FEP-LINED LDPE TUBING

TYPICAL PROPERTIES FOR FEP FLUOROPOLYMER RESIN			
PROPERTY	**ASTM METHOD**	**UNITS**	**FEP GRADE 100**
MECHANICAL			
Specific Gravity	ASTM D-792		2.14
Tensile Strength, 23°C (73°F)	ASTM D-2116	MPa (psi)	23 (3,400)
Ultimate Elongation, 23°C (73°F)	ASTM D-2116	%	300
Flexural Modulus, 23°C (73°F)	ASTM D-790	MPa (psi)	620 (90,000)
Hardness, Durometer, Shore D	ASTM D-2240		56
Coefficient of Friction	ASTM D-1894		0.25
Deformation Under Load, 23°C (73°F), 6.9 MPa (1,000 psi), 24 hours	ASTM D-621	%	0.50
Water Absorption, 24 hours	ASTM D-570	%	0.004
ELECTRICAL			
Surface Resistivity	ASTM D-257	ohm-sq	10^{15}
Volume Resistivity	ASTM D-257	ohm-sq	10^{17}
Dielectric Strength, 0.254mm (10 mil)	ASTM D-149	kV/mm (V/mil)	79 (2,000)
Dielectric Constant, 21°C (70°F),1 kHz-500MHz	ASTM D-1531		2.05
Dissipation Factor, 21°C (70°F), 1 MHz	ASTM D-1531		0.0006
Arc Resistance	ASTM D-495	seconds	165
THERMAL			
Melting Point	DTA, ASTM D-3418	°C (°F)	260 (500)
Deflection Temperature: 455 kPa (66 psi) 1820 kPa (264 psi)	ASTM D-648	°C (°F)	77 (170) 48 (119)
Oxygen Index	ASTM D-2863	%	>95
Upper Service Temperature		°C (°F)	204 (400)
GENERAL			
Weather Resistance	Florida Exposure	No significant change in tensile strength, slight decrease in elongation, but still high after 25 years.	
Chemical Resistance	ASTM D-543	outstanding	

TYPICAL PROPERTIES FOR LDPE			
PROPERTY	**ASTM METHOD**	**UNITS**	**LDPE**
MECHANICAL			
Specific Gravity	ASTM D-792		0.925
Tensile Strength, 23°C (73°F)	ASTM D-2116	(psi)	1,000
Ultimate Elongation, 23°C (73°F)	ASTM D-2116	%	100
Flexural Modulus, 23°C (73°F)	ASTM D-790	(psi)	35,000
Hardness, Durometer, Shore D	ASTM D-2240		45
Water Absorption, 24 hours	ASTM D-570	%	<0.01%
Melting Point	DTA, ASTM D-3418	°C	105°C

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610 / 272-8960

MSDS

MATERIAL SAFETY DATA SHEET

This product information is provided to assist our customers in assessing compliance with health/safety/environmental regulations.

SECTION 1: CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Manufacturer:
Markel Corporation
435 School Lane
Plymouth Meeting, PA 19462

FEP
Liner/PE

Telephone:
610/272-8960
Chemtrec: 800-424-9300
Dated: March 1, 2005

Chemical Name and Synonyms:
Polyethylene, PE, Polyolefin, Resin

Trade Name:
Polyethylene
Tubing and/or Jacketing Polymer

Chemical Family:
Ethene / Hexene Copolymer

SECTION 2: COMPOSITION and INGREDIENT INFORMATION

INGREDIENT	PERCENT	CAS#:
Ethene / Hexene Copolymer	> 98	25213-02-9
Product contains NO ingredients in concentrations of 1% or greater which are defined as hazardous according to OSHA standard (29CFR1910.1200)		

There is NO chemical present in this product at a concentration of 0.3% or more classified as a carcinogen by IARC, NTP or OSHA.

Some versions of this composition may contain carbon black at a concentration of < 0.2%

HAZARDOUS MIXTURES:

Polypropylene is a thermoplastic resin. In the solid state, it is not hazardous. During processing when converted to the molten state, normal precautions for the handling of hot, sticky, fluid melts should be observed.

SECTION 3: HAZARD IDENTIFICATION

Appearance: Natural solid walled tubing or jacketing. (May be colored if desired.)

Odor: Slight to no odor.

Potential Health Effects:
Eye: (X) Skin: (X) Inhalation: ( ) Ingestion: ( )

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Potential Health Effects: (Continued)

Eyes: In its solid state, this is an unlikely route of entry. Operations that cause abrasion could release dust or small particulates which may cause eye irritation or abrasion experienced as mild discomfort and slight excess redness of the eye.

Skin: In its solid state, this is an unlikely route of entry. Operations that cause abrasion could release dust or small particulates which may cause skin irritation or abrasion experienced as mild discomfort and slight localized redness.

