



Successful Performance Chemicals of Sanyo Chemical Group

# UTILIOL-GA-15P

Base material for water-based metalworking fluid

Metalworking processes are indispensable for automobile and machine manufacturing, etc. Metalworking oil is used for reducing friction and cooling in metalworking. Metalworking oils include water-insoluble oils with excellent lubricity (processability) and water-soluble oils that have excellent cooling properties and that are nonflammable with low risk of fire. In recent years, water-soluble oils have been attracting attention from the viewpoint of improving the working environment and reducing the environmental load. However, there are many cases where the lubricity of water-soluble oils is insufficient. Efforts to improve lubricity often results in increased foaming as another issue. This is why, the replacement from water-insoluble oils to water-soluble oils have not been easy. (Table 1.)

In addition to lubricity and foaming, there are various other needs to address, such as improving processing accuracy, increasing processes speeds, diversifying materials compatibility, extending the life of machines and products, and recycling and reducing costs to reduce the amount of waste oil drainage.

Sanyo Chemical Industries has developed UTILIOL GA-15P as a product to address all of these issues.

Table 1. Low foaming requirement for Machine and processing application

Classification			Circulation or Spray	Low foaming needs (assumption)
Base material for processing liquid	Machining	Cutting	Circulation	Required
		Grinding		
	Deformation processing	Rolling		
		Drawing		
		Forging	Spray	
	Press working			
	Others	Heat treatment	Circulation	
Die casting		Spray		
Base material for other lubricant		Hydraulic fluid	Circulation	Not required
		Gear oil and other	No Spray or Circulation	

### Abstract of the new technology

Polyalkylene glycol (PAG) type water-soluble polyether is currently the mainly used base of water-soluble metalworking oil, and plays an important role such as imparting permeability to the metal interface and lubricity. We make full use of our strengths in surface control technology, polymer design technology, and alkylene oxide

adduct (AOA) manufacturing knowledge to develop the new base material UTILIOL GA-15P with significantly improved lubricity while maintaining the positive characteristics of water-soluble metalworking oils.

### Features of the technology

The features of UTILIOL GA-15P are as follows.

1. High flash point (Table 2.)

Table 2. General property of UTILIOL GA-15P and other PAG base material.

[unit]	Developed item	SANYO Conventional items		
	UTILIOL GA-15P	NEWPOL GEP-2800	NEWPOL PE-61	BLEMBER LUB-90
Appearance	Liquid	Liquid	Liquid	Liquid
Cloud point (1wt%aq.) [°C]	52	74	24	7
Kinetic viscosity (40°C) [mm <sup>2</sup> /s]	263	198	144	461
Flash point [°C]	255	240	210	230

Table 3. Low foaming requirement for Machine and processing application

[unit]		Developed item	SANYO Conventional		
		UTILIOL GA-15P	NEWPOL GEP-2800	NEWPOL PE-61	BLEMBER LUB-90
Appearance (20°C)		Colorless liquid	Colorless liquid	Colorless liquid	Slightly turbid liquid
Cloud point [°C]		52.3	>75.0	25.5	18.4
Lubricity	Last non-seizure load[N]	390	156	283	285
	Friction coefficient (at 100N)	0.140	0.157	0.132	0.135
Low foaming	Bubble height (Right after the test) [cm]	5.2	8.2	4.5	5.3
	Bubble height (1min after) [cm]	2.9	7.2	3.0	3.3

<evaluation method>

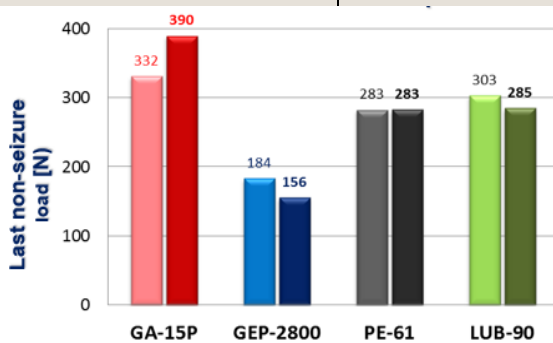
Appearance: Visual, Cloud point: Visual  
last non-seizure load: SRV test  
Bubble height: Bio mixer test

Cutting fluid(ex.)	Polyether	Medium chain fatty acid amine salt	water
Component[wt%]	0.75	2.40	96.85

2. Water soluble polyether with excellent seizure resistance (Table 3,4.)
3. Low foaming property (Table 3,5)
4. Smoother cutting of difficult-to cut gummy metals such as aluminum
5. Metalworking fluid diluted with water is highly transparent

These features not only enable high-speed machining, but are also expected to be suitable for a wide variety of metal machining processes and improve work efficiency. In addition, by achieving both lubricity and low foaming properties, which were the main drawbacks of water-soluble metalworking oil, we can obtain merits such as reduction of environmental load, improvement of working environment, and improvement of cooling efficiency.

Table 4 Last non-seizure load (SRV test)



<Test Method(SRV test)>

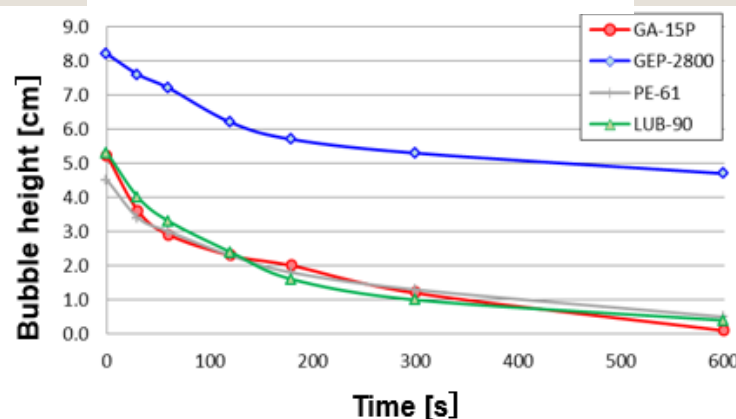
Evaluated lubricity (last non-seizure load) by using SRV test method.  
Evaluated samples(Left graph) : Each polyether base(0.50wt%), Medium chain fatty acid amine salt (2.40wt%), water (97.10wt%)  
(Right graph) : Each polyether base(0.75wt%), Medium chain fatty acid amine salt (2.40wt%), water (96.85wt%)  
Test piece : Steel ball(SUJ-2, Φ10mm), Steel disk(SUJ-2)  
Test conditions : Load: 50→500N, Frequency: 50Hz, Amplitude: 1.0 mm, Temperature: 30°C

## Feature plan

Taking advantage of the excellent performance of UTILIOL GA-15P will expand the application of metalworking oils to be applicable to a wide range of difficult-to-cut materials and will also expand the use to other water-based lubricants bases.

Various industries such as home appliances, automobiles, buildings, and infrastructure are supported by advanced metal processing technology. We will continue to propose solutions to improve the technology of metalworking oils and contribute to the development of various industries through manufacturing improvements.

Table 5 Low foaming evaluation (Bio Mixer test)



< Evaluation method (BIOMIXER test) >

Poured 150ml samples into 300ml tall beaker, then did the low foaming test by using BIOMIXER. Observed chronological bubble height changes.  
Samples: Each polyether base(0.50wt%), Medium chain fatty acid amine salt (2.40wt%), water(97.10wt%)  
Test conditions: Speed:11500rpm, Stirring time: 40s, Temperature: 23°C  
Observation times: keep settle 30s after stop stirring, then start evaluation. Evaluate 30s, 1min, 2min, 3min, 5min, 10min after stop stirring.

## [Contact (about the product)]

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