

SPECIALTY SHEET GOODS

Now that's some good 'sheet'.

Overview

- ◉ What are Sheet Goods?
- ◉ Where They are Used
- ◉ How They are Made
- ◉ Various Types of Sheet
- ◉ Polymer and Their Uses
- ◉ Essential Properties
- ◉ Designing For Your Application
- ◉ How Home Rubber Can Help

What are Sheet Goods?

- The RMA Handbook defines sheet rubber as:
... a suitably vulcanized compound of natural rubber or synthetic rubber or blends thereof, of uniform quality and dimensions, designed for general purpose applications and usually furnished in roll or slab form.

Where They are Used

● O-Rings

- Static
 - Rubber O-Rings
 - Lathe Cut O-Rings
- Dynamic
 - Rotating Pump Shafts
 - Hydraulic Cylinders

● Gaskets and Seals

● Vacuum Blankets

How are Sheet Goods Made?

- ◎ Press
 - Compression
- ◎ Mandrel
 - How?
- ◎ Rotocure
 - How it Works...

Types of Sheet Goods

- ◉ All Rubber
- ◉ CI Sheet
 - CBS vs. COS
 - Ranging from Standard Cotton to Kevlar
- ◉ Rubber Bonded to Metal
 - Steel, AL, SS, etc.

Polymer Types

- ◉ EPDM
- ◉ FKM (Fluorocarbon)
- ◉ Nitrile, XNBR and HNBR
- ◉ Natural Rubber
- ◉ Other Types

EPDM

Chemical Description	Ethylene Propylene Diene Rubber
Abbreviations (ASTM 1418)	EPDM
ISO / DIN	EPDM
Other Trade Names	EP, EPT, EPR
ASTM D2000 Designations	BA, CA, DA
Low Temperature Range	-60°F / -51°C
High Temperature Range	300°F / 149°C

EPDM

Physical Properties	Very Good	Good	Fair	Poor
Abrasion Resistance		2		
Acid Resistance		2		
Chemical Resistance	1			
Cold Resistance		2		
Compression Set Resistance		2		
Dynamic Properties		2		
Electrical Properties		2		
Elongation		2		
Flame Resistance				4
Heat Resistance		2		
Impermeability		2		
Oil Resistance				4
Ozone Resistance	1			
Tear Resistance		2		
Tensile Strength		2		
Water Steam Resistance	1			
Weather Resistance	1			

EPDM

Chemical Resistance	Very Good	Good	Fair	Poor
Cleaning Agents (alkalis)	1			
Gasoline				4
Glycol Brake Fluids (Dot 3&4)	1			
Hot Water / Steam to 300°F	1			
Mineral Oils / Greases / Fuels				4
Organic & Inorganic Acids	1			
Petroleum Oils				4
Phosphate-ester Brake Fluids	1			
Polar Solvents (Keytones)				4
Silicone Oils & Greases	1			
Silicone Base Brake Fluids	1			
Steam up to 399°F	1			
Steam 400°F to 500°F			3	

FKM

Chemical Description	Fluorocarbon Rubber
Abbreviations (ASTM 1418)	FKM
ISO / DIN	FKM
Other Trade Names	Viton ®, Fluorel ®
ASTM D2000 Designations	HK
Low Temperature Range	5°F / -15°C
High Temperature Range	390°F / 199°C

F K M

Physical Properties	Very Good	Good	Fair	Poor
Abrasion Resistance		2		
Acid Resistance	1			
Chemical Resistance	1			
Cold Resistance				4
Compression Set Resistance	1			
Dynamic Properties		2		
Electrical Properties			3	
Elongation			3	
Flame Resistance	1			
Heat Resistance	1			
Impermeability		2		
Oil Resistance	1			
Ozone Resistance	1			
Tear Resistance			3	
Tensile Strength		2		
Water Steam Resistance			3	
Weather Resistance	1			

