Cost Effectiveness of Automatic Lubricators

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The financial analysis method presented in this document will assist you in evaluating the cost and savings impact of upgrading from manual lubrication methods to electro-mechanical self-contained automatic lubricators. Beyond the many operational benefits that can be gained when adopting this new lubrication technology, the financial impact of such action on the company's bottom line must be considered. That is the purpose of this article. Any reference to automatic lubricators or lubricators in this article means specifically the newest technology, electro-mechanical devices.

Looking at the number of pounds of lubricant used in one year, and with several additional items of required information and a few assumptions you can generate the financial data you will need to justify your action (or inaction) in upgrading your plant lubrication to current technology. The burden of the actual calculations required to obtain the result of the analysis is removed if you use the worksheet template (MS Excel®) being offered, free of charge, by the sponsor of this paper. Upon entry of information called for on the Information Input form, provided with the template, the analysis results are calculated and available for printing. You can change the Input data as many times as desired, playing the "what if" game until you are satisfied with the result.

This method of analysis will permit you to look at the lubrication process in your entire plant as a whole, or at individual departments or specific functional areas. You can then proceed by selecting those areas with the largest financial payback to begin your program of automating; or rather, begin in those areas that will benefit the most from improvement in the lubrication process offered by current technology. Most important, you will be approaching the matter with knowledge of the financial impact of your action.

Your upgrade program may have more favorable results than shown by the analysis. This is because the analysis does not factor into the result some of the benefits to be derived by the added capability of the new technology. For example, in practice you will undoubtedly find that it will not be necessary to purchase an automatic lubricator for each bearing in your plant. There will probably be situations in which a single automatic lubricator may be used to lubricate two or more lubrication points, thus reducing the number of lubricators required and reducing your initial investment. Another potential area of savings not quantified in the analysis is that of lubricating operating equipment without the need for shut-downs, lock-outs and the resulting lost production.

Improved control over lubrication injection, available with this new technology, provides additional benefit. With a feature referred to as External Control the lubricator will work in concert with the operation of the machine being lubricated, providing lubrication only when the machine is in use. Using a PLC, which is controlling operation of the machine itself, to control the lubricator can provide lubrication based upon a count of machine cycles, hours of operation or some other criteria. Thus continuous lubrication can be insured and over-lubrication can be avoided.

In an effort to keep this analysis simple we have assumed that the lubricator size to be used in the program of conversion is the mid-sized automatic lubricator having a replaceable lubricant cartridge containing 240cc of lubricant. In practice this is the most widely used lubricator size. Other lubricator sizes are available, that may be better suited to individual situations. Those use cartridges containing 120cc or 480cc of lubricant. Features of the electro-mechanical lubricators, including programmable control over the rate of lubricant injection, and availability of several sizes of lubricators offer considerable flexibility in matching capability to application requirements.

Basis of the Analysis

The analysis applies to the application of lubricating grease. It recognizes that there are two cost elements involved with automatic lubrication, the expendable lubricant cartridge kit consisting of a replaceable lubricant cartridge and battery pack and the one-time, upfront investment cost of the automatic lubricator.

The common denominator used in this analysis is the number of cubic centimeters of lubricant consumed in a given period of time. For the purpose of this analysis that period is defined as one year.

The use of this common denominator permits a comparison to be made between the costs of a system using the manual application of lubricant with a system using automatic lubricators to apply the same volume of lubricant.

The analysis method requires the use of several user defined variables that best describe actual operating conditions. These variables are described individually later in this paper.

The modification of the variables permits the user of the analysis to play “what if” games for the purpose of determining a “best fit” with the real world in his or her operating environment and for different operating areas of the plant with different lubrication requirements.

The Conclusion

The results of the analysis are the following:

The total annual cost of manual lubrication application and the total annual cost of expendables when applying the same volume of lubricant using self-contained automatic lubricators.

The resulting annual cost savings or additional cost and the % of change to manual lubrication cost are calculated.

From the cost savings thus developed and the unit cost to purchase the specific automatic lubricator being reviewed you can quickly calculate the number of lubricators that can be purchased in the first year of the program that will result in a first year break-even.

If you have fewer number of bearings for which automatic lubricators must be purchased to complete your program you will have a first year positive outcome, that is, you will have a first year savings.

If you have more bearings for which automatic lubricators must be purchased than covered by first year savings for expendables the project will have a first year additional cost.

Second year savings, and beyond, will be the total savings shown in the analysis with or without the purchase cost of additional lubricators that were not cost justified in the first year.

