The Synthetic Rubber Manual

10th Edition — 1986

International Institute of Synthetic Rubber Producers, Inc.

QUICK REFERENCE INDEX TO POLYMERS

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THE INTERNATIONAL INSTITUTE OF SYNTHETIC RUBBER PRODUCERS, INC.

PURPOSES

The purposes of the Institute are to promote and further the manufacture and use of synthetic rubber polymers, and consistent with the interests of the general public, the Institute endeavors:

1. To gather, receive, prepare and disseminate information and statistics concerning the synthetic rubber industry worldwide.

2. To promote the standardization of synthetic rubber polymers.

3. To cooperate with all governments and government agencies regarding matters affecting the industry.

4. To promote and encourage the development of international trade in synthetic rubber polymers.

5. To promote research, development and scholarship in fields related to synthetic rubber.

6. To promote the generation and exchange of information pertaining to the safety and health of employees and customers of the synthetic rubber industry.

7. To encourage development and exchange of information relating to the protection of the world's environment.

8. To do all that is reasonably proper or advisable, in conformity with all applicable laws, for attainment of the above purposes.

ORGANIZATION

The institute was organized in 1960 by 14 synthetic rubber companies. It now represents 47 producers in 19 countries.

Institute members are organized into four geographic Sections in Europe, the Far East, North America and Latin America.

COMMITTEES

The Activities of the Institute are accomplished through Committees made up of specialists from member companies. The Committees meet in their respective geographic Sections. They have undertaken a variety of tasks which have included sponsorship of research, sponsorship of projects relating to the health and safety of workers, assigning designations of newly discovered rubber derivatives, sponsorship of statistical programs, developing new packaging techniques, modernizing shipping techniques and dissemination of general and technical information to the public, the industry, and the business and technical community on a worldwide basis.

MANAGEMENT

The Management of the Institute is vested in the Board of Directors composed of one representative from each member company. Day-to-day operations are conducted by the Managing Director and his staff. The Institute is represented by Counsel, who is responsible for all operations of the Institute being conducted in accord with existing laws in the countries of the various member companies.

MEMBERSHIP LIST

EUROPEAN SECTION

Bayer AG ..... West Germany
CALATRAVA Empresa para la Industria PETROQUÍMICA, S.A. ..... Spain
Compagnie du Polyisoprène Synthétique ..... France
Dutral S.p.A. ..... Italy
DISTUGIL ..... France
DU PONT DE NEMOURS INTERNATIONAL S.A. ..... Switzerland
Eni Chemical S.A. ..... Switzerland
Essochem Europe, Inc. ..... Belgium
Finaprene n.v. ..... Belgium
Goodyear France ..... France
Huels AG ..... West Germany
Karbochem Division of Sentrachem Ltd. ..... South Africa
Naamloze Vennootschap, DSM Holland ..... Netherlands
Polysar International S.A. ..... Switzerland
Shell International Chemical Company Limited ..... United Kingdom

FAR EASTERN SECTION

Asahi Chemical Industry Co., Ltd. ..... Japan
Australian Synthetic Rubber Co., Ltd. ..... Australia
Denki Kagaku Kogyo K.K. ..... Japan
Indian Petrochemical Corporation Limited ..... India
Japan Synthetic Rubber Co., Ltd. ..... Japan
Korea Kumho Petrochemicals Co., Ltd. ..... Korea
Mitsubishi Chemical Industries Limited ..... Japan
Mitsui Petrochemical Industries Ltd. ..... Japan
Nippon Zeon Company, Ltd. ..... Japan
Sumitomo Chemical Company, Ltd. ..... Japan
Synthetics & Chemicals Limited ..... India
Taiwan Synthetic Rubber Corporation ..... Republic of China
Toyo Soda Manufacturing Company ..... Japan
Ube Industries ..... Japan

LATIN AMERICAN SECTION

Companhia Pernambucana de Borracha Sintética – COPERBO ..... Brazil
Hules Méxicanos, S.A. ..... Mexico
Negromex, S.A. ..... Mexico
NITRIFLEX, S.A.Industria e Comercio ..... Brazil
PASA Petroquímica Argentina S.A. ..... Argentina
PETROFLEX – Industria e Comercio S.A. ..... Brazil

NORTH AMERICAN SECTION

American Synthetic Rubber Company ..... U.S.A.
BFGoodrich ..... U.S.A.
Copolymer Rubber & Chemical Corporation ..... U.S.A.
Denka Chemical Corporation ..... U.S.A.
DiversiTech General, a GenCorp Company ..... U.S.A.
E.I. du Pont de Nemours & Company (Inc.) ..... U.S.A.
Exxon Chemical Americas ..... U.S.A.
Firestone Synthetic Rubber & Latex Company ..... U.S.A.
Goodyear Tire & Rubber Company ..... U.S.A.
Polysar Limited ..... Canada
Shell Chemical Company ..... U.S.A.
UNIROYAL, INC. ..... U.S.A.

THE SYNTHETIC RUBBER MANUAL

(Formerly The Elastomers Manual)

INTRODUCTION

This Manual tabulates the types of styrene-butadiene, polybutadiene, polyisoprene, ethylene-propylene, butyl, nitrile, polychloroprene, fluorinated, chlorosulfonyl polyethylene, epicholorhydrin, silicone, ethylene vinyl acetate, polysulfide, polyisobutylene, polypropylene oxide, urethane, and thermoplastic rubbers. Most are described according to their method of manufacture and general physical and chemical properties. The descriptions are not intended to serve as purchase specifications.

