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:

**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

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.

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**How to Order**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum base fluid kit (single test bottle)</td>
<td>927292</td>
</tr>
<tr>
<td>Petroleum base fluid kit (Carton of 10 test bottles)</td>
<td>927293</td>
</tr>
<tr>
<td>Water base fluid kit (single test bottle)</td>
<td>932995</td>
</tr>
</tbody>
</table>
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; i.e., 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.

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**FLUID ANALYSIS REPORT**

**SAMPLE CODE:** 1034  
**DATE:** 06-01-94

**COMPANY NAME:** XYZ Corporation  
**SYSTEM TYPE:** Hydraulic System  
**EQUIPMENT TYPE:** LOADER  
**MACHINE ID:** x1111  
**FILTER ID:**

**SAMPLE DATE:** 06-01-94  
**HOURS (on oil/unit):** 100 / 100  
**SYSTEM VOLUME:** 20 L

**FLUID TYPE:** CITGO AW 46  
**ANALYSIS PERFORMED:** AI-BSTV4 (W)

### Automatic Particle Count Summary

<table>
<thead>
<tr>
<th>Size (µm)</th>
<th>Counts per ml.</th>
<th>Cleanliness Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 2</td>
<td>353242.0</td>
<td></td>
</tr>
<tr>
<td>&gt; 5</td>
<td>34434.0</td>
<td></td>
</tr>
<tr>
<td>&gt; 10</td>
<td>2342.0</td>
<td></td>
</tr>
<tr>
<td>&gt; 15</td>
<td>26/22/14</td>
<td></td>
</tr>
<tr>
<td>&gt; 25</td>
<td>154.0</td>
<td></td>
</tr>
<tr>
<td>&gt; 50</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

**FREE WATER PRESENT:**

- YES
- NO

**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.
Fluid Analysis
Par-Test™

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

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 an 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. New fluid samples should be sent in for each different fluid to be analyzed. This will be used to determine the status.

Viscosity Analysis - ASTM D445

<table>
<thead>
<tr>
<th>WEAR METALS AND ADDITIVES</th>
<th>PPM BY WEIGHT</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>120.0</td>
<td>H</td>
</tr>
<tr>
<td>Copper</td>
<td>510.0</td>
<td>H</td>
</tr>
<tr>
<td>Chromium</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Lead</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Aluminum</td>
<td>1.0</td>
<td>N</td>
</tr>
<tr>
<td>Tin</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Silicon</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Zinc</td>
<td>423.0</td>
<td>N</td>
</tr>
<tr>
<td>Magnesium</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Calcium</td>
<td>540.0</td>
<td>H</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>10.0</td>
<td>L</td>
</tr>
<tr>
<td>Barium</td>
<td>1.0</td>
<td>N</td>
</tr>
<tr>
<td>Boron</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Sodium</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Silver</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Nickel</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Tungsten</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Manganese</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
<tr>
<td>Antimony</td>
<td>&lt; 1.0</td>
<td>N</td>
</tr>
</tbody>
</table>

L = LOW  N = NORMAL  H= HIGH

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

WEAR METALS AND ADDITIVES
Iron: Ferrous wear particle typically from pumps, gears, cylinders, or rust
Copper: Brass (copper/zinc) and bronze (copper/lead) in bearings and bushings
Chromium: (white non ferrous metal) Chrome from cylinder rods, bearings, valve spools
Lead: Babbit or copper lead bearings
Aluminum: White nonferrous metal from pump bodies, bushings, bearings, and grinding compounds
Tin: Babbit bearings, platting
Silicon: Sand/dirt contamination or anti-foaming 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
Phosphorous: 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
**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.

### FLUID ANALYSIS REPORT

#### Legend
- > 2µm -
- > 5µm -
- > 15µm -

#### 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

<table>
<thead>
<tr>
<th>Range Code</th>
<th>More than</th>
<th>Up to and including</th>
<th>Range Code</th>
<th>More than</th>
<th>Up to and including</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>5,000,000</td>
<td>10,000,000</td>
<td>18</td>
<td>1,300</td>
<td>2,500</td>
</tr>
<tr>
<td>29</td>
<td>2,500,000</td>
<td>5,000,000</td>
<td>17</td>
<td>640</td>
<td>1,300</td>
</tr>
<tr>
<td>28</td>
<td>1,300,000</td>
<td>2,500,000</td>
<td>16</td>
<td>320</td>
<td>640</td>
</tr>
<tr>
<td>27</td>
<td>640,000</td>
<td>1,300,000</td>
<td>15</td>
<td>160</td>
<td>320</td>
</tr>
<tr>
<td>26</td>
<td>320,000</td>
<td>640,000</td>
<td>14</td>
<td>80</td>
<td>160</td>
</tr>
<tr>
<td>25</td>
<td>160,000</td>
<td>320,000</td>
<td>13</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>24</td>
<td>80,000</td>
<td>160,000</td>
<td>12</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>23</td>
<td>40,000</td>
<td>80,000</td>
<td>11</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>22</td>
<td>20,000</td>
<td>40,000</td>
<td>10</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>21</td>
<td>10,000</td>
<td>20,000</td>
<td>9</td>
<td>2.5</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>5,000</td>
<td>10,000</td>
<td>8</td>
<td>1.3</td>
<td>2.5</td>
</tr>
<tr>
<td>19</td>
<td>2,500</td>
<td>5,000</td>
<td>7</td>
<td>.64</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>.32</td>
<td>.64</td>
</tr>
</tbody>
</table>
**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.

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**ON-SITE FLUID ANALYSIS PRODUCT**

PLC-3000