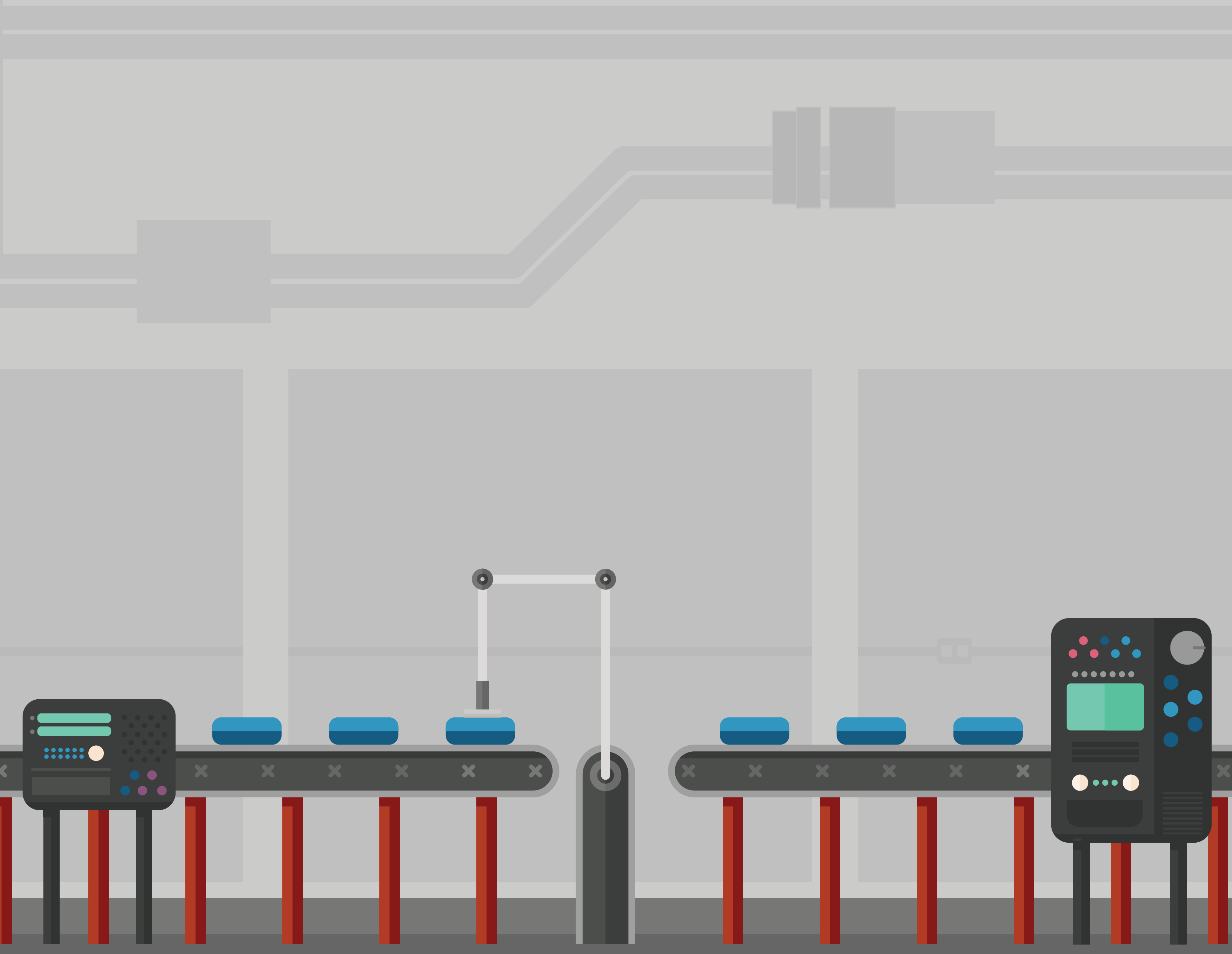
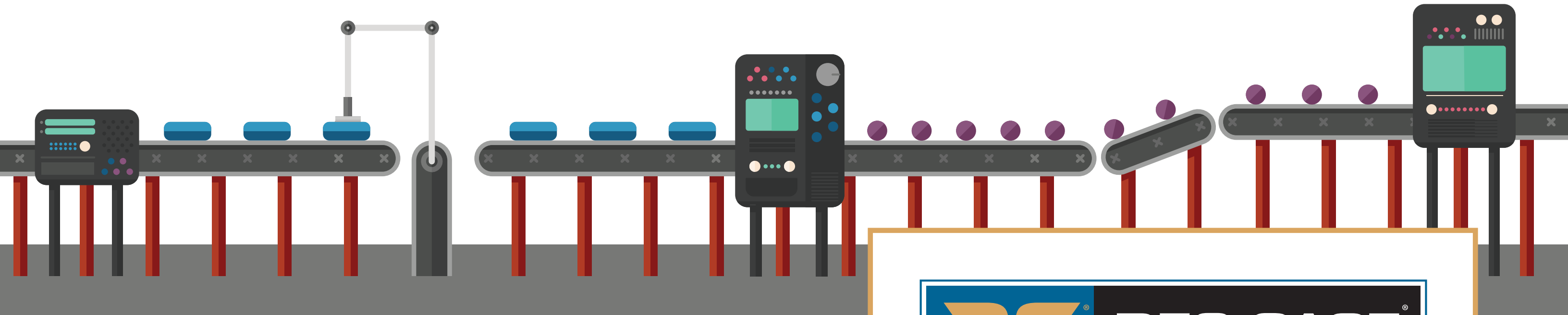
# TAKING FLUID CLEANLINESS TO THE NEXT LEVEL WITH PERMANENT OFFLINE FILTRATION



