Scotia Portable Fluid Contamination Analysis Kit

User Guide

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1.0 INTRODUCTION

The Scotia portable contamination analysis kit forms an invaluable tool for monitoring contamination control.

It enables you to make an on-the-spot assessment of systems fluid cleanliness and to identify the types of contaminant.

The kit comes complete with everything you require for immediate use, including a high quality microscope with 100x magnification and mechanical vernier stage; and a robust, quiet, electric vacuum pump. You are also supplied with full operating instructions and guidance to its application in a wide range of oil condition monitoring and trouble-shooting.

2.0 OUTLINE OF METHOD

A representative sample of hydraulic fluid is removed from the system and a known volume (usually 100 ml) is drawn through a 47mm diameter laboratory membrane filter disc using vacuum leaving the contaminants on the surface of the filter disc. Residual Sample fluid is washed from the filter disc using a suitable solvent, and the membrane filter disc is transferred to a suitable protected container such as a petri slide. The surface of the filter disc is examined microscopically to determine the amount and nature of contaminant present in the fluid sample.

3.0 SAMPLING PROCEDURE

3.1 OVERVIEW

Sample bottles should be clean to minimise the interference of contaminant from the bottles with the contamination results reported. The bottles should always be marked with a date, machine type and location where sample was obtained at least.

It is important that the sampling procedure is carried out in a manner that ensures the sample is representative of the bulk fluid. A sample from the top of a reservoir that has been idle will be much cleaner than a sample taken from the flowing line of the same system a few minutes after a system start-up. Conversely, a sample taken from the initial drainings from the bottom of a reservoir that has been standing for long periods will be much dirtier than the actual system fluid.

The methods described below, if followed carefully, should provide a representative sample.

- The preferred method of extracting fluid samples from pressurised lines containing flowing fluid has been published by the International Standard Organisation (ISO 4021). This standard states that whenever extracting a fluid sample from a line there should always be turbulence to provide uniform mixing of the contaminant. Turbulence can be created by positioning the sampling valve immediately downstream of an obstruction to flow, such as component or a right angled pipe fitting.

3.2 SAMPLE BOTTLES

Sample bottles should be clean to minimise the interference of contaminant from the bottles with the contamination results reported. The bottles should always be marked with a date, machine type and location where sample was obtained at least.

3.3 ASSEMBLY OF VACUUM FILTRATION APPARATUS

Connect plastic connector (A) to filter flask connector (B). Connect plastic tubing connector to the intake vacuum pump connector. Insert rubber stopper (E) into mouth of vacuum flask and insert filter support (D). Place PTFE sealing ring (G) and stainless steel support (F) on filter support (D).

Using tweezers, remove one membrane filter disc from its container taking care to separate filter disc from waxed separating papers. Place and centre the filter disc. (F) printed grid side up, on the filter support (D). Immediately place the graduated filter funnel (H) on to base, centrally over the membrane filter disc (F) and secure with holding clamp (J). Do not slide filter funnel over the filter disc during process since laboratory membrane discs are fragile and easily torn. Place the glass lid (K) over the graduated filter funnel so atmospheric contaminant introduction is minimised.

NOTE: Ensure glasses (H) and (K) are thoroughly rinsed with filter solvent.