In the case of styrene-butadiene, polybutadiene, and polyisoprene rubbers, the International Institute of Synthetic Rubber Producers, Inc., has established a program for the assignment of numbers for new polymers. This program is under the jurisdiction of the Committee on Nomenclature and Testing under rules and regulations prepared by the Committee and approved by the Board of Directors. Any producer of these rubbers or latices, either dry or latex, may apply for a commerciai number by making formal application to the Institute.

The styrene butadiene and solution rubbers in the various tables include those which carry regular Institute numbers as well as those which do not carry regular Institute numbers.

In the case of styrene-butadiene rubbers, the Institute numbering system is the same basic numbering system estabiished by the Office of Rubber Reserve, R.F.C. and continued by the American Society for Testing and Materials.

The numbering system in Tables III and IV is arranged as follows:

1000 series Hot non-pigmented rubbers
1500 series Cold non-pigmented rubbers
1600 series Cold black masterbatch with 14 or less parts of oil per 100 parts SBR
1700 series Cold oil masterbatch
1800 series Cold oil black masterbatch with more than 14 parts of oil per 100 parts SBR
1900 series Emulsion resin rubber masterbatches

Various producers have been assigned ranges of code numbers for designating new semi-commercial dry rubbers or latices containing styrene-butadiene or only butadiene (emulsion polymerization). These code numbers are shown below:

Semi-Commercial Numbers*	Company
3000-3499	American Synthetic Rubber Corporation
3500-3999	Copolymer Rubber & Chemical Corporation
4500-4999	BFGoodrich Tire Group
5000-5499	Goodyear Tire & Rubber Company
5500-5599	EniChem Elastomeri
5700-5799	Shell Chimie, S.A.
5800-5899	Shell International Chemical Company Limited
5900-5999	Huels AG
6000-6499	UNIROYAL, INC.
7000-7499	Polysar Limited
7500-7999	Shell International Chemical Company Limited
8000-8499	SYNPOL INC.
9000-9499	DiversiTech General, A GenCorp Company
9500-9599	Nippon Zeon Company, Ltd.
9600-9699	Japan Synthetic Rubber Co., Ltd.
9700-9799	Australian Synthetic Rubber Co., Ltd.
9800-9899	PETROFLEX-Industria e Comercio S.A.
9900-9999	PASA Petroquímica Argentina S.A.
10000-10499	Hules Méxicanos S.A.

* For those producers with blocks of 500 numbers, each should be further divided by type according to the following tabulation:

Producer's Code Number	Product Type
0-49	Hot Non-Pigmented Polymers
100-149	Cold Non-Pigmented Polymers
150-199	Cold Black Masterbatch with 14 or less parts of oil per 100 parts SBR
200-249	Cold Oil Masterbatch
50-99 and 250-299	Cold Oil Black Masterbatch with more than 14 parts of oil per 100 parts SBR
300-349	Hot Latex
350-399	Cold Latex
400-499	Unassigned

ABBREVIATIONS USED IN TABLES III-XXXVI

In addition to the abbreviations associated with the names of the manufacturing companies, the following abbreviations are used in Tables III through XXXVI.

A	Acid	ND	Non-Discoloring
A-AL	Acid Alum	NST	Non-Staining
AL	Alum	PAR	Paraffinic
AR	Aromatic	PHR	Parts per Hundred of Rubber
FA	Fatty Acid	RA	Rosin Acid
GA	Glue Acid	SA	Salt Acid
G-AL	Glue Alum	S-AL	Salt Alum
HI-AR	Highly Aromatic	SL-ST	Slightly Staining
HSP	High-Styrene Resin	ST	Staining
NAPH	Naphthenic	SYN	Synthetic

Carbon Black Types are classified in "Recommended Practice for NOMENCLATURE FOR RUBBER-GRADE CARBON BLACKS, ASTM Standard D-1765."

ASTM NOMENCLATURE FOR CARBON BLACKS

(TYPES USED IN CURRENT POLYBUTADIENE AND SBR MASTERBATCHES)

INDUSTRY TYPE	ASTM Classification	Industry Type	ASTM Classification	Definitions	
SAF	N110	HAF-HS	N347	SAF	Super abrasion furnace
ISAF	N220		N351	ISAF	Intermediate super abrasion furnace
ISAF-HS	N234		N375	HAF	High abrasion furnace
ISAF-HS	N242	FEF	N550	FEF	Fast extrusion furnace
	N285	GPF-HS	N650	SRF	Semi-reinforcing furnace
	N299	SRF-HS	N765	EPC	Easy processing channel
HAF-LS	N327	SRF	N770	HS	High structure
HAF	N330	SRF-HM	N787	LS	Low structure
HAF-HS	N339	EPC	S300	HM	High modulus

The American Society for Testing and Materials has published a "Standard Practice for DESCRIPTIONS OF TYPES OF PETROLEUM EXTENDER OILS," ASTM Designation: D2226-82, which is shown below:

CLASSIFICATION OF OIL TYPES

Types	Asphaltenes max., per cent	Polar Compounds max., per cent	Saturated Hydrocarbons per cent	Common Name
101	0.75	25	20 max.	Highly aromatic
102	0.5	12	20.1 to 35	Aromatic
103	0.3	6	35.1 to 65	Naphthenic
104[a]	0.1	1	65 min.	Paraffinic

. . .[a] Type 104 oils are further classified into two sub-types 104A and 104B for SBR polymers only. Type 104B oils are those that have a viscosity-gravity constant of 0.820 maximum. Type 104A oils are those that have a viscosity-gravity constant greater than 0.820.

