

**Improving the
Safety, Reliability and
Productivity
of Coke Handling Bucket Cranes**

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**User's List
Coker Cranes by Konecranes**

Ordered	Customer	Project	Qty.	Capacity	Bucket	Type
2007	Fluor	Marathon, Garyville, LA	1	30 Ton	17 Yd. Mech.	Bridge Crane
2006	Bechtel - France	Reliance India	2	35 MT	20 Yd. Mech.	Bridge Crane
2006	Fluor	Tesoro Golden Eagle	1	44 Ton	25 Yd. Mech.	Bridge Crane
2006	Foster Wheeler Iberia	BP Spain	1	17 MT	8 M Mech.	Semi-Gantry
2005	Bechtel, ConocoPhillips	Borger Refinery, TX	1	30 Ton	17 Yd. Mech.	Bridge Crane
2004	ConocoPhillips	Alliance Refinery, LA	1	18 Ton	10.5 Yd. Mech.	Bridge Crane
2003	Larsen & Toubro	Indian Oil Co., Panipat	1	44 MT	25 M. Mech.	Semi-Gantry
2001	Bechtel	Hovensa, St.Croix	1	45 Ton	25 Yd. Mech.	Bridge Crane
2000	Foster Wheeler	Sincor, Ven.	2	25 m-ton	11.5 M. Mech.	Semi-Gantry
2000	SK Engineering	PEMEX, Madero	2	27 ton	18 Yd. Mech.	Semi-Gantry
2000	Bechtel	Marathon, Garyville, LA	1	27 Ton	17 Yd. Mech.	Bridge Crane
1998	Consorcio Contrina	VEHOP, Venezuela	2	22 m-ton	12.5 Yd. Mech.	Bridge Crane
1997	Chiyoda Corp.	Melaka Refinery	1	15 m-ton	8 M. Mech.	Bridge Crane
1996	Foster Wheeler	Lyondell Citgo	2	27 ton	18 Yd. Mech.	Semi-Gantry
1991	Bechtel / Conoco	Billings, MT	1	8 ton	4 Yd. Mech.	Bridge Crane
1990	Bechtel	Star - Port Arthur	1	25 ton	17 Yd. Mech.	Bridge Crane
1984	Texaco	Anacortes, WA	1	17 Ton	8 Yd. Hyd.	Semi-Gantry
1983	Fluor	Puget Sound Plant	1	14 ton	8 Yd. Hyd.	Bridge Crane
		Total	23			

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Principal Issues

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Safety

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Design for Improved Safety



Crane Operator's Environment:

- Enclosed A/C Cab with HEPA particulate filter
- Purafil chemical filter.
- Enclosed environmentally controlled E-Room
- Filtered air
- Out of elements electrical maintenance
- AutoPilot Semi-Automation
- Independent Traveling Cab

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Principal Issues

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Maintenance

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Limited Time Available for Maintenance:

- Short weekly maintenance intervals
- Infrequent turnarounds for major repairs



Maintenance Reducing Features:

- Control House, Pressurized, with A/C
- Wired-In Spare Inverters
- Regenerative Network Braking
- Platformed Maintenance Access for All Mechanical and Electrical Components
- Inverter Duty Motors
- Improving access to components
- Designing longer lifetimes

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Designing for Higher Reliability

- Longer key component lifetime.
- Shorter repair times
- Quicker problem solving.



Reliability Improvements:

- Moment Isolation System
- 50,000 Hrs Bearing Life
- Carburized Gearing
- Grouped Lubrication Fittings
- Rope Over-wrap Preventors
- Rope storage on drum to re-reeve Bucket 3 Times
- Load Cells on Each Drum, with Summing
- Higher drum/sheave to rope ratios 30:1 vs. 24:1

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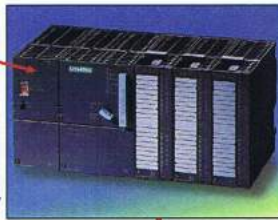
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Reliability Solutions:

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PLC Platform

Programmable Logic Controller (PLC)



Drive commands
Status Request

Status Response
Diagnostic data

Konecranes Inverter Controls



- Encoders
- Laser
- Sensors
- Radio
- etc.

