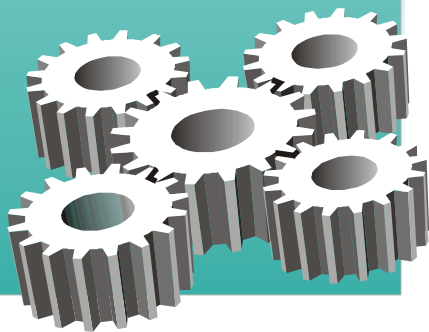


# THE BETA

# BULLETIN



Machinery Analysis



INSIDE VOLUME 8 #3

## Remote Monitoring and Diagnostics (RM&D)

### What is it?

RM&D refers to analysis of machinery performance and condition data performed remotely from the source.

### What forms does this take?

There is a large range of possibilities. Submitting a vibration spectrum via FAX for an opinion from an expert is a basic form. Toward the other end of the range: data from a continuous monitor system transmitted to a remote location where application specialists work. An in-between example: users in the field collect data with portable data collectors, then transmit this to the remote specialist site in a batch manner. The number of possible variations is unlimited.

### What are the benefits?

Turning condition and performance data into optimum decisions requires human intervention. In many cases, specialist knowledge is required. RM&D is a powerful means by which the expertise of the specialist can be leveraged.

### Why now?

There are probably two reasons why this activity is becoming more common. Firstly, it has become practical and cost effective to move large amounts of data between (almost) any two points on the globe. Secondly, the need has increased. Downsizing has resulted in the loss of many experienced personnel, and the remaining staff frequently do not have enough time, even if they do have the expertise.

### Who offers this type of service?

In some cases, it is the central technical support group in the operating company that performs the RM&D activity. Some original equipment manufacturers are starting to offer RM&D service to cover their equipment. Machinery specialist organizations such as Beta Machinery Analysis are another source.

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### **Beta Machinery Analysis RM&D Service**

BMA has provided basic RM&D services for years. These have taken the form of telephone consultation and analysis of data submitted via FAX. In problem solving and trouble-shooting, this approach is often all that is required for our specialists to guide the customer to a solution. It is obviously very cost effective.

In other cases, customers submit data files for analysis and feedback. This involves data screening and interpretation by the end user, with Beta providing more in-depth analysis or validation of user interpretation.

BMA also offers RM&D based on continuous monitoring. One means of delivering this service is via M-HEALTH Real Time, the powerful monitoring system from Dynalco Controls.

BMA is developing other links for RM&D. The range of possibilities is large. We work with each customer to develop the most practical and cost effective solution for the specific circumstances.

## Extending Engine Overhaul Periods

Operators of “high speed” engines can realize significant benefit through optimizing overhaul periods. It is generally agreed that manufacturer recommended intervals tend to be conservative. When an engine runs below its rated load level for extended periods, recommended time-based overhauls may be very conservative.

A solution to this problem is to assess the condition of the engine to determine whether an overhaul is warranted or whether it can safely be deferred. There are a number of available analytical tools and techniques that, properly applied, will lead to optimum overhaul decisions.

Beta Machinery Analysis has been asked to evaluate engines approaching their nominal service life and to make recommendations concerning maintenance. Recently one customer asked Beta to apply our analysis techniques to a Caterpillar 3606 with about 17,000 operating hours. The question was whether to proceed with a top end overhaul at the 20,000 hour point or to defer the maintenance for another year.

## Condition Assessment

The application of condition assessment techniques is the means by which optimum overhaul periods can be determined. At Beta, we use a variety of inspections, tests and data sources. These are outlined in the table below.

Analysis of the information collected determines, with a high degree of confidence, how much degradation has occurred and whether there are any impending failures. However, since there is a lot of information to be

Assimilated and since this is not pure science, the analysis process is demanding. Beta has developed a very helpful tool that we call a MARS Chart (Machinery Rating System Chart).

## MARS Chart

The MARS chart enables condensing a lot of information about engine condition onto one single form. It highlights any indications of degradation, drawing attention to required maintenance areas. An overall score assigned to each engine helps to rank a group of engines in order of priority.

The MARS chart for the Caterpillar 3606 mentioned above is shown to the right. The areas of evaluation are shown as blocks of data: wrist pin clearance, rod bearing clearance, etc., on down to oil analysis. Where applicable, there is a data item for each cylinder showing the measured value. For example, in the area “overall cylinder condition”, measured leakage rates for cylinders 1 to 6 are shown as 6, 8, 8, 8, 6 and 6 SCFM.

Each measurement is then given a score out of a maximum possible score, depending on applicable limits. The measured flow rates are given 20 out of 20, since they are all below the guideline of 8.9 SCFM.

Note that this engine scores well in all categories. A few points are lost relating to some minor valve train and liner wear. An overall score of 95% is achieved.

