

### • Resolve unusual engine vibration and noise

Prevent catastrophic engine failure with a Fairbanks Morse analysis

During a routine annual engine analysis on Fairbanks Morse engines, a customer mentioned having problems in another location. The engine having problems was not manufactured by Fairbanks Morse, but we were happy to help. This particular diesel engine was having severe vibration issues and was making loud noises under load. These symptoms were getting worse over the last year. We inquired about the recent repair history. The customer stated that during the overhaul two years prior, they had performed the usual piston ring and liner work as well as replaced the camshafts due to having too many pitted lobes. The customer began seeing problems one year after the overhaul. They had damaged their coupling and failed a crankshaft thrust bearing at different intervals. After repairs and inspections of both the engine and coupling or thrust bearing, they would still have the above mentioned symptoms. The customer had already checked:

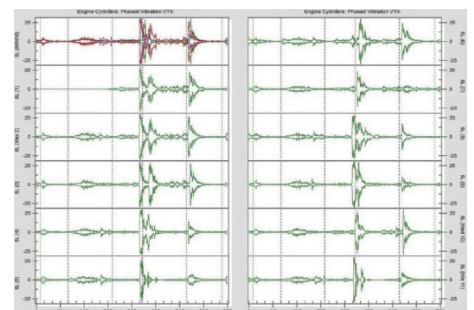
- Valve lash
- Gear train back lash
- Rod and Main bearing fastener tightness
- Foundation bolt tightness
- Injection timing
- Balance using a cylinder pressure indicator

The only problem that the customer found was that the balance was out of range, so they reset injection back to factory specifications. One month later, the balance was out of range again. The Analyst asked them to recheck timing prior to arrival and they found it was out again, but some cylinders were early and others were late, with no pattern or obvious route of guidance.

#### Engine analyzer results

The Fairbanks Morse analyst performed the usual verbal discussions, walk around, and data collection using our diesel engine analyzer. Upon review of the data, we found:

- The engine was severely out of range with respect to balance (255 psi spread)
- Peak firing pressure statistics vice exhaust temperatures did not point to specific cylinder timing issues
- All cylinders had over a 100 psi spread of peak pressure within 50 periods
- Spread of the peak pressure angle was not consistent and high (anywhere from 5 to 10 degrees)
- Phased vibration signatures were similar, not having consistently timed events
- Low frequency phased vibration was so severe that the accelerometer could not settle out



- Frame movement was higher than previous data
- Gear mesh frequency was so “noisy” that no particular number could be singled out

The Fairbanks Morse analyst suspected there was a problem with the gearing and asked the Supervisor to shut the engine down and allow us to perform a visual inspection. All the helical gear teeth were found to have the usual wear patterns. However, during data collection we noticed a prominent yet inconsistent low frequency noise at the gear end. Review of the camshafts revealed the problem, one bank had thrust one-half inch away from the end support and the other was against it. We could also see the same amount of gap between the cam thrust face at the bearing. There was a similar misalignment between the gear faces.

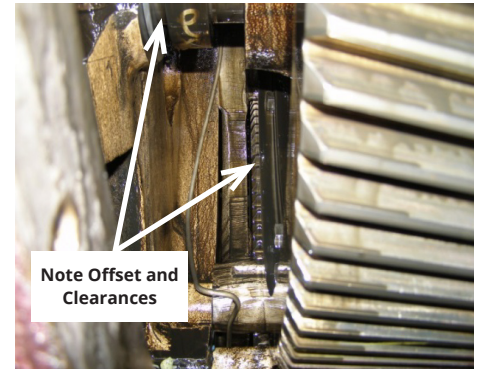
The Fairbanks Morse analyst spoke to management and made the recommendation to stop use of the machine. Specifically, we stated they needed to disassemble the camshafts and inspect for further issues with the gear hubs and rectify the looseness of the thrust faces. Feedback from the customer revealed that the hubs had been incorrectly fit to the cams two years ago as there was 360 degree fretting, the keys and keyways were half sheared and the lock nuts were loose.

If the customer had continued running this engine, there is a high probability that further catastrophic failure and possibly major injury would occur. The Fairbanks Morse analyst had to make the decision that the recommendation to shut down was the best and safest in order to protect personnel and equipment.

Safety is of the utmost importance to Fairbanks Morse. To prevent catastrophic engine failure and possible personnel injury, contact Fairbanks Morse for an engine analysis today.

For more information, please visit [www.fairbanksmorsedefense.com](http://www.fairbanksmorsedefense.com) or email us at [FM.marketing@FMDefense.com](mailto:FM.marketing@FMDefense.com)

### Offset and clearances



### Engine analyzer results

Comb. Start (deg ATDC)	Max Rise Rate (psi/deg)	AVE (psig)	STDDEV (psi)	MAX (psig)	MIN (psig)	DELTA (psi)	PFP Angle ATDC	Exhaust Temp.
-2	32	1041	33	1097	980	78	16	699 F
2	21	1020	23	1065	980	57	15	737 F
-12	26	1058	33	1121	1000	95	15	727 F
5	22	975	30	1083	941	12	16	660 F
-3	33	1053	36	1142	995	90	15	669 F
7	23	915	27	985	889	-48	14	600 F
5	21	1006	33	1088	954	43	14	697 F
3	27	1084	40	1162	1016	121	18	710 F
NA	22	829	13	884	820	-134	8	699 F
-1	28	1019	33	1092	938	56	15	661 F
8	22	851	49	949	802	-112	14	567 F
3	22	996	45	1076	909	33	17	718 F
8	22	874	41	980	818	-89	14	649 F
6	23	896	43	991	824	-67	13	781 F
4	21	923	26	980	884	-40	15	HI 812 F
NA	21	868	36	951	819	-95	15	LO 486 F
AVG 2	24	963	34			73	15	679.5 F

**FAIRBANKS MORSE**  
**DEFENSE**

701 White Avenue  
Beloit, Wisconsin 53511 USA  
1-800-356-6955

[FM.Marketing@fmdefense.com](mailto:FM.Marketing@fmdefense.com)

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