Do your Walk-around Equipment Inspections Actually Contribute to Asset Reliability?

By
Forrest Pardue, President, 24/7 Systems Inc.
Dick Hancock, Reliability Consultant, 24/7 Systems Inc.

Operators doing Basic Operator Care, mechanics/millwrights/electricians performing Craft Inspections, and lubrication technicians running Lube Routes probably spend more time around your operating assets than just about anyone else in the plant. Shouldn't you know what those inspection techs know about developing equipment condition problems?

Many plants rely on their work order system to schedule walk-around inspections, with the actual inspection details being kept in a separate system such as spreadsheet-based forms. When the work order is generated, the operators or technicians print the appropriate inspection forms and record the point by point information as they walk the route, including notes about potential problems. Unfortunately, this valuable equipment condition information is now trapped on the paper form and not easily communicated to those in a position to make maintenance execution decisions.

> *"…they were scheduled to be greased every 3 months, but you never knew if they got greased or not because it was just a work order…a WO you get in a normal CMMS just says "completed" or "done" but has 50 machines on the WO – no details on each individual asset and point."*
>
> *Reliability Engineer, Plastics Plant*

To remedy this problem reliability engineers at a plastics plant and a paper mill moved their existing inspection details to a cloud database system that uses Android, IOS, or Windows tablets for field collection. This resulted in more efficient field collection, and distribution of pertinent information via automated emails and web browser. This also allows a broad audience involved in maintenance decisions to see problems found during inspections on a dashboard alongside issues being reported by higher tech condition monitoring such as vibration analysis, thermography, or oil analysis. Walk-around inspections became just as important as their higher tech systems in driving reliability decisions.

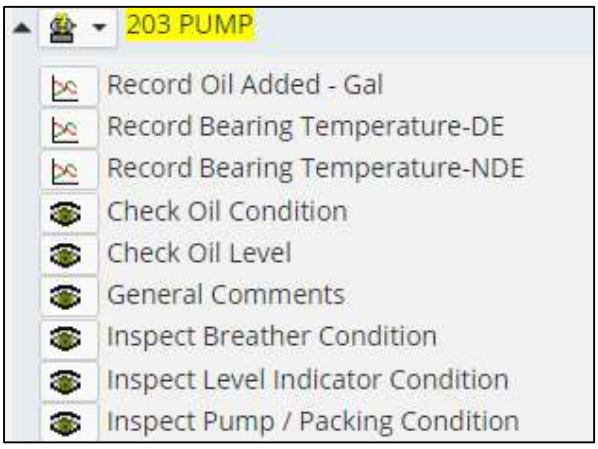


Fig 1 – Example of typical lube route points

The type of measurement points collected varies widely by equipment type and application, and due to different program objectives. Some measurement points are strictly lubrication based, such as 'Record Grease Added', 'Check Oil Level in Sight Glass', or 'Inspect Packing' (Fig 1). Other

points may record vibration and temperature trend values, or call for observations on equipment health, cleanliness, and safety. Using ultrasonic measurements to determine proper greasing volume is also a common practice, typically using 'baseline', 'as found', & 'as left' dB values for this procedure. (Fig 2)

Fig 2 – Example of typical Ultrasonic greasing route points

One of the first decisions required in moving from paper-based to smart tablet inspections is how to define measurement points. Numeric value points such as 'Record Grease Added' or Record Initial dB' can translate very directly from old paper forms. On the other hand, observation points such as 'Check Oil Condition' or 'Inspect Level Indicator' present more choices.

Paper forms have a finite amount of space, so they typically use short response fields such as 'OK/Not Ok' or asked questions that could be answered 'Yes/No'. Tablet screens could also be set for such short responses, but with drop down menu options they also offered the increased space for more detailed answers. For example (Fig 3):

