

# PUMP SYSTEM ASSESSMENT



Even before beginning a formal Pump System Assessment, KCF uses a simple pre-screening survey to collect information about your system for a Life-cycle Cost analysis. This analysis helps determine how strong a business case exists for a formal assessment. We also assess the criticality of the system as well as potential concerns with the way the system is configured or performs to determine if strong potential exists for system optimization.

## THE PROCESS:

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8. Implement Countermeasures
9. Validate the Results
10. Transfer Lessons Learned

### ✓ Life-cycle Cost analysis to assess the business case

Motor Calculations								Hydraulic Calculations					Energy Calculations						
Vol (V)	Cur (A)	PF	PF Cg?	Mo Ef	VFD Ef	Ph Cor	BHP	Head (ft)	Flow (GPM)	Sp Gr	WHP	Act Pu Ef	Rat Pu Ef	Op Hr %	\$/KW-h	An Act Cost	An Rat Cost	An Av Cost	
2300	78	0.90	Yes	0.90	1.00	1.73	337.4	600	1360	1.03	212.2	62.9%	80%	92%	\$0.07	\$175,296	\$137,843	\$37,453	

Rated Life (Yr)		Act Life (Yr)		One-Time Costs			Annual Costs					Life-Cycle Costs			
Rated Life (Yr)	Act Life (Yr)	Purchase	Install	Disposal	Labor	Maint	Downtime	Environ	Safety	Energy	Total LCC	Rated LCC	Total Av LCC	An Av LCC	
10	2	\$0	\$0	\$0	\$0	\$182,969	\$0	\$0	\$0	\$175,296	\$3,582,653	\$2,817,200	\$765,453	\$76,545	

### ✓ Investigation into system criticality, configuration, and performance

Operational									Condition/Care							Configuration/Creation							Overall Severity								
3	3	1	2	2	2	3	3	3	3	3	3	2	2	2	3	1	1	2	3	3	3	2	2	2	2	3	2				
Safety/Environ.	Criticality	Monitoring	% Operation	Horsepower	Pressure	Flow	Downtime costs	Energy costs	Maint. costs	MTBR	MTBF	Mech. seal failure	Bearing failure	Vibration	Cavitation	Deter. of base	Deter. of piping	Motor trips	Elbow/Valve Near Inlet	Bypass	Throttling	Pumps in parallel	Run intermittently in cont. process	Run continuously in batch process	Fixed speed, varying demand	System changed, same pump	Pump changed, same system	Operational Severity	Cond./Care Severity	Config./Creat. Severity	Overall Severity
2	4	2	4	3	3	3	2	2	3	4	4	4	4	3	3	3	2	2	4	0	2	0	0	0	0	2	0	2.10	1.74	1.20	4.41

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After the decision is made to pursue a formal Pump System Assessment, KCF works with you to craft a Scope of Work document. In it, the boundaries of the system are defined and a plan is detailed for collecting and analyzing necessary data. We simultaneously coordinate the formation of an assessment team representing all stakeholders to ensure that every facet of the assessment is supported by appropriate personnel.

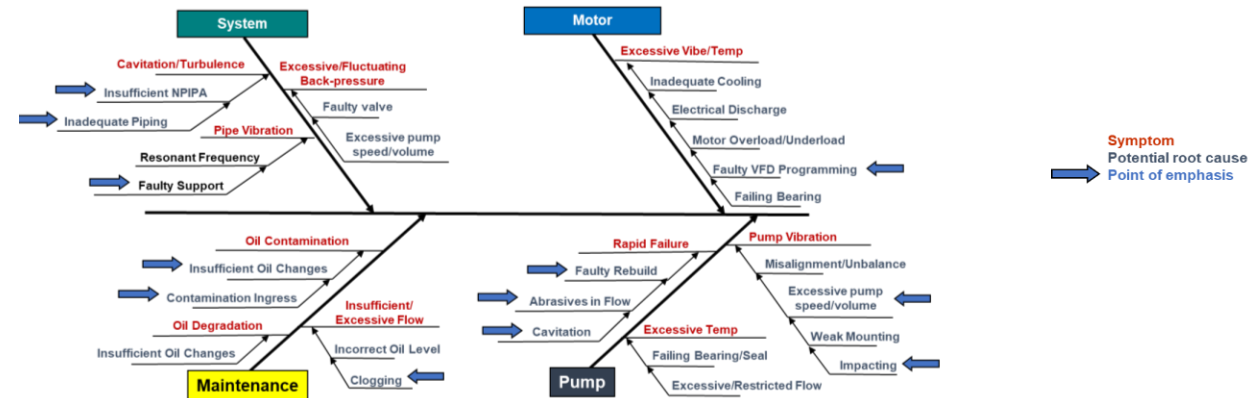
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### ✓ Definition of roles and responsibilities

