



Fluid Analysis

Par-Test™

Fluid analysis has proven to be a critical tool for any preventive maintenance program. Fluid analysis is able to identify potential problems that cannot be detected by human senses. A comprehensive fluid analysis program can help prevent major hydraulic or lube oil system failures.

Par-Test is a complete laboratory analysis, performed on a small volume of fluid. The report you receive is a neatly organized three page format. One may quickly analyze the test results of an individual sample and/or look at a trend analysis for up to five different samples. Two types of services are offered through Par-Test, a water base fluid analysis kit or a petroleum base fluid analysis kit. For both types of services the Par-Test kit includes a pre-cleaned glass bottle, mailing container with pre-addressed label, sample information data sheet (to be completely filled out by end user) and the following analysis:



Fluid sampling for Par-Test involves important steps to insure you are getting a representative sample. Often, erroneous sample procedures will disguise the true nature of the system fluid. A

complete sampling procedure is detailed on the back of this brochure. There also is a National Fluid Power Association standard (NFPA T2.9.1-1972) and an American National Standards Institute Standard (ANSI B93.13-1972)

for extracting samples from a fluid power system.



Petroleum Base Kit

Particle Count
Photomicrograph
Free Water Analysis
Spectrometric Analysis
Viscosity Analysis
Water Analysis (PPM)
Neutralization Analysis

Water Base Kit

Particle Count
Photomicrograph
Spectrometric Analysis
Viscosity Analysis
Neutralization Analysis

How to Order

<i>Description</i>	<i>Part Number</i>
Petroleum base fluid kit (single test bottle)	927292
Petroleum base fluid kit (Carton of 10 test bottles)	927293
Water base fluid kit (single test bottle)	932995

FLUID ANALYSIS REPORT

SAMPLE CODE: 1034 **DATE:** 06-01-94
 XYZ Corporation
 12345 Middleton Rd.
 Anywhere USA 41114
Attn:



PARTEST Fluid Analysis Service
 Parker Hannifin Corporation
 16810 Fulton County Road #2
 Metamora, OH 43540
 Tel:(419)644-4311
 Fax:(419)644-6205

SAMPLE DATA

COMPANY NAME: XYZ Corporation **SAMPLE DATE:** 06-01-94
SYSTEM TYPE: Hydraulic System **HOURS (on oil/unit):** 100 / 100
EQUIPMENT TYPE: LOADER **SYSTEM VOLUME:** 20L
MACHINE ID: x1111 **FLUID TYPE:** CITGO AW 46
FILTER ID: **ANALYSIS PERFORMED:** AI-BSTV4 (W)

AUTOMATIC PARTICLE COUNT SUMMARY

Size	Counts per ml.	Cleanliness Code
> 2 µm	353242.0	26/22/14
> 5 µm	34434.0	
> 10 µm	2342.0	
> 15 µm	154.0	
> 25 µm	17.0	
> 50 µm	1.0	