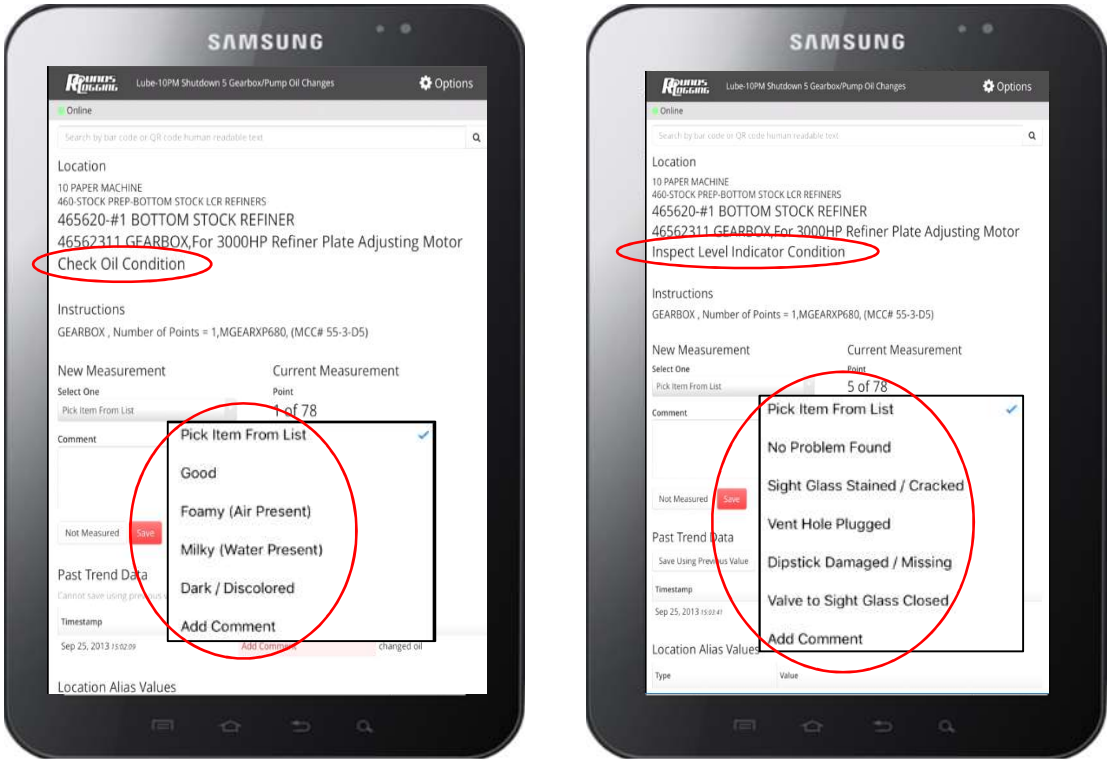


Fig 3 – Examples of expanded Observation pick lists with more condition status choices

Paper forms might include notes on alarm levels for a measurement point, but it is still up to the tech to recognize and document exceptional measurements. In contrast, the smart tablet instantly notifies the tech when an out of bounds measurement is saved and allows the tech to add comments and photographs to document an equipment issue. Since the tablet is communicating with a cloud database it will also show previous measurement history to aid the technician's decisions (Fig 4). For numeric trend points, alarms can be set for low or high values, useful in such cases as reading oil levels in a reservoir with a graduated sight glass. For both text-based Observation and numeric Trend points, saving an out of bounds or alarm value will trigger a request for more information about potential equipment problems (Fig 5).