The Institute numbering system for stereo and related rubbers is shown below:

	Butadiene and Copolymers	Isoprene and Copolymers
Dry Polymer	1200-1249	2200-2249
Oil Extended*	1250-1299	2250-2299
Black Masterbatch	1300-1349	2300-2349
Oil-Black Masterbatch**	1350-1399	2350-2399
Latex	1400-1449	2400-2449
Miscellaneous	1450-1499	2450-2499

* Dry polymer containing any quantity of oil

** Black masterbatch containing any quantity of oil

INSTITUTE CLASSIFICATION FOR LATICES

The Institute has developed a system of classifying latices according to chemical family; nominal total solids content; nominal bound comonomer content; and if appropriate, certain additional features. The system is described below:

Chemical family

The chemical family is represented by a prefix letter, as follows:

A = acrylate-butadiene rubber (ABR)
B = butadiene rubber (BR)
C = chloroprene rubber (CR)
I = isoprene rubber (IR)
N = nitrile-butadiene rubber (NBR)
S = styrene-butadiene rubber (SBR)

Total solids content

The total solids content is represented by the first digit, as follows:

1 = less than 20.0%
2 = 20.0 to 29.9%
3 = 30.0 to 39.9%
4 = 40.0 to 49.9%
5 = 50.0 to 59.0%
6 = 60.0 to 69.9%
7 = 70.0% or greater

Bound comonomer content

The nominal bound comonomer content of the contained polymer is represented by the second digit, as follows:

0 = no comonomer
1 = less than 20.0%
2 = 20.0 to 29.9%
3 = 30.0 to 39.9%
4 = 40.0 to 49.9%
5 = 50.0 to 59.9%
6 = 60.0% or greater

In the case of styrene-butadiene latex which is reinforced with polystyrene or a copolymer of butadiene and styrene, the bound comonomer content includes the bound styrene content of the reinforcing polymer.

Additional features

A suffix letter represents the following additional features:

X = denotes that the latex is carboxylated;
Y = denotes that the latex is reinforced;
P = denotes the presence of vinyl pyridine in polymer.

The International Standards Organization has prepared a system of latex classification. This system is similar to the Instititute's system insofar as representation of the total solids content and bound comonomer content. However, the prefix letters denoting the chemical family are different, and the suffix letters are different from the system adopted by the Institute.

The essential features of the proposed International Standards Organization classification system are listed below:

Chemical family

The nomenclature is represented by prefix letters, as follows:

ABR = acrylate-butadiene rubber
BR = butadiene rubber
CR = chloroprene rubber
EPDM = terpolymer of ethylene, propylene, and a diene with the residual unsaturated portion of the diene in the side chain
EPM = ethylene-propylene copolymer
IIR = isobutene-isoprene rubber
IR = isoprene rubber
NBR = nitrile-butadiene rubber
NIR = nitrile-isoprene rubber
PSBR = pyridine-styrene-butadiene rubber
SBR = styrene-butadiene rubber
XNBR = carboxylated-nitrile-butadiene rubber
XSBR = carboxylated-styrene-butadiene rubber

Classification for Rubbers

The nomenclature used in this manual is represented by prefix letters as follows:

ABR = acrylate-butadiene rubber
BR = butadiene rubber
CR = chloroprene rubber
EPDM = terpolymer of ethylene, propylene, and a diene with the residual unsaturated portion of the diene in the side chain
EPM = copolymers of ethylene and propylene
IIR = isobutene-isoprene
IR = isoprene rubber, synthetic
NBR = nitrile-butadiene rubber
PBR = pyridine-butadiene rubber
PSBR = pyridine-styrene-butadiene rubber
SBR = styrene-butadiene rubber
XNBR = carboxylic-nitrile-butadiene rubber
XSBR = carboxylic-styrene-butadiene rubber
BIIR = bromo-isobutene-isoprene rubber
CIIR = chloro-isobutene-isoprene rubber
ACM = copolymers of ethyl or other acrylates and a small amount of a monomer which facilitates vulcanization
CFM = polychlorotrifluoroethylene
CO = epichlorohydrin polymer
ECO = ethylene oxide (oxirane) and chloromethyl oxirane (epichlorohydrin copolymer)
CSM = chlorosulfonylpolyethylene
IM = polyisobutene
EAM = ethylene vinyl acetate
Q = rubbers having silicone in the polymer chain
PVMQ = silicone rubbers having methyl, phenyl, and vinyl substituent groups on the polymer chain
MQ = silicone rubbers having only methyl substituent groups on the polymer chain, such as dimethyl polysiloxane
VMQ = silicone rubber having both methyl and vinyl substituent groups on the polymer chain
T = rubbers having sulphur in the polymer chain
AU = polyester urethanes
EU = polyether urethanes
GPO = polypropylene oxide
FKM = hexafluoropropylene-vinylidene fluoride copolymer

THERMOPLASTIC RUBBERS (Y)

