Polyacetal (POM)

DURACON®

SW-01

CF2001/CD3501

High Sliding

POLYPLASTICS CO., LTD.

Introduction

Every year there are demands for friction and wear resistance improvements in **DURACON® POM**. The ultimate goal of these demands is "greaseless" application. We have developed a wide variety of grades to expand the range of greaseless applications to fully satisfy such challenging demands. However, problems needing improvement still remain, such as:

1) Creaking noise in operation
2) Malfunction of parts by the increasing friction

Therefore, our aim is to develop a "greaseless" material available for a wider application range. Now we have developed **DURACON SW-01**, which decreases creaking noise and friction under high surface pressure applications and is considered at present to be the most applicable greaseless grade.

DURACON SW-01 has the properties shown below and is quite effective for cams, sliders and other parts used under high torque conditions.

Properties

1. No creaking noise under a broad range of surface pressure conditions.
2. Very little wear under high surface pressure.
3. Low coefficient of friction regardless of the mate material.
4. A slide grade having rigidity equal to that of **DURACON** general purpose grades.

General Properties of SW-01

table1-1 General Properties（ISO）

Item	Unit	Test Method	High Sliding
			SW-01
			High Sliding
Color			CF2001/CD3501
ISO(JIS)quality-of-the-material display:		ISO11469 (JIS K6999)	>POM+PE-KD10<
Density	g/cm^3	ISO 1183	1.42
Water absorption (23°C,24hrs,1mmt)	%	ISO 62	0.6
MFR (190℃、2.16kg)	g/10min	ISO 1133	7
MVR (190℃, 2.16kg)	cm^3/10min	ISO 1133	6
Tensile strength	MPa	ISO 527-1,2	50
Strain at break	%	ISO 527-1,2	20*1
Tensile modulus	MPa	ISO 527-1,2	2,700
Flexural strength	MPa	ISO 178	75
Flexural modulus	MPa	ISO 178	2,500
Charpy notched impact strength (23℃)	kJ/m^2	ISO 179/1eA	5.4
Temperature of deflection under load (1.8MPa)	℃	ISO 75-1,2	80
Coefficient of linear thermal expansion (23 - 55℃、Flow direction)	$x10^{-5}$/℃	Our standard	11
Coefficient of linear thermal expansion (23 - 55℃、Transverse direction)	$x10^{-5}$/℃	Our standard	11
Electric strength (3mmt)	kV/mm	IEC 60243-1	18
Volume resistivity	Ω·cm	IEC 60093	2×10^{14}
Surface resistivity	Ω	IEC 60093	-
Volume resistivity (Our standard)	Ω·cm		-
Surface resistivity (Our standard)	Ω		-
Mold Shrinkage (60×60×2mmt, Flow direction, Cavity Pressure 60 MPa)	%	ISO 294-4	2.4
Mold Shrinkage (60×60×2mmt, Transverse direction, Cavity Pressure 60 MPa)	%	ISO 294-4	2.2
Rockwell hardness	M(Scale)	ISO2039-2	70
Specific wear amount (Thrust, vs C-Steel, material side, pressure 0.49MPa, 30cm/s)	$x10^{-3}mm^3/(N·km)$	JIS K7218	-
Specific wear amount (Thrust, vs C-Steel, steel side, pressure 0.49MPa, 30cm/s)	$x10^{-3}mm^3/(N·km)$	JIS K7218	-
Coefficient of Dynamic Friction (Thrust, vs C-Steel, pressure 0.49MPa, 30cm/s)		JIS K7218	-
Specific wear amount (Thrust, vs C-Steel, material side, pressure 0.98MPa, 30cm/s)	$x10^{-3}mm^3/(N·km)$	JIS K7218	0.16