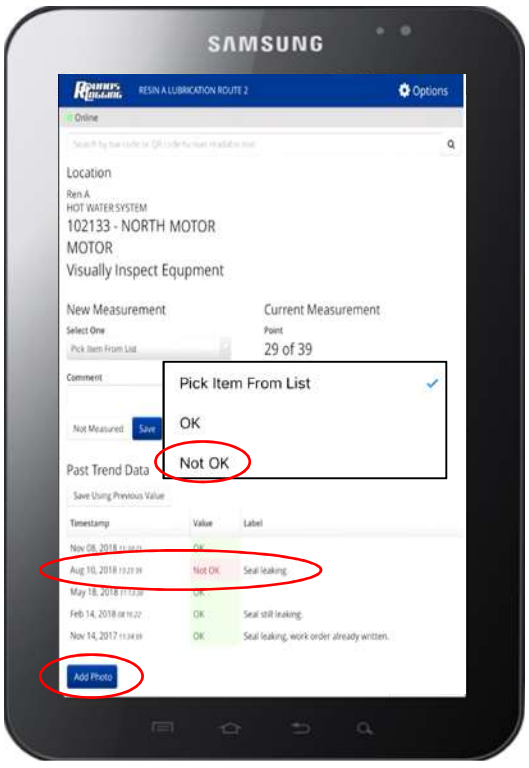


Fig 4 – Out of Bounds notification on an Observation point

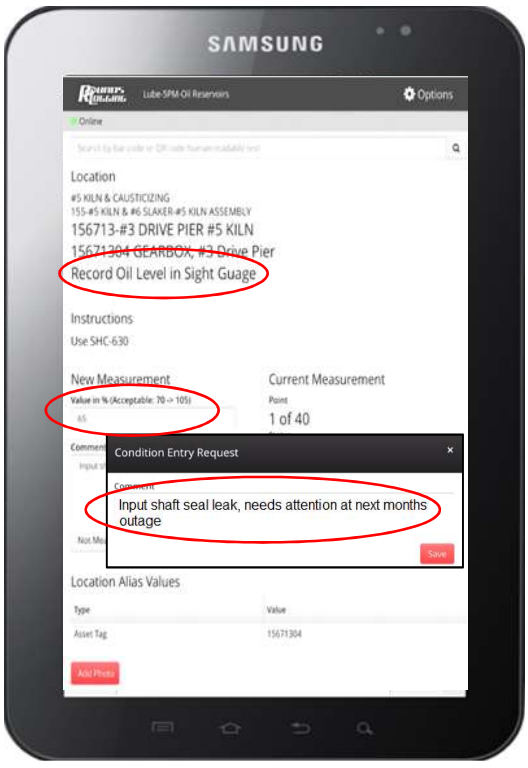


Fig 5 – Low/High alarm point on a numeric Trend point

While these advantages of tablets over paper forms were important in both Reliability Engineer's decision to upgrade their inspection programs, the improved ability to retrieve and use information from the cloud-based system was even more significant.

> *"The paper reports seem to go into a stack of papers on a supervisor's desk and they are not reviewed the way they should be." Reliability Engineer, Paper Mill*

Inspection information on paper forms is perishable. The reports often disappear physically into a file cabinet or a desk-top stack; even when they do get reviewed the critical information is quickly lost in the pace of daily maintenance action. For a period of time the plastics plant engineer tried transferring the field data from the paper forms into Excel™, but eventually realized the double work involved and the need for a more efficient process.

"With paper sheet and clipboard and you would have to come back and fill everything out in excel. So you are really doing twice the amount of work before we had the tablets... Still, it was an excel spreadsheet, you can only do so much with it." *Reliability Engineer, Plastics Plant*

Both reliability engineers understood that storing the collected walk-around route information in a cloud database would provide far greater flexibility for retrieving and using the information – and there would be no wasted double entry time translating from paper to Excel™ since the data would go directly from the smart tablets into the database.

Immediately following completion of an inspection route on a smart tablet, the browser-based system uses data in the cloud database to trigger emails to preselected personnel notifying those people about alarm items in their area of responsibility (Fig 6). The email includes a link to a route summary report, where alarm and out of bounds points are sorted to the top of the report so the recipients can make decisions on actionable items (Fig 7).

"To be able to get the issues in front of the right people by automatic email system is a big benefit…" *Reliability Engineer, Paper Mill*

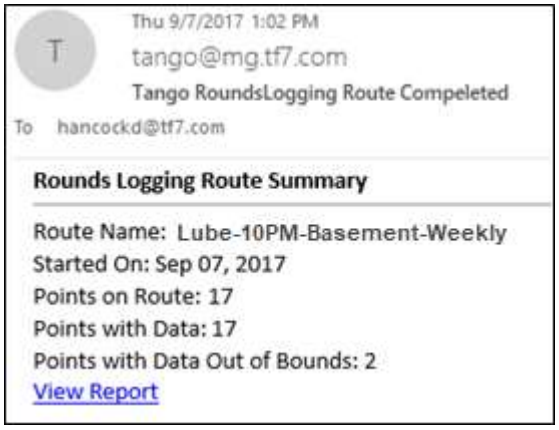


Fig 6 – Route completion notification by email

Fig 7 – Route summary with problems sorted to top of list

Name: 161 Unit 1 Cranes - Monthly
User: John Reliable
Downloaded: Jul 14, 2018, 16:09:45
Uploaded: Jul 14, 2018, 16:19:51

