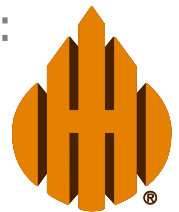


Why Supplemental Filters?

White Paper Sponsored by:

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Why Supplemental Filters ?

Building the case for adding kidney loop filters that improve fluid cleanliness levels.

Why is added filtration needed on equipment today?

- OEM filtration systems from the factory “rarely” come with a bypass depth filtration system
- OEM/Inline filtration is full flow and cannot constrict fluids’ path to the engine and other components
- Best case, inline filters can only remove contaminants as small as 10 microns, with low efficiency, and cannot remove water or suspended soot
- This leaves room for damaging contaminants and moisture/soot to remain and build up in the system

Contamination Kills

- A. According to the bearings division of TRW, "contamination is the number one cause of bearing damage that leads to premature removal."**
- B. Machine Design Magazine reports that "less than 10 percent of all rolling-element bearings reach the fatigue limit because contamination usually causes wear or spalling failure far earlier."**
- C. According to Caterpillar, "dirt and contamination are by far the number one cause of hydraulic system failures." J. I. Case states that "one thing holds true about hydraulic systems: the systems must be kept clean -- spotlessly clean -- in order to achieve the productivity they're capable of."**
- D. Protractive studies by the U.S. Navy show that the cost of contamination on marine and aviation equipment per operating hour exceeds 60 percent of the cost of fuel per hour on the same equipment**
- E. Massachusetts Institute of Technology states that "six to seven percent of the gross national product (\$240 Billion) is required just to repair the damage caused by mechanical wear." Wear occurs as a result of contamination.**
- F. Oklahoma State University reports that when fluid is maintained 10 times cleaner hydraulic pump life can be extended by 50 times.**

Hitachi ZX850 Hydraulic Harvard 1000 2-GPM System



Hitachi ZX850 ISO Trending

Pre-Filtration Sample Results

	4μ	6μ	14μ
ISO	20	19	18
Particles/ml	7,202	3,160	1,386

**93.8%
reduction**
in overall
particulates

Post-Filtration Sample Results

	4μ	6μ	14μ
ISO	16	14	12
Particles/ml	448	113	28

ISO Cleanliness Code improvement in 919 hours of operating time on Harvard 1000 system:

- 4 grades cleaner at 4 microns
- 5 grades cleaner at 6 microns
- 6 grades cleaner at 14 microns

Caterpillar D6T Hydraulic Harvard 125 0.75-GPM System



Caterpillar D6T ISO Trending

Pre-Filtration Sample Results

	4μ	6μ	14μ
ISO	19	17	17
Particles/ml	3,488	1,154	764

83.9%
reduction
in overall
particulates

Post-Filtration Sample Results

	4μ	6μ	14μ
ISO	16	12	8
Particles/ml	563	30	2

ISO Cleanliness Code improvement in 2,109 hours of operating time on Harvard 125 system:

- 3 grades cleaner at 4 microns
- 5 grades cleaner at 6 microns
- 9 grades cleaner at 14 microns

Komatsu DP65PX Dozer Transmission

Harvard 500 0.50-GPM System



Komatsu DP65PX ISO Trending

Pre-Filtration Sample Results

	4μ	6μ	14μ
ISO	23	20	15
Particles/ml	57,397	9,512	223

92.4%
reduction
in overall
particulates

Post-Filtration Sample Results

	4μ	6μ	14μ
ISO	19	16	13
Particles/ml	4,356	633	61

ISO Cleanliness Code improvement in 268 hours of operating time on Harvard 500 system:

- 4 grades cleaner at 4 microns
- 4 grades cleaner at 6 microns
- 2 grades cleaner at 14 microns

Caterpillar 980K Hydraulic and Transmission Harvard 500 Systems



Caterpillar 980K Hydraulic ISO Trending

Pre-Filtration Sample Results

	4μ	6μ	14μ
ISO	21	19	18
Particles/ml	10,370	4,718	1,450

**91.4%
reduction**
in overall
particulates

Post-Filtration Sample Results

	4μ	6μ	14μ
ISO	17	16	15
Particles/ml	897	391	188

ISO Cleanliness Code improvement in 1,063 hours of operating time on Harvard 500 1-GPM system:

- 4 grades cleaner at 4 microns
- 3 grades cleaner at 6 microns
- 3 grades cleaner at 14 microns

Caterpillar 980K Transmission ISO Trending

Pre-Filtration Sample Results

	4μ	6μ	14μ
ISO	18	16	15
Particles/ml	1,500	493	202

**90.7%
reduction**
in overall
particulates

Post-Filtration Sample Results

	4μ	6μ	14μ
ISO	14	13	12
Particles/ml	140	53	23

ISO Cleanliness Code improvement in 272 hours of operating time on Harvard 500 0.50-GPM system:

- 4 grades cleaner at 4 microns
- 3 grades cleaner at 6 microns
- 3 grades cleaner at 14 microns