Item	Unit	Test Method	High Sliding
			SW-01
			High Sliding
Specific wear amount (Thrust, vs C-Steel, steel side, pressure 0.98MPa, 30cm/s)	$x10^{-3}mm^3/(N\cdot km)$	JIS K7218	0.01>
Coefficient of Dynamic Friction (Thrust, vs C-Steel, pressure 0.98MPa, 30cm/s)		JIS K7218	0.14
Specific wear amount (Thrust, vs M90-44, material side, pressure 0.06MPa, 15cm/s)	$x10^{-3}mm^3/(N\cdot km)$	JIS K7218	4.0
Specific wear amount (Thrust, vs M90-44, M90-44 side, pressure 0.06MPa, 15cm/s)	$x10^{-3}mm^3/(N\cdot km)$	JIS K7218	5.0
Coefficient of Dynamic Friction (Thrust, vs M90-44, pressure0.06MPa, 15cm/s)		JIS K7218	0.21
Flammability		UL94	HB
The yellow card File No.			E45034
Appropriate List number of Ministerial Ordinance for Export Trade Control			Item 16 of Appendix -1

*1) Nominal strain at break

All figures in the table are the typical values of the material and not the minimum values of the material specifications.

1. Sliding properties

1.1 Creaking noise in sliding

Shown here is creaking noise generation under varying conditions of surface pressure on **SW-01** parts.

No creaking noise is generated under high surface pressure conditions as compared with the conventional sliding grade AW-01.

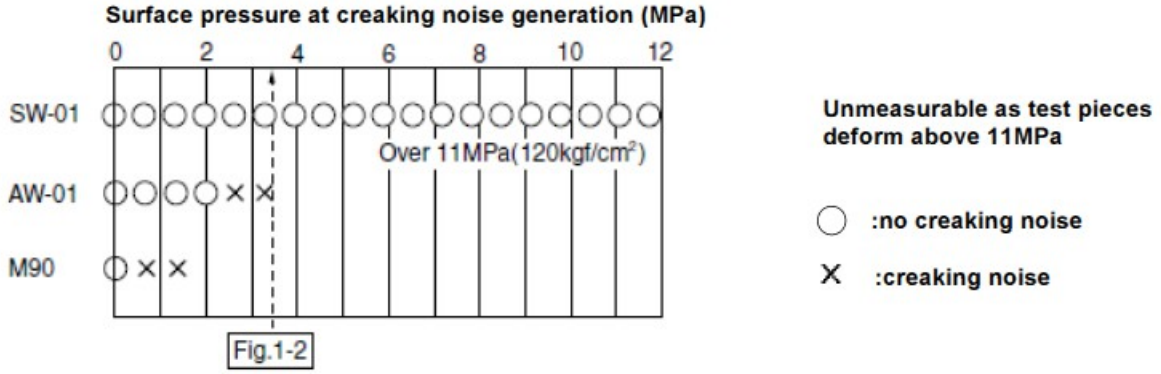


Fig. 1-1 Creaking noise generation (against M90 parts)