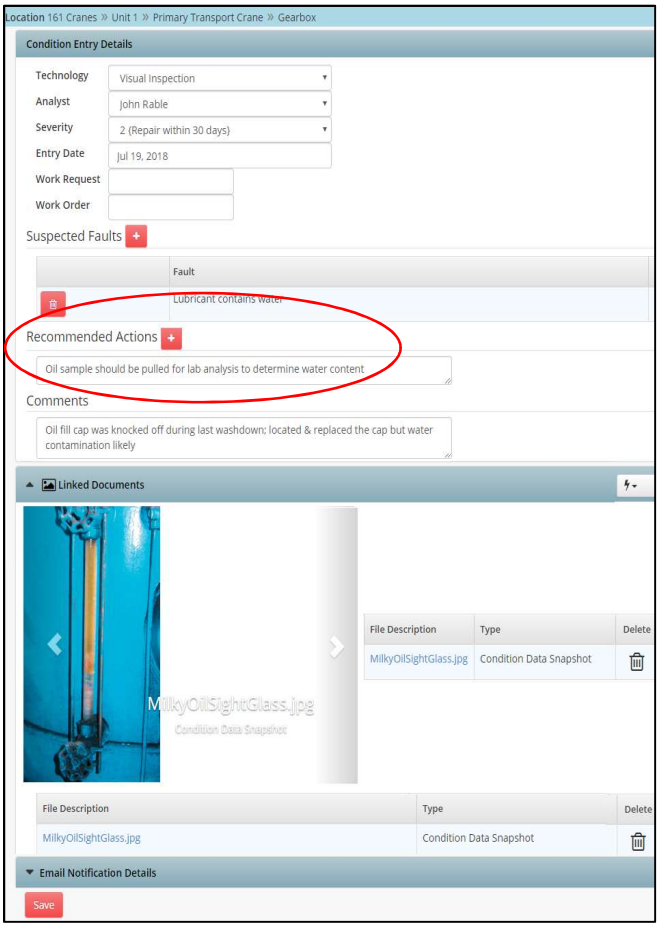
	State	Value	Trend	Location	Condition	Linked Documents
	Out of Bounds	Overfull	Check Oil Level	161 Cranes Unit 1 Primary Transport Crane Gearbox	Add Entry *Comment:* Level in sight glass is 5% high	
	Out of Bounds	Deficiency Causing Improper Operation	General Condition	161 Cranes Unit 1 Primary Transport Crane Gearbox	Add Entry *Comment:* Oil fill cap was knocked off during last washdown; located & replaced the cap but water contamination likely	
	Out of Bounds	Milky color	Check Oil Condition	161 Cranes Unit 1 Primary Transport Crane Gearbox	Add Entry *Comment:* Oil fill cap was knocked off during last washdown; located & replaced the cap but water contamination likely	MilkyOilSightGlass.j
	OK	0	Record Oil Added	161 Cranes Unit 1 Primary Transport Crane Gearbox		
	OK	No oil leaks seen	Check for Oil Leaks	161 Cranes Unit 1 Primary Transport Crane		

When a decision is made to escalate a reported lube problem to the browser-based dashboard of actionable items, the 'Add Entry' button opens a simple form for documenting the fault, severity, and action recommendations. Once the problem entry is saved e-mails notifications are sent to preselected

users who have that asset in their area of responsibility, letting them know that the item has been added to the dashboard of known problems found by all condition monitoring activities in place (Fig 8).

At the same time the e-mails are sent, this new condition problem found by the lube tech is immediately posted to the browser-based Condition Status Dashboard. For one gearbox, the lube route tech found milky lubricant due to a loose reservoir cap during a washdown; the milky lube issue posted on July 19th was the first of three items for this gearbox. The recommended oil sample analysis came back from the lab confirming water contamination and was posted on August 12th. Then, even though the oil had been changed when the oil sample was drawn, a follow-up special vibration test found a developing output shaft bearing problem on August 27th.

Fig 8 – Escalating a found problem to the condition status dashboard



The open problem details from all three technology sources are stored in the same cloud database and are presented under one listing for the gearbox on the interactive Condition Status Dashboard (Fig 9).