FFKM = perfluoro rubbers of the polymethylene type having all substituent groups on the polymer chain either fluoro, perfluoroalkyl or perfluoroalkoxy groups
FKM = fluoro rubber of the polymethylene type having substituent fluoro and perfluoroalkoxy groups on the polymer chain
FVMQ = silicone rubber having fluorine, vinyl and methyl substiture groups on the polymer chain
PMQ = silicone rubbers having both methyl and phenyl substituent groups on the polymer chain
AFMU = terpolymer of tetrafluoroethylene, trifluoronitrosomethane, and nitrosoperfluorobutyric acid
AEM = copolymers of ethyl or other acrylate and ethylene
ANM = copolymers of ethyl or other acrylate and acrylonitrile
CM = chloro-polyethylene

Further discussion on nomenclature may be found in International Standards Organization Recommendation R 1629 and American Society for Testing Materials D 1418.

ISO STANDARDS, RECOMMENDATIONS, AND TECHNICAL REPORTS ON RUBBER AND RUBBER PRODUCTS PREPARED BY ISO/TC 45 ON RUBBER AND RUBBER PRODUCTS

ISO Number	Title
S 34-1979	Determination of Tear Strength of Vulcanized Natural and Synthetic Rubbers (Crescent Test Piece)
S 37-1977	Rubber, Vulcanized – Determination of Tensile Stress-Strain Properties
S 48-1979	Vulcanized Rubbers – Determination of Hardness (Hardness between 30 and 85 IRHD)
S 123-1974	Rubber Latex – Sampling
S 124-1974	Rubber Latices – Determination of Total Solids Content
S 132-1983	Vulcanized Rubbers – Determination of Resistance to Flex Cracking (De Mattia)
S 133-1981	Rubber, Vulcanized – Determination of Crack Growth (De Mattia)
S 188-1982	Rubber, Vulcanized – Accelerated Ageing or Heat-Resistance Tests
S 247-1978	Rubber – Determination of Ash
S 248-1979	Rubber, Raw – Determination of Volatile Matter Content
R 289-1963	Determination of Viscosity of Natural and Synthetic Rubbers by the Shearing Disk Viscometer
Amd. 1-1969	
S 471-1977	Rubber – Standard Temperatures, Humidities and Times for the Conditioning and Testing of Test Pieces
S 667-1981	Rubber, Compounded – Determination of Cure Rate – Shearing Disk Method
S 706-1976	Rubber Latices – Determination of Coagulum Content
S 812-1968	Method of Test for Temperature Limit of Brittleness for Vulcanized Rubbers
S 815-1972	Vulcanized Rubbers – Determination of Compression Set Under Constant Deflection at Normal and High Temperatures
S 816-1976	Vulcanized Rubbers – Determination of Tear Strength of Small Test Pieces (Delft Test Pieces)
S 845-1977[G]	Cellular Rubbers and Plastics – Determination of Apparent Density
S 976-1977	Rubber Latices – Determination of pH
S 1124-1983	Carbon Black for Use in the Rubber Industry Delivered in Bulk or in Bins – Sampling
S 1125-1976	Carbon Black for the Rubber Industry – Determination of Ash Content
S 1126-1974	Carbon Black for Use in the Rubber Industry – Determination of Loss on Heating
S 1138-1981	Rubber, Compounding Ingredients – Carbon Black – Determination of Sulfur Content
S 1304-1974	Carbon Black for Use in Rubber Industry – Determination of Iodine Adsorption Number
S 1306-1981	Rubber Compounding Ingredients – Carbon Black (Pelletized) Determination of Pore Density
S 1310-1974	Carbon Black for Use in the Rubber Industry – Sampling Packaged Shipments
S 1396-1975	Vulcanized and Unvulcanized Compound Rubber – Determination of Copper Content – Zinc Diethyldithiocarbamate Photometric Method
S 1397-1975	Compounded Rubber – Determination of Manganese Content – Sodium Periodate Photometric Method
S 1399-1982	Rubber, Vulcanized – Determination of Permeability to Gases – Constant Volume Method
S 1400-1975	Vulcanized Rubbers of High Hardness (85 to 100 IRHD) – Determination of Hardness
S 1407-1976	Rubber – Determination of Solvent Extract
S 1408-1976	Vulcanized Rubber – Determination of Carbon Black Content – Pyrolytic Method
S 1409-1982	Rubber Latex – Determination of Surface Tension
S 1431/1-1980	Rubber, Vulcanized – Resistance to Ozone Cracking – Part 1: Static Strain Test
Amd.-1-1982	
S 1431/2-1982	Rubber, Vulcanized – Resistance to Ozone Cracking – Parts 2: Dynamic Strain Test
S 1432-1982	Rubber, Vulcanized – Determination of Stiffness at Low Temperature (Gehman Test)

ISO STANDARDS, RECOMMENDATIONS, AND TECHNICAL REPORTS ON RUBBER AND RUBBER PRODUCTS PREPARED BY ISO/TC 45 ON RUBBER AND RUBBER PRODUCTS