## Recommendation

We recommended that the customer not proceed with the top end overhaul at this time. There was no indication of any significant degradation. This will save money. (It does not just defer expenditures; there is an absolute saving of significant magnitude.) The availability of the unit is also increased.  
(insert table)



# Beta's MACHINERY Rating System

<b>Company:</b>		<b>Location:</b>		<b>Date:</b>	August 25,1999
<b>Machine Type:</b>	High Speed Separable Engine	<b>Unit Name:</b>	K615	<b>"B" Test:</b>	1
<b>Make:</b>	Caterpillar	<b>Serial No.:</b>		<b>"A" Test:</b>	1
<b>Model:</b>	G3606	<b>Bore:</b>	11.81	<b>Analyst:</b>	RJF JTH
<b>No. of Cylinders:</b>	6	<b>Stroke:</b>	11.81	<b>Hours Total:</b>	17,538
				<b>Hours O/H:</b>	17,538

COMPONENT:	MAX SCORE	GIVEN SCORE	MEASURED VALUE ( TOP # IS THE RIGHT BANK)								Installed		
			1	2	3	4	5	6	7	8	MIN. SPEC.	MAX. SPEC.	MAX. WEAR
Wrist Pin Clearance	<b>Actual Value</b>		10	10.5	11	11	10	11			11	16	18.4
	240	231	36	38	40	40	36	40			Measured Inch/1000		
			0	0	0	0	0	0					
Connecting Rod Bearing Clearance	<b>Actual Value</b>		9	10	9	10	10	9			7	11	15.5
	300	300	50	50	50	50	50	50			Measured Inch/1000		
			0	0	0	0	0	0					
Overall Cylinder Condition	<b>Actual Value</b>		6	8	8	8	6	6			8.9	11.8	17.7
	120	120	20	20	20	20	20	20			Flow (SCFM) @ 80 PSI		
											Leakage rate past head and/or rings/liner		
Ring and Liner Condition	240	216	36	36	36	36	36	36			A Insp.Ultrasonics, G Borescope Inspection		
Head and Valve Condition	120	108	18	18	18	18	18	18			A Insp.Ultrasonics, G Borescope Inspection		
Primary Ignition Condition	30	30	5	5	5	5	5	5			Megaohm meter Infinite OHM		
Blow-by	120	108	18	18	18	18	18	18			"A" inspection Ultrasonics 450 SCFH @ 91% Load		
Exhaust Resistance	N/A	N/A									A Insp.	10"	H2O
Intake Resistance	20	18									A Insp.	-10"	H2O
Manifold Balance	20	20									A Insp.	0.5"	Hg
External Leaks	10	10									Beta/Customer		Visual
Oil Analysis	200	190									Oil Analysis Report		
<b>TOTALS</b>	<b>1420</b>	<b>1351</b>											

**\*\*Main bearing clearances are not measured by Beta. Mechanics should inspect main bearings annually.**

<b>Action Suggested:</b>	<b>Reviewed By:</b> J. Hoffman	<b>95%</b>
<b>No maintenance action required.</b>	<b>Beta Rep.:</b> R. Finlay	
	<b>Company Rep.:</b>	

# Training By Beta

Training by Beta takes place in the classroom or in the field or plant. Instruction is provided by Beta staff who are not only proficient in the topic being presented, but are actively engaged in delivery of services in that area.

## Custom Targeted Training

Beta will work with you to meet your specific training objectives. Typical learning experiences are:

- \* Engine/Compressor Analysis
- \* Spectrum Analysis
- \* Turning Data into Strategic Machinery Information
- \* Creating a Return on Investment (ROI) Culture

Courses can be developed for the basic, intermediate or advanced level

For further information contact Manny Angulo at 800-836-4068 or John Harvey at 800-561-2381

## Free Seminar Program

Beta offers several no-charge, half-day seminars to introduce and cover the basics of a number of machinery related topics. These include:

- \* Pulsation/Vibration Analysis for Reciprocating Compressors
- \* Beyond Predictive Maintenance
- \* Torsional Analysis
- \* Balancing Compressor Design with Risk
- \* Gas Turbines/Centrifugal Compressors

The Bulletin insert gives information on the seminars scheduled for early in the New Year. Please fax this to us, indicating the dates you are interested in attending. Other courses will be added to the Calendar as required. We may be able to offer these seminars at your location if that is your preference.

For further information please contact Ruth Ring at 800-561-2382.

## *Rotating and Reciprocating Equipment Analysis Excellence Since 1967*

Vibration

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Pulsation

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Performance

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Alignment

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Torsional Vibration

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Rotor Dynamics

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Stress/Strain

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Balance

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Machinery Optimization

## Beta Machinery Analysis

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