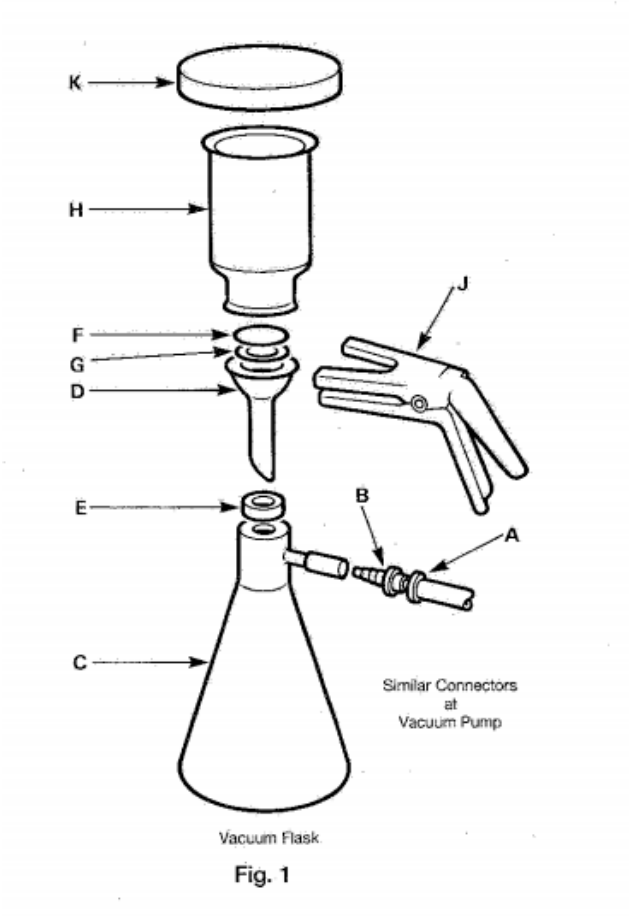

Fig. 1

3.4 LABORATORY MEMBRANE

Use Millipore filter disc~~, part number RAWG 04700~~, 1.2 micrometre pore size, with black grid lines for all hydraulic fluids other than phosphate ester fluids. Phosphate ester fluids will attack and soften the cellulose acetate filter membrane and blind the pores making it impossible for you to draw your sample through.

Special filter discs are available for use with phosphate ester fluids.

3.5 TRANSFERRING FLUID SAMPLE

3.5.1 Thoroughly agitate fluid sample bottle to ensure that all contaminants are in suspension.

3.5.2 If you think fluid sample is clean, pour 100ml of fluid from the sampling bottle into the graduated filter funnel. If you think the sample is dirty, pour in only 10 to 20ml as pretest. If it plugs the filter disc, there is no need for further testing since the sample has been shown to be very dirty. If, however, the sample readily passes through the filter disc without leaving a heavy residue of contaminant on the upper surface of the filter disc then insert a new filter disc and start again with 100ml fluid volume in the funnel.

3.5.3 Replace glass lid over filter funnel and start vacuum pump.

3.5.4 If the system fluid is highly viscous (>60cSt) the flow will be low but the filtering time will be greatly shortened by heating the sample or by adding filtered solvent. *Always ensure a filter disc is fitted to the solvent dispenser nozzle.

3.5.5 After drawing the fluid sample through the filter disc release the vacuum then gently rinse the filter disc and funnel thoroughly with filtered solvent. If the filter disc is not rinsed down, the membrane filter will be saturated with system fluid which makes the contaminant difficult to observe under the microscope. Do not direct solvent directly at the filter disc as it will disturb the distribution of particulate.

3.5.6 Turn on vacuum to pull solvent through membrane and leave to air dry for a few minutes.

*The solvent (1.1.2 trichloro 1.2.2 trifluorethane) is not compatible with most water based fluids, therefore it cannot be used to lower viscosity when using these fluids. Filtered deionized water should be used for these fluids. It is permissible to use liquid solvent for cleaning purposes as long as cleaned parts are thoroughly dry prior to use.

3.5.7 Turn off vacuum pump and release the vacuum in the flask.

3.5.8 Use tweezers to carefully remove the filter disc from the glass filter holder.

3.5.9 Place the filter disc, grid side up, in clean petri slide and replace petri slide cover. Label the petri slide.

4.0 MICROSCOPE

4.1 ASSEMBLY PROCEDURE

- Remove microscope from box, connect to electrical power and switch on to incident lighting.
- Place petri slide containing contaminant on filter disc under the microscope and remove petri slide lid.
- Focus the microscope and adjust the microscope lamp intensity to obtain maximum particle definition.

4.2 MANIPULATION OF MICROSCOPE

- Familiarity in the manipulation of the microscope can only be acquired by practice in focusing, and sizing particulate contamination with the micrometre scale graticule in the eye piece of the microscope. The operator should practice to determine the capabilities and characteristics of his equipment with confidence.
- There is a damped mechanical moving stage which holds the petri slides on the microscope base which facilitates complete inspection of the membrane filter disc.

5.0 SAMPLE ANALYSIS

5.1 SIZING CONTAMINANTS

When using the micrometre scaled graticule to arrive at particle sizes use the following parameters:

- Using the 10X objective lens, the smallest incremental graduation is 10 micrometres. Use this lens for observing and scanning the filter disc and for comparing contaminant density with standard photographs provided.
- Using the 4X objective lens, the smallest incremental graduation is 20 micrometres. Use this lens only for observing the larger particles and for confirming an even distribution of contaminant over the surface of the filter disc. The lower power provides for greater depth of focus which may make it easier to observe some of the larger particles.