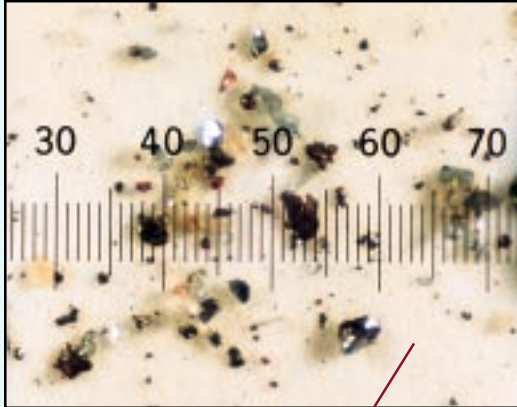
FREE WATER PRESENT

YES

NO

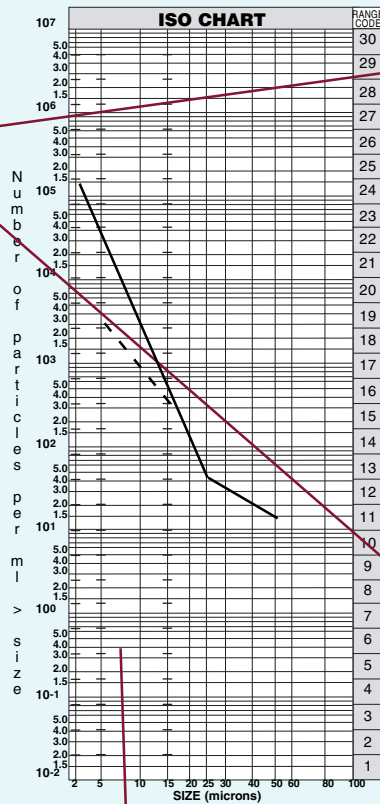
PHOTO ANALYSIS

Mag.: 100x Vol.: 20 ml Scale: 1 div = 20 µm



REMARKS

- WARNING**
- The recommended CLEANLINESS Code is not met. Clean-up maintenance may be warrant.
 - Dotted graph line indicates recommended ISO Code level.



Sample Data

Information supplied by the user regarding the fluid to be analyzed. Complete and accurate information is crucial for a useful analysis.

Particle Count

Results are reported over 6 different particle size ranges and expressed as an ISO code (modified). The counts are per milliliter of fluid and the reporting is cumulative; ie. The particle count in the >2 micron row includes the number of particles greater than 5, 10, 15, 25 and 50 microns as well as particles between 2-5 microns in size. Particle resuspension method is utilized for water based fluid samples.

Free Water Analysis

Determines if the water present is beyond the saturation point of the fluid. At the saturation point, the fluid can no longer dissolve or hold any more water. Its appearance becomes cloudy or "milky". Many hydraulic oils saturate between 500 and 1000 PPM of water.

Photo Analysis

A photomicrograph of a small volume of fluid (20 ml) magnified 100X. This analysis gives a quick glance at the contamination present in the fluid. Each line of the graduated scale represents 20 microns in size.

The full color photomicrograph helps identify particles which would otherwise be grouped by class.

ISO Chart

Graphically illustrates the particle count on a graph. The recommended cleanliness code level, if given on the submittal form, is shown by a broken line on the ISO chart.

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SPECTROMETRIC ANALYSIS		
WEAR METALS AND ADDITIVES	PPM BY WEIGHT	STATUS*
IRON	120.0	H
COPPER	510.0	H
CHROMIUM	< 1.0	N
LEAD	< 1.0	N
ALUMINUM	1.0	N
TIN	< 1.0	N
SILICON	< 1.0	N
ZINC	423.0	N
MAGNESIUM	< 1.0	N
CALCIUM	540.0	H
PHOSPHORUS	10.0	L
BARIUM	1.0	N
BORON	< 1.0	N
SODIUM	< 1.0	N
MOLYBDENUM	< 1.0	N
SILVER	< 1.0	N
NICKEL	< 1.0	N
TITANIUM	< 1.0	N
MANGANESE	< 1.0	N
ANTIMONY	< 1.0	N
L = LOW N = NORMAL H= HIGH		

* These levels are based on average industry standards and may not be applicable to your particular system.

Viscosity Analysis - ASTM D445	
SSU @ 100 °F: 100.0	CST @ 40°C: 21.6

Water Analysis - ASTM D1744
Water Content (ppm): 101.0

Neutralization Analysis - ASTM D794
TAN: 0.1

REMARKS
1) Please check spectrometric analysis for abnormal conditions

Viscosity Analysis

Viscosity is a very important property of a fluid in terms of system performance. Viscosity expresses the internal friction between molecules in the fluid. Typically a breakdown in viscosity will be seen as an increase. Both SSU at 100°F and cSt at 40°C are reported.

Water Analysis

Karl Fischer test gives accurate measure of water concentration in the sample fluid. The results are reported in parts per million (PPM) and allow for detection of water levels well below the saturation point.