Inhalation: In its solid state, this is an unlikely route of entry. Operations that cause abrasion could release dust or small particulates. Overexposure to high concentrations of dust may cause respiratory irritation. Product is not volatile at ambient temperatures. Vapors generated by heating operations in enclosed areas may cause minimal irritation.

Ingestion: Unlikely

Sensitization: None known

Medical Conditions Aggravated by Exposure:
There is no evidence that this product aggravates an existing medical condition.

SECTION 4 - FIRST AID MEASURES

Eyes: Flush eyes with plenty of water for several minutes. Remove larger particles from the eye as one would any foreign object. Get medical attention if eye irritation persists or particulates are difficult to remove from the eye.

Skin: Wash skin with plenty of soap and water for several minutes. Get medical attention if skin irritation develops or persists.

Inhalation: If irritation, headache, or drowsiness occurs, remove to fresh air.

Other Instructions: None

SECTION 5 - FIRE FIGHTING MEASURES

Ignition Temperature – AIT (degrees C):
343°C (650°F)
Flash Point (degrees C):
Not applicable.
Flammable Limits % (Lower – Upper):
Not applicable.

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SECTION 5: FIRE-FIGHTING MEASURES (Continued)

Recommended Fire Extinguishing Agents and Special Procedures:

Use water spray, dry chemical, foam, or carbon dioxide to extinguish flames. Use water spray to cool fire-exposed materials or containers. Water or foam may cause frothing.

Unusual or Explosive Hazards:

Hazardous melting and dripping may occur at elevated temperatures. May burn at or above flash point, and airborne dust may explode if ignited. See National Fire Protection Prevention Association Bulletin 654, "Dust Explosion Prevention, Plastics Industry 1975".

Special Protective Equipment for Firefighters:

NIOSH approved positive pressure self contained breathing apparatus – firefighter turnout gear.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Observe general good housekeeping procedures. Sweep up excess material and categorize for reuse after cleaning or scrap.

If processing involves molten material, allow spilled compound to solidify and then sweep up.

SECTION 7: HANDLING AND STORAGE

Handling:

Observe general good housekeeping procedures. Sweep up excess material spills immediately to avoid slipping hazards. The handling of this product while fabricating may generate nuisance dusts. Take necessary precautions to prevent exposure to these dusts.

Storage:

Periods of exposure to high temperatures should be minimized. Water contamination should be avoided.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Protective Equipment:

Eye/Face Protection:

Safety glasses, chemical type goggles, or face shield recommended to prevent eye contact. Heat resistant shield recommended when processing hot material.

Skin Protection:

Protective clothing such as coveralls or lab coats should be worn. Heat protective clothing should be worn when handling heated materials.

Respiratory Protection:

As employed with normally accepted industrial practices. Local exhaust is recommended.

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SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION (Continued)

Ventilation:

Local exhaust is recommended. It is recommended that adequate ventilation be provided in areas of fabricating or processing where fumes are a potential side effect.

Exposure Limit for the total product:

None established for this product.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Natural tube
Boiling Point (°C):	Not applicable
Specific Gravity:	0.92 – 0.98 ($H_20 = 1$)
Vapor Pressure:	Not applicable
VOC Content:	Non-volatile
Solubility in Water:	Insoluble
Odor:	Odorless
Melting/Freezing Point (°C):	136°C (266°F)
pH:	Not applicable
Viscosity:	Not applicable
Vapor Density:	Not applicable
Other:	None

SECTION 10: STABILITY AND REACTIVITY

Stability:	Stable.
Incompatibility (Materials to Avoid):	Avoid contact with strong oxidizers and all sources of ignition. Solid material may be softened by some hydrocarbons.
Hazardous Polymerization:	Will not occur.
Comments:	If thermal degradation occurs a variety of decomposition products may occur including, simple hydrocarbons, to gasses such as carbon, carbon monoxide, carbon dioxide, acids, ketones, and aldehydes.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Methods:

This product has been evaluated for RCRA characteristics and does not meet the criteria of a hazardous waste if discarded in purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because the product use, transformation, mixtures, processes, etc. may render the resulting material hazardous.

SECTION 14: TRANSPORTATION INFORMATION

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DOT:	Not Regulated
IMDG:	Not Regulated
ICAO:	Not Regulated
TDG:	Not Regulated

SECTION 15: OTHER INFORMATION

None

	NFPA	HMIS
Health:	0	0
Fire:	1	1
Reactivity:	0	0

DISCLAIMER:

This product is not intended for use in medical or dental implants.