Second year savings and beyond will continue until the lubricators have reached the end of their useful life at which time they will require replacement with new lubricators. Useful life will depend upon the quality of the original lubricator product that was purchased and the operating conditions in which they are being used. Generally a three to five year life may be expected, though in reasonably good operating conditions a longer life span can occur.

Recognizing that equipment inspection is often a responsibility included with the manual lubrication process the cost of three PM inspections between the lubricant cartridge change-outs has been included in the cost developed for automatic lubrication.

The Calculation Template

The analysis template, that is here provided to perform the calculations for you, lists not only the variables required to complete the calculations but includes examples of what the values of these variables might be in a typical plant environment. You should

change any of the variables shown on the template to those that represent the conditions that exist in your actual situation. Your changes will be immediately reflected in the two analysis schedules, **The True Cost of Time** and the **Cost Comparison**.

The analysis can be used to evaluate any other similar products available on the market by simply changing the two cost factor variables representing specific products, that is, the cost of the Lubricator and the cost of the Cartridge Replacement Kit. Be certain that the cost of the Cartridge Replacement Kit includes the cost of the battery pack needed to power the self-contained version of the product.

To download the template click on the following URL.

http://www.memolub.com/files/Sound Money V1.7.xls

The remainder of this article describes, in detail, the variables that are required in the analysis and the calculations that use these variables. Should you choose to perform the analysis without using the template, or simply want more information on how the template works, this information should answer your questions.

It is important to note that the final section of this paper, Cost Reduction or Additional Cost includes a method of checking the general reasonableness of the variables that you have used in running the analysis. You might like to take a look at it.

The Variables

Here are the variables you'll use in your analysis. Your numbers will vary from those used as examples. It may be necessary to look to others in the organization for assistance, such as your Human Resources Department, for the correct fringe benefit rate as a % of hourly labor cost.

Calculating True Cost of Time

First the hourly rate for the lubrication position must be increased to include the cost of fringe benefits. If, as an example, the hourly rate is $16.00 and the fringe benefits are 20% of the base rate the adjusted rate is

$16.00 + $3.20 = adjusted rate $19.20 per hour.

Next the total paid hours for that position must be calculated. If the schedule is a 40 hour work week, 5 days per week for 52 weeks per year the paid hours is 2080.

The resulting annual cost of the position is therefore

$19.20 x 2,080 hours = $39,936.

Calculating Actual Time Worked

To determine the actual cost of performing the lubrication function it is necessary to consider time deductions from hours paid to establish hours actually available for work during the year. These deductions typically include the hours of paid vacation, hours of paid holidays, paid sick days. In our example we're assuming 10 days vacation + 10 days paid holidays + 5 paid sick days = 25 days x 8 hours a day = 200 hours.

Deducting the paid time not worked hours from the hours paid or 2,080 hours paid – 200 paid not worked = 1,880 hours actually "at work"

Our example also assumes that our people receive two paid breaks per day of 15 minutes each. Over 235 work days per year this amounts to an additional 118 hours of paid time not worked. Deducting the 118 hours from 1,880 hours at work indicates that there were 1,763 hours available for work each year.

One final adjustment is required to establish the net hours of productive work that can reasonably expected. That is the estimated level of work efficiency. In our example we have assumed an efficiency rate of 80%. Applied to the 1,763 hours available for work we have determined that there are 1,410 hours of productive work per year.

Dividing the total annual labor cost of $39,936 by the hours of productive work of 1,410 we conclude that the cost of each hour of productive work is $28.32 which is $0.47 per minute. It is this cost that will be carried forward into subsequent calculations.

The True Cost of Time

Once again, the factors and values that are appropriate to your calculations may vary from those that we have used, but, at minimum, these are the factors we believe should be considered in establishing The True Cost of Time.

Lubricant Used

This is an important factor in your analysis, not so much as regards the cost of the lubricant but rather in the volume of lubricant consumed. Your records may tell you the number of containers of lubricant, of each size, that were purchased during last fiscal year. To this you can add your inventory at the beginning of that year and deduct the inventory at the end of the year. If your records indicate a sizable difference in purchases during the current year from last year you might want to make an adjustment, up or down, to more accurately reflect what is happening in the current year. For your next calculation your lubricant consumed must be stated in pounds.

Continuing with our example we are going to assume that we consumed 275 pounds of lubricant last year at a cost of $605.

These pounds are converted to cc's (cubic centimeters) by multiplying pounds used by 475 (that is, there are about 475cc's of grease per pound). Thus last year we consumed 130,625cc's of lubricant. Hold this number; you'll use it in the next calculation.

