Testing Fire and Seawater Lift Pumps

Use of Ultrasonic Analysis in the Testing of Isolating Valves

Summary

Offshore installations use a series of isolation valves to divert the flows from the various pumps. One of the main reasons a pump test can "fail", is if the isolating valves are passing. This article describes testing the isolating valves using ultrasonic analysis. Overhaul of an isolating valve costs significantly less than undertaking an unnecessary pump major overhaul.

MB04029

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4 pages
September 2004

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Introduction

Development Engineering International Ltd (DEI) carries out fire pump performance testing on a significant number of offshore Oil and Gas installations in the UK sector of the North Sea, this forming part of the routine condition monitoring programme.

The pumps typically are of two types, “Line Shaft” and “Electrically Submersible” (ESPs). The line shaft type consists of a diesel engine driving a pump via a 90-degree gearbox, the pump being tens of meters below the deck level, and below the surface of the sea. The ESP is an integral motor pump unit, which again is tens of meters below the deck level, and below the surface of the sea.

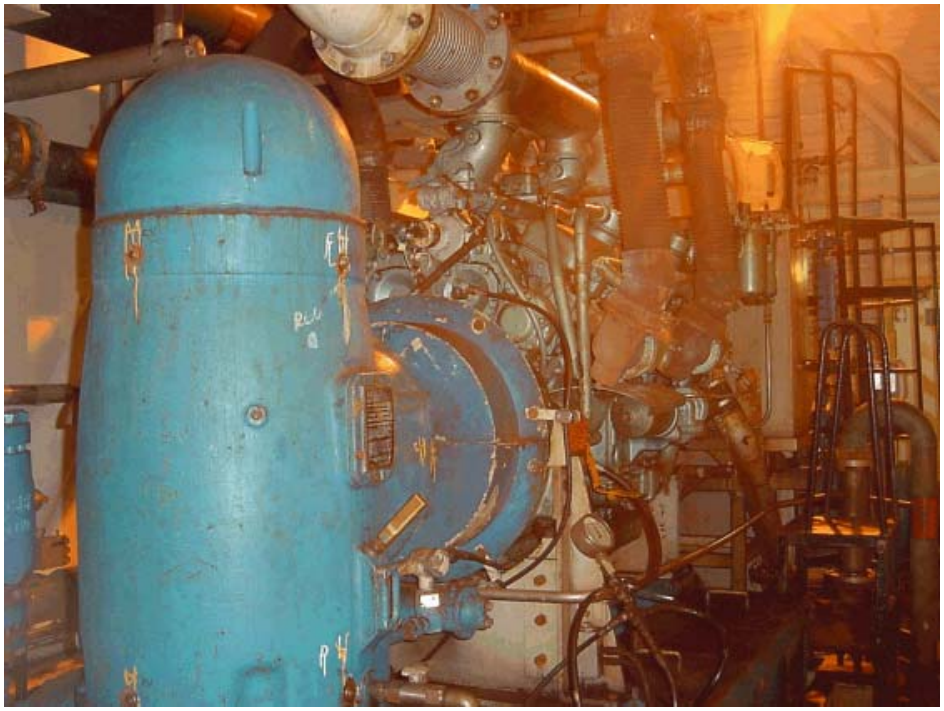


Figure 1: Typical Line Shaft Fire Pump

The tests involve measurements of flow, pressure and rotary speed across the operating range of the pumps using non-intrusive methods. These readings are then compared against the ‘as built’ performance curve, and in the case of firewater pumps, is used to determine whether the unit meets the installation’s safety case. If an unacceptable level of deterioration is evident the unit is overhauled or replaced. Testing of this type has been used successfully to alleviate the need for costly routine pump overhauls and has saved operators huge sums of money over the life cycle of their production facilities.

Ultrasonic Analysis

Offshore installations use a series of isolation valves to divert the flow from the pump on test from the ring main to a test loop with an overboard dump (see Figure 2). One of the main reasons a pump can fail a test is if the test loop and ring main isolating valves are passing. DEI has recently began testing isolating valves using an ultrasonic analysis tool, the Ultraprobe 2000, to ensure that pumps are not being pulled for overhaul unnecessarily. Overhaul of an isolating valve costs less for a client than undertaking an unnecessary pump major overhaul.

