

SK4051TSU Transmission Servicing Oil Cart White Paper

HABCO's SK4051TSU transmission servicing oil cart unit was designed to greatly reduce labor and waste oil during routine servicing and transmission flush procedures. Filtering new oil through the SK4051TSU prior to introduction into gearboxes, virtually eliminates premature filter contamination indication on aircraft internal gearbox filters.

The TSU has been field tested for over two years. More than 160 units are presently in use by the active U.S. Army and the National Guard.

The SK4051TSU was engineered as a Transmission Servicing Cart, not an oil purification system. How it works: Oil drained from the aircraft gearbox first passes through a chip strainer to catch large metallic particles, which if left, could activate the aircraft chip detector and damage the gearbox. The bowl of the chip strainer is easily opened to allow for examination and analysis of trappings.

After the chip strainer, the oil then passes through dual high efficiency filter cartridges. The cartridges supplied are a low cost commercial type, which tests have shown to eliminate more than 97% of all particles greater than 4 microns in size¹. The dual filters consist of 2 identical elements in series, one acts as a pre-filter and the second serves as a final filter.



Benefits of the SK4051TSU Transmission Servicing Cart include:

- Reduced labor during servicing procedures: The SK4051TSU is used to drain oil from the transmission during serviceability inspections. Doing so virtually eliminates the possibility of spillage and other environmental impacts.
- Eliminating waste oil during flush procedures: When transmission flush is required, due to chips or other particulate contamination, the SK4051TSU allows for recycling of 100% of the existing oil.

¹ Based on testing by Avion – May 23, 2007



- Reducing requirements for large quantities of oil products for deployments due to recycling capability.
- **ROI Data:** Users report that the TSU pays for itself in a short time based on new fluid cost and cost of old fluid waste removal. Return on Investment for the TSU on a UH-60 Black Hawk is 8 - 10 filtration cycles (used fluid) and 4 - 7 filtration cycles for the CH47 Chinook (see chart below). Kansas National Guard paid for its TSU unit with oil savings in 5 ½ months.
- **Trend Data Integrity:** By recycling the fluid, trend data integrity is maintained and the history of the transmission remains intact with the filtered fluid. Putting new fluid in means starting a new baseline for trend data.
- **Better and Cleaner:** New fluid can be made cleaner with filtration in the TSU. New fluid is considered dirty and may contain particulates of 10 microns or larger.
- **Clean Connection:** Provides a clean and simple procedure for transmission maintenance during a drain and flush. This is accomplished with a direct hose connection to the drain port for removing the fluid, with the same hose refilling the transmission after filtration.
- **Filtration:** Removes particulates to 3 microns. TSU comes with extra COTS (Commercial off the Shelf) spin-on cartridges for filters. A pressure indicator gauge on the panel indicates when the filter should be changed.
- **Portable:** The TSU is battery powered and can be used remotely for approximately 45 minutes. (Each filtration cycle lasts about 10 to 15 minutes.) It holds approximately 14 gallons of fluid, which, when coupled with being battery powered, makes it a great fill cart.
- **Short Term Savings:** The TSU eliminates the need to throw away fluid after a drain and flush. Eliminating this waste of fluid in order to meet requirements when drain and flush must be done multiple times, makes the TSU energy efficient and environmentally friendly.
- **Small Footprint:** With cargo footprint or space on aircraft at a premium, the SK4051TSU cuts down on deployment costs - only a fraction of the fluid shipping that has been required in the past is needed with the TSU.
- **Environmental Waste Reduction:** The SK4051TSU is environmentally friendly and cost effective. Environmental issues make it costly to dispose of chemicals and fluid waste. Since the TSU eliminates the need to throw away fluid after transmission maintenance, it helps protect the environment as well as the budget.



- **Inspection:** The SK4051TSU comes standard with an inline screen & bowl to catch and hold chips for analysis.
- **Warranty:** The SK4051TSU is covered under HABCO's 24 month no nonsense warranty.
- **Flusher:** The SK4051TSU can be used upstream of the transmission to flush the oil cooler when required by the maintenance procedure..
- **Fluids:** The SK4051TSU cart can filter DOD-L-85734, Mil-L-7808, and Mil-L-23699 plus other synthetic fluids.

TSU Case Study with Kansas National Guard

"I first saw the TSU at a Blackhawk Users Conference and immediately knew HABCO was on to something. At that time, we were going through hundreds of gallons of transmission oil, doing gearbox replacements, drain and flushes, and special inspections. We did the math and figured if we purchased a TSU, it would pay for itself in eight months. It actually took 5 ½ months!"

– John Alexander, CW4 AV, AMO-KSARNG

Situation

When regulations switched to requiring 3-micron oil filters in transmissions, "brand spanking new oil was too dirty for the filter," said John Alexander, CW4 AV with the Kansas National Guard. New oil from the can is 7 microns. Because of that, an aircraft's impending bypass indicator would extend after a recent oil change, and the pilot would bring it in for maintenance. "It took three filters to get oil clean enough to function normally in the transmission," Alexander reflected. We were going through three brand new filters at \$178 each with every oil change."

Also, before discovering the TSU, it was a mess to drain oil from an aircraft. "You'd find an empty 30-gallon drum, pull the plug, get out of the way, and hope oil didn't spray out all over your uniform," Alexander explained. "You'd end up with a huge mess, a dirty 30-gallon drum with 8 or 9 gallons of dirty oil that needed to get dumped into an approved container, which then needed to be cleaned out."