## INTRODUCTION

In recent years, portable filtration units, often referred to as filter carts, have become a common tool in the lubrication professional's arsenal. Increasing demand for these systems has led to the development of a wide range of new products and driven down prices, which is a good thing. When filter carts first came onto the scene they were primarily used by service providers for decontaminating large systems. These early models were typically designed for low viscosity oils in large volume systems and were on the expensive side, making them unsuitable or impractical for many applications. As awareness of precision lubrication and contamination control grew and maintenance programs began utilizing these services more often, many began purchasing their own filter carts, but usually only one unit for an entire plant. Very quickly, plants began to realize they were wasting time and money by switching products, so they started dedicating filter carts for particular lubricants in order to avoid flushing requirements and to increase their capacity to decontaminate systems. Now, the next evolution in offline filtration is permanently installed kidney loop systems. While portable systems will always have their place, permanent solutions offer several benefits including better average fluid cleanliness and far fewer man-hours.

Ideally, portable filtration should be used as a "condition-based" activity, providing a means to decontaminate systems when the particle count exceeds an acceptable limit. Having this option offers the ability to decontaminate any system in a plant when many of those systems can't justify their own dedicated filtration system. These systems provide additional value with the inclusion of water absorbing filters, offering the ability to remove water from small systems as well. The potential problem with portable filtration comes with the required resources for moving and setting up the system. If the filter cart was used with another lubricant previously, there are also flushing requirements and possibly filter changes as well. The time requirements may be minimized by properly fitting the reservoirs with quick connect fittings, but it is still a significant drain on resources. This is not really a problem for on-demand or condition-based filtration, but when the task is performed regularly, such as every month or every week, this time can really add up. An additional consideration is that periodic filtration is potentially unable to maintain target cleanliness levels. It may be that fluid cleanliness targets are only met for a short period after filtration and then remain unacceptably high until the next scheduled filtration task. The chart in Figure 1 illustrates this potential problem in a gearbox for which the target particle count is 19/17/14.