<u>Customer</u>	<u>KCF</u>	<u>Third-party (optional)</u>
✓ Team Leader	✓ Pump System Assessor	✓ Design Firm Rep.
✓ Capital Projects Manager	✓ National Sales Manager	✓ Installer
✓ Maintenance/Reliability Manager	✓ Strategic Account Manager	✓ OEM Rep.
✓ Controls/Process/Elec. Engineers	✓ Optimization Specialist	✓ Maint. contractor
✓ Procurement Specialist	✓ Technical Analyst	
✓ Millwrights	✓ Field Analyst	

### ✓ Development of data collection and analysis plan



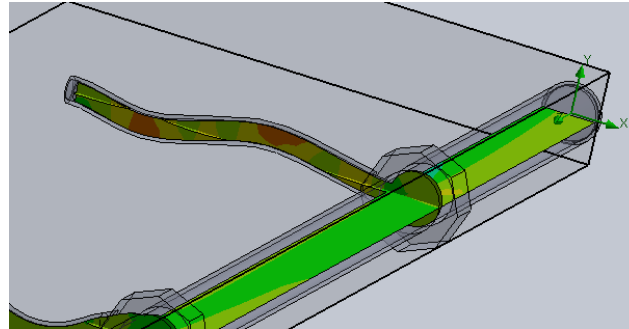
# PUMP SYSTEM ASSESSMENT

**At KCF, we excel at collecting and interpreting data.** KCF can measure data like pressure, flow, current, and voltage or integrate it from your systems. We can also deploy many other tools, including motion amplification, thermal imaging, asset teardown, CFD analysis, and more. KCF's certified assessors then dig into that data using a systems approach to identify root cause(s) of failures and make practical recommendations for optimizing your system.

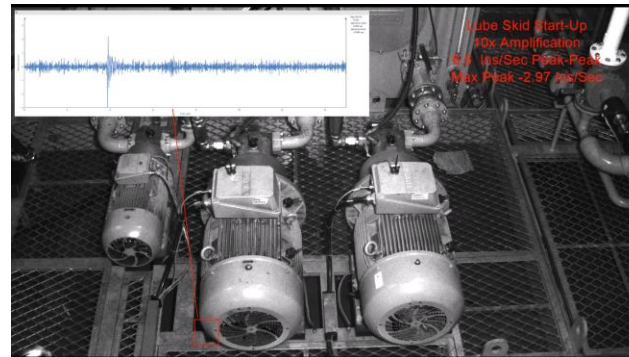
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✓ *CFD showing regions of high and low flow*