Communication
via Profibus Cable



Operator's Panel

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Productivity

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DynAGrab Hoist Control

Hoist Control Issues:

- Manual Joystick Control
Difficult to Learn
- Long Training Time Needed
- Inefficient Handling, Spillage
- Uneven Load Sharing
Between Hoists
- Overloading Motors,
Burn-Outs
- Snapped Ropes

Closing/Holding Drum Synchronization:

- Reduced Operator Train-up
Time
- More Effective Load Handling
- Even Sharing of Load
Between Hoists
- Reduced Stress on Machinery
- Longer Rope Life

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Hoist Control DynAGrab Synchronization Controller

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Features:

- Load Balancing
- Automatic Sinking & Filling
- Field Weakening
- Fast Stop / Slack Rope Control
- Drum Rotation Synchronization
- Fault Detection
- Jammed Grab Detection
- SAFETY: Overload Protection
- Less Demanding of Operator
- Higher Coke Handling Thru-put



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Load Control Issues

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DynAPilot Sway Control

Damage from Collisions:

- Bucket impacts on hopper
- Bucket impacts on pit wall
- Difficulties in fines basins
- Excessive load spillage



Sway Dampening / Zone Control:

- Reduced load sway
- Restricted areas (pit walls, hopper)
- Smart Limits / Reduced Creep Areas
- Quicker, safer movements
- Reduced spillage at hopper
- Eliminates lost time caused by load swinging

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Maintenance Feedback

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Konecranes DynAReg

Resistor Bank Problems:

- Coke Dust on Resistors
- Reduced Resistance, Burn-Out
- Damage to Inverter Drives
- Maintenance Time for Cleaning



Regenerative Control:

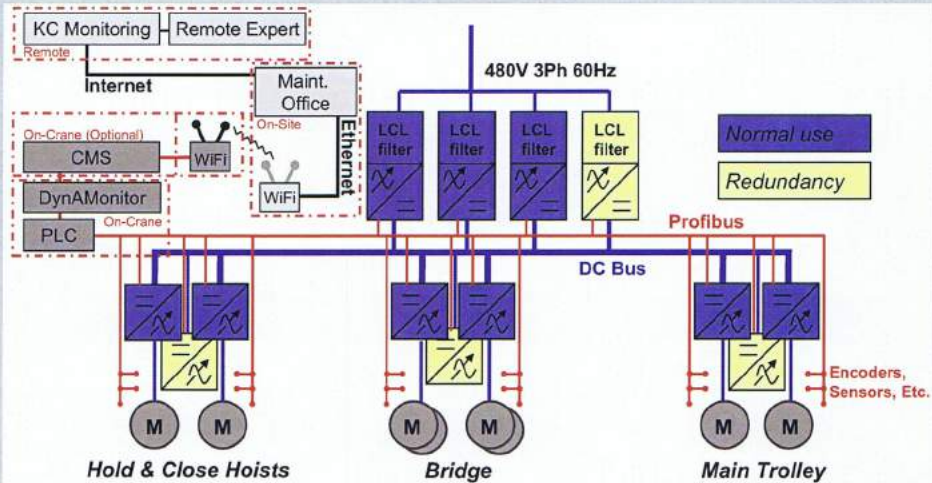
- Eliminates Braking Resistors
- Reduced Risk of Failures
- Reduced Maintenance Time
- Active Front End Cleans Incoming Power, Protecting Drives
- Power Going Back to Grid is Cleaned, Protecting Adjacent Equipment

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Coker Crane Typical Configuration Data Collection – Remote Monitoring

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Condition Monitoring & Reporting DynAMonitor

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- Over 400 data points monitored on a typical process crane
- Voltage, current, temperature, over/under speed, brake wear, limit switches, etc.
- Reports on status, condition and faults on operator display panel.
- Remote data access option.
- Alert user to potential problems before they are catastrophic
- Analyze data from the manufacturing process
- Common in other industries
- Real time reporting.