DES-CASE

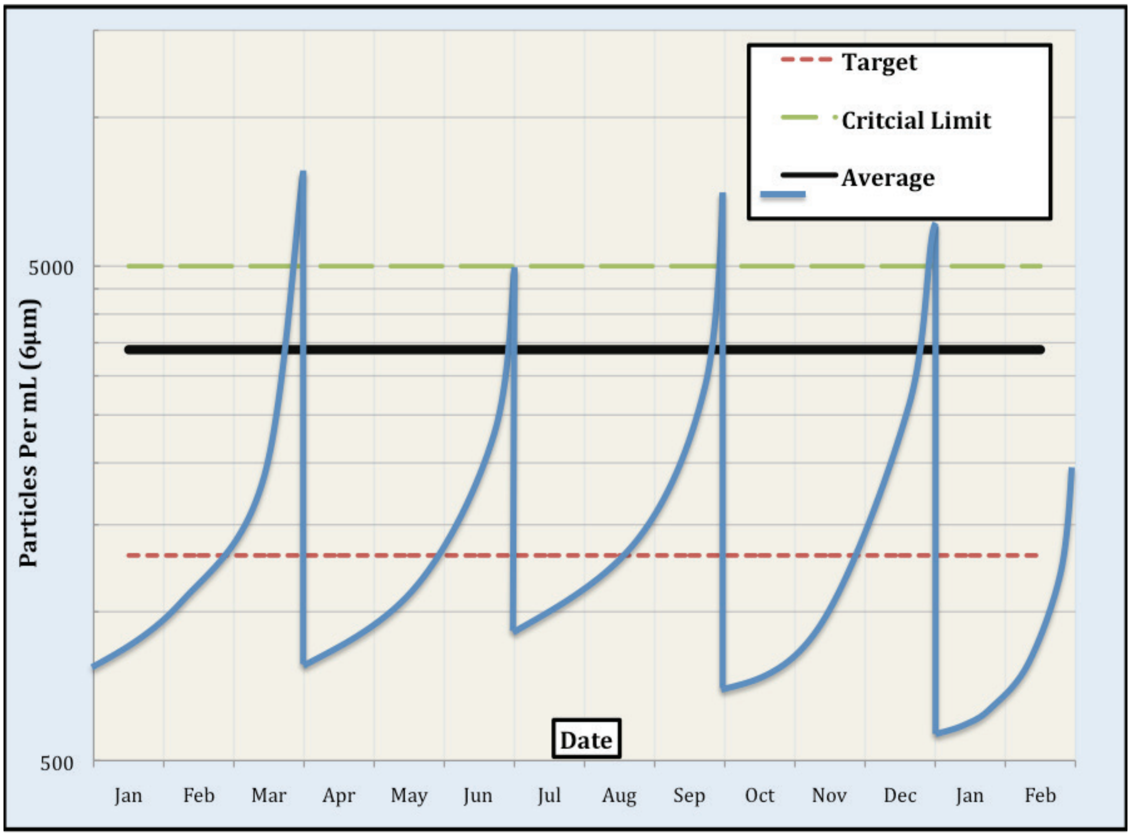



Figure 1

In this example, the target cleanliness for the gearbox is only met for a short time after filtration. With a target of 19/17/14, the 6m particle concentration should be below 1300 particle/mL. With quarterly filtration, the average particle concentration in this size range is 3,900 which corresponds to a particle count of 20/18/15. While this only represents an increase of one ISO code, the actual number of particles is almost 3 times the target. With a permanently installed filtration system, this system would likely be cleaner than the target.