5.2 IDENTIFICATION OF SILT

Silt, (sub 5 micrometre particulate) normally shows up as a coloured background on the filter disc. When a system is properly filtered using Pall Ultipor 83=200 filters, the white membrane background colour should be nearly equal to that of a new membrane and at worst a very light shade of grey. However, note that petroleum base fluids can discolour the filter disc light brown to orange due to oxidation caused by excessive heat in the system.

5.3 INVESTIGATION OF TEST RESULTS

Often it is only necessary to visually observe the dirt that is circulating in a system to identify the problem. The comparison with a “clean” fluid is usually quite dramatic.

6.0 CLEANING PROCEDURE

6.1 OVERVIEW

- All glass pieces, sample bottles and beakers in the portable contamination analysis kit should be cleaned before and after use.
- Rinse with filtered solvent or wash thoroughly in a hot detergent solution and rinse with hot tap water.
- Allow to dry naturally by draining. If a cloth or paper towel is used to dry the glass pieces, fibres will stick to the surfaces and show up later when the membrane filter discs are microscopically analysed. Always flush glassware with filtered solvent after wiping dry.

6.2 1L SOLVENT DISPENSER

The kit contains 25mm 0.8µm filter membranes for insertion into the filter holder located on the outlet of the solvent dispenser.

Use of the filter membrane in this filter holder ensures the dispensing of “clean” solvent during membrane preparation and glassware cleaning.

6.3 LOADING MEMBRANES

- Firmly holding the main body of the gun, unscrew the locking nut and separate the two sections of the holder.
- With forceps carefully remove the O-ring from the body of the holder.
- Tilt the body to remove both stainless steel support screens.
- With forceps separate 1 25mm 0.8µm filter membrane from its protecting waxed paper discs.
- Place the filter membrane, face up, on to one of the stainless steel support screens and place the second screen on to filter, thereby sandwiching the membrane between the two support screens.
- Replace the screens into the holder body ensuring that the face-up side is upstream to the fluid flow.
- Replace the O-ring on top of the screens and bring the two housing bodies together. Screw the locking nut in place to seal the unit.
- Pressurise dispenser and flow at least 100ml of solvent through the filter assembly to flush out any contaminant in the downstream portion.
- The filter should be changed each time the solvent dispenser is filled with solvent.

6.4 ISO CLEANLINESS LEVEL

An estimate of the ISO Cleanliness Level can be obtained by comparing the prepared slide with the photographs in the booklet provided.

Slides should ideally be prepared using a 100ml sample volume of test fluid.

Compare the density of contaminant of X100 with each of the standard photographs to obtain the closest match.

APPENDIX A – KIT CONTENTS

1. 240V KNF Laboport or Gast Vacuum Pump.
2. Solvent dispenser
3. 1l vacuum flask
4. 6x Sample bottle
5. Millipore 300ml Filter funnel
6. Spring clamp and Base with rubber stopper
7. Stainless filter support screen and Teflon support screen gasket
8. Manual (cycle) pump for pressurising solvent dispenser
9. Comparator book and instructions
10. 1 x pack of 25mm, 0.8 micron solvent dispenser filters/membranes
11. 2 x pack of 1.2 micron filter membranes
12. 1 x pack of 3.0 micron filter membranes
13. 3 x plastic beakers, 600ml, 400ml, 250ml and plastic funnel
14. Manually operated particle counter
15. Manual sampling, hand vacuum pump & 1.6m nylon hose and adaptors (not available in all kits)
16. Pair of tweezers
17. 25 X Petri slides
18. Petri dish
19. Microscope

APPENDIX B – NOTES ON CONTAMINANT ANALYSIS

Always check at 40X for an even particle distribution.

1. **Bright metal**

(a) Any shape, often irregular.
(b) Highly reflective.
(c) Any size usually under 25µm.
(d) Non ferrous metals usually bronze (yellow colour). Aluminium not common.

2. **Black Metal**

(a) Any shape.
(b) Not highly reflective.
(c) Any size, but usually under 25µm

3. **Silica**

(a) Irregular shape. Hard, angular in appearance.
(b) Crystalline, often broken or chipped.
(c) Colourless to light browns (pale colours).
(d) Translucent or transparent

4. **Elastomers & Plastics**

(a) Irregular shape – usually large (>25µm).
(b) Wide range of reflectivity possible, but usually not very reflective.
(c) Any colour - commonly transparent or white or black.