HYDRAULIC LIFTERS / PUSHRODS: ARE THEY WORTH IT?

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Introduction: Over the past year, several of our clients have asked us, "Are hydraulic lifters/pushrods worth the price?" Rather than jumping to conclusions based on design and theory alone, we conducted a field survey of five oil and gas companies (36 engines) to compare the "hype" against the "facts". As a general rule, the answer is a resounding "Yes". This report provides a brief summary of the results of the field survey and a short worksheet that can be used to answer the question, "Are they worth it?"

The Hype vs. the Facts: The "hype" describes those features and benefits that are typically touted by sales persons to describe the basic theory, design, and manufacturing concept of hydraulic lifters and pushrods. The "facts" represent the field application and real-life experiences of operators using the equipment. The table below compares the touted features against field experience.

Based on this information, "The Facts" tend to support "The Hype" in terms of performance and benefits. This comparison was relatively easy to make when interviewing field personnel based on the subjective nature of the features and benefits of hydraulic lifters / pushrods.

"The Hype" Theory, Design, and Manufacturing Concepts	**"The Facts"** Real-Life Field Experiences
• Automatic compensation for temperature	• In a solid lifter and pushrod applications, increased temperatures cause the pushrod to grow, taking up clearance, and potentially not allowing the valve to fully close. The hydraulic lifter does maintains zero tappet clearance as the engine's operating temperatures change and does not leave valves open or closed.
• Extended valve train life	• Of all the benefits, this is the most obvious long-term improvement observed in the field. Upon installation, most operators experienced significantly less noise and clatter (when compared to solid lifters and pushrods) and experienced significantly less wear on the camshaft and cam follower.
• Easy replacement of existing lifters/pushrods	• The conversion is relatively simple in that the existing pushrods can be replaced by new ones in a matter of a few hours. • Valve timing is determined by the engine's camshaft. As a result of changing from solid to hydraulic lifters/pushrods and maintaining zero clearance, the valves will generally stay open longer (longer valve duration). For the most part, this does not impact the operation of the engine since the valve timing occurs at non-critical times in the combustion cycle. NOTE 1: In applications on engines that are not widely field tested, it would be worthwhile to monitor fuel consumption and hydrocarbon exhaust emissions to watch for detrimental effects of the change. NOTE 2: When the camshaft is rebuilt during subsequent overhauls, it should be profiled for hydraulic lifter applications.
• Reduces equipment shutdowns for valve adjustments	• The hydraulic lifters / pushrods can be monitored and adjusted while the engine is running. Solid lifters / pushrods can also be adjusted this way but are typically done with the engine shutdown. • The benefit most observed in the field was the reduced need to make adjustments at all with the hydraulic lifters.
• Reduces valve recession – extending head life	• Of all the benefits, this has proven to be the most valuable in field experience. By operating with zero clearance in the valve train and eliminating the clicking and clacking of fixed clearance valve trains, power cylinder heads (4-cycle engines) have experienced extended life between scheduled major and minor overhauls. In fact, several customers reported extending the time between head changes by up to one (1) year.
• Reduces fuel consumption	• Hydraulic lifters do not reduce fuel consumption on their own; however, if the engine balance is improved as a result of the replacement, a slight fuel savings was sometimes observed.
• Enhances cylinder peak pressure balance	• As a stand-alone component, the hydraulic lifter / pushrod does not enhance cylinder balance. However, due to the fact that it automatically compensates for temperature and wear, the time period between adjustments is significantly longer – extending the time period between engine balances (typically caused by excessive valve train clearance).
• Easier to adjust and set tappet clearance	• Hydraulic lifters are much easier to adjust and set than solid lifters. • Note: It is critical that all air is bled from the lifters when initially installed; otherwise the lifters will collapse and work improperly. This procedure is only needed during the initial installation of the lifters.

Quantifying the Value: Quantifying the value of the hydraulic lifter / pushrod proved to be a more difficult process. Based on the field interviews, I received a wide range of comments regarding labor savings, maintenance savings, fuel efficiency, etc. As such, the data was summarized and analyzed to determine the average economic value of hydraulic components.

The economic value of hydraulic lifters / pushrods is primarily achieved in two (2) ways:

1. Reduced operating costs associated with setting/adjusting lifters and balancing the engine.
2. Reduced repair costs due to extended parts life for power cylinder heads, valves, and camshaft and followers.

The economic evaluation done for this study included data covering 36 engines at five different oil and gas companies. As such, the computed values should be fairly representative of large 4-cycle reciprocating engines. The average economic value for each benefit is shown in the table below.

Conclusions: Based on the information collected from field users it is obvious that hydraulic lifters and pushrods generally result in significant savings in terms of operations and repairs. It is also nice to report that the manufacturer's claims are relatively accurate when compared to actual field experiences.

Attached to this report is a simple worksheet that can be used to determine the potential payback for hydraulic lifters and pushrods given a user's specific engine data.

	Solid Lifters / Pushrods (unit cost per 8,000 hours runtime)	Hydraulic Lifters / Pushrods (unit cost per 8,000 hours runtime)	Average Savings (8,000 hours runtime)
Reduced operating labor costs ($35/hr labor costs)	Adjustments: 4 hrs Balancing: 16 hrs	Adjustments: 1 hr Balancing: 8 hrs	(20 hrs – 9 hrs) at $35 per hour = 11 hrs * $35 = **$385 per 8,000 hrs**
Extended parts life – Reduced repair costs (1850HP engine, includes repair labor and parts, annual inspections, and rebuild costs)	Average Repair Costs: $38 per HP	Average Repair Costs: $25 per HP	($38 – $25) at 1850 HP = **$24,050 per 8,000 hrs**

Total: $24,435 per 8,000 hrs

Economic Value Worksheet for Hydraulic Lifters and Pushrods Conversions

Using the basic assumptions from the field survey, the following worksheet can be used to compute the benefit and payback of hydraulic lifters for large, 4-cycle engines.

Typical Engine Horsepower (BHP) _____ (BHP)

Typical Engine Run-hours per Year (hours) _____ (run-hours)

Labor Rate ($/hr) _____ ($/hr)

Lifter / Pushrod Conversion Cost (parts + labor) _____ ($)

Step 1. Calculate the reduction in operating expenses:

_____ x _____ x 11 ÷ 8000 = _____ $ Saved per Year
<Labor Rate> <Run-Hours>

Example: $42 per hour x 6500 run hours x 11 ¸ 8000 = $375.38 saved per year

Step 2. Calculate the reduction in repair costs:

_____ x _____ x 13 ÷ 8000 = _____ $ Saved per Year
<Horsepower> <Run-Hours>

Example: 2000 HP x 6500 run hours x 13 ¸ 8000 = $21,125 saved per year

Step 3. Calculate the payback:

_____ ÷ (_____ + _____) = _____ Payback (in years)
<Conversion Cost> <Answer Step 1> <Answer Step 2>

Example: $6,750.99 ¸ ($375.38 + $21,125.00) = 0.31 years (3.77 month) payback

In this example, the conversion to hydraulic lifters/pushrods would be paid for in 3.77 months based on reduced operating costs and repair costs.