MILITARY HANDBOOK

RUBBER

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1. The following pages of MIL-HDBK-149B have been revised and supersede the pages listed:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
195	24 July 1987	195	1 February 1984
196	1 February 1984	196	Reprinted without change

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-HDBK-149B will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the military handbook is completely revised or canceled.

Custodians:
Army - MR
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Preparing activity:
Army - MR

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Review activities:
Army - AR, ME, AT

AMSC N/A

/FSC 9320/

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TABLE XXVIII. Use of rubber in acids and alkali at room temperature.

Rubber		Acid								Alkali	
		Hydrochloric		Sulfuric		Nitric fuming dil.*		Phosphoric		Sodium Hydroxide	
		conc.	dil.	conc.	dil.					conc.	dil.
Acrylonitrile Butadiene	NBR	C	OK	C	OK	NG	NG	NG		C	OK
Butyl	IIR	OK	OK	C	OK	C	OK	OK		OK	OK
Chloroprene	CR	C	OK	C	OK	NG	C	C		OK	OK
Chlorosulfonated Polyethylene	CSM	NG	C	C	OK	NG	C	OK		OK	OK
Ethylene Propylene Diene	EPDM	OK	OK	C	OK	C	OK	OK		OK	OK
Fluorocarbon	FKM	C	OK	C	OK	C	C	OK		C	OK
Fluorosilicone	FVMQ	NG	OK	NG	OK	OK	NG	C		OK	OK
Methyl Vinyl Silicone	VMQ	OK	C	NG	OK	NG	C	C		OK	OK
Natural	NR	NG	OK	C	OK	NG	C	C		C	OK
Perfluoroelastomer	FFKM	OK	OK	OK	OK	OK	OK**	OK		OK	OK
Phosphonitrilic Fluoroelastomer	FZ	NG	C	NG	C	NG	C	NG		C	OK
Polysulfide	EDT	NG	OK	NG	OK	NG	C	NG		OK	OK
Polyurethanes	AU,EU	NG	NG	NG	NG	NG	NG	NG		NG	NG
Styrene Butadiene	SBR	NG	OK	NG	OK	NG	C	NG		C	OK

Legend: OK - Suitable

NG - Not suitable

C - Use with caution, preferably after service tests.

*26%

**70%

7.4 Effects of Heat and Humidity (Hydrolysis)

7.4.1 The combination of high atmospheric temperatures and high humidity is usually of little concern to rubber designers and engineers, because natural and most man-made rubbers are quite resistant to such conditions. Polyester urethane rubbers, AU, however, are a notable exception, many of them breaking down rapidly in hot, humid atmospheres. At temperatures above about 120°F (50°C) and in the presence of high humidity, polyester urethanes hydrolyze by scission of main chain ester groups. The result is reversion of the rubber to a tar-like mass. Below about 120°F (50°C) and again in the presence of high humidity, the breakdown is evidence by cracking followed by gradual softening. Both types of hydrolytic degradation usually occur in less than one year of exposure outdoors.

7.4.2 A short term laboratory test method has been developed for use in the evaluation of the hydrolytic stability of vulcanized rubber. Useful primarily in identifying the poor hydrolytic stability of polyester urethanes, the test method should prove invaluable for use with all newly developed polymers whose hydrolytic stability is suspect.

7.4.3 The method is ASTM Standard D3137, "Standard Test Method for Rubber Property - Hydrolytic Stability." Tensile dumbbell specimens are exposed to the influence of humid environments under definite conditions of temperature, humidity, and time. The resulting hydrolytic degradation is determined by measuring the change in tensile strength after exposure over distilled water. Exposure time and temperature are 96 hours and 185°F (85°C), respectively. The test method recommends that dumbbell specimens also be exposed to dry heat in an air oven (ASTM Standard D573) for 96 hours at 185°F (85°C). This latter procedure aids in distinguishing between the effects of hydrolysis and those due to heat aging.

7.4.4 The data shown in table XXIX resulted from tests of eighteen rubber compounds using ASTM Standard D3137. The compounds are all based on commercially available polymers and standard recipes. The tests were conducted at 180°F (82°C) which was the test temperature specified in the original version of ASTM Standard D3137. The currently specified temperature is 185°F (85°C) but the data of table XXIX are valid because no significant differences were noted when tests were performed at the two temperatures.

7.4.5 Of the eighteen compounds tested, all but the two based on polyester urethanes are, from years of experience, known to be stable to hydrolysis. The results of the tests over water verify this fact. The changes in tensile strength of all but the polyester urethanes range from +8 to -15 percent. Changes of this magnitude are not considered to be significant because they are within the range of values attributed to the reproducibility of the tensile test. Two compounds exhibited significant losses in tensile strength after exposure over water, suggesting that these two polyester urethane (AU) compounds would deteriorate rapidly in himid climates.