✓ *Teardown showing abrasive wear*



✓ *Motion amp footage showing hard start*



✓ *Thermal imaging tracking efficiencies*

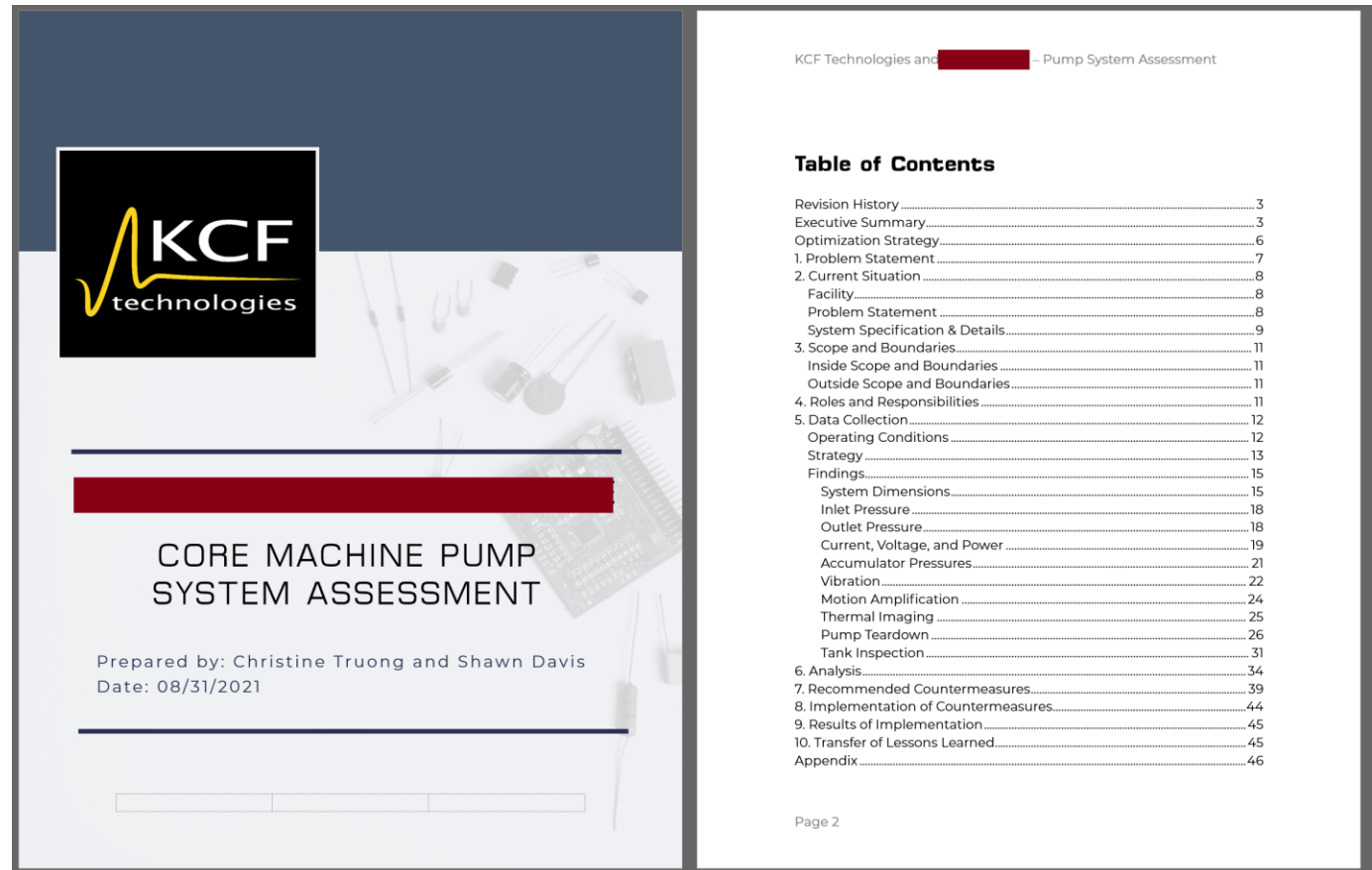
# PUMP SYSTEM ASSESSMENT



A **Pump System Assessment culminates in a comprehensive report.** This report begins with a high-level executive summary and continues with a detailed description of the methodologies used, data collected, analysis performed, and countermeasures recommended based on potential life-cycle savings. The report completes the assessment phase of the study, but it is not the end of the work.

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**An assessment is nice, but it results in no change unless countermeasures are implemented.** KCF may be contracted to work with you throughout this critical phase of the process, but it is up to your team to do the heavy lifting. Once you've implemented countermeasures, KCF can help validate the results and work with you not only to optimize the system under study but also to transfer lessons learned to similar systems throughout your company.

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Costs Incurred	Cost	Recur (yr)	Costs Avoided	Savings	Recur (yr)
Variable Frequency Drive	\$ (19,000)	0	Pump Purchase/Rebuild	\$ 12,000	2
Labor for Install	\$ (6,000)	0	Pump Install	\$ 4,000	2
PLC/VFD Programming	\$ (3,000)	0	Pump Disposal	\$ -	2
Downtime for Install (Sched)	\$ -	0	Labor	\$ -	1
Pump System Assessment	\$ (30,000)	0	Maintenance	\$ 14,000	1
Cust. Time/Labor for Assess	\$ (10,000)	0	Downtime	\$ 40,000	1
Pressure/Level/Flow Sensors	\$ (12,000)	0	Environmental	\$ -	1
Data Analysis	\$ (6,000)	1	Safety	\$ -	1
			Energy	\$ 19,000	1
<b>Total One-Time</b>	<b>\$ (80,000)</b>			<b>\$ -</b>	
<b>Total Annual</b>	<b>\$ (6,000)</b>			<b>\$ 81,000</b>	
<b>Rated Life (yr)</b>	<b>10</b>			<b>10</b>	
<b>Total Life-cycle</b>	<b>\$ (140,000)</b>			<b>\$ 810,000</b>	
<b>Annual Savings</b>				<b>\$ 81,000</b>	
<b>Net Life-cycle Savings</b>				<b>\$ 670,000</b>	
<b>Time To Achieve ROI (yr)</b>				<b>1.73</b>	