F K M

Chemical Resistance	Very Good	Good	Fair	Poor
Aliphatic Hydrocarbons	1			
Ammonia Gas, Amines, Alkalis				4
Aromatic Hydrocarbons	1			
Chlorinated Hydrocarbons		2		
Dilute Alkalis	1			
Gasoline	1			
Glycol Base Brake Fluids				4
Ketones			3	
Mineral & Vegetable Oils	1			
Mineral Oil ASTM No. 1 IIRM 902	1			
Non-Flammable Hydraulic Fluid	1			
Silicone Oils & Grease	1			
Steam To 500°F				4

Nitrile

(Including XNBR & HNBR)

Chemical Description	Acrylonitrile-Butadiene Rubber
Abbreviations (ASTM 1418)	NBR
ISO / DIN	NBR
Other Trade Names	Buna-N
ASTM D2000 Designations	BF, BG, BK, CH
Low Temperature Range	-22°F / -30°C
High Temperature Range	258°F / 100°C

NITRILE

Physical Properties	Very Good	Good	Fair	Poor
Abrasion Resistance		2		
Acid Resistance			3	
Chemical Resistance			3	
Cold Resistance		2		
Compression Set Resistance		2		
Dynamic Properties		2		
Electrical Properties			3	
Elongation		2		
Flame Resistance				4
Heat Resistance		2		
Impermeability		2		
Oil Resistance	1			
Ozone Resistance				4
Tear Resistance			3	
Tensile Strength		2		
Water Steam Resistance			3	
Weather Resistance			3	

NITRILE

Chemical Resistance	Very Good	Good	Fair	Poor
Aliphatic Hydrocarbons	1			
Alkali and salt solutions		2		
Aromatic Hydrocarbons				4
Brake Fluid Glycol Base				4
Brake Fluids Non-Petroleum				4
Chlorinated Hydrocarbons				4
Dilute acids		2		
Hydraulic Fluids HFA, HFC, HFB	1			
Polar Solvents (Ketones)				4
Silicone Fluids	1			
Steam to 500°F				4
Strong Acids				4
Water	1			

XNBR vs. HNBR

XNBR

- Carboxyl Groups Introduced into Butadiene
- Improved Abrasion Resistance
- Extra Cross-linking
- Higher Continuous Temperature
- Better Compression Set
- Better Tear Resistance

HNBR

- HSN – Highly Saturated Nitrile
- Improved Chemical Resistance
- Used in More Dynamic Applications
 - Extremely Deep Oil Wells
 - Auto AC Units
- Does Not Perform Well in:
 - Esters
 - Chlorinated Hydrocarbons

Natural Rubber

Chemical Description	Natural Rubber
Abbreviations (ASTM 1418)	NR
ISO / DIN	NR
Other Trade Names	Isoprene (IR)
ASTM D2000 Designations	AA
Low Temperature Range	-60°F / -51°C
High Temperature Range	220°F / 104°C

N A T U R A L R U B B E R

Physical Properties	Very Good	Good	Fair	Poor
Abrasion Resistance	1			
Acid Resistance			3	
Chemical Resistance			3	
Cold Resistance		2		
Compression Set Resistance		2		
Dynamic Properties	1			
Electrical Properties		2		
Elongation			3	
Flame Resistance				4
Heat Resistance			3	
Impermeability			3	
Oil Resistance				4
Ozone Resistance				4
Tear Resistance		2		
Tensile Strength	1			
Water / Steam Resistance			3	
Weather Resistance			3	

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Chemical Resistance	Very Good	Good	Fair	Poor
Acids, Inorganic		2		
Alcohols		2		
Animal & Vegetable Oils				4
Brake Fluids, Non-Petroleum Based		2		
Dilute Acids		2		
Dilute Alkalis		2		
Hydraulic Fluids				4
Ketones			3	
Petroleum Oils (Below 250°F)				4
Refrigerant Ammonia		2		
Silicone Fluids	1			
Steam to 500°F				4
Transmission Fluids (Type A)				4