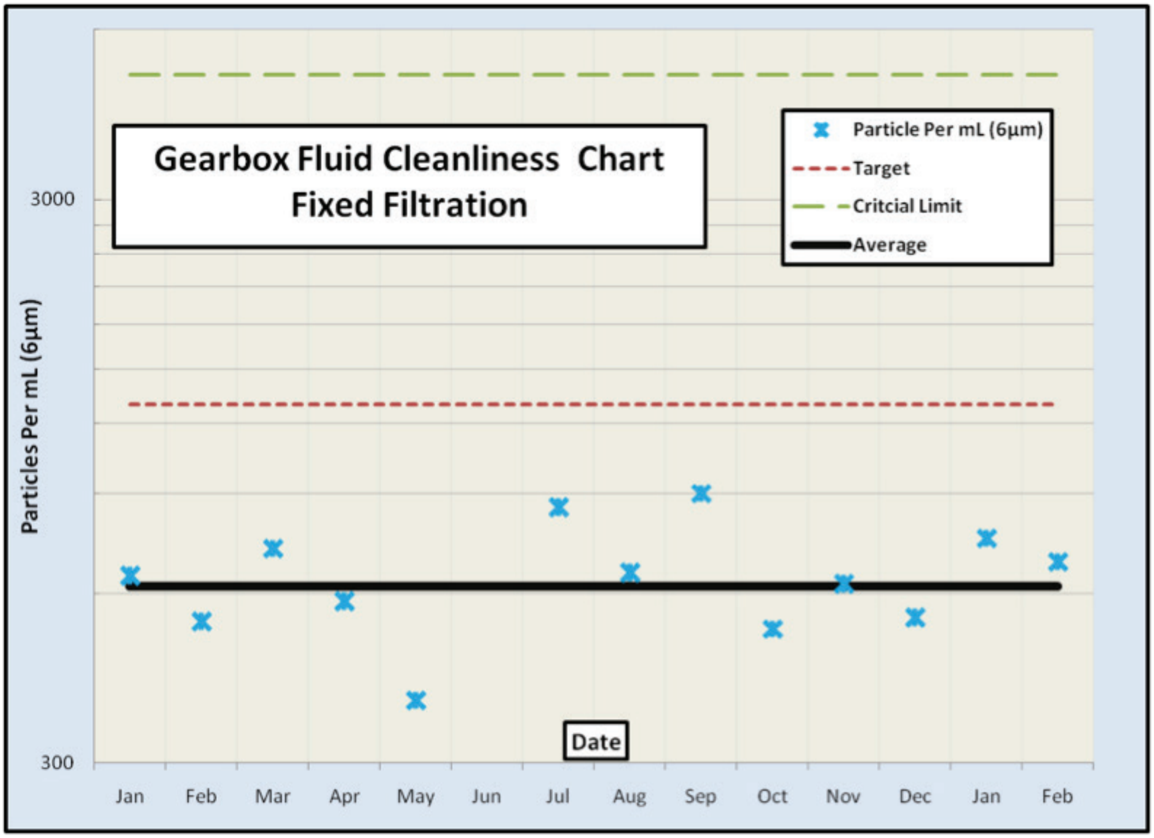
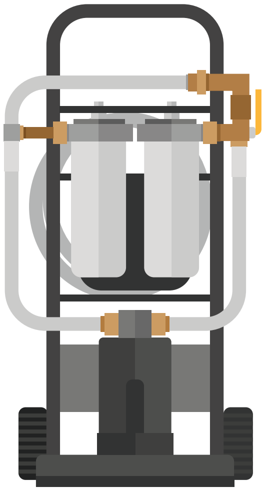



**Figure 2**

When fixed filtration is utilized the average particle concentration at 6µm is only 618 particles per mL vs. the 3900 with portable filtration. This corresponds to an average particle count of 18/16/13. To determine whether the cost of a fixed system can be justified, one must know the historical mean time between failures for this gearbox, the average cost of each failure, the typical cost of each filtration task performed quarterly, and the relationship between component life and fluid cleanliness. To analyze the cost to benefits in this case, the following assumptions are used:

*CASE 1: QUARTERLY FILTRATION WITH FILTER CART*

- Mean time between failure (MTBF) = 3 years
- Average cost of failure (AFC) = $10,000
- Annualized repair cost = $3,333
- Average particle count (APC) = 20/18/15
- Average man-hours per filtration task = 1.5
- Average man-hours per year = 6
- Average labor cost $75 per hour
- Average filtration cost = $450 / year
- Total maintenance cost = $450 + $3,333 = $3,783



To estimate the mean time between failures using fixed filtration we use the assumed data in case one with the chart in Figure 3.

