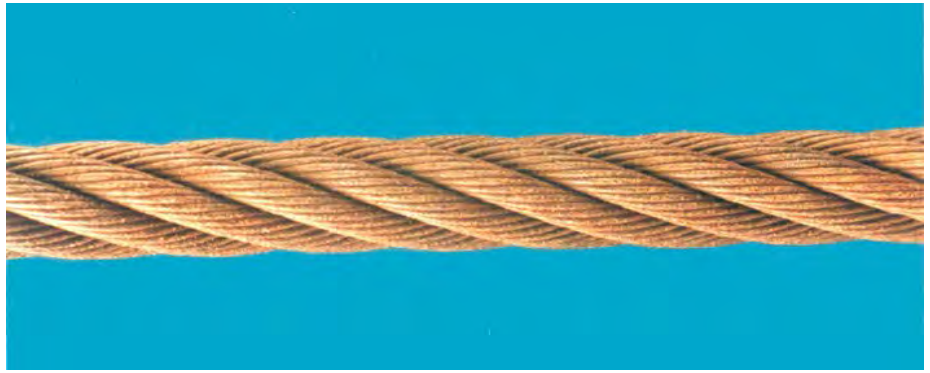
- Loops
- Loosening of individual wires or strands
- Nodes
- Thinning
- Formation of Kinks
- Flat Areas

TYPICAL PROBLEMS WITH CRANE WIRES



Abrasion

- Common problem with wires
- Normal wear and tear
- If more than 10% loss in nominal diameter replace wire
- Lack of lubrication



Corrosion

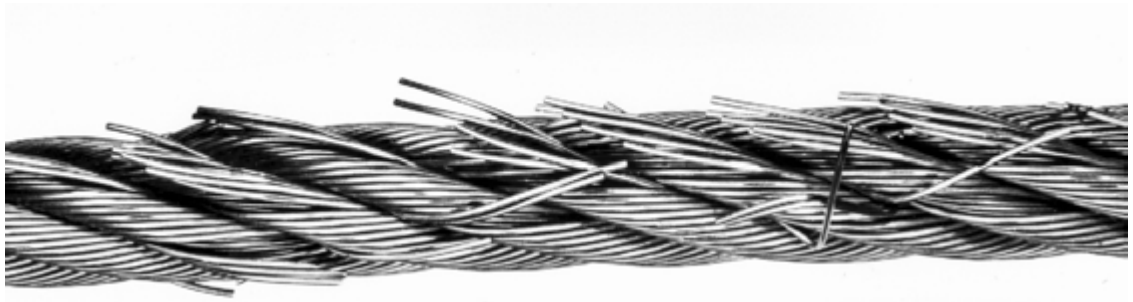
- Common problem with wires
- Lack of lubrication
- Will reduce strength of wire by reducing it’s metallic cross section
- Fatigue will be accelerated

TYPICAL PROBLEMS WITH CRANE WIRES

Wire Rope with Fatigue Breaks

- Repetitive bending over a sheave.
- Fatigue develops on surface in direct contact with sheave or drum.
- This contact phenomena compounds fluctuating bending stresses.

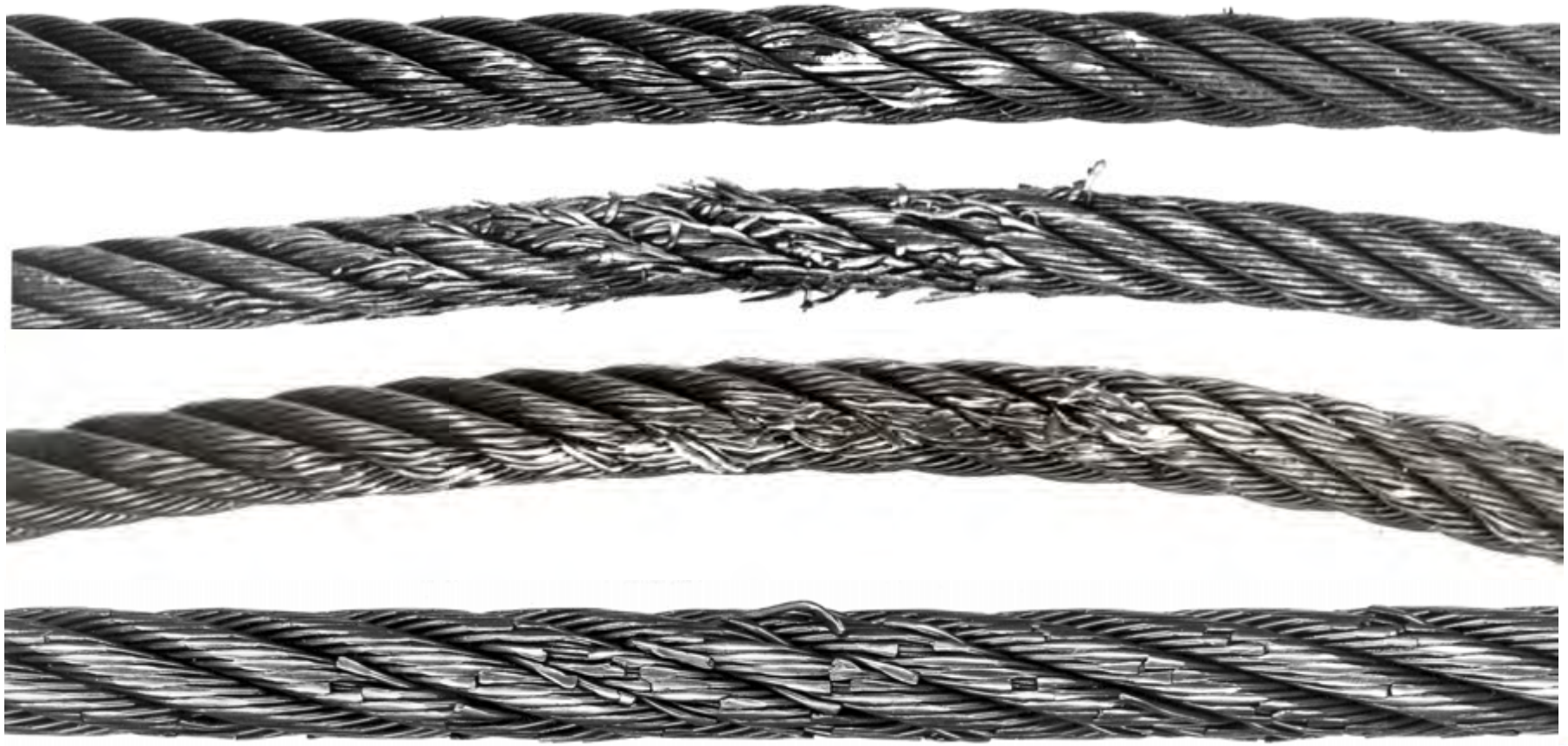
Valley Breaks (fatigue breaks)



