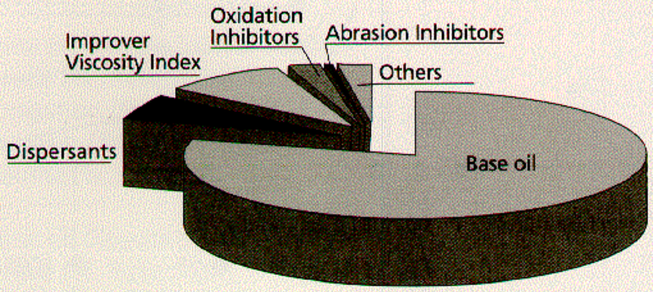
7. OIL RESISTANCE

Components in motor oils

Many amine additives are contained in engine oils and gear lubricants

An Example of Engine Oil Component

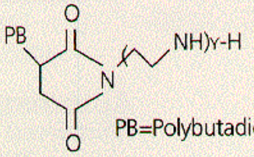


Oil Seals

AFLAS is resistant against highly reactive organic and inorganic chemicals.
AFLAS shows excellent durability to automotive oils heavily formulated with amine additives.
AFLAS is applicable even in dirty environment, such as gear seals, where PTFE resin seal is not applicable.

Examples : Oxidation Inhibitor C_2H_5-CH(CH_3)-NH-Ph-NH-CH(CH_3)-C_2H_5

Dispersant



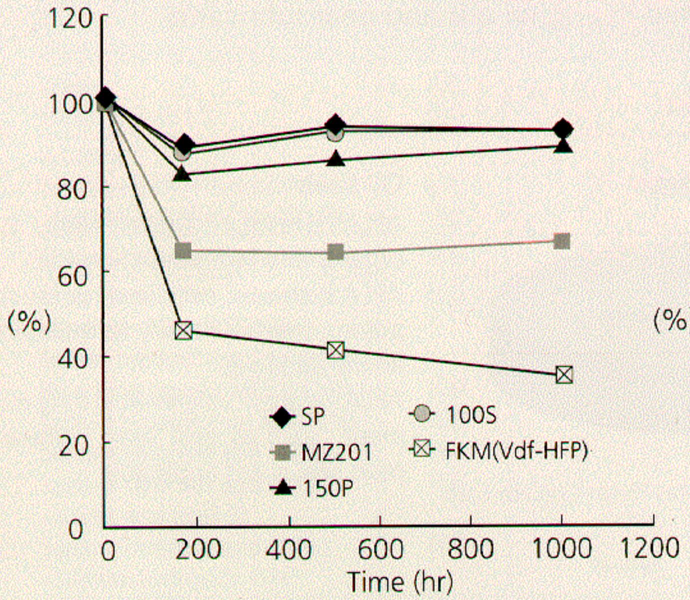
PB=Polybutadiene

Applications for Automotive Fluids: AFLAS vs FKM

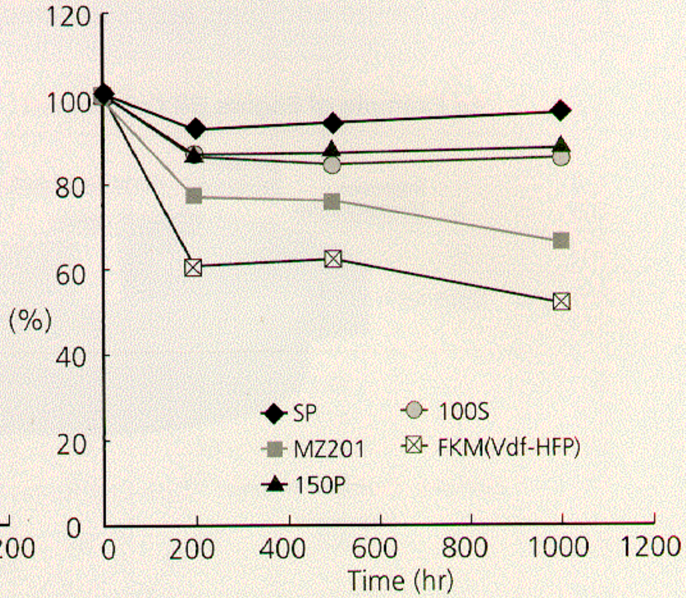
Fluid	Component	Application	Temperature °C	AFLAS	FKM
Engine oils		Crank shaft seal	160	1	2-3
		Valve stem seal	160	1	2-3
AT fluids		Transmission seal	135	1	3
Gear oils		Pinion seal			
		Axle seal			
		Differential gear seal			
Brake fluids	polyglycolether		135	2	2
Coolants	glycol-H_2O	Cylinder liner seal	135	2	2-3
		Water pump seal			
		Cylinder head gasket			
Operating oils	glycol-H_2O	Shock absorber seal	110	2	2-3
	phosphate			2	2
	Silicone oil			2	1
Fuels	gasoline		110	3	1
	light oil			3	1
	heavy oil			2	1
	100% Methanol			1	2-3