Fig 9 – All current problems on an asset found by different condition monitoring sources integrated on browser-based dashboard

Integrated Condition Status Report

		Severity	Asset	Component	Technology	Most Recent Severity	Days Awaiting Checkoff	Work Order Status	Work Order Numbers	Latest Status Comments	Case Closure
		1	CLDWELL	MOTOR1	• Infrared • Vibration - Route	1	173	1 of 2	• 02-14056	• Still waiting on special sheilded bearings -	
		1	Primary Transport Crane	Gearbox	• Visual Inspection • Oil Analysis - Lab • Vibration - Special Test	1	179	2 of 3	• 03-221221 • 08-030221A		
		2	2CENTAC	Compressor	• Oil Analysis - Screening	2	346	0 of 1			
		2	WASTE	FANS2	• Electrical - Online	2	11	0 of 1			
		3	7120019	NBRIDGE	• Visual Inspection	3	166	0 of 1			
		3	1CENTAC	Motor	• Electrical - Online	3	1189	0 of 2			
		4	1CENTAC	Compressor	• Visual Inspection	4	160	0 of 1	• Awaiting: 08-0630028		

This dashboard became the focal point for planning meetings between maintenance, reliability, and operations, providing information to help scheduling decisions and tracking progress of planned maintenance execution. At the plastics plant the cloud database is linked to the SAP work order system, allowing automated information transfer from condition-based calls to create work orders, and then updating the Condition Status Dashboard when a work order is closed. For this gearbox case a bearing replacement was done during a scheduled October outage - the case was then closed, stored in the history section of the cloud database, and removed from the active problem dashboard.

> *"You were looking for leaks from lubrication, leaks from process, seals, packing, high temperature, something making a lot of noise… they can document all those things. Having the tablet is almost real-time. You put it into the tablet and that day, the WO can be put out."*
>
> *Reliability Engineer, Plastics Plant*

In addition to the short-term goal of eliminating failures in service, the historical information from walk-around inspections and other condition monitoring sources is also extremely valuable for the longer-term goal of extending equipment life between repairs. For example, trending dB levels helped the plastics plant reliability engineer show others that the ultrasonic greasing method helped reduce grease usage and over-greasing failures at the same time.

> *"Before the tablet program, they were scheduled to be greased every 3 months, but you never knew if they got greased or not because it was just a work order…So, it gave us a lot more control over what we were doing. This reduced a lot of over greasing issues. It brought it to the forefront that you don't need to keep pumping grease into things."*
>
> *Reliability Engineer, Plastics Plant*

In addition to driving condition-based maintenance action, the reliability engineers also found the web-hosted database inspection information to be invaluable during insurance or internal audits:

> *"The biggest thing was being able to pull stuff out while they're (auditors) standing there, live, and showing them on the screen. Everything was right out in the open. We could say, "pick one" and go in and see when it was inspected. During the report out, we would usually be "best within the company" by just having our data organized in one place."*
>
> *Reliability Engineer, Plastics Plant*

SUMMARY:

The technicians and operators performing walk-around inspections at your plant can know a lot about equipment condition issues. Go beyond keeping track of what they're finding in a perishable paper format – take advantage of modern cloud database and smart tablet technology to bring that information into the daylight so it can assist your other condition monitoring technologies in improving equipment reliability.

Author Biographies:

Forrest Pardue, President, 24/7 Systems Inc., Knoxville, TN

After earning a BSEE at North Carolina State and then an MBA, Forrest has worked in the field of vibration analysis and predictive maintenance for more than 30 years. As one of the founding members of Computational Systems, Inc (CSI), he was actively involved in the technical and market development of modern condition monitoring technologies. Following Emerson Electric's acquisition of CSI in 1998, Forrest co-founded 24/7 Systems. He recognized that the greatest challenge facing industrial maintenance had shifted to the measurement, management, and improvement of plant asset reliability. 24/7 Systems is focused on the development and delivery of Reliability Information Management software and services.

Dick Hancock, Reliability Consultant, 24/7 Systems Inc., Knoxville, TN

A 1972 graduate of the University of Georgia, Dick has over 35 years' experience in the operation and maintenance of industrial machinery. In the 1980's he worked for a Caterpillar dealership in Texas and Louisiana, providing large horsepower gas compressor packages for oilfield service. In the 1990's he helped Computational Systems, Inc (CSI) grow into the leading provider of predictive maintenance systems. Following Emerson Electric's acquisition of CSI, he served as VP of Marketing. Currently Dick is a sales and marketing consultant working with 24/7 Systems, Inc. to provide web-based Reliability Information Management services to manufacturing plants and their condition monitoring contractors.