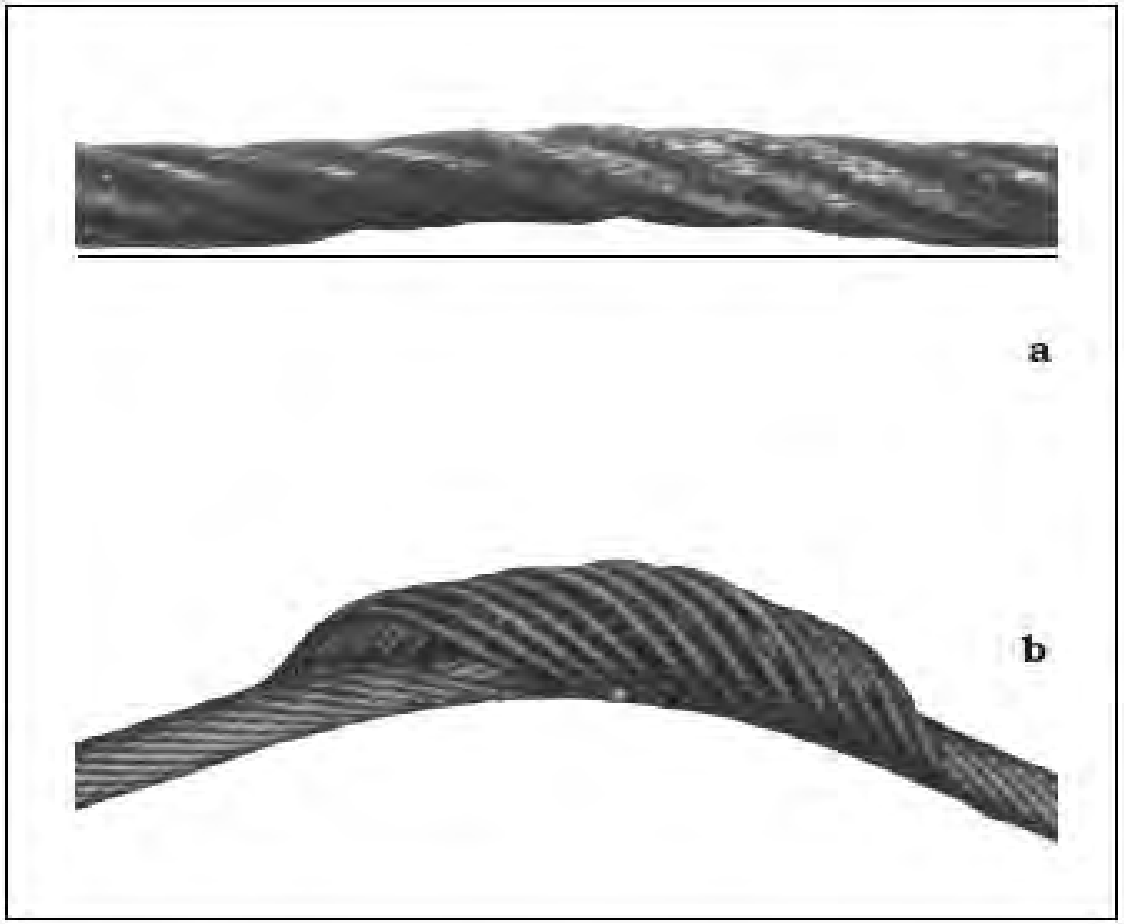
- Fatigue breaks in the wires
- Fatigue breaks develop in the valleys between the outer strands
- Results in secondary bending stresses
- Large diameter sheaves and high factors of safety