ISO Number	Title
S 1435-1981	Rubber Compounding Ingredients – Carbon Black (Pelletized) Determination of Sieve Residues
S 1437-1975	Carbon Black for Use in the Rubber Industry – Determination of Sieve Residue
S 1629-1976	Rubbers and Latices – Nomenclature
S 1652-1974	Rubber Latex – Determination of Viscosity
S 1653-1975	Vulcanized Rubbers – Determination of Compression Set Under Constant Deflection at Low Temperatures
R1654-1971	Raw Rubber and Rubber Latex – Determination of Copper
S 1655-1975	Raw Rubber and Rubber Latex – Determination of Manganese Content – Potassium Periodate Photometric Method
S 1657-1975	Raw Rubber and Rubber Latex – Determination of Iron Content – 1,10-Phenanthroline Photometric Method
R1767-1971	Vulcanized Rubbers – Determination of Rebound Resilience – Lüpke Pendulum Method
S 1795-1974	Raw Rubber in Bales – Sampling
S 1796-1982	Rubber, Raw – Sample Preparation
S 1817-1975	Vulcanized Rubbers – Resistance to Liquids – Methods of Test
S 1818-1975	Vulcanized Rubbers of Low Hardness (10 to 35 IRHD) – Determination of Hardness
S 1826-1981	Rubber, Vulcanized – Time-Interval Between Vulcanization and Testing – Specification
S 1827-1976	Rubber, Vulcanized – Determination of Modulus in Shear-Quadruple Shear Method
S 1853-1975	Conducting and Antistatic Rubbers – Measurement of Resistivity
S 1866-1975	Pelletized Carbon Black for Use in the Rubber Industry Delivered in Bulk or in Bins – Specification for Maximum Fines Content
S 1867-1975	Carbon Black for Use in the Rubber Industry – Specification for Sieve Residue
S 1868-1982	Carbon Black for Use in the Rubber Industry – Specification Limits for Loss on Heating
S 2002-1975	Raw Styrene-Butadiene Rubber (SBR) – Determination of Organic Acid Content
S 2003-1975	Raw Styrene-Butadiene Rubber (SBR) – Determination of Soap Content
S 2006-1974	Synthetic Rubber Latex – Determination of High Speed Mechanical Stability
S 2007-1981	Rubber, Unvulcanized – Determination of Plasticity – Rapid Plastometer
S 2008-1980	Rubber Latex, Styrene-Butadiene – Determination of Volatile Unsaturates
S 2028-1982	Butadiene Homopolymer and Copolymer Latices – Preparation of Dry Polymer
S 2058-1973	Raw Styrene-Butadiene Rubber (SBR) – Determination of Volatile Matter
S 2230-1973	Vulcanized Rubber – Guide to Storage
S 2285-1981	Rubber, Vulcanized – Determination of Tension Set at Normal and High Temperatures
S 2302-1978	Rubber, Isobutene Isoprene (IIR)-Evaluation Procedures
S 2303-1975	Rubber, Isoprene (IR) – Non Oil-Extended, Solution Polymerized Types – Test Recipe and Evaluation of Vulcanization Characteristics
Add. 3-1980	Rubber, Raw Styrene-Butadiene, Emulsion Polymerized Test Recipe and Method of Evaluation
S 2393-1973	Rubber Test Mixes – Preparation, Mixing and Vulcanization – Equipment and Procedures
S 2438-1981	Rubber Latex, Synthetic – Codification
S 2453-1975	Styrene-Butadiene Copolymers – Determination of Bound Styrene Content

ISO STANDARDS, RECOMMENDATIONS, AND TECHNICAL REPORTS ON RUBBER AND RUBBER PRODUCTS PREPARED BY ISO/TC 45 ON RUBBER AND RUBBER PRODUCTS

ISO Number	Title
S 2475-1975	Rubber, Chloroprene (CR)—General Purpose Types—Evaluation Procedures
S 2476-1980	Rubber-Butadiene (BR)—Solution Polymerized Types—Test Recipe and Evaluation of Vulcanization Characteristics
Amd. 1-1976	
T 2630-1978	Rubber, Raw—Sampling for Inspection by Variables
S 2781-1981	Rubber, Vulcanized—Determination of Density
S 2782-1977	Rubber, Vulcanized—Determination of Permeability to Gases—Constant Pressure Method
S 2856-1981	Elastomers—General Requirements for Dynamic Testing
S 2921-1982	Rubber, Vulcanized—Determination of Low-Temperature Characteristics—Temperature—Retraction Procedure (TR Test)
S 3136-1983	Styrene-Butadiene Rubber Latices—Determination of Bound Styrene Content
S 3257-1982	Rubber Compounding Ingredients—Carbon Black—Test Recipe and Method of Evaluation in Styrene Butadiene Rubbers
S 3385-1982	Cellular Polymeric Flexible Materials—Determination of Fatigue by Constant Load Pounding
S 3386/1-1979	Flexible Cellular Materials—Determination of Compression Stress/Strength Characteristics and Compression Stress Value—Part1: Low Density Materials
S 3387-1978	Rubbers—Determination of Crystallization Effects by Hardness Measurements
S 3417-1977	Rubber—Measurement of Vulcanization Characteristics with the Oscillating Disc Curemeter
S 3582-1978	Cellular Plastic and Cellular Rubber Materials—Laboratory Assessment of Horizontal Burning Characteristics of Small Specimens Subjected to a Small Flame
S 3858-1977	Carbon Black for Use in the Rubber Industry—Determination of the Light Transmittance of Toluene Extract—Rapid Method
S 3858/2-1982	Carbon Black for Use in the Rubber Industry—Determination of Light Transmittance of Toluene Extract—Part 2: Method for Product Evaluation
S 3861-1977	Rubber Hose for Grit Blasting
S 3862-1980	Rubber Hoses and Hose Assemblies—Rubber—Covered, Spiral Wire Reinforced, Hydraulic Type
S 3865-1977	Rubber, Vulcanized—Methods of Test for Staining in Contact with Organic Material
S 3899-1976	Rubber—Nitrile Latex—Determination of Residual Acrylonitrile Content
S 3900-1976	Rubber—Nitrile Latex—Determination of Bound Acrylonitrile Content
S 4097-1980	Rubber, Ethylene-Propylene-Diene (EPDM)—Non-Oil Extended Raw General Purpose Types—Evaluation Procedures
S 4632/1-1982	Rubber, Vulcanized—Classification—Part 1: Description of the Classification System
S 4652-1981	Rubber Compounding Ingredients—Carbon Black—Determination of Specific Surface Area—Nitrogen Absorption Method
S 4655-1977	Rubber—Reinforced Styrene-Butadiene Latex—Determination of Total Bound Styrene Content
S 4656/1-1977	Carbon Black for Use in Rubber Industry—Determination of Dibutylphthalate Absorption Number—Part 1: Method Using Absorptometer
S 4656/2-1981	Rubber Compounding Ingredients—Carbon Black—Determination of Dibutylphthalate Absorption Number—Part 2: Method of Using Plastograph or Plasticorder
S 4658-1980	Rubber, Acrylonitrile-Butadiene (NBR)—Test Recipe and Evaluation of Vulcanization Characteristics

