



Technical Bulletin # 03-01

PARTICULATE CONTAMINATION TESTING

Oils are the lifeblood of industrial equipment. They provide lubrication, cooling, force and direction to critical machine components. They are pumped, distributed, sprayed, poured and washed over machine surfaces before being returned to the reservoir for accumulation, cleaning and cooling. The problems with oil arise as they accumulate and generate contaminants as they follow this path through the equipment. This brief outline is designed to make you familiar with the new ISO 1171 Particle Size Classification Code and the revamped ISO 4406:1999 Contamination Code rating system. A solid understanding of what these ratings mean will allow you to make critical decisions about your filtration equipment and allow you to make informed decisions about how to enhance the productivity of your equipment.

WHAT IS THE ISO SYSTEM

ISO are the initials, and commonly used name, of the International Standards Organization. The increasing globalization of our economy generated the need for a common standard for technical comparison that could be used worldwide. The ISO was formed from a multitude of US and foreign based engineering and scientific organizations to create production, engineering and testing standards that could be used as worldwide benchmarks.

The ISO ratings for both particle size (ISO 4402) and contamination concentration (ISO 4406) have recently been amended to reflect increasingly accurate means of measurement and the need for contamination scales that are meaningful to the workplace environment. The particle size standard is now ISO 11171 and it measures a three-dimensional size of the debris particles instead of the two dimensions measured in the 4402 rating. This changes the size scale slightly but offers a more realistic view of the debris being measured. The ISO 4406:1999 contamination concentration scale uses three debris size points (4 microns, 6 microns and 14 microns) instead of the two points measured under the old 4406 scale. The current scale also measures the number of particles found in 1 mL of oil versus the 100 mL sample volume used previously. For each steps upwards on the scale the amount of debris doubles. A correlative scale is included in the reference section of this bulletin.

WHAT CLEANLINESS RATING DO I NEED

Equipment manufacturers and fluid power associations have established basic cleanliness levels for general types of equipment. Typically the pressure of a system and the clearances between the moving parts of the equipment are the starting points for determining the cleanliness level required for optimum equipment

function. Applications such as two-piece can manufacturing and servo valve operation also require removing semi-solid material to maintain accurate machine function. Periodic oil analysis results will show whether or not your oil is being cleaned to the desired standards. The following are guidelines for basic equipment. The optimum cleanliness level for your equipment may vary and these ratings are guidelines to help you establish an oil quality control program relevant to your equipment and production requirements.

PRESSURE BASED RATINGS

Pressure in PSI (BAR)	Recommended ISO 4406:1999 Rating
0- 500 (0-35)	20/18/15
500-1500 (35-100)	19/17/14
1500-3000 (100-200)	16/14/11

COMPONENT BASED RATINGS

COMPONENT	Recommended ISO 4406:1999 Rating
GEAR PUMP, VANE PUMP, DIRECTIONAL VALVES	19/17/14
PISTON PUMP, PROPORTIONAL VALVES, METAL WORKING	18/16/13
SERVO VALVES	16/14/11

ISO 4406:1999 CLEANLINESS RATING CORRELATION TABLE

ISO CLASS PARTICLES PER 1 mL Fluid

ISO CODE	NAS	ACFTD	MIL STD	ISO CODE	PARTICLE COUNT
406:1999	1638	GRAVIMETRIC	1246A	7	.064- 1.3
		mg/L		8	1.3 – 2.5
24/23/20		100.0	700	9	2.5 - 5.0
23/21/18	12		600	10	5- 10
22/20/17	11	10.0		11	11 - 20
21/19/16	10			12	21 - 40
20/18/15	9			13	41 – 80
19/17/14	8		300	14	81 - 160
18/16/13	7	1.0		15	161 - 320
17/15/12	6			16	321 - 640
16/14/12			200	17	641 – 1,300
16/14/11	5			18	1,301 – 2,500
15/13/10	4	0.10		19	2,501 – 5,000
14/12/9	3			20	5,001 – 10,000
13/11/8	2		100	21	10,001 – 20,000
12/10/8				22	20,001 – 40,000
12/10/7	1			23	40,001 – 80,000
12/10/6		0.01		24	80,001 – 160,000