TYPICAL PROBLEMS WITH CRANE WIRES

Rope damage caused Crushing and Crossover on Drums



TYPICAL PROBLEMS WITH CRANE WIRES



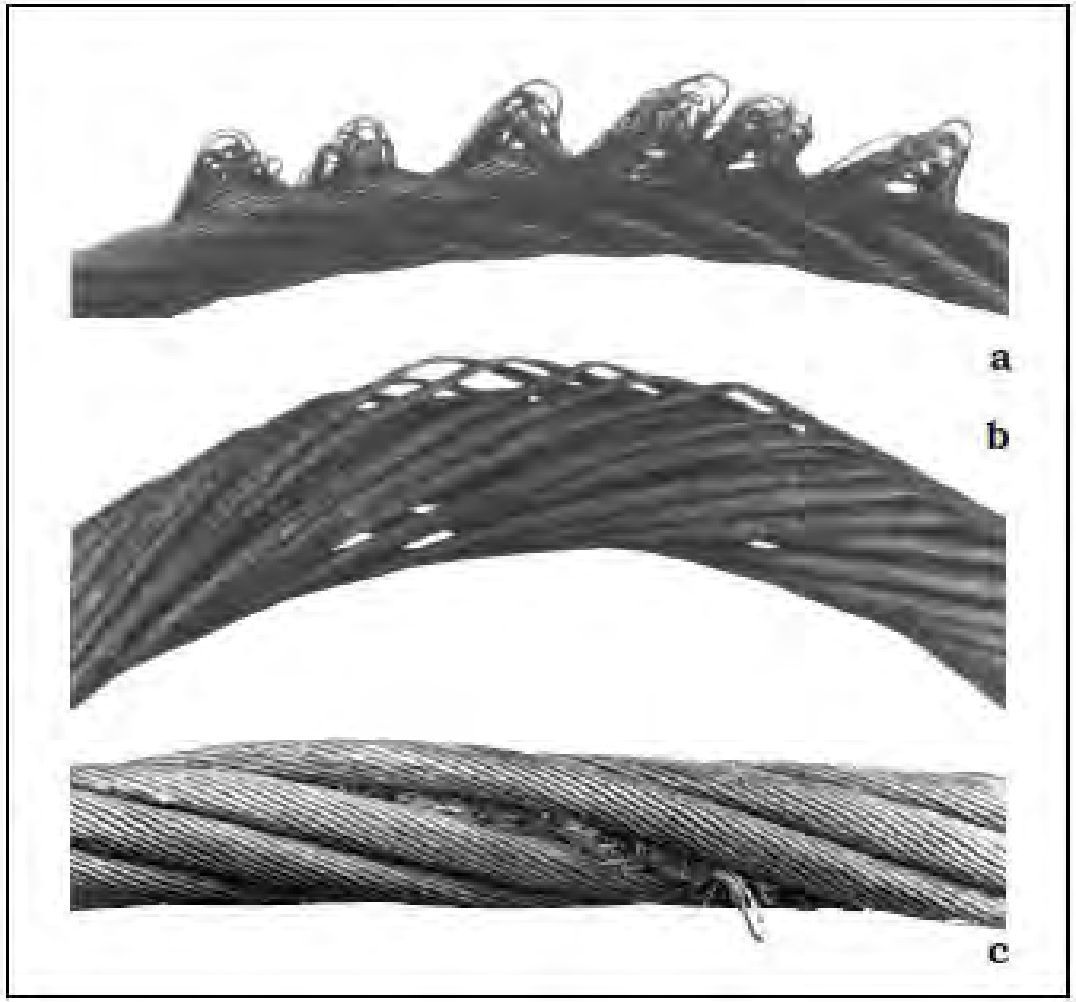
a) WAVINESS

- May not affect the strength of the rope.
- But under no load the max. wave should not be greater than the dia. + 1/3

b) BASKET / BIRDCAGE

- Basket deformation develops when the outer layer becomes longer than the inner layer core.

TYPICAL PROBLEMS WITH CRANE WIRES



a) LOOP

- Formations caused by shock loading

b) LOOSE WIRES

- If found without any adjacent mechanical damage, then corrosion can be the cause.
- If mechanical damage found then examine rope fully for further use.

c) NODES

- Increase in rope diameter , caused by shock loading

TYPICAL PROBLEMS WITH CRANE WIRES

a) THINNING

- Fibre core disintegrates
- Strand takes its place in areas of sustained heavy loads over the sheaves

b) KINKS

- Deformation caused by loop in a rope being twisted when a rope cannot rotate about it's axis to release the torque.

c) FLAT AREAS

- Caused by bending rope over sharp objects, rim of sheaves, underside of hatch coamings etc.