ISO STANDARDS, RECOMMENDATIONS, AND TECHNICAL REPORTS ON RUBBER AND RUBBER PRODUCTS PREPARED BY ISO/TC 45 ON RUBBER AND RUBBER PRODUCTS

ISO Number	Title
S 4659-1981	Rubber, Raw Styrene-Butadiene (Carbon Black or Carbon Black and Oil Masterbatches)—Test Recipe and Method of Evaluation
S 4661-1977	Rubber—Preparation of Test Pieces
S 5435-1981	Rubber Compounding Ingredients—Carbon Black—Determination of Tinting Strength
S 5475-1978	Rubber—Identification of Polymers—Pyrolytic/Gas Chromatographic Method—Single Polymer
S 5478-1980	Rubber—Determination of Styrene Content—Nitration Method
S 6101/1-1981	Rubber—Determination of Metal Content—Flame Atomic Absorption Spectrometric Method—Part 1: Determination of Zinc Content
S 6209-1981	Rubber Compounding Ingredients—Carbon Black—Determination of Solvent Extractable Materials
S 6235-1982	Rubber, Raw—Determination of Block Polystyrene Content—Ozonolysis Method

TABLE I PRODUCERS OF SYNTHETIC RUBBER

Producer and Abbreviation	Plant Location	Home Office Address	Trade Name	Type of Rubber
American Cyanamid Company Rubber Chemicals Department (CY)	U.S.A.	Bound Brook, New Jersey 08805	CYANACRYL CYANAPRENE	ACM
American Synthetic Rubber Corporation (AS)	U.S.A.	P.O. Box 32960 Louisville, Ky. 40232	AMSYN ASRC CISDENE FLOSBRENE FLOSTEX	SBR Latex SBR BR SBR Liquid SBR Latex
Asahi Chemical Industry Co., Ltd. (AC)	Japan	1-2, 1-chome, Yurakucho Chiyoda-Ku, Tokyo	ASADENE TUFDENE TUFPRENE	BR SBR YSBR
Australian Synthetic Rubber Co., Ltd. (AU)	Australia	Maidstone St. Alton, Victoria 3018	AUSTRAPOL	SBR, BR
Badische Anilin & Soda-Fabrik AG (BA)	West Germany	6700 Ludwigshafen	OPPANOL B	IM
Bayer AG (B)	West Germany	509 Leverkusen- Bayerwerk	BAYPREN PERBUNAN N LEVAPREN SILOPREN UREPAN ACRALEN A	CR NBR EAM Q AU ACM
Bayer Elastomeres (B)	France	Boite Postal 41 76170 Lillebonne	BAYSTAL PYRATEX	SBR XSBR, PSBR
Bayer UK (B) Latex Production Division	U.K.	Bromsgrove/ Worcestershire		SBR XSBR PSBR
BFGoodrich Chemical Group (GC)	U.S.A.	6100 Oak Tree Boulevard Cleveland, Ohio 44131	HYCAR HYCAR HYDIZIN	NBR ACM CO
BFGoodrich Ameripol Tire Division (AM)	U.S.A.	500 S. Main St. Akron, Ohio 44318	AMERIPOL	SBR
BP Chemicals Limited (BP)	U.K.	Sully, South Glamorgan CF6 2YU	BREON POLYBLACK	NBR NBR
Borg-Warner Chemicals (BO)	U.K.	York House, Clarendon Ave. Leamington Spa, Warwicks.	BORG-WARNER LATEX	SBR
Bunawerke Huels Gmbh (BW)	West Germany	4370 Marl, Krs. Recklinghausen	BUNA EM BUNA CB BUNA AP BUNA VI	SBR BR EPM, EPDM BR, SBR
CALATRAVA Empresa para la Industria Petroquímica, S.A. (CA)	Spain	Avda. del General Peron, 29 Edifício Eurocentro 28020 Madrid	CALPRENE	SBR, BR YSBR

