Hydraulic Component Contaminant Level Specification

INTRODUCTION

Each part has a maximum particle size distribution specification and a maximum mass (weight) specification. These specifications are based on the internal wetted volume or surface area of a part. Once a part is classified as a pump, valve, etc., refer to the appropriate contaminant determination procedure, (see references below) to establish the volume or surface area for the part. The specifications for the part based on this volume or surface area are then determined by Clauses 1 and 2 below.

In order for a part to be considered acceptable, it must meet either the small particle size distribution specification per Clause 2, or the contaminant mass and maximum particle size specification per Clause 3. (Note: Acceptability of hoses is to be determined per Clause 4.) The small particle size distribution is determined by electronic liquid automatic particle counter and the contaminant mass specification by gravimetric analysis with microscopic inspection of the largest particle.

If disagreement between the electronic particle counter analysis and the gravimetric analysis occurs relative to the specifications, the priority analysis method shown below shall be used to determine acceptability depending on the type of part, unless there is a note on the part drawing stating which method is to be used as a final determination of acceptability.

In general, the Contaminant Determination Procedure (see references) does not call for disassembly of parts. In some cases, contaminant may remain in certain passages of valves, pump, etc. after being subjected to the procedure. A part may be considered unacceptable, if subsequent disassembly reveals excessive contamination in the part's hydraulic passages, excluding threaded areas.

It is expected that parts will be supplied with packaging adequate to prevent internal contamination and corrosion during shipping and handling.

Type of Part	Priority Analysis Method	Corresponding Lab Procedure
1. Valves	Electronic Particle Counter	ES-A7004
2. Conduits (Tubes & Fittings)	Gravimetric	ES-A7005
3. Pumps/Motors	Electronic Particle Counter	ES-A7027
4. Cylinders	Electronic Particle Counter	ES-A7029
5. Hoses	Gravimetric	ES-A7146
6. Gears, Shafts, etc	Electronic Particle Counter	ES-A7028

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1. SCOPE

To describe a specification for allowable contaminant levels in hydraulic component parts as installed on a new vehicle. It is anticipated that this procedure will be used for, but not limited to, monitoring cleanliness levels of production parts.

2. SMALL PARTICLE SIZE DISTRIBUTION SPECIFICATION

The maximum allowable particulate contaminant level is as follows:

Particle Size in Microns	Maximum Particles Per ml or per cm^2 Greater Than the Indicated Size
10	10,000
20	2,000
30	700
40	300

(See Graph on Page 4)

3. MASS SPECIFICATION

Each part must conform to either the internal volume (Clause 3.1) or surface areas (Clause 3.2) specification, as shown in the appropriate contaminant determination procedure, and the maximum particle size specification. (Clause 3.3)

3.1 INTERNAL VOLUMES

Calculate the maximum mass of contaminant allowed using the volume determined per the appropriate contaminant determination procedure.

Volume	Specification
Volume less than 0.05 liter:	5 mg
Volume greater than 0.05 liter and less than or equal to 10 liters	100 mg/liter
Volume greater than 10 liters:	1000 mg plus 30mg/liter for every liter over 10 liters

3.2 SURFACE AREA

Calculate the maximum mass of contaminant allowed using the surface area determined per the appropriate contaminant determination procedure.

Surface Area	Specification
Area less than 50 cm^2	5 mg
Area greater than 50 cm^2	0.10 mg/cm^2

3.3 LARGE PARTICLE SIZE SPECIFICATION

No metal, sand, hard rubber, or other hard particles, which could be considered detrimental to a hydraulic system, larger than 500 microns are allowed. Soft fibers such as hair, lint, etc., larger than 500 microns are not to be considered for this specification.

4. HOSE MASS SPECIFICATION

Each part must conform to the surface area specification and the maximum particle size specification.

4.1 SURFACE AREA

Calculate the maximum mass of contaminant allowed using the area determined per the hose contaminant determination procedure.

Area Less Than 50 cm^2

Level	Specification
1	5 mg
2	2 mg
3	1 mg

Area Greater Than 50 cm^2

Level	Specification
1	.10 mg/cm^2
2	.04 mg/cm^2
3	.02 mg/cm^2

4.2 LARGE PARTICLE SIZE SPECIFICATION

Level	Maximum Hard Particle Size (Microns)
1	1,000
2	500
3	500

No metal, sand, hard rubber, or other hard particles, which could be considered detrimental to a hydraulic system, larger than shown above, are allowed. Soft fibers such as hair, lint, etc., larger than the specified size are not to be counted, except by weight. If particles are fragile such as plating and break up when gently probed, only the remaining solid pieces are to be measured for conformance to this specification.

5. REFERENCES

ISO 5598 —Fluid Power Systems and Components -- Vocabulary
ES-A7004—Hydraulic Valve Contaminant Determination Procedure
ES-A7005—Hydraulic Conduit Contaminant Determination Procedure
ES-A7027—Hydraulic Pump and Motor Contamination Determination Procedure
ES-A7029—Hydraulic Cylinder Contamination Determination Procedure
ES-A7146—Hydraulic Hose Contamination Determination Procedure
ES-A7028—Hydraulic Component Contamination Determination Procedure

PARTICULATE CONTAMINATION CHART