The information contained herein is accurate to the best of our knowledge. We do not suggest or guarantee that any hazards listed herein are the only ones which exist. Markel Corporation makes no warranty of any kind, express or implied, concerning the safe use of this material in your process or in combination with other substances. Effects can be aggravated by other materials and/or this material may aggravate or add to the effects of other materials. User has the sole responsibility to determine the suitability of the materials for any use and the manner of use contemplated. User must meet all applicable safety and health standards.

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MSDS
MATERIAL SAFETY DATA SHEET

This product information is provided to assist our customers in assessing compliance with health/safety/environmental regulations.

SECTION 1: CHEMICAL PRODUCT & COMPANY IDENTIFICATION MSDS - Dated: February 12, 1999

MANUFACTURER:

MARKEL CORPORATION
435 SCHOOL LANE
PLYMOUTH MEETING, PA 19462

TELEPHONE:

610/272-8960 (256-306-5000)

COMMON NAME AND FEATURE: FLUOROCARBON POLYMER. THERMAL AND CHEMICAL RESISTANCE
TRADE NAME: FEP TUBING OR WIRE JACKETING
CHEMICAL NAME: FLUORINATED-ETHYLENE PROPYLENE (FEP)

NFPA:

Health:	1
Flammability:	0
Reactivity:	0

SECTION 2: INFORMATION ON INGREDIENTS

COMPONENT	CAS. NO.	OSHA PEL	ACGIH TLV	COMPONENT Wt%
Tetrafluoroethylene / Hexafluoropropylene Copolymer	25067-11-2	Not Established	Not Established	100

Formula: $-(CFZ\text{-}CFZ)_n\text{-}(CF_2\text{-}CF)_n\text{-}$ (CF_9)
ND = Not determined

*OSHA PEL's may vary from state to state.
*All ingredients in quantities ≤ 1% (0.1% for carcinogens or teratogens) that are potentially hazardous per OSHA definitions.

SECTION 3: HAZARDS IDENTIFICATION

PHYSICAL DESCRIPTION: Translucent or colored tube or wire jacket.
ODOR: No odor.
POTENTIAL HEALTH EFFECTS: The fluoropolymer contained in this product in its raw form is nearly inert. The primary hazard occurs in the event of high temperature exposure, whether by fire or processing. At temperatures above 250 °C, inhaling thermal decomposition products could result in chills, headache, nausea, breathing discomfort, cough, and sore throat. The symptoms generally disappear within 24-48 hours. Above 500 °C, hydrogen fluoride and other toxic fluorinated compounds are produced; inhalation under these conditions may result in serious lung irritation.

SECTION 4. FIRST AID MEASURES

INGESTION:	Highly unlikely. Give 8-10 ounces of water by mouth. DO NOT INDUCE VOMITING. If large amount is ingested, contact a physician.
EYE CONTACT:	Immediately flush with plenty of water. If irritation persists, get medical attention.
SKIN CONTACT:	Wash affected area with soap and water.
INHALATION:	Normally inhalation problems are not expected (unless heated). If heated to high temperatures, may cause chills, headaches, nausea, breathing, discomfort, cough, or sore throat. Move to fresh air and get medical attention.

SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT:	Non Flammable
FLAMMABLE LIMITS:	LEL: None UEL: None
HAZARDOUS COMBUSTION PRODUCTS:	Toxic and corrosive by-products, including Hydrofluoric Acid, Fluorophosgene, Perfluoroisobutene etc may be formed by thermal decomposition at high temperatures.
EXTINGUISHING MEDIA:	Foam, CO_2, Dry chemical and water spray
PROTECTIVE EQUIPMENT:	Use NIOSH/MSHA approved SCBA and bunker gear. Evolution of acidic gases may require complete washdown of protective clothing prior to removal.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	When heating above 250°C or in fire condition decomposition products may be formed including Hydrofluoric Acid, Fluoro-phosgene, Perfluoroisobutene, etc.

*PFIB: Perfluoroisobutene $(CF_3)_2C\text{-}CF_2$ TLV 0.01 ppm. Extremely toxic substance.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Ensure clean up is done by trained personnel wearing appropriate personnel protective equipment.
Collect spilled material and separate from other material Put it into separate containers. Dispose properly.
Spilled material is a slipping hazard.

SECTION 7. HANDLING & STORAGE

PRECAUTIONS IN HANDLING AND STORAGE

Use product for intended purposes.
Close containers after each use. Wash hands after handling.
If smoking tobacco becomes contaminated by this material, exposure to toxic gases through inhalation can occur. Therefore, do not smoke in the work areas and wash hands and face after handling in order to avoid transfer of the material onto smoking materials.
Do not store with flammable materials, such as solvents or oils.
Do not allow material to be exposed to excessive heat (e. g. from use of torch, welding, etc.)