TYPICAL PROBLEMS WITH CRANE WIRES

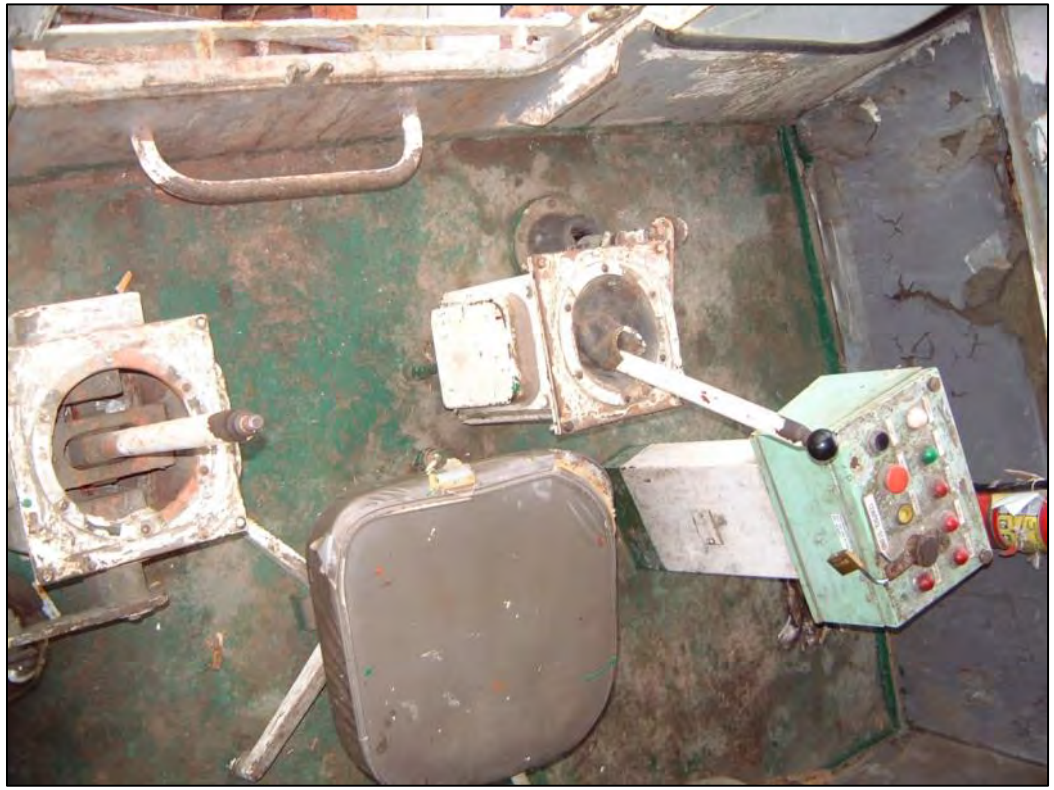
TYPICAL PROBLEMS WITH CONTROL SYSTEMS

Control System Problems

- Sticking or Damaged Control Levers
- Non function of limit switches
- Sticking hydraulic oil control valves due to dirty oil
- Earthing of electrical contactors and circuit boards due to condensation or water ingress