TABLE I (continued) PRODUCERS OF SYNTHETIC RUBBER

Producer and Abbreviation	Plant Location	Home Office Address	Trade Name	Type of Rubber
Chemopetrol (CH)	Czecho-slovakia	Praha 2 Nabrezi B. Engelse 72	KRALEX	SBR
Combinatul Petrochimic Borzesti Uzina de Cauciuc (CB)	Romania	Str. Cauciucului 1 Gheorghiu-Dej	CAROM	SBR
Compagnie Française de Raffinage (CF)	France	22 rue Boileau, 75016 Paris	TOTAL BUTYL	IIR
Compagnie du Polyisoprene Synthétique (CP)	France	174 Bd Saint-Germain 75006 Paris		IR
Companhia Pernambucana de Borracha Sintetica, COPERBO (CO)	Brazil	Rua do Hospicio, 601 Caixa Postal 1331 50.000 Recife	COPERFLEX	BR
Copolymer Rubber & Chemical Corporation (C)	U.S.A.	P.O. Box 2591 Baton Rouge, LA 70821	COPO CARBOMIX EPsyn NYsyn NYsynblack	SBR SBR EPDM NBR NBR
CPR Division, The Upjohn Company (UP)	U.S.A.	555 Alaska Avenue Torrance, CA 90503	PELLETHANE	YEU YAU
Daikin Industries,Ltd. Chemical Division (DN)	Japan	Shin Hankyu Bldg. 12-39, 1-Chome Umeda, Kita-Ku Osaka	DAI-EL	FKM
Denka Chemical Corporation (DE)	U.S.A.	8701 Park Place Houston, TX 77017	DENKA-USA	CR
Denki Kagaku Kogyo K.K. (DK)	Japan	10, Yuraku-cho, 1-chome Chiyoda-Ku, Tokoyo	DENKA CHLOROPRENE	CR
Distugil (DI)	France	45-47 rue de Villiers B.P. 122 F-92527 Neuilly-sur-Seine	BUTACLOR	CR
DiversiTech General A GenCorp Company (G)	U.S.A.	Chemical/Plastics Division P.O. Box 951 Akron, Ohio 44329	GENTRO GENTRO-JET GEN-TAC GEN-FLO	SBR SBR (CBMB) SBR (VP LATEX) SBR (LATEX)
Doverstrand Limited (DO) (A Company within The Revertex Group)	U.K.	Central Road Temple Fields Harlow, Essex CM20 2AH	REVINEX BUTAKON	SBR NBR ABR
Dow Corning Corporation (DC)	U.S.A.	Midland, Michigan 48640	SILASTIC	MQ, VMQ PMQ, PVMQ, FVMQ

TABLE I (continued) PRODUCERS OF SYNTHETIC RUBBER

Producer and Abbreviation	Plant Location	Home Office Address	Trade Name	Type of Rubber
Dutral S.p.A.	Italy	Largo G. Donegani, ½ 20121 Milan	DUTRAL CO DUTRAL TER ELAPRIM TECHNOFLON	EPM EPDM NBR, ACM CFM
E.I. du Pont de Nemours & Co., (Inc.) (DU)	U.S.A.	Polymer Products Department Wilmington, Delaware 19898	NEOPRENE NORDEL VITON VAMAC HYPALON HYTREL	CR EPDM CFM EAM CSM Y EU
EniChem Elastomers Ltd. (EN)	U.K.	Charleston Road Hardley Hythe Southampton SO4 6YY, UK	INTOL INTEX UNIDENE INTENE INTOLAN INTOLENE	SBR LATICES SBR BR EPM / EPDM BR
EniChem Elastomeri S.p.A. (EN)	Italy	Strada 3, Palazzo B1 Milanofiori 20094 Assago (Milano) Italy	EUROPRENE EUROPRENE CIS EUROPRENE N EUROPRENE SOL S EUROPRENE SOL T EUROPRENE SOL EUROPRENE HS EUROPRENE EVA EUROPRENE AR EUROPRENE LATICE	SBR BR NBR SBR YSBR SBR SBR YEAM ADM LATICES
Esso Chemical Ltd. (EC)	U.K.	Arundel Towers Portland Terrace Southampton S09 2GW	ESSO BUTYL CHLOROBUTYL	IIR CIIR
Exxon Chemical Americas (ECA)	U.S.A.	13501 Katy Freeway Houston, Texas 77079, or P.O. Box 3272 Houston, Texas 77001	EXXON BUTYL CHLOROBUTYL VISTALON VISTANEX BROMOBUTYL	IIR CIIR EPM, EPDM IM BIIR
Finaprene N.V. (FI)	Belgium	Scheldelaan 2, B-2030 Antwerp	FINAPRENE	BR, SBR YSBR
Firestone Synthetic Rubber & Latex Company (F)	U.S.A.	381 W. Wilbeth Road Akron, Ohio 44301	DURADENE STEREON DIENE	SBR SBR BR
General Electric Company (GE)	U.S.A.	Silicone Products Department Waterford, NY 12188	SILPLUS TERFIL BLENSIL	VMQ, FVMQ MQ

