Fluid Sampling Protocol

Objective: To obtain a fluid sample that is representative of the actual condition of the fluid in the system in terms of cleanliness, dryness, additives, and the presence of wear particles being generated by the fluid wetted parts.

Where to Sample: When deciding on a sampling location, the following rules need to be adhered to as closely as practically possible:

a. Obtain sample from a turbulent section of the system to ensure that fluid is not flowing smoothly at the sampling point but is turning and rolling to uniformly suspend and distribute the contaminant. Install valves at or after sharp bends such as elbows.
b. Obtain sample from downstream of equipment after it has completed its primary function such as lubricating a bearing or gear or has passed through a hydraulic pump or actuator. The return line is a good sampling location for monitoring system condition and wear debris.
c. Do not obtain the sample downstream of a filter unless assessment of the filter performance is the goal of the sampling. Obtain sample upstream of the filters and any other contamination removal device such as separators or dehydrators.
d. Sample from tanks only when it is unavoidable and do not use the drain port directly. Use compression type fittings incorporating a valve and tube extending into the fluid sump through the drain port for proper tank sampling.
e. Sample top accessible tanks by inserting a tube about half way under the fluid surface and using a vacuum pump to draw the sample. The tube can be tied to a length of steel tube or rod to keep it straight. If the tank dipstick port is used, extreme care should be taken to avoid scraping against the surfaces.
f. It is important for the trending of the fluid condition that the same sample location be used each time.

How to Sample:

The system being sampled should be at normal operating temperature and flow conditions at the time of the sampling. It is recommended that the system be operated for at least 30 minutes with actuators cycling prior to talking samples. If not possible to sample when the equipment is operating, sample as soon as safely possible after shutdown to prevent the settling of contaminants.

1. **Sampling from a permanently installed sampling valve (see Figure 1)**

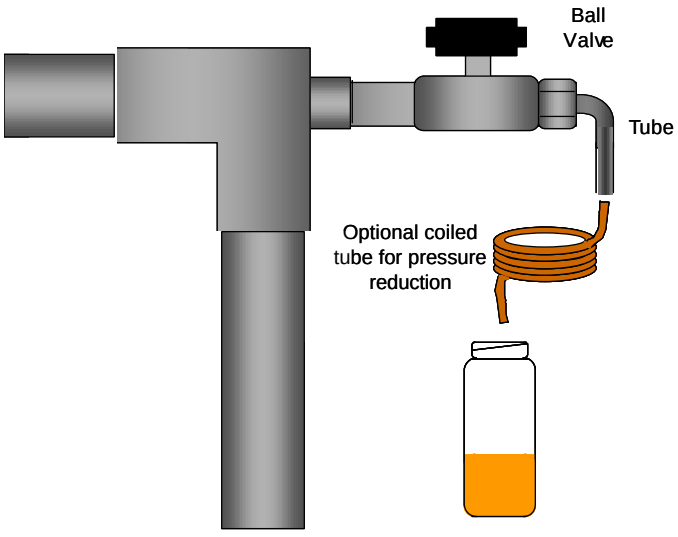

Figure 1

a. Wipe the outside of the valve with a clean, lint free rag.
b. Open the sampling valve and let about one liter (1 quart) pass

through to flush the valve and the associated pipes. Do not touch the valve during the sampling. The flush fluid can be collected in a clean container for reuse.

c. Open the sample bottle cap, taking care not to contaminate. Hold the cap in hand or place on a clean surface, face down.
d. Fill the sample bottle about halfway, cap and shake well to flush the internal surface. Discard the fluid.
e. Fill the sample bottle until the fluid level is about 1 cm (½") from the top.
f. Cap the bottle immediately and then close the sampling valve.
g. Label the sample bottle with sample details, fill out the sample form and enclose both in the supplied plastic container for transport.

Note: If the system is not installed with proper sampling valve with PTFE or similar seals then increase the flushing fluid volume (step b) to at least 10 liters (2.5 gallons).

Important! Sampling from high-pressure lines should be done by experienced personnel using a coil of tubing, commonly available, for reducing the pressure to a safe level (See ISO 4021).