TYPICAL PROBLEMS WITH CONTROL SYSTEMS

Control Levers



Damaged Control Lever Units

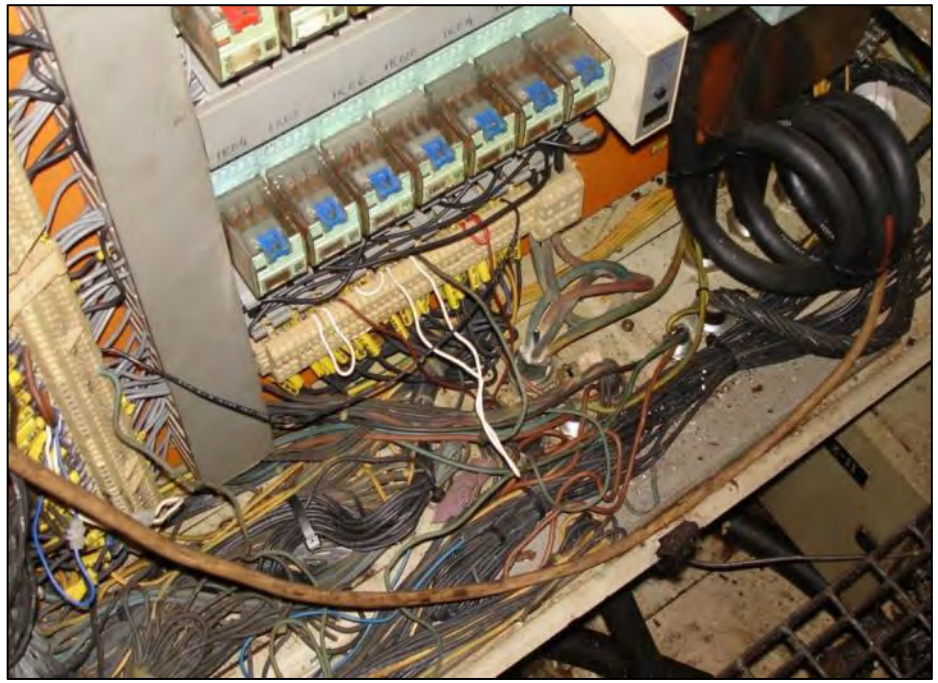
TYPICAL PROBLEMS WITH CONTROL SYSTEMS

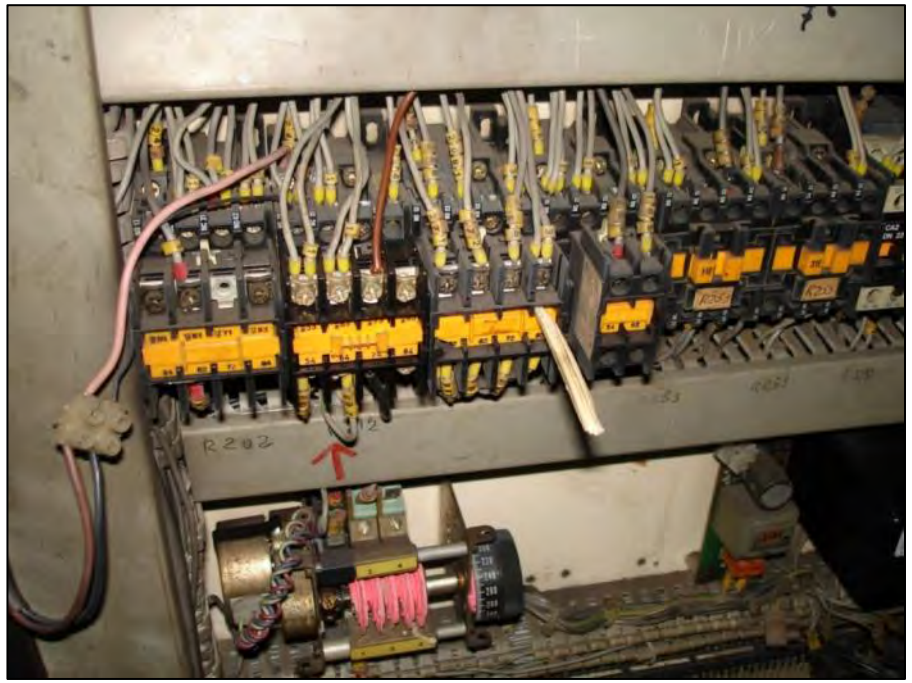
Control Panels

- Poor maintenance of panel
- Corrosion indicates water ingress
- Lack of spares

TYPICAL PROBLEMS CONTROL SYSTEMS

Control Panels / Boxes

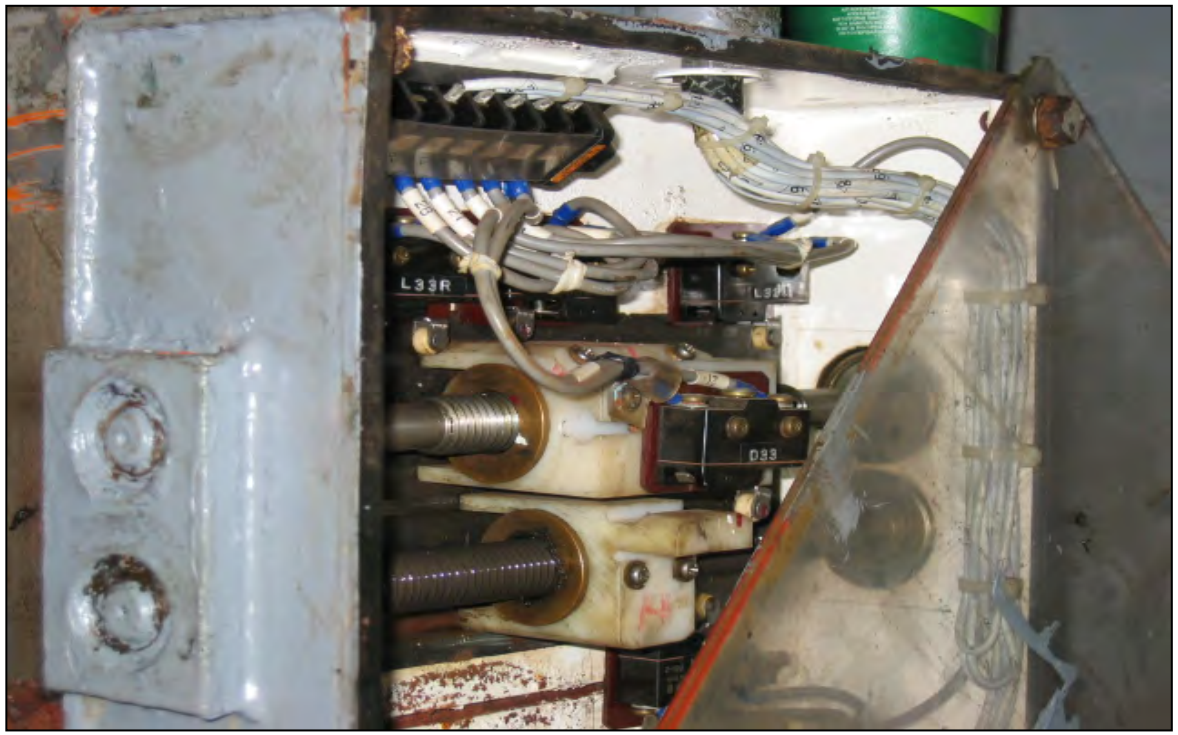




- Water or Dampness can cause electrical faults
- Recommended to fit a space heat to avoid condensation where possible
- Short cuts are dangerous

TYPICAL PROBLEMS WITH CONTROL SYSTEMS

Limit Switches



- Damaged Limit Control Unit

- Slack Wire Limit Coated in Grease

TYPICAL PROBLEMS CONTROL SYSTEMS

Limit Switches

- Full/empty drum roller may wear, resulting in limit not operating.

- Limit Switch By-Pass

TYPICAL PROBLEMS CONTROL SYSTEMS

Limit Switches

- Limit Switch By-Pass secured by a lock