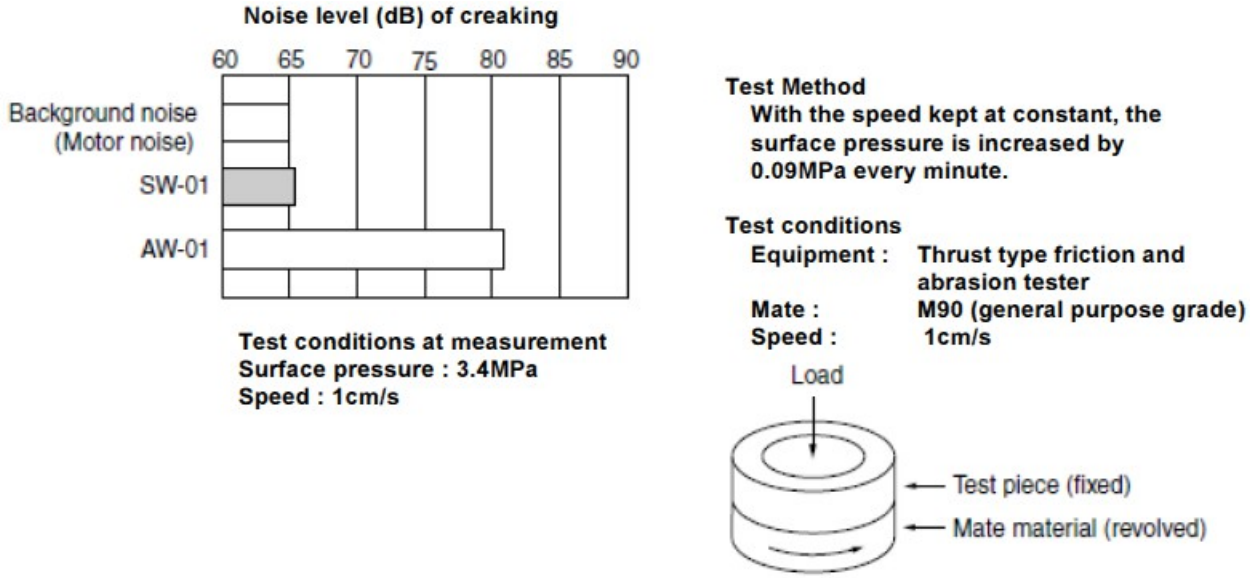


Fig. 1-2 Noise level of creaking [at 3.4 MPa level in Fig. 1-1]

1.2 Limit PV value

Table 1-1 Limit PV value

Unit: $X10^{-1}$MPa· cm/s

Mate	SW-01	AW-01	M90-44
Carbon steel	1,030	850	500
M90-44	63	39	39

Test conditions:
Equipment : Thrust type friction and abrasion tester
Mate : Carbon steel : M90
Speed : 30cm/s : 15cm/s
Time : 30min

1.3 Sliding properties under a broad range of sliding conditions

Shown here are the abrasion volume and coefficient of dynamic friction of **SW-01** parts when slid under many different conditions.

Both the **SW-01** and AW-01 parts show outstanding friction and wear characteristics under a broad range of sliding conditions regardless of the mate material.

Also **SW-01**'s superiority is more evident in the higher pressure side in most cases, but it is necessary to note that this is reversed in the lower surface pressure side with M90 as the mate.