Neutralization Analysis

Referred to as the Total Acid Number (TAN) this titration test measures the acid level of the sample fluid. The production of acidic material causes oxidation degradation or aging of most fluids. This activity is promoted by elevated temperatures, presence of entrained metal particles, and intimate contact with air. It is the rate of increase of the TAN during any given time period that is significant, not just the absolute value.

Remarks

Quick statements or alerts about any unusual results from one of the tests reported on this page.

Spectrometric Analysis

Results obtained by Rotating Disk Electrode (ROE) Spectrometer and reported in terms of parts per million (PPM). Twenty different wear metals and additives are analyzed to help determine the condition of the fluid. The spectrometric test is limited to identifying particles below 5-7 micron in size. Base line (new) fluid samples should be sent in for each different fluid to be analyzed. This will be used to determine the status.

WEAR METALS AND ADDITIVES

Iron: Ferrous wear particle typically from pumps, gears, cylinders, or rust

Copper: Brass (copper/zinc) and bronze (copper/tin) in bearings and bushings

Chromium: (white non ferrous metal) Chrome from cylinder rods, bearings, valve spools

Lead: Babbitt or copper lead bearings

Aluminum: White nonferrous metal from pump bodies, bushings, bearings, and grinding compounds

Tin: Babbitt bearings, plating

Silicon: Sand/dirt contamination or antifoaming additive in oil

Zinc: Plating or anti-wear additive in oil

Magnesium: Detergent, dispersive additive in oil, bearings, water

Calcium: Dispersant additive or acid neutralizer

Phosphorus: Anti-wear or fire resistant additive in fluid

Barium: Corrosion, rust inhibitor additive in oil

Boron: Detergent, dispersive additive in oil

Sodium: Detergent or coolant additive

Molybdenum: Alloy metal or anti friction additive

Silver: White non ferrous metal

Nickel: Alloy metal

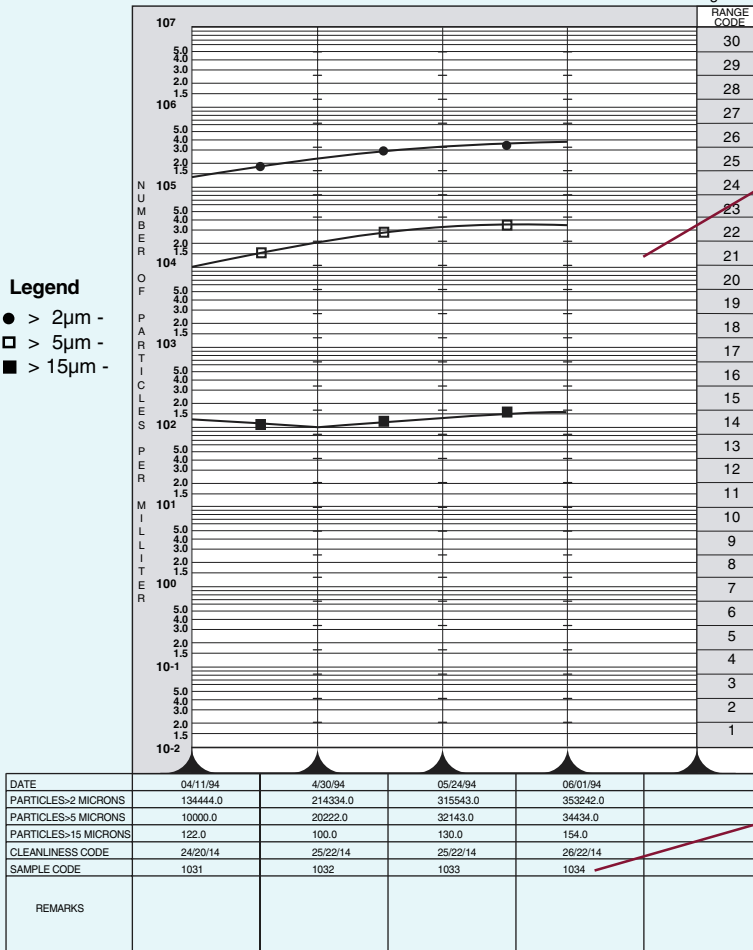
Titanium: White non ferrous metal

Manganese: White non ferrous metal

Antimony: Babbit bearings, greases

FLUID ANALYSIS REPORT

Page 3 of 3



Trend Analysis

Graphical history for up to 5 samples plotted for 2, 5 and 15 micron and greater size particles. This analysis is a valuable tool for tracking the progress of a system over a given time period.