TYPICAL PROBLEMS WITH CONTROL SYSTEMS

Hydraulic Oil

- Oil is neglected.
- Condensation can cause problems.
- Water in system caused corrosion.
- Dirt in hydraulic oil - control valves to stick / jam.
- If emulsion is formed,
- Crane can be slow to operate.
- Can cause intermittent problems.

TYPICAL PROBLEMS WITH CONTROL SYSTEMS

Hydraulic Oil

- Blocked oil cooler.
- Oil will over heat.
- System will go into alarm
- Will cause intermittent problems

Have the oil regularly analysed (at least every 3 months)

TYPICAL PROBLEMS WITH MECHANICAL COMPONENTS

Mechanical Components

- Brakes
- Slewing Bearing Ring
- Hydraulic motors
- Gears

TYPICAL PROBLEMS WITH MECHANICAL COMPONENTS

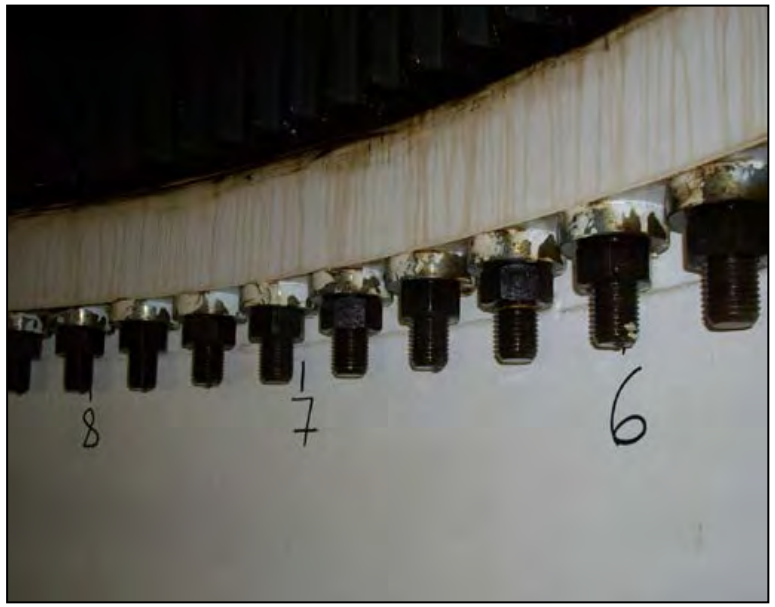
Brakes

Brakes are spring loaded & should hold crane in fixed position when:-

- Loss of hydraulic pressure
- Loss of electrical power
- Limit is reached
- Slack wire occurrence (lowering)
- Overload during hoisting

