



Molding of Millathane® Millable Urethane Rubber

Millathane® millable polyurethane rubbers are processed on conventional rubber processing equipment such as mills, internal mixers and calenders. Like other synthetic rubbers, Millathane® compounds can be compression, transfer, and injection molded. Millable polyurethane rubbers can be extruded to make preforms for compression molding or strips for injection molding or for use in extrusion roll building. Alternatively, millable polyurethanes rollers can be produced with an extruder using a cross-head die.

MOLDING

Millathane® compounds can be molded using compression, transfer, and injection molding techniques. Problems which may be encountered are similar to those experienced with other synthetic rubbers and can usually be solved through mechanical or compounding modifications. The linear shrinkage of vulcanizates of millable urethane compounds varies somewhat with the type of loading, ranging from approximately 1.5% to 2.5%.

Optimum press cures are obtained with sulfur systems at temperatures from 285°F (140°C) to 330°F (165°C), with curing times varying from approximately seven to 60 minutes. With peroxide curing systems, temperatures from 300°F (149°C) to 360°F (182°C) are suggested, depending on the peroxide used, with cycles ranging from two to twenty minutes.

Excellent mold release is provided by using Mann™ Easy Release™ 200, Mann™ Easy Release™ 400, Crystal® 1053 water-based mold release or silicone mold release lubricants, but indiscriminate use can cause poor flow and knitting problems.

TRANSFER AND COMPRESSION MOLDING

The choice of time and temperature for curing molded goods is of utmost importance. The best properties of millable urethane compounds are obtained by curing at longer times at low temperatures particularly with a sulfur-cured system. Millathane compounds are also cured with peroxide curing agents. Cure cycles may be reduced by using higher temperatures, with some sacrifice to the physical properties. Reversion can occur when temperatures are too high or if compounds are cured too long.

As with other synthetic rubber compounds, the same state of cure may be obtained at different temperatures by varying the time of cure. Cure time is reduced by approximately half for each 18°F (10°C) increase in temperature.

INJECTION MOLDING

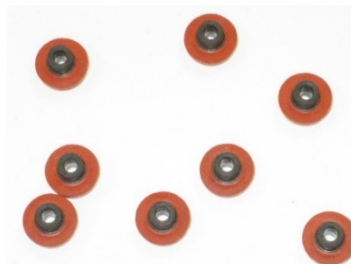
Millathane® millable urethane compounds can be injection molded to produce highly abrasion resistant parts. The Mooney viscosity of the millable urethane compounds should be in the range of 35 to 45 ML(1+4)/100°C) for good flow. Product bulletins should be consulted for incorporation of process aids and balancing filler and plasticizer levels. Cure times can be shortened by adjusting the temperature or by suitable choice of peroxide or sulfur curing agents. As with other synthetic rubbers, time, temperature and pressure parameters must be determined before going into production.



Molding of Millathane® Millable Urethane Rubber (cont.)

The small rollers seen in the picture below were molded using the conditions shown in the table, below. These small molded rollers were made from the Millathane® HT compound shown below, and are used in ATM machines worldwide. In this application excellent abrasion resistance and high coefficient of friction are required.

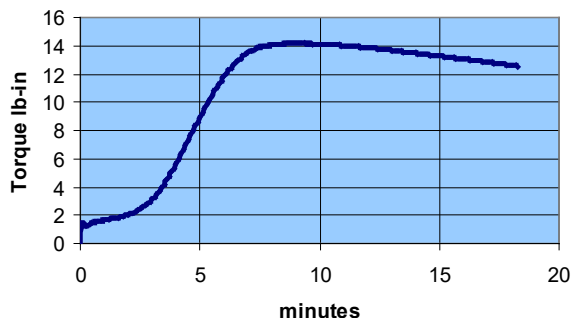
Injection Molding Conditions	
Screw & Barrel	70°C – 80°C (158°F – 176°F)
Accumulator	70°C – 80°C (158°F – 176°F)
Mold Temperature	170°C (338°F)
Cure Time	6 minutes
Injection Pressure	50 Bar (725 psi)
Injection Speed	50 mm/sec (1.96 in./sec)



Millathane® HT Injection Molding Compound

Millathane® HT	100.0	Physical Property, cure 7'/170°C (338°F)	
Zinc Stearate	0.5	Durometer, Shore A	70
Carbowax 3350	2.0	100% Modulus, psi (MPa)	185 (1.3)
Hi-Sil 233	25.0	200% Modulus, psi (MPa)	278 (1.9)
TP-95	5.0	300% Modulus, psi (MPa)	432 (3.0)
Red Iron Oxide	1.0	Tensile Strength, psi (MPa)	3360 (23.2)
MBTS	4.0	Elongation, %	675
MBT	2.0	Tear Die C, lb/in (kN/m)	176 (30.8)
Thanecure® ZM	2.0	DIN Abrasion, mm ³ loss	92
RM Sulfur	2.0		

Rheometer 170°C Millathane® HT
Injection Molding Compound



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