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Maintenance Data Analysis CMS: Remote Monitoring

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- Real time data is available in multiple locations
- Troubleshoot problems before getting on crane
- Remote Expert Assistance
- Diagnose problem off line in clean, safe environment
- Predictive maintenance can adjust maintenance intervals to suit changing crane usage
- Promotes Pro-active vs. Re-active Maintenance
- Archives about 4 Years of Data



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Runway Structure Issues

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DynATrak

Structure Problems:

- Skewing of Bridge Effects
Rail Alignment
- Damage to Rail Attachments
- Misalignment of Beams and Columns
- Wheel and Rail Wear
- Stress on Wheel Bearings and Crane Structure

Konecranes Auto-Steering Control:

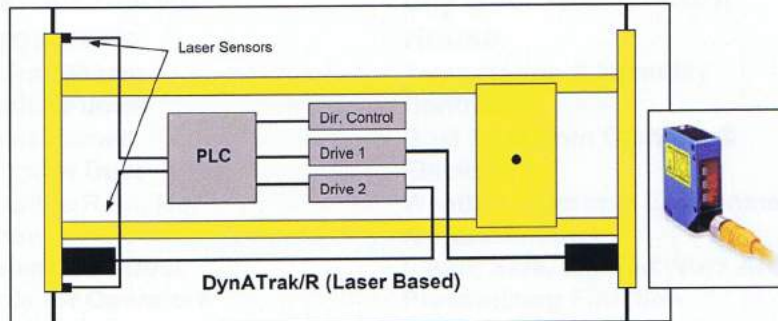
- Harmful Lateral Loads Virtually Eliminated
- Dramatic Reduction in Wheel/Rail Wear
- Reduced Stress on Wheel Bearings
- Reduced Stress to Crane Structure
- Alignment of Runway Preserved
- Improves Safety by Limiting Structural Overloads

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Konecranes DynATrak Laser-Based DynATrak/R Configuration

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- PLC drives bridge via 2 separate inverters
- Laser measurement maintains constant flange-to-railhead distance

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Environmental Issues

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Corrosive Coke Pit Environment:

- Moisture / Steam
- Corrosive Fumes
- Ignitable Fumes
- Conductive Dust
- Exposed to Rain, Ice, Weather
- Abrasive Coke Dust
- Hazards for Operators



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Environmental Issues

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Hazardous Coke Pit Environment:

- Moisture / Steam
- Corrosive Fumes
- Ignitable Fumes
- Exposed to Rain, Ice, Weather
- Abrasive Coke Dust
- Hazards for Operators

Fully Enclosed Operator's Cab:

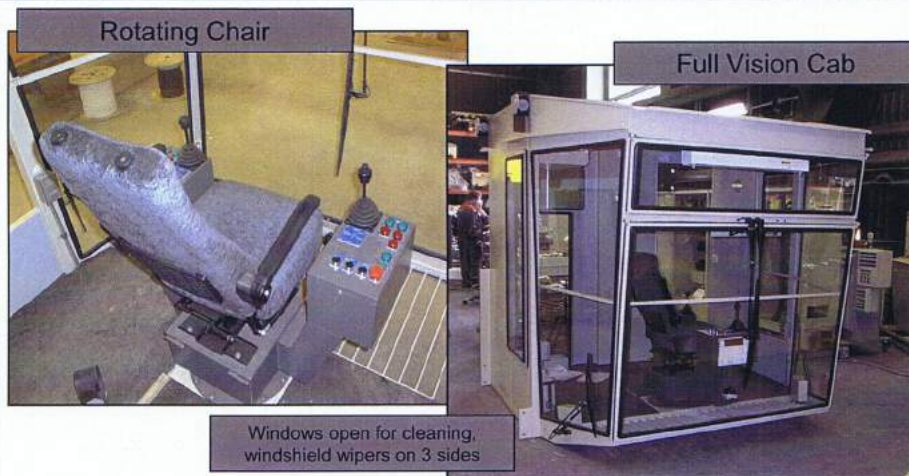
- Temperature & Humidity Controlled
- Protected Environment for Operator
- Ergonomic Chair and Controls
- Windows Arranged for Maximum Visibility
- Safe, Comfortable Work Area
- Pressurizing Filtration
- Redundant A/C Available
- Stainless Steel Exterior Available
- Chemical Filtration Available

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Environmental Issues Operator's Cab

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Control Issues

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Large Control Components:

- Significant time and effort to change out a failed inverter
- Rewiring necessary
- Large, heavy components
- Crane down during change-outs



Wired-In Spare Inverters:

- Increase Crane Reliability Proposition
- Quick switch over from problem VF Drive Unit to Stand-by
- Allows "Off Line" repair when time available
- Prolongs lifetime of Spare Drives with Energized Environment.
- Significant savings in unplanned down time.