TYPICAL PROBLEMS WITH MECHANICAL COMPONENTS

Wear on Slew Bearing & Bolt Integrity

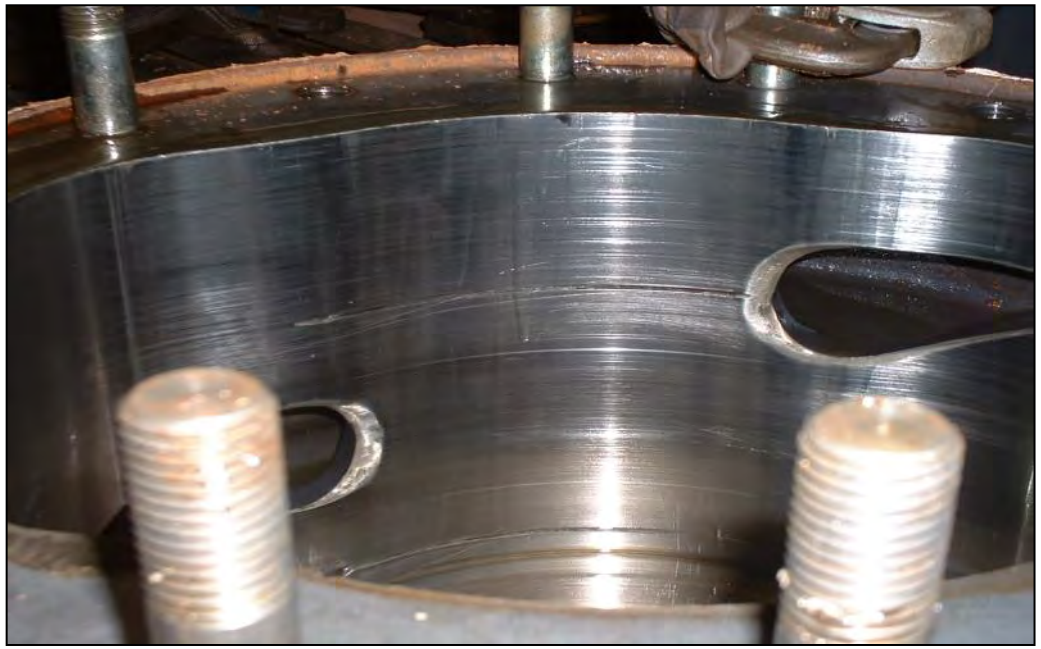


- Measure wear of slew bearing (Rocking Test)
- Bolts to be checked for tightness using torque wrench
- Grease samples to be taken for metallic content

- Undetected excessive wear can result in crane loss & serious injury to personnel

TYPICAL PROBLEMS WITH MECHANICAL COMPONENTS

Damage to Hydraulic Motor



Surface scored by abrasive particles on inside of hydraulic motor

- Dirty hydraulic oil
- Component breakdown

TYPICAL PROBLEMS WITH MECHANICAL COMPONENTS

Gearbox Failure

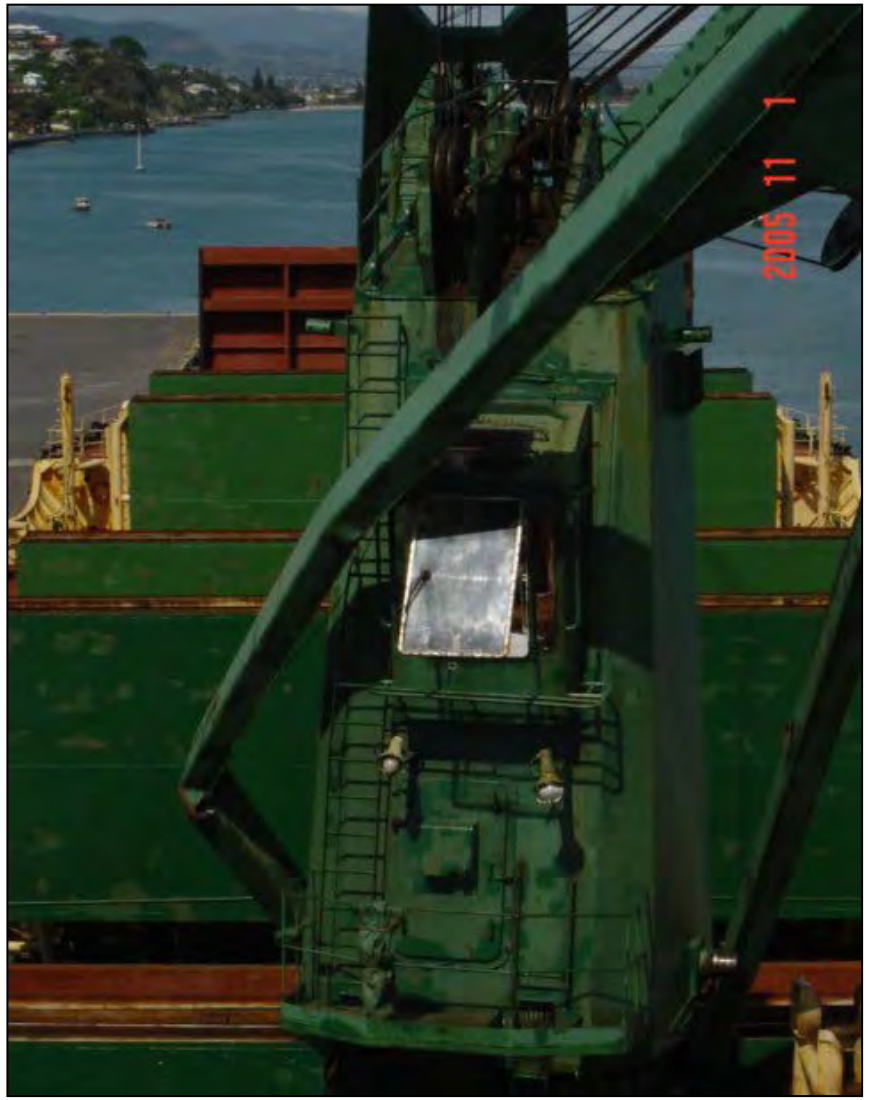
- Poor maintenance regime
- Lack of lubrication
- Component failure
- Particles within the grease