Manual Lubrication

Here are the two variables you'll want to use in playing "what if". These are the numbers that are more subjective than the others and where your judgment is of greatest importance. These are the numbers that will change from department to department or functional area to functional area. If you set this entire analysis up on a computer worksheet it will greatly simplify the process of making a number of estimates with changing variables for different areas of the company or just refining estimates for the same area of the plant. The variables are - -

Strokes

The average number of grease gun strokes given to each bearing during each lubrication cycle for the department or area being analyzed. We have assumed each grease gun stroke is equivalent to 1cc of lubricant. Remember, this is an average; some bearings may receive more strokes and some less. In our example we are saying that the average bearing in the area being analyzed receives 5 strokes from a hand grease gun or 5cc's of grease.

This number, that is, the average number of strokes per lube cycle, 5, is divided into the total grease consumed during the year of 130,625cc's. The result, 26,125, is the number of lubricant applications that occurred during the year, that is, the total number of bearings that were serviced.

Minutes

This is the estimated average time required to lubricate one bearing on each lubrication cycle. The average should include travel time, time spent obtaining ladders or man lifts, changing grease gun cartridges etc.

For our example we are estimating an average of 6 minutes is spent in manually lubricating each bearing including the mentioned overhead items.

If the cost of one productive minute is $0.47 and on average 6 minutes are spent servicing one bearing the cost to service one bearing is $2.82.

To this must be added the cost of the lubricant. Let's say we spent a total of $605 on total grease consumed. Dividing this by 26,125 applications equals $0.023 per application.

Thus the total cost per application, for time and material is $2.84.

Therefore the total cost of 26,125 applications in the manual lubrication program is $74,195.

Automatic Lubrication

To apply the same volume of grease with automatic lubricators using replaceable lubricant cartridges with a capacity of 240cc we must divide the total volume of lubricant consumed, stated in cc by the capacity of the lubricant cartridge or 130,625cc divided by 240cc. This equals 544 lubricator cartridges.

The total cost of lubricant cartridges is 544 times the cost per cartridge. In our example we have assumed a lubricant cartridge cost of $21.00. The total cartridge cost is therefore, 544 x $21.00 or $11,424.

To this must be added the cost of the change-out of 544 lubricant cartridges and the cost of 3 inspections that we assumed should occur during the course of the cartridge life. The total of 1,632 inspections plus 544 cartridge change-outs is a total of 2,176 service calls on all lubrication point during the year. If the time required for a service call on the bearing is equivalent to the time required to perform manual lubrication or $2.82 each, the total cost of this cartridge replacement and inspection activity is $6,136. Therefore, the total cost of lubricant cartridges and service labor is $17,560.

Cost Reduction or Additional Cost

Comparing this cost $17,560, to the total cost of Manual Lubrication developed above of $74,195 results in a reduction of $56,635 or 76.3%.

You can use the following calculation to check the general reasonableness of your estimate of the Strokes and Minutes variables, and thus, the accuracy of the overall result of the analysis.

Multiply the number of manual "lubricant applications" that you calculated occurred during the year, which in the example was 26,125, by your estimate of the average minutes required to lubricate one bearing; in our example this was 6 minutes. The total time required for manual lubrication was therefore 156,750 minutes or 2,612.5 hours. In your calculation of The True Cost of Time you determined that there were 1,410 hours of productive time available per year per employee. By dividing the hours required for

lubrication by the hours of productive time available you can determine the theoretical number of people that are needed to perform manual lubrication.

> 2,612.5hours/1410 hours = 1.9 people are required for manual lubrication.

Does this compare with your actual assignment of people? If so, your estimates of the variables of average “Strokes” from a hand grease gun and the ‘Minutes’ variable of time required to service a bearing were correct. If there is a significant difference you can modify the values used as these variables and rerun the analysis until the calculated people requirement is near equal to your actual assignment. This should provide a close estimate of the savings you can expect through the installation of electro-mechanical automatic lubricators.

The Bottom Line

This example brings the realization of the true value of time and money of lubricating your equipment. Updating to electro-mechanical lubricators can have a cost savings of up to 75% while giving your maintenance team more time to complete other important projects.

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The Sponsor of this White Paper, PLI, LLC, is the exclusive United States and Canadian distributor of the MEMOLUB Automatic Lubrication System. PLI, LLC is making available, at no cost, a Microsoft Excel® computer template which will facilitate the running of the analysis described in this White Paper. By simply entering the required variables, described in this paper, the analysis can be run and rerun as many times as you desire. It can also be used to compare other products available on the market by simply changing the cost factors appropriate for each product being compared.

To obtain the computer template, copy and paste the following URL in the search line on your computer browser. http://www.memolub.com/files/Sound Money V1.7.xls

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