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Gearing Issues

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Low Quality Gearing:

- Long Lead / Expensive Spares
- Must open gearbox to remove drum
- Hoist gear quality traditionally low, AGMA 4 to 6
- Failures can be catastrophic, damaging hoist machinery

High-Quality Gearing:

- All gearing 58 HRC, carburized, finish ground
- AGMA Class 11 minimum
- Moment isolation mounting preserves alignment
- 50,000 hrs Bearing Life exceeds CMAA Class F



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Mechanical Issues

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Reported Problems:

Hoist Machinery Problems:

- Cracked Drum Welds
- Leaking Oil Seals
- Drum Gear Misalignment
- Complicated Disassembly
- Fatigue in Drum Shaft



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Konecranes Moment Isolating Machinery Mounting:

- Eliminates Drum Gear Misalignment
- Eliminates Cracking of Drum Welds
- Drum Removable Without Opening Gear Box
- No Fatigue on Non-Rotating Drum Shaft

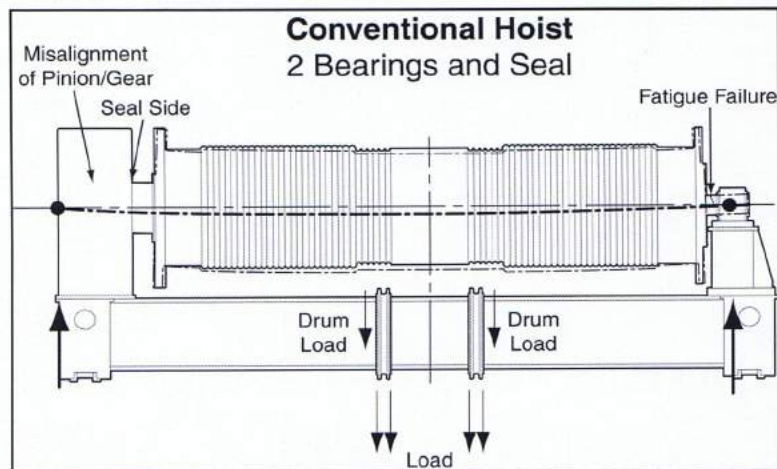
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Mechanical Issues

Konecranes Moment Isolation

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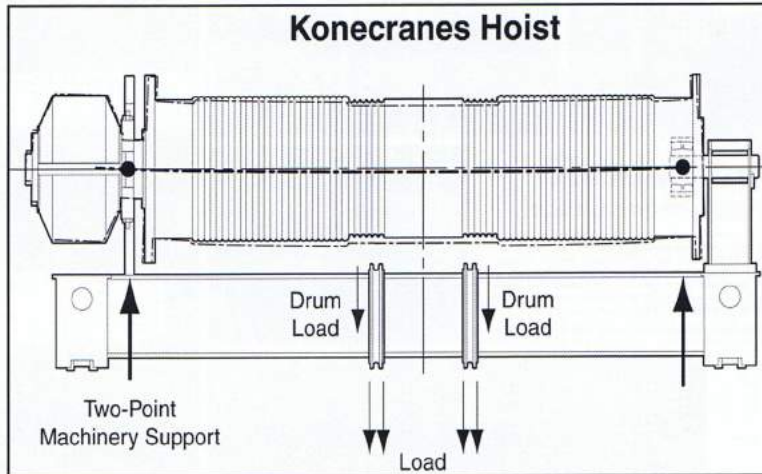


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Mechanical Issues Konecranes Moment Isolation

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Buyer-Seller Partnership

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Crane Buyer

- Process Knowledge
- Equipment Knowledge
- Operational Experience
- Maintenance History
- Lessons Learned

Crane Vendor

- Proven Applications
- R&D Efforts
- Economies of Scale
- Crane Expertise
- Global Perspective
- Experience in Other Industries/Regions

Partnership
Best fit of
Product
to Project

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