1 : Suitable 2 : Applicable 3 : Not applicable

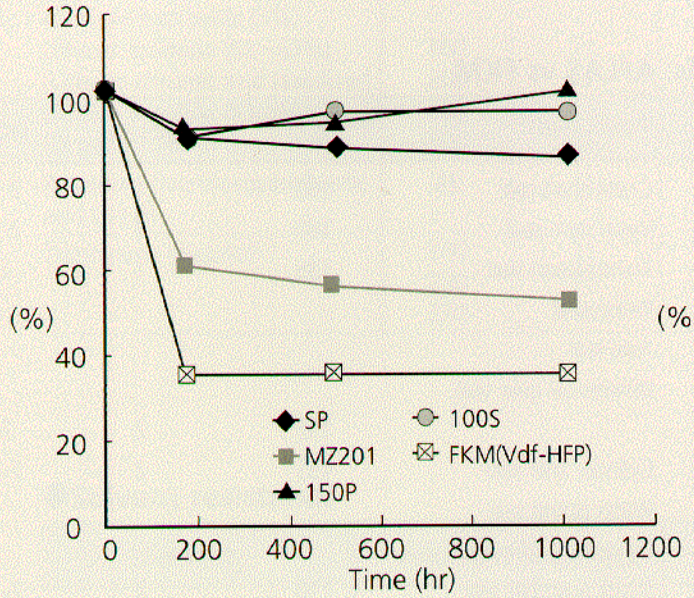
Engine Oil
(Immersed in Toyota SJ Oil at 175 °C)
Retention of Tensile Strength



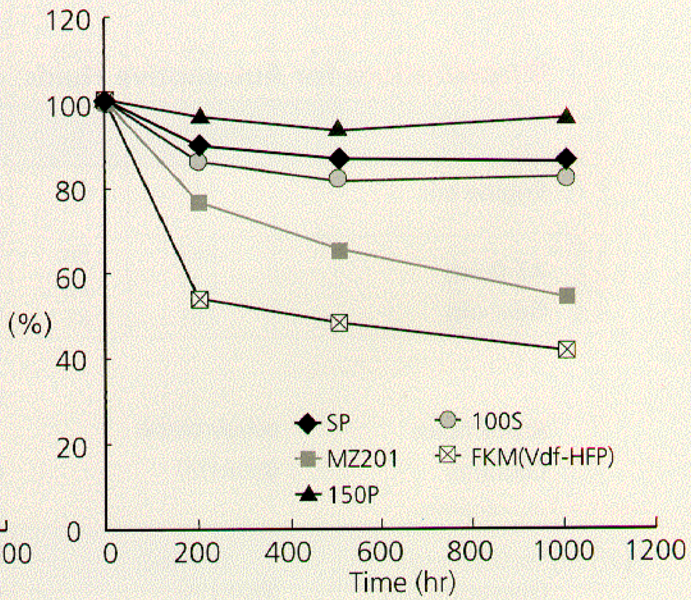
Automatic Transmission Fluid
(Immersed in Toyota Auto Fluid D-II at 175 °C)
Retention of Tensile Strength



Engine Oil
(Immersed in Toyota SJ Oil at 175 °C)
Retention of Elongation



Automatic Transmission Fluid
(Immersed in Toyota Auto Fluid D-II at 175 °C)
Retention of Elongation