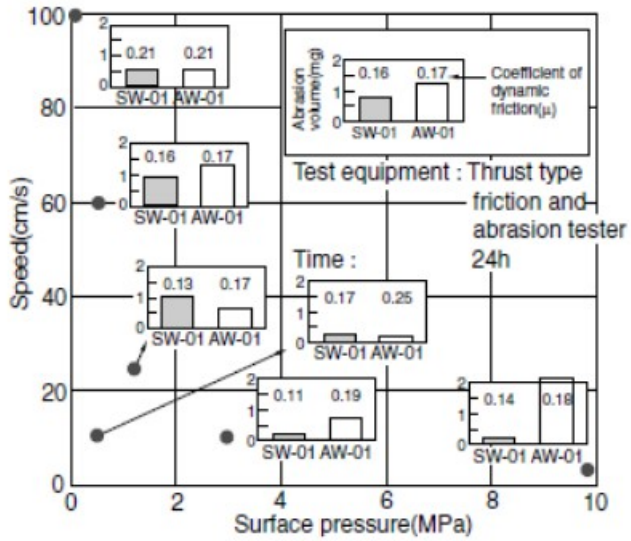


Fig. 1-3 Abrasion volume against Carbon steel

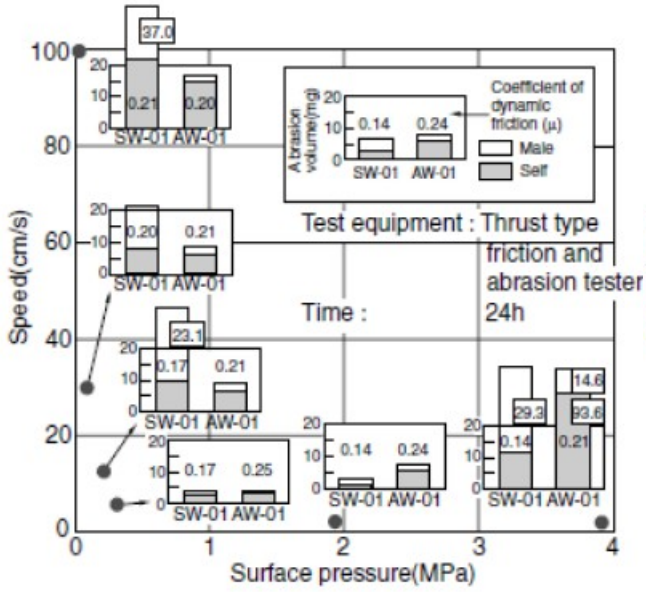


Fig. 1-4 Abrasion volume against M90

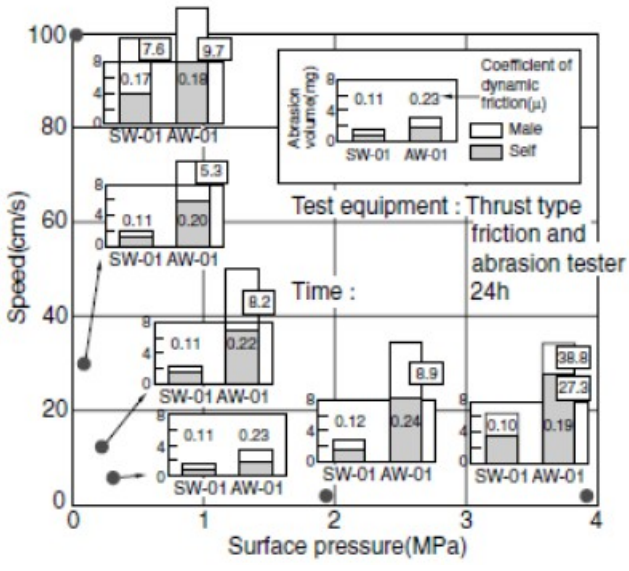


Fig. 1-5 Abrasion volume against same material

1.4 Sliding properties under standard conditions

Shown here are the test results of **SW-01** parts under the standard conditions on a thrust-type friction and abrasion tester.

When the mate material are M90, a general purpose grade of **DURACON**®, and DURANEX® 3300, a 30% GF filled PBT resin, **SW-01** shows a far lower level of friction as compared with that of AW-01. Against a steel (Carbon steel) mate, the abrasion volume increases; however, as described before it is reversed under the high surface pressure condition, and the abrasion volume of **SW-01** is less.

Meanwhile, regarding the coefficient of dynamic friction, **SW-01** has a lower level than that of both mate materials.

Table 1-2 Friction-wear properties against each resin

(Specific wear amount X10^{-3}mm^3/N・km)

	High slidings vs M90-44		vs C-steel	vs Same material	vs DURANEX® 3300	
	Material side	M90-44	Material side	Total	Material side	3300
DURACON® SW-01	4	9	0.2	3	1.5	0.8
DURACON® M90-44	35	65	0.3	100	22	3.9
DURACON® AW-01	7	14	0.2	8	3.3	1.8

Table 1-3 Friction-wear characteristics against each resin

(Coefficient of dynamic friction μd)

	vs M90-44	vs C-steel	vs Same material	vs DURANEX® 3300
DURACON® SW-01	0.21	0.1	0.18	0.2
DURACON® M90-44	0.37	0.4	0.39	0.4
DURACON® AW-01	0.3	0.2	0.22	0.2

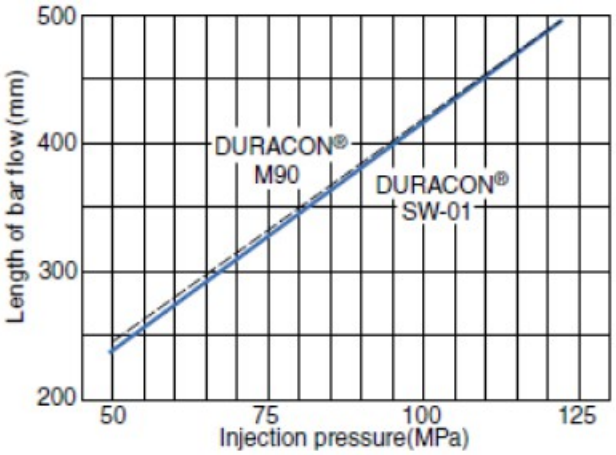
Test conditions:

Equipment	**: Thrust type friction and abrasion tester**	
Mate	**: M90-44, 3300,**	
	Same material	**: Carbon steel**
Surface pressure	**: 0.05MPa**	**: 0.98MPa**
Speed	**: 15cm/s**	**: 30cm/s**
Time	**: 24h**	**: 24h**

2. Moldability

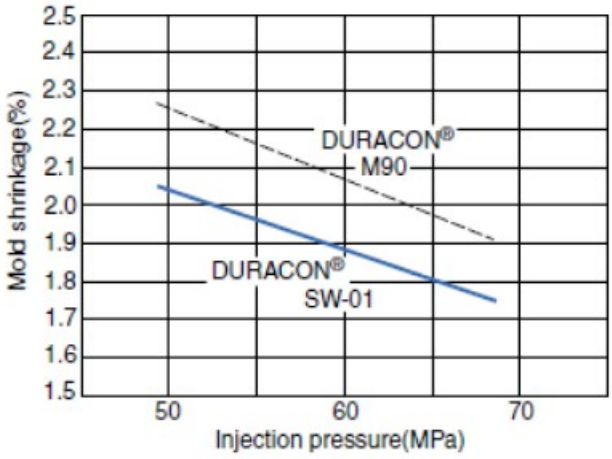
2.1 Flowability and Mold shrinkage

SW-01 shows mostly the same excellent flowability as M90 general purpose grade **DURACON**. And mold shrinkage rate of **SW-01** is lower by about 10% than that of M90 general purpose grade **DURACON**.



Molding conditions
Cylinder temp. : 190-190-170-150°C
Mold temp. : 80°C
Injection speed : 67mm/s
Mold : 2mmt bar flow mold

Fig. 2-1 Length of bar flow (2mmt)



Molding conditions
Cylinder temp. : 190-190-170-150°C
Mold temp. : 80°C
Injection speed : 25mm/s
Molding cycle : Holding pressure 20s/cooling 10s
Mold :120sq.X2mmt flat plate,
side gated 4w X2t

Fig. 2-2 Mold shrinkage (2mmt)

2.2 Notes for successful molding

DURACON SW-01 has the moldability comparable with that of general purpose grades; however, because it contains a high performance lubricant, special attention should be paid to the following:

- A mold temperature setting above 60°C is recommended. If the mold temperature is low, the lubricant may sometimes stick to the mold.
In such a case, the lubricant must be wiped off with a waste cloth.
- When the molding operation is continued for a prolonged period of time, the mold must be cleaned from time to time depending on the amount of the lubricant stuck to it.
- When the appearance of molded parts is stressed, the balance of gate size and injection speed must be taken into consideration. If the shear rate is too fast at the gate section, the lubricant may separate.

Polyplastics

NOTES TO USERS

- All property values shown in this brochure are the typical values obtained under conditions prescribed by applicable standards and test methods.
- This brochure has been prepared based on our own experiences and laboratory test data, and therefore all data shown here are not always applicable to parts used under different conditions. We do not guarantee that these data are directly applicable to the application conditions of users and we ask each user to make his own decision on the application.
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- For all works done properly, it is advised to refer to appropriate technical catalogs for specific material processing.
- For safe handling of materials we supply, it is advised to refer to the Safety Data Sheet "**SDS**" of the proper material.
- This brochure is edited based on reference literature, information and data available to us at the time of creation. The contents of this brochure are subject to change without notice upon achievement of new data.
- Please contact our office for any questions about products we supply, descriptive literatures or any description in this brochure.

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