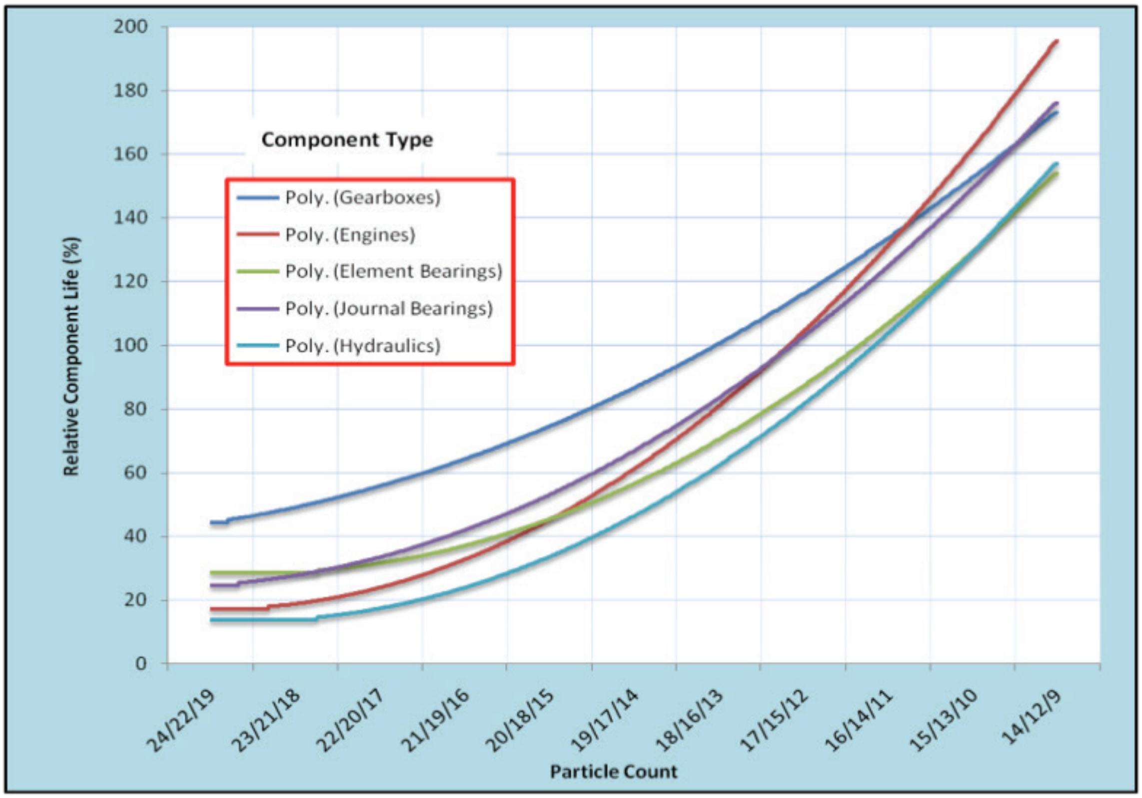



Figure 3

Based on the chart, the gearbox in Case 1 is currently achieving about 80% component life at 20/18/15. When fixed filtration is employed, the particle count moves to 18/16/13 which should improve component life to about 110% for a relative component life of 110/80 or an improvement of about 38%. This improvement should move MTBF from 3 years to about 4.125 years which yields the following:

- Mean time between failure (MTBF) = 4.125 years
- Average cost of failure (AFC) = $10,000
- Annualized repair cost = $2,500
- Average particle count (APC) = 18/16/13
- Average man-hours per filtration task = 0
- Average filtration cost = $0 / year
- Total maintenance cost = $2,500

In this example, the maintenance cost of the gearbox improved from approximately $3,800 per year to $2,500 per year for a savings of $1,300 or about 35%. To complete the analysis we simply compare these numbers to the cost of installing a filtration unit (about $1,500).

| YEAR | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| **Program Benefits** | $0 | $1,300 | $1,300 | $1,300 | $1,300 | $1,300 |
| **Program Costs** | | | | | | |
| *Upfront* | $1,500 | $0 | $0 | $0 | $0 | $0 |
| *Ongoing increased filter cost* | — | $0 | $0 | $0 | $0 | $0 |
| **Total Costs** | $1,500 | $0 | $0 | $0 | $0 | $0 |
| **Net Cash Flow** | -$1,500 | $1,300 | $1,300 | $1,300 | $1,300 | $1,300 |
| **Select Discount Rate** | 6% | | | | | |
| **Discount Factor** | 100% | 94% | 89% | 84% | 79% | 75% |
| **Discounted Net Cash Flow** | -$1,500 | $1,226 | $1,157 | $1,092 | $1,030 | $971 |
| **Investment Analysis** | | | | | | |
| *Five-Year Net Present Value (NPV)* | $3,976 | | | | | |
| *Internal Rate of Return (RR)* | 82% | | | | | |

**Table 1**

If this project is considered over a five-year period the net present value of the $1,500 investment is about $4,000, providing an internal rate of return of about 82% which is quite attractive.

In this example, the numbers are pretty strong showing fixed filtration as the clear winner. Of course, not all examples will turn out this way. There are many systems where occasional or condition-based filtration is the most economical solution, but one should always take a critical look at each case and evaluate the benefits of both options. While filter carts will likely always be the best option for fluid transfers and decontamination of stored lubricants in drums and totes, they may not always be the best option for maintaining optimum cleanliness levels in your machines.

Des-Case Corporation | 675 N. Main St. | Goodlettsville, TN 37072
Main: 615.672.8800 | Fax: 615.672.0701 | descase.com