TABLE I (continued) PRODUCERS OF SYNTHETIC RUBBER

Producer and Abbreviation	Plant Location	Home Office Address	Trade Name	Type of Rubber
Goodyear France (GF)	France	Avenue des Tropiques 2A de Courtaboeuf B.P. 31 91941 Les Ulis Cedex	PLIOLITE CHEMIGUM	SBR NBR
Goodyear Tire & Rubber Company (GT)	U.S.A.	Akron, Ohio 44316	PLIOLITE PLIOFLEX BUDENE NATSYN CHEMIGUM	SBR SBR BR IR NBR
Hercules Incorporated (HE)	U.S.A.	Marketing Division 910 Market Street Wilmington, Delaware 19899	HERCLOR PAREL	CO GPO
Huels AG (CW)	West Germany	4370 Marl, Krs. Recklinghausen	LIPOLAN LITEX VESTENAMER VESTOPREN	SBR SBR TOR YEPM
Hules Mexicanos, S.A. (HX)	Mexico	Leibnitz 14, 4°Piso Col. Anzures Delagacion Miguel Hidalgo CP 11590 Mexico, D.F.	HUMEX	SBR, NBR
Indian Petrochemicals Corporation Ltd. (IP)	India	P.O.: Petrochemicals Dist. Vadodara 391 346 Gujarat	CISAMER	BR
Industrias Resistol S.A. (RE)	Mexico	Presidente Masaryk 61 Mexico 5, D.F.	ARLATEX	SBR
Japan Butyl Co., Ltd. (JB)	Japan	10-3, Ukishima Kawasaki-ku, Kawasaki	JSR BUTYL ESSO BUTYL	IIR IIR
Japan Elastomer Co., Ltd. (JA)	Japan	1-2, 1-chome, Yurakucho Chiyoda-ku, Tokoyo	ASAPRENE	SBR, BR, YSBR
Japan EP Rubber Co., Ltd. (JE)	Japan	No. 100; Kawajiri-cho Yokkaichi-City Mie Prefecture	JSR EP	EPM, EPDM
Japan Polyisoprene Co., Ltd. (JP)	Japan	34 Owada, Kamisu-cho Kashima-gun, Ibaragi-Ken	JSR IR	IR
Japan Synthetic Rubber Co., Ltd. (JS)	Japan	JSR Building 2-11-24, Tsukiji Chuo-ku, Tokyo	JSR	SBR, BR, NBR
Karbochem Division of Sentrachem Ltd. (KC)	South Aftica	Box 19 Sasolburg, 9570	AFPOL AFSOL AFDENE	SBR SBR BR

TABLE I (continued) PRODUCERS OF SYNTHETIC RUBBER

Producer and Abbreviation	Plant Location	Home Office Address	Trade Name	Type of Rubber
Kombinat VEB, Chemische Werke BUNA (VE)	East Germany	4212 Schkopau über Merseburg	BUNA	SBR,BR, NBR
Korea Kumho Petrochemical Co., Ltd. (KO)	South Korea	Dae-Il Building 18, 1-Ka, Namdaemun-ro Chuo-ku, Seoul	KOSYN	SBR, BR NBR
Kuraray Isoprene Chemical Co., Ltd. (KR)	Japan	8-2, e-chome, Nihonbashi Chyo-ku, Tokyo 103	KURARAY	IR
Commercial Chemicals Division/3 M (3M)	U.S.A.	3M Center, Building 223-6S-04 Saint Paul, MN 55144	FLUOREL KEL-F	FKM CFM
Mitsubishi Chemical Industries Limited (MC)	Japan	Mitsubishi Building 5-2, Marunouchi 2-chome Chiyoda-ku, Tokyo 100	DIAPOL	SBR
Mitsui Petrochemical Industries Ltd. (MI)	Japan	Kasumigaseki Building P.O. Box 90 Tokyo 100	MITSUI-EPT	EPDM
Naamloze Vennootschap DSM (DS)	Netherlands	P.O. Box 43 6130 AA Sittard	KELTAN	EPM, EPDM
Neftochim (NE)	Bulgaria	Pl. Banski 2 Sofia 6	BULTEX	SBR
Negromex, S.A., de C.V. (N)	Mexico	Bosque de Ciruelos 304 Oficina 601 Fraccionamiento Bosques de Las Lomas Mexico 10, D.F.	SOLPRENE	SBR, BR, YSBR
Nitriflex S.A. Industria E Comercio (NX)	Brazil	P.O. Box 4596 01000 São Paulo-SP	NITRIFLEX	SBR, XSBR, NBR, XNBR
Nippon Zeon Co., Ltd. (NZ)	Japan	Furukawa Sogo Building 6-1 Marunouchi, 2-chome Chiyoda-ku, Tokyo	NIPOL GECHRON	SBR, NBR, BR, IR, ACM ECO
Organic Chemicals Division W.R. Grace & Co. (DA)	U.S.A.	55 Hayden Avenue Lexington, Mass. 02173	DAREX	SBR, NBR
PASA Petroquímica Argentina, S.A. (PA)	Argentina	Suipacha 1111, Piso 11 Buenos Aires	ARPOL ARNIPOL	SBR NBR
Petkim Petrokimya A.S. (PK)	Turkey	P.O. Box 104 Yenisehir, Ankara	PETKAUCUK	SBR, BR
PETROFLEX-Industria e Comercio S.A. (PX)	Brazil	Rua Parana-Campos Eliseos Duque de Caxias Caixa Postale 79, CEP 25.000 Rio de Janeiro	PETROFLEX PETROLATEX	SBR SBR