ISO Range Code

Index Number that is associated with a range of particles. Below is a list of the range numbers and the corresponding particle quantities.

Sample Code

Assigned to the test kit form for a ready reference. This code can be used to track the sample from start to finish.

NUMBER OF PARTICLES PER ML					
Range Code	More than	Up to and including	Range Code	More than	Up to and including
30	5,000,000	10,000,000	18	1,300	2,500
29	2,500,000	5,000,000	17	640	1,300
28	1,300,000	2,500,000	16	320	640
27	640,000	1,300,000	15	160	320
26	320,000	640,000	14	80	160
25	160,000	320,000	13	40	80
24	80,000	160,000	12	20	40
23	40,000	80,000	11	10	20
22	20,000	40,000	10	5	10
21	10,000	20,000	9	2.5	5
20	5,000	10,000	8	1.3	2.5
19	2,500	5,000	7	.64	1.3
			6	.32	.64

SAMPLING PROCEDURE

Obtaining a fluid sample for analysis involves important steps to make sure you are getting a representative sample. Often erroneous sampling procedures will disguise the true nature of system cleanliness levels. Use one of the following methods to obtain a representative system sample.

I. For systems with a sampling valve

- A. Operate system for at least 1/2 hour.
- B. With the system operating, open the sample valve allowing 200 ml to 500 ml (7 to 16 ounces) of fluid to flush the sampling port. (The sample valve design should provide turbulent flow through the sampling port.)
- C. Using a wide mouth, pre-cleaned sampling bottle, remove the bottle cap and place in the stream of flow from the sampling valve. Do NOT "rinse" out the bottle with initial sample.
- D. Close the sample bottle immediately. Next, close the sampling valve. (Make prior provision to "catch" the fluid while removing the bottle from the stream.)

- E. Tag the sample bottle with pertinent data; include date, machine number, fluid supplier, fluid number code, fluid type, and time elapsed since last sample (if any).

II. Systems without a sampling valve

There are two locations to obtain a sample in a system without a sampling valve: in-tank and in the line. The procedure for both follows:

A. In the Tank Sampling

1. Operate the system for at least 1/2 hour.
2. Use a small hand-held vacuum pump to extract sample. Insert sampling device into the tank to one half of the fluid height. You will probably have to weight the end of the sampling tube. Your objective is to obtain a sample in the middle portion of the tank. Avoid the top or bottom of the tank. Do not let the syringe or tubing come in contact with the side of the tank.
3. Put extracted fluid into an approved, pre-cleaned sample bottle as described in the previous sampling valve method.

4. Cap immediately.
5. Tag with information as described in sampling valve method.

B. In-line Sampling

1. Operate the system for at least 1/2 hour.
2. Locate a suitable valve in the system where turbulent flow can be obtained (ball valve is preferred). If no such valve exists, locate a fitting which can be easily opened to provide turbulent flow (tee or elbow).
3. Flush the valve or fitting sample point with a filtered solvent. Open valve or fitting and allow adequate flushing. (Take care to allow for this step. Direct sample back to tank or into a large container. It is not necessary to discard this fluid.)
4. Place in an approved, pre-cleaned sample bottle under the stream of flow per sampling valve methods.
5. Cap sample bottle immediately.
6. Tag with important information per the sampling valve method. Note: Select a valve or fitting where the pressure is limited to 200 PSIG (14 bar) or less.

ON-SITE FLUID ANALYSIS PRODUCT



PLC-3000