Top 3 Benefits of TSU Reported by Aircraft Maintenance Group:

1. **Reduced aircraft downtime.** *Extended impending bypass button caused a lot of downtime. Each time it came on, the aircraft couldn't fly. Would take up to 3 days to service, change oil filter and get aircraft back up. As a maintenance officer, it's a huge benefit to increase aircraft flight time.*



2. **No mess.** *Much easier and cleaner to deal with oil changes – now we can clean up with a paper towel. Plus, we don’t have 8 gallons of waste oil to get rid of after every drain and flush.*
3. **Cheaper.** *Not wasting perfectly good filters every time an aircraft needs an oil change and being able to use the same filtered aircraft oil during a drain and flush is a big savings. Used to stock 55-gallon barrels of aircraft oil. Won’t buy another 55-gallon barrel of oil because I won’t use it. Will just buy quarts from now on.*

TSU Performance to Expectations: Done well. Kansas National Guard got first ones HABCO built. Newer models even better, with double the power and battery capacity.

Who Benefits from TSU: Entire maintenance group from mechanic to maintenance officer. Makes life easier. Once they know how to use it, they love it. Don’t get uniform covered with oil. Now it’s a closed system. Oil doesn’t spray out because TSU vacuums it out of transmission.

“I’ve been in the helicopter maintenance world for over 27 years, and this is the first time I’ve ever felt that a product was absolutely worth my endorsement. And I know I’m not the only maintenance officer that feels this way. I’ve heard the senior AMCOM representatives say the same thing.” - John Alexander, CW4 AV, AMO-KSARNG

Possible Savings Chart based on 2 to 4 oil changes per year.

	Savings Per year	
	Fleet of 8	
	2 Changes/yr	4 Changes/yr
Blackhawk	\$11,840	\$23,680
Chinook		
41 Qts -	\$13,280	\$26,560
67.5 Qts -	\$23,360	\$46,720

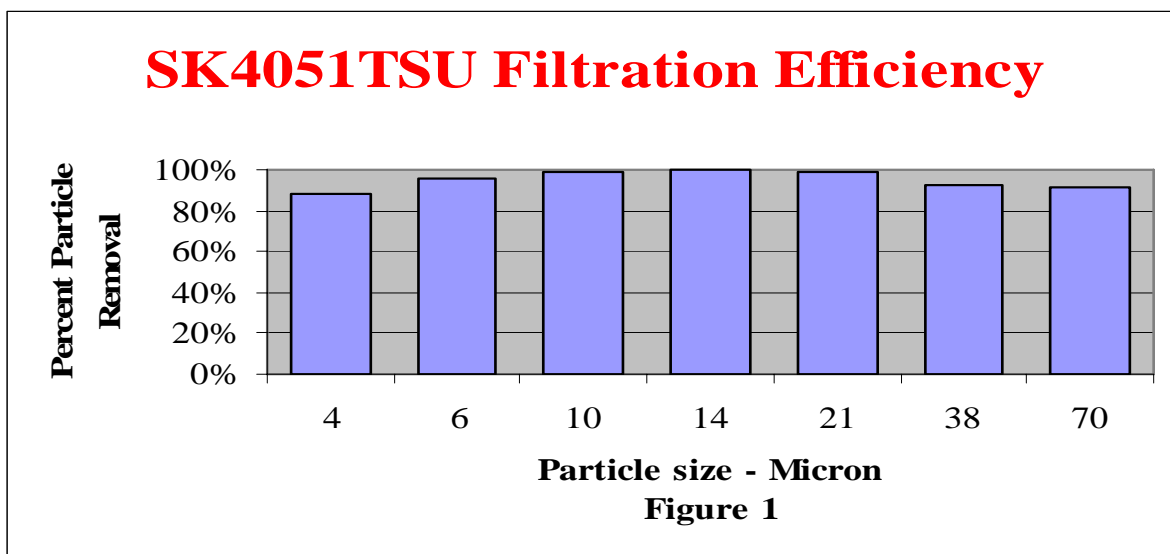
Blackhawk	\$740	per change
Chinook		
41 Qts -	\$830	
67.5 Qts -	\$1460	per change

	Savings Per year	
	Fleet of 16	
	2 Changes/yr	4 Changes/yr
Blackhawk	\$23,680	\$47,360
Chinook		
41 Qts	\$26,560	\$53,120
67.5 Qts	\$46,720	\$93,440

Blackhawk	\$740	per change
Chinook		
41 Qts -	\$830	
67.5 Qts-	\$1460	per change

Field Testing / Evaluation of the SK4051TSU Includes:

- Avion Inc. Test Report, June 6, 2006. Testing included extended run tests with oil sampling to determine that the filtration process did not degrade the oil. Report concludes that the SK4051TSU should be approved for use. Particle Filtration Efficiency resulting from their testing is shown in Figure 1.
- Avion Inc. testing performed in May, 2007. Test included use of particulate contaminated oil to demonstrate effectiveness of factory supplied Purolator™ filter. Recorded data shows a total particulate removal efficiency of 97.8% for all particles 4 microns and greater in size.



Important facts about the SK4051TSU:

- The SK4051TSU Transmission Servicing Cart is not intended to be an oil purification cart. It is intended to greatly reduce cost and labor associated with routine service and maintenance on aircraft gearboxes.
- The SK4051TSU does not harm or improve oil chemistry. Sampling is still required in accordance with accepted Army procedures.
- As with all filter media, a partially dirty filter element may release particle fines due to shock or vibration in normal use. This would be most evident when servicing a gearbox with fresh oil after having filtered oil with a considerable particulate contamination. The use of dual main filters reduces this problem by allowing the user to install a new final filter cartridge moving the existing final filter to now become the pre-filter.



- In normal operation, 100% of the gearbox oil passes through the filtration path when the oil is drawn from the aircraft into the SK4051TSU tank. 100% of the oil is then filtered a second time as the fluid is pumped from the tank back to the aircraft. Additional filtration by circulation provides only marginal additional benefit.