Other Types

◉ Chloroprene

- Neoprene
- Baypren

◉ Polyurethane

- Millathane
- Vibrathane
- Adiprene

◉ Chlorinated Polyethylene

- Hypalon

◉ Silicone

- KE
- Silatic
- SilPlus

Chloroprene

PROS

- Relatively Inexpensive
- Widely Adaptable
- Performs Well in:
 - Mild Acids
 - Silicone Oils
 - Water
 - Automotive

CONS

- Does NOT Perform Well in:
 - Aromatic Hydrocarbons
 - Ketones (MEK)
 - Strong Acids

Polyurethane

PROS

- Excellent Abrasion Resistance
- Extreme Pressure Ratings
- Excellent Properties Over Wide Temperature Range

CONS

- High Cost

Chlorinated Polyethylene

PROS

- Improved Neoprene
- Good Resistance to:
 - Chemicals
 - Abrasion
 - Weather
 - Extreme Temperatures
- Used in:
 - Automotive Hose
 - Gas Applications
 - Electrical Jacketing
 - Magnetic Applications

CONS

- Limited Availability
- Poor Compression Set
 - Limits its Use for Sealing

Silicone

PROS

- Excellent High Temperature Rating
- Curable with Both Sulfur and Peroxide
- Sulfur
 - Oxygen
 - Ozone
 - UV Light
- Peroxide
 - Non-reactive
 - Non-toxic
 - Fungus Resistant
- Excellent Compression Set

CONS

- Does NOT Perform Well in Dynamic Applications
 - Low Abrasion Resistance
 - Poor Tear
 - Poor Tensile
 - Mold Shrinkage
 - High Swell in Fuels (Aromatic and Aliphatic)

Essential Properties

- General Physicals
 - Hardness, Durometer
 - Tensile, psi
 - Elongation, %

Making a Good Gasket/Seal

- ◉ Compression Set

- ASTM D395
- Why Most Important
- How Is it Measured?

- ◉ Set vs. Deflection

- Difference

- ◉ Deflection vs. Durometer

- ◉ Material(s) of Choice

Making a Good Gasket/Seal

● Tear Resistance

- ASTM D412
- How Is it Measured?
- In Applications
- Material(s) of Choice

Making a Good Gasket/Seal

◉ Chemical Compatibility

- Like vs. Like
- How Chemicals Attack Rubber
- Volume Change
 - Swell
 - Measured as %
 - Testing for . . .
- Best Choices for Chemicals

Making a Good Gasket/Seal

◉ Environmental Factors

- Ozone
- Oxygen

◉ Temperature Effects

- High
- Low

Appropriate Material Based on Application

◉ More Information the Better

- Application
- Dimensional Tolerances
 - Thickness
 - Width and Length
- Material Specifications
 - General Physicals
 - Chemical Properties
 - Specialized Properties

Questions for Special Grade Sheet Rubber

- Description
- Service Conditions
- Specifications

Questions to be Answered

● Description

- Thickness, Width and Length (if special)
- Tolerance (commercial or special)
- Quantity
- Durometer +/- 5 (Shore A)
- Tensile Strength (if important)
- Elongation (if important)
- Cloth Inserted (CI)
- Cloth One Side (COS)
- Cloth Both Sides (CBS)
- All Rubber (no fabric)
- Surface: smooth, cloth-impression, no preference
- Color other than black
- Whether untrimmed would be satisfactory

Questions (continued)

● Service Conditions

- Temperature
- Type of Heat: Hot Air, Steam, Water, Oil
- Type of Oil – if in Contact
- Chemical
- Concentration of Chemical (in %)
- Confirmed Gasket (Partial or Total)
- Abrasive Condition
- Ozone
- Other

Questions (continued)

● Specifications

- Government Specification
- ASTM or SAE Specification
- Customer Specification
- Blueprint
- Other

Home Rubber's Capabilities

- ◉ Materials
- ◉ Sizes
- ◉ CI
- ◉ Surface
- ◉ Colors

For More Information

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