2. Sampling reservoirs / sumps using vacuum hand pump (available from Pall)

a. Clean the area around the reservoir opening to be used for tube entry with a clean, lint free rag.
b. Measure the length of tubing required to reach the middle of the tank, add 15 cm (6") to it and cut the tubing.
c. Insert tubing through the head of the vacuum pump. The tubing should extend about 2 cm (1") beyond the base of the pump head into the bottle.
d. Insert the tube into the reservoir at about the middle. Be mindful not to scrape the tube against surfaces while inserting and while inside the tank.
e. Operate the hand pump to fill the bottle half way.
f. Unscrew the bottle slightly to break the vacuum, let the hose drain. Detach the bottle from the pump, cap and shake well. Discard the fluid.
g. Repeat the above step once more to thoroughly rinse the bottle and tube.
h. Fill the sample bottle until the fluid level is about 1 cm (½ ") from the top.
i. Unscrew the bottle slightly to break the vacuum, let the hose drain. Detach the bottle from the pump and cap. Close the reservoir opening.
j. Label the sample bottle with sample details, fill out the sample form and enclose both in the supplied plastic container for transport.

3. Sampling from drain ports

Note: Avoid sampling from drain ports if possible. Sampling sumps such as gearboxes is preferable from the fill port or the dipstick. If the drain port is the only possible location:

a. Install a compression type fitting at the drain port with a piece of metal tubing passing through the compression fitting midway into the sump and the outside end of the tube fitted with a ball valve with PTFE seals. See Figure 2.

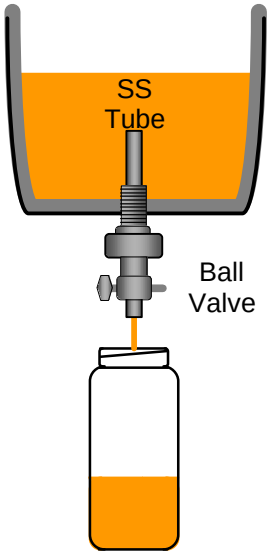

Figure 2

b. With the sump under normal operating conditions, open the sampling valve. Fill the sample bottle to about half. Put cap on, shake well and discard the fluid.
c. Refill the bottle leaving about 1 cm (½") space at the top. Cap the bottle then close the valve.
Note: Due to high viscosity or lack of head pressure the fluid might not readily flow under gravity. In this case the vacuum pump can be used to draw the fluid from the valve. See Figure 3.

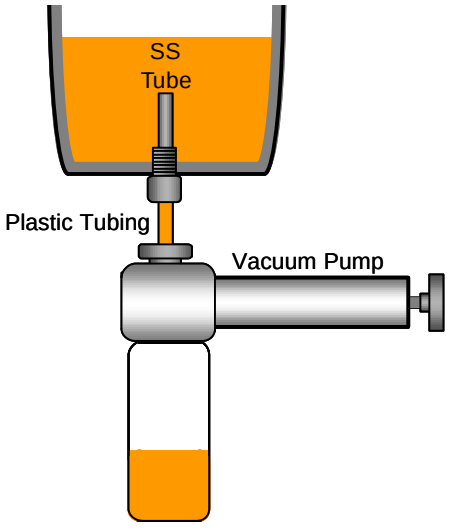

Figure 3

d. Label the sample bottle with sample details, fill out the sample form and enclose both in the supplied plastic container for transport.

4. Sampling from nozzles

Note: Systems such as those for rolling mill and machining coolant are best sampled at the nozzles utilized in these systems.

a. With the coolant system under normal operating conditions, remove the cap from the sample bottle and place it under the flow from the nozzle.
b. Fill the bottle to about half without touching the nozzle. Cap the bottle, shake well and discard the fluid.
c. Refill the bottle leaving about 1 cm (½") space at the top.
d. Cap the bottle, place the label, fill out the sample form and enclose both in the supplied plastic container for transport.

How often to Sample:

Sampling frequency is determined by the nature of the machine, its use and how critical the early warning of impending problems with the machine is. The following table shows typical sampling intervals for common systems used in the industry. Each user needs to determine the optimum sampling interval for their machine based on their experience and the relative importance of the machine in their operation.

Machine Type	Typical Sampling Interval (hours)
Hydraulics – Mobile	200 / monthly
Diesel Engines – Off Highway	150 / oil change
Transmissions, Differentials	300 / monthly
Gas Turbine – Industrial	500 / monthly
Steam Turbine	500 / monthly
Air / gas Compressor	500 / monthly
Chiller	500 / monthly
Gear Boxes – high speed / duty	300 / monthly
Gear Boxes – low speed / duty	1000 / quarterly
Hydraulics – Industrial	300 / quarterly

Important!

1. Observe appropriate personal safety precautions including eye/face protection, gloves, slip resistant shoes, etc. and avoid fluid spillage.

2. For additional details refer to document ISO 4021 “Hydraulic Fluid Power – Particle Contamination Analysis – Extraction of Fluid samples from lines of an operating system”.

3. Incorrect sampling procedures will adversely affect the cleanliness level of the sample. It is difficult to obtain a sample cleaner than the actual system, but very easy to obtain one that is dirtier.