SECTION 8. EXPOSURE CONTROLS & PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY PROTECTION:	If material is heated above 250 °C, use a NIOSH/MSHA approved air purifying respirator with dust/mist cartridges to protect against airborne particulates. If material is heated above 500 °C, use a positive pressure air supplied respirator or SCBA.
EYE PROTECTION:	Approved safety glasses
PROTECTIVE CLOTHING:	Normal full clean room clothing should be worn.
VENTILATION:	Use local exhaust ventilation if this material is heated above 250 °C. Workers should wash face and hands prior to using smoking materials.
OTHER PROTECTIVE EQUIPMENT:	Eyewash station

SECTION 9. PHYSICAL & CHEMICAL PARAMETERS

BOILING POINT (°C):	Not Applicable
MELTING POINT OF POLYMER (°C):	245-275 °C
APPARENT DENSITY (1120=1) AT 23°C:	1-1.5
VAPOR PRESSURE (mmHg):	Not Applicable
EVAPORATION RATE(Butyl acetate=1):	Not Applicable
VOLATILES:	Not Applicable
SOLUBILITY IN WATER:	Insoluble

SECTION 10. STABILITY & REACTIVITY

STABILITY:	Stable
CONDITIONS TO AVOID:	Excessive Heat
INCOMPATIBILITIES;	May react with metals, such as sodium, magnesium, aluminum at elevated temperatures (above 425 °C); may react upon prolonged exposure to fluorine or in oxygen fluorine mixtures at high temperatures and pressures. Contact with incompatible material could result in fire or explosion.
HAZARDOUS DECOMPOSITION OR BY PRODUCTS:	Toxic and corrosive gases including Hydrofluoric Acid, Fluoro-phosgene, Perfluoroisobutene at high temperatures above 500 °C.
HAZARDOUS POLYMERIZATION:	Should not occur

SECTION 11. TOXICOLOGICAL INFORMATION

ACUTE EFFECTS OF EXPOSURE

Ingestion:	Do not swallow. Small amounts swallowed during normal handling operation are not likely to cause injury. Swallowing larger amounts may cause injury.
Eye Contact:	Normally low irritation is expected.
Skin Contact:	Low irritation to skin.
Inhalation:	Normally inhalation problems are not expected. When thermally decomposed, this material can cause chills, headaches, nausea, breathing, discomfort, coughing, or sore throat.
CHRONIC EFFECT OF EXPOSURE:	None known
NOTE TO CONSUMERS:	Information provided in this section is oriented to medical and public health professionals involved in the assessment and treatment of excessive and/or accidental exposures. No substantive evidence of teratologic or reproductive effects known.
CARCINOGENS:	This material is not listed by OSHA, NTP and IARC Excessive exposure to thermal degradation products may result in delayed pulmonary edema in some cases, and on very high exposure, damage to the liver and kidneys. These substances may include: perfluoroisobutene (TLV =10 ppb), carbonyl fluoride (TLV = 2 ppm TWA, 5 ppm STEL), hydrogen fluoride (TLV= 3 ppm, Ceiling).

SECTION 12. ECOLOGICAL INFORMATION

ECOTOXICITY:	No data. Ecotoxicity is expected to be limited due to low solubility in water.
ENVIRONMENTAL FATE:	No data

SECTION 13. DISPOSAL CONSIDERATIONS

Comply with Federal, State, and Local regulations concerning Health and Environment when disposing of materials. Regulations may also apply to empty containers, liners, or rinsate. DO NOT INCINERATE unless incinerator is capable of scrubbing hydrogen fluoride and other acidic combustion products.

SECTION 14. TRANSPORT INFORMATION

DOT HAZARD DESCRIPTION:	Not regulated
CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG):	Not regulated
UN CLASSIFICATION:	Not regulated

SECTION 15. REGULATORY INFORMATION

SARA Title III:	Not regulated
CERCLA RQ:	Not regulated
OTHER:	Canadian Workplace Hazardous Materials information System (WHMIS); does not meet criteria European Union (Eli) Classification and Labeling Information: classification has not been published in Commission Directives 93/72IEEC or 94/691EC for components of this product. States such as Pennsylvania, New Jersey, California, Vermont, Massachusetts, and Rhode Island may have specific requirements or components of this product listed; consult specific state regulatory requirements for additional information.

SECTION 16. OTHER INIFORMATION

REFERENCES:

1. Guide for The Safe Handling of Fluoropolymer Resin. Fluoropolymer Division of the Society of the Plastics Industry. Published 1998.

Refer to the American Conference of Governmental industrial Hygienists (ACGIH) documentation of TLV's (Threshold Limit Values) for individual components, Fluoropolymers Safe Handling Guide published by The Society of the Plastics Industry, and the DOT Emergency Response Guidebook.

[MEDICAL USE]

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