STRUCTURE DAMAGE

Structural Damage

- Jib Damage
- Crane housing / turret damage

STRUCTURAL FAILURE



Jib Damage

- Failure due to detached port heel bearing pin and retaining bolts

STRUCTURAL FAILURE

Jib Damage

- Miss-use of limit switch by stevedore

- Failure of the luffing wire

STRUCTURAL FAILURE

Crane Turret Collapse

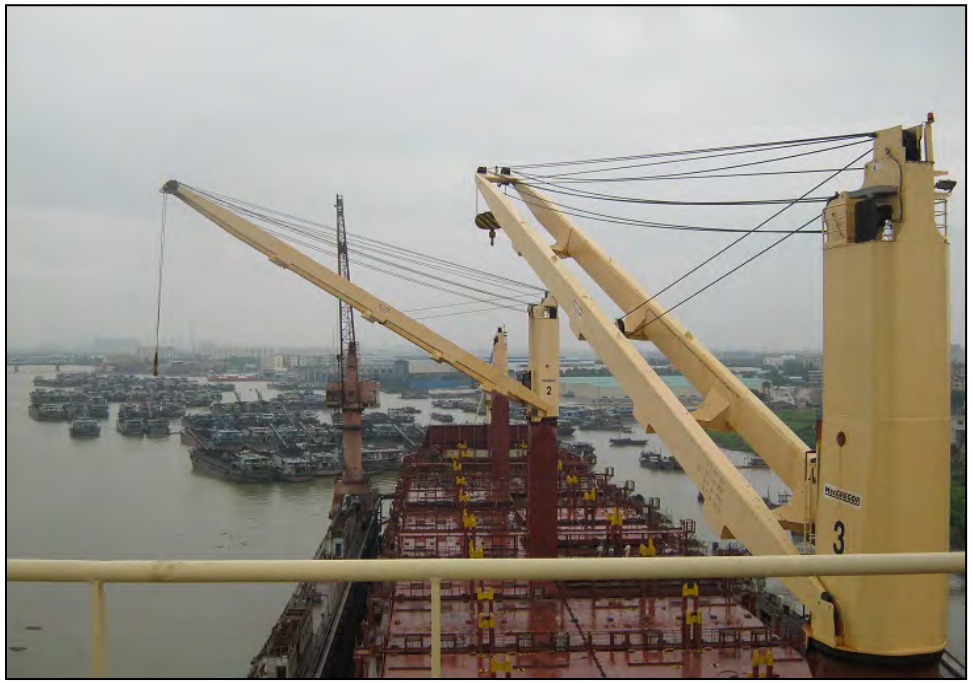
During loading operation

- Slewing bearing ring collapsed and disintegrated

STRUCTURAL FAILURE

Proof Testing of a Crane after a Repair

Weight used during Proof Testing



Pedestal Crane Turret

MAINTENANCE & INSPECTION

- **Follow Crane Manufacturer's Recommendations**
- **Inspect the Wires**
- **Inspection & Maintaining the Blocks and Sheaves**
- **Check the Hydraulic Oil Systems**
- **Check the Control Mechanism & Monitoring Systems**
- **Check the Safety Limits - Hoisting, Luffing and Slewing limits**
- **Adequate stock of spares to be carried**

- **All the above should be part of the PMS**

BULK CARRIER GRABS

- Clamshell Grabs used for loading / discharge of bulk cargoes
- Generally single wire for cranes with one drum (hoisting)
- Three types of lock mechanism to secure the closing of the grab
  - Hand Trip (manual control) – to open grab separate wire/line must be pulled by hand or winch
  - Touch Down (Automatic) – to open or close it has to make contact with the cargo
  - Radio remote control (with stop start) – opens and closes when ever required

BULK CARRIER GRABS

- Grabs are usually fitted with spill / kick plates
- Reduces grab capacity for high density cargoes
- Crane SWL must not be exceeded
- Grab + Cargo = Crane SWL

BULK CARRIER GRABS

BULK CARRIER GRABS

Problems associated with Grabs

- Roller bearings or bushes used for pivot points to be sealed - prevents cargo ingress
- Often ship's grabs are not used for long period of time – must be regularly tested
- Ensure after use that the grab is thoroughly cleaned and fully operational
- Thoroughly check grab wires (if fitted)
- Cutting edge suitability – for soft cargoes (grain / fertiliser)
- Cutting edge suitability - for hard cargoes (iron ore pellets / anthracite coal)
- Should be maintained under the PMS

Summary

- Cranes Generally Reliable
- Require Regular Maintenance – Ensure all areas are covered within the PMS
- Owners claim problem is due to Stevedores, Charterers claim problem is due vessel
- Common stevedore damage is due to wire failure or operating crane outside limits
- Most problems due to lack of good planned maintenance

SHIP CRANES / WIRES PROBLEMS AND THEIR PREVENTION

END OF PRESENTATION

Thank you for your kind attention