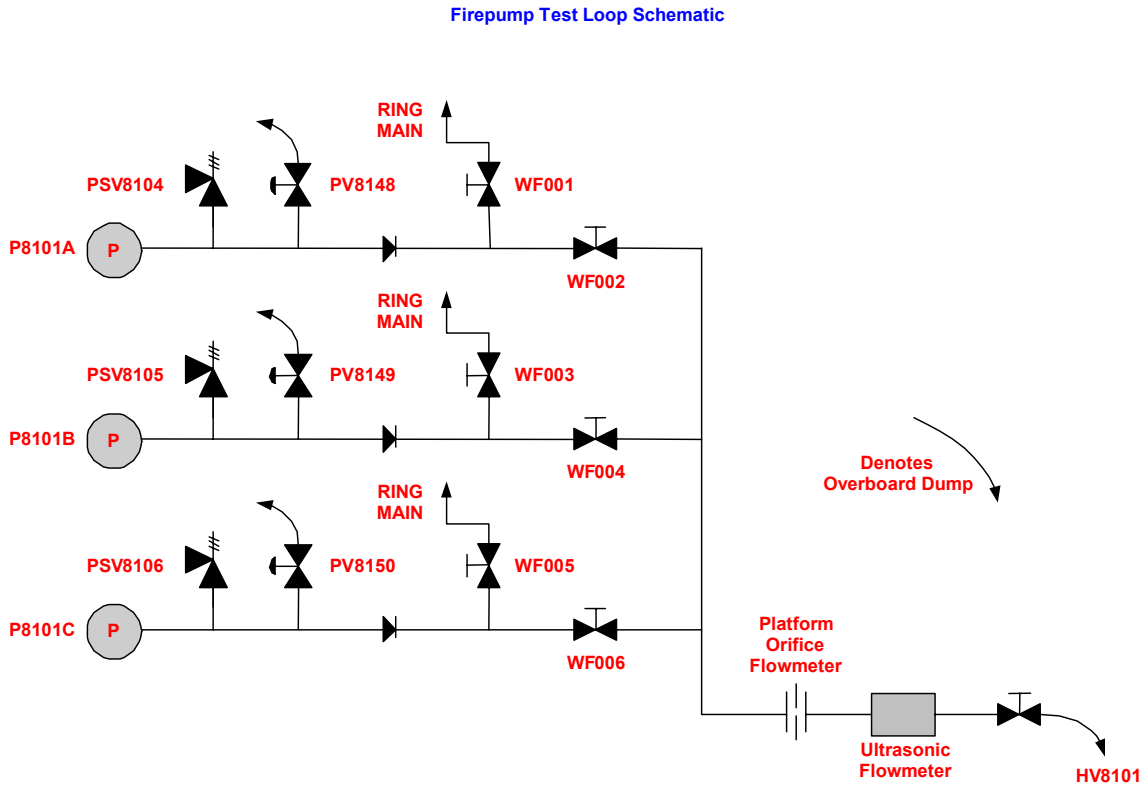


Figure 2: Typical Fire Pump Test Loop.

As can be observed from Figure 2, the valves to be tested are planned in advance, and a table produced to collect the upstream and down stream readings. For the purposes of repeatability, the 50% dial readings were recorded and converted to dB using the transfer curve supplied with the instrument. As can be seen the upstream readings were noted to be lower than the downstream in all cases. No leak sounds were heard at the upstream side of any of the valves. These results can then be compared/trended with subsequent readings on a routine basis.

The table below shows the results of recent isolating valve testing during a pump test on an offshore installation, which was used to prove that all of the isolating valves were operating correctly. Notice WF001, WF004, and WF006 correspond to the valve numbers in Figure 2.

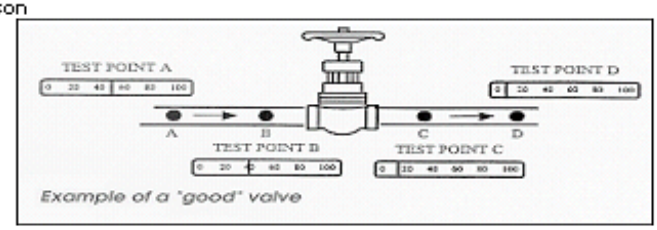
Fire Pump Isolation Valve Leak Check Readings - Ultraprobe 2000 Serial No 25863

Readings Taken By: John Wilson

Ultraprobe Settings

Meter Freq

Lin *Fixed Band*



P8101A Pump

Date 24/05/2004

Valve	WF001			WF004			WF006		
Position	50% Dial	dB	Delta dB	50% Dial	dB	Delta dB	50% Dial	dB	Delta dB
A	7.57	4.00	0.00	7.91	2.50	0.00	7.48	5.00	0.00
B	8.03	2.00	-2.00	7.31	7.00	4.50	8.18	1.00	-4.00
C	9.50	-1.00	-5.00	8.84	-1.00	-3.50	8.08	1.00	-4.00
D	8.89	-1.00	-5.00	10.00	-1.80	-4.30	7.68	3.50	-1.50

Figure 3: Typical Fire Pump Isolating Valves.

Conclusions and Recommendations

DEI experience shows that the Ultraprobe 2000 has proven to be useful in ensuring isolating valves are not leaking. DEI now recommends that the Ultraprobe 2000 be used on all pump tests of this nature in the future to monitor the condition of isolating valves so that measures can be taken during testing to eliminate valve leakage as the cause of pump performance deterioration.

Further Reading

Alan Bandas, Ultrasonic Inspection, UESystems_03002. http://www.aptitudeXchange.com

SKF, Connecting the Inspector 400 Ultrasonic Probe to the Microlog CMVA, CM3053. http://www.aptitudeXchange.com

About DEI

DEI is an international maintenance engineering consultancy committed to the application of technology to asset performance improvement. The main focus of the Company's delivery to clients is the reduction of maintenance and operation support costs without compromising safety or integrity. While DEI's activities extend to one-off consultancy exercises, our core services are delivered via on going, day-to-day involvement with the client throughout the life of an installation. Whether a new facility or an existing operation, DEI has the capabilities and expertise to assist clients to maximize the effectiveness of their maintenance effort.

Formed in 1981 to provide engineering solutions for the challenges of the North Sea Oil and Gas Industry, DEI now has extensive activities throughout the power and process industries world-wide. The company has active bases in Aberdeen, Abu Dhabi, Stavanger, Perth (Australia) and Kuala Lumpur. In December 1999, DEI was acquired by the SKF Group. DEI will remain a semi-autonomous company within the SKF Service Group.

See: http://www.dei-ltd.co.uk