Oil Resistance

	AFLAS SP*	AFLAS MZ201*	AFLAS 150P	AFLAS 100S	FKM*
Engine oil (Toyota SJ)175℃x70hr					
Tensile (%, Retention)	87	98	71	76	96
Elongation (%, Retention)	78	60	116	105	78
Hardness (Point, Change)	4	6	-1	-1	1
Volume (%, Change)					
Engine oil (Toyota SJ)175℃x168hr					
Tensile (%, Retention)	88	64	82	87	46
Elongation (%, Retention)	89	60	91	90	35
Hardness (Point, Change)	-6	-1	-5	-6	0
Volume (%, Change)	9	7	9	9	1
Engine oil (Toyota SJ)175℃x500hr					
Tensile (%, Retention)	93	53	85	92	41
Elongation (%, Retention)	87	47	93	95	35
Hardness (Point, Change)	-8	-3	-6	-6	1
Volume (%, Change)	9	5	9	10	1
Engine oil (Toyota SJ)175℃x1000hr					
Tensile (%, Retention)	92	66	88	92	35
Elongation (%, Retention)	84	51	99	95	35
Hardness (Point, Change)	-5	-1	-5	-5	3
Volume (%, Change)	8	6	7	7	0
Engine oil (Toyota CD)175℃x200hr					
Tensile (%, Retention)	87	79	84	88	69
Elongation (%, Retention)	89	76	93	90	59
Hardness (Point, Change)	-3	-2	-3	-3	0
Volume (%, Change)	9	4	7	8	4
Engine oil (Toyota CD)175℃x500hr					
Tensile (%, Retention)	93	69	89	96	73
Elongation (%, Retention)	92	56	94	90	51
Hardness (Point, Change)	-7	-4	-5	-7	1
Volume (%, Change)	7	4	7	8	1
Automatic Transmission Fluid (Toyota)175℃x200hr					
Tensile (%, Retention)	92	76	82	86	61
Elongation (%, Retention)	89	76	96	86	54
Hardness (Point, Change)	-4	-2	-4	-3	1
Volume (%, Change)	8	4	9	14	1
Automatic Transmission Fluid (Toyota)175℃x500hr					
Tensile (%, Retention)	94	82	87	84	62
Elongation (%, Retention)	86	79	93	81	48
Hardness (Point, Change)	-8	-2	-5	-6	-1
Volume (%, Change)	10	5	9	8	9
Automatic Transmission Fluid (Toyota)175℃x1000hr					
Tensile (%, Retention)	109	66	88	86	52
Elongation (%, Retention)	85	54	96	82	41
Hardness (Point, Change)	-7	-12	0	-8	-1
Volume (%, Change)	11	6	10	10	3

* ; Cure promoters are incorporated.

●Oil Resistance

	AFLAS SP*	AFLAS MZ201*	AFLAS 150P	AFLAS 100S	FKM*
Shell SPIRAX EP80 175℃x70hr					
Tensile (%, Retention)	94		67		53
Elongation (%, Retention)	102		93		34
Hardness (Point, Change)	-6		-11		5
Volume (%, Change)	9		8		1
Shell SPIRAX EP80 175℃x168hr					
Tensile (%, Retention)	88			70	41
Elongation (%, Retention)	102			84	33
Hardness (Point, Change)	-7			-11	-1
Volume (%, Change)				9	
Shell SPIRAX EP80 175℃x500hr					
Tensile (%, Retention)	84		78		42
Elongation (%, Retention)	108		101		37
Hardness (Point, Change)	-7		-6		0
Volume (%, Change)			5		
Shell SPIRAX EP80 175℃x1000hr					
Tensile (%, Retention)			65	79	
Elongation (%, Retention)			85	86	
Hardness (Point, Change)			-14	-6	
Volume (%, Change)			21	6	
Stauffer Blend7700 175℃x200hr					
Tensile (%, Retention)	83	58	66	65	73
Elongation (%, Retention)	94	81	88	82	86
Hardness (Point, Change)	-17	-21	-15	-17	-11
Volume (%, Change)	27	37	22	22	15
Stauffer Blend 7700 175℃x500hr					
Tensile (%, Retention)	72	57	64	66	74
Elongation (%, Retention)	95	85	102	88	85
Hardness (Point, Change)	-17	-24	-23	-14	-11
Volume (%, Change)	33	35	21	21	17
Stauffer Blend 7700 175℃x1000hr					
Tensile (%, Retention)	66	53		62	64
Elongation (%, Retention)	85	86		89	89
Hardness (Point, Change)	-7	-21		-18	-19
Volume (%, Change)	45	38		20	24
50% LLC (Furukawa chemical industry) 160℃x70hr					
Tensile (%, Retention)	90	80	82	81	67
Elongation (%, Retention)	101	110	104	94	72
Hardness (Point, Change)	-6	-4	-6	-6	-4
Volume (%, Change)	8	8	5	4	10

* ; Cure promoters are incorporated.

Oil Resistance

	AFLAS SP*	AFLAS MZ201*	AFLAS 150P	AFLAS 100S	FKM*
Heavy Oil C (100%) 140℃x72hr					
Tensile (%, Retention)	85	84	84	85	87
Elongation (%, Retention)	91	93	98	92	88
Hardness (Point, Change)	-10	-4	-6	-8	-1
Volume (%, Change)	9	7	9	8	3
Heavy Oil C (60%) 140℃x72hr					
Tensile (%, Retention)	80	72	69	68	83
Elongation (%, Retention)	94	116	101	87	93
Hardness (Point, Change)	-6	-4	-6	-9	-5
Volume (%, Change)	10	9	10	9	8
Ethylenediamine 25℃ x 168hrs					
Tensile (%, Retention)	106	15	105	105	
Elongation (%, Retention)	109	24	108	93	degradated
Hardness (Point, Change)	3	-20	5	1	
Volume (%, Change)	1	112	1	0	

* : Cure promoters are incorporated.