

## Doble Wire Specification

**Wire Name;** Wire, #6awg flexible u-thane ins.

**Doble Number;** 181-0006, rev B


**Construction Specification;**

- #6 AWG extra flexible copper wire
- stranded wire, at 1,050 / 36
- construction at 7 x 150 x 36
- rope lay (twist) at one turn per inch
- jacketed at 25 to 30 mil, polyurethane (see below)
- marked as shown below

**Marking;** Doble #181-0006, rev.B (clean with soap & water only)

**Jacket Material** Polyurethane, polyester based

(typical) BF Goodrich "Estane #58863 NAT 025"  
 The primary characteristic desired is insensitivity to UV light, and other environmental conditions that could render the jacket opaque, The application requires that the wire can be seen through the jacket. The product is used outdoors and frequently under harsh conditions.

B	5729	RE-WRITTEN	JPL	3-6-92	
REV	ECN	DESCRIPTION OF CHANGE	APPR	DATE	
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DRAWN	DATE	TITLE			
CHECKED		WIRE, #6 AWG FLEXIBLE UTHANE INS			
ENGINEER					
MANUFACTURING					
RELEASE AT REV		DRAWING NO.	SHT 1 OF	REV	
		72 A -5906	5	B	

### Polyurethane Stability

<u>Exposed to,</u>	<u>Time,</u>	<u>Temp.</u>	<u>Observations</u>
Mineral Oil	164 hrs.	@ 100°C	Becomes amber colored, no other apparent damage
Silicone Fluid	164 hrs.	@ 100°C	(Lighter than mineral oil) amber, no other damage
Askarel	164 hrs.	@ room temp	Not discolored, some swelling
Hexane	164 hrs.	@ room temp	No apparent damage
Acetone	164 hrs.	@ room temp	After 1 hr., swelled & opaque
1,1,1 Trichloroethane (F-13)	164 hrs.	@ room temp	Opaque and swelled
Tetrachloro- ethylene	164 hrs.	@ room temp	Some discoloring, some swelling
Methylene Chloride	164 hrs.	@ room temp	After 1 hr., swelled, yellowed and opaqued
Freon	164 hrs.	@ room temp	Slight swelling, some whitening
KOH(Basic)	164 hrs.	@ room temp	Slight yellowing
H <sub>2</sub> SO <sub>4</sub> (Acidic)	164 hrs.	@ room temp	Dissolved immersed portion, section exposed to fumes became brittle
Heat, Air Oven	1 month	@ 100°C	Amber colored, no physical changes
Cold, Refrigerated	1 month	@ -5°C	No change
Heat & Water, in oven	1 month	@ 80°C	Dark amber colored, opaque
Light	1 month	in UV chamber	No apparent change
Dishwashing Powder(NaOH, NaSiO <sub>3</sub> ),	164 hrs.	room temp	Moderate yellowing
Spartan Multi- Service Cleaner	164 hrs.	room temp	No apparent damage

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MEMO TO: Jim LaCroix, Paul Griffin

February 6, 1992

MEMO FROM: Bob Muise

SUBJECT: Polyurethane Stability Study

SCOPE

This study was to determine the effects if any, exposure to various chemical and/or environmental conditions has on B. F. Goodrich Estane Thermoplastic Polyurethane, used as the insulating material on ground cables.

CONDITIONS

Samples of ground cable with the Estane insulation were exposed to laboratory conditions that simulated or accelerated conditions which might occur in the field. The insulation may come in contact with insulating fluids, solvents, cleaners, chemicals and certain environmental conditions, or combinations of these. The samples were placed in bottles of the various chemicals or solvents. These samples were either left at room temperature or heated in an oven to accelerate aging. Table I lists the condition, length of time, and the temperature of the exposure, and observed effects.

CONCLUSIONS

The insulation should not be exposed to halogenated solvents. Excessive deterioration can result, depending on length of exposure. Exposure to the various insulating fluids, especially at elevated temperatures, should be kept at a minimum. Long term exposure to basic cleaning solutions can result in some discoloration. Acid cleaning is to be avoided. Do not clean with polar solvents such as acetone. Do not wash in dishwasher as hot water will make the transparent coating translucent and eventually opaque. Long term environmental exposure does not seem to pose any problems.

RECOMMENDATIONS

The ground cable insulation should be cleaned with a warm, but not hot, soap and water solution or with a hydro carbon solvent, such as kerosene. Immediately after cleaning, the insulation should be wiped dry.

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## Product Data

**ESTANE<sup>®</sup>**

ESTANE 58863 NAT 025

THERMOPLASTIC POLYURETHANE

	ASTM METHOD	TENSILE STRENGTH PSI	ULTIMATE ELONGATION %	100% MODULUS PSI	300% MODULUS PSI
ORIGINAL PROPERTIES	D-412	5500	620	1000	1550
Heat Stability (Air-oven 1 wk)	D-573				
@ 121°C		3700	730	1000	1600
@ 140°C		1600	520	7500	1200
UV stability (Fade-o-meter)	D-1499				
after 20 hrs.		6000	630	1050	1600
60 hrs.		5900	640	1100	1650
100 hrs.		5500	660	1000	1650
200 hrs.		4100	590	1050	1650
Hydrolytic Stability	D-3137				
Immersion @ 75°C					
after 2 wks.		4350	700	1050	1600
4 wks.		3800	620	1100	1650
6 wks.		3375	630	1100	1625
8 wks.		3150	630	1100	1575
Immersion @ 85°C					
after 2 wks.		3500	720	1000	1550
4 wks.		2900	660	1050	1500
6 wks.		2800	720	1000	1500
8 wks.		2375	670	1000	1450
Immersion @ 100°C					
after 2 wks.		2300	700	1000	1500
4 wks.		2650	580	950	1300
6 wks.		---	---	---	---
8 wks.		---	---	---	---

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Chemical Group

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ESTANE 58863 NAT 025	TENSILE STRENGTH PSI	ULTIMATE ELONGATION %	100% MODULUS PSI	300% MODULUS PSI	WEIGHT CHANGE %	VOLUME CHANGE %
Original Properties	5500	620	1000	1550	---	---
<b>SERVICE FLUID IMMERSION(1)</b>						
ASTM Fuel A @ R. T.						
after 70 hrs.	6200	620	1000	1650	+ 3.99	+ 5.94
2 wks.	6200	680	1000	1600	+ 3.27	+ 5.81
4 wks.	5400	610	1050	1650	+ 3.49	+ 6.11
ASTM Fuel B @ R.T.						
after 70 hrs.	4200	640	900	1400	+ 17.70	+ 25.02
2 wks.	4300	670	900	1450	+ 17.63	+ 25.04
4 wks.	4200	660	900	1500	+ 18.37	+ 26.10
ASTM Fuel C @ R. T.						
after 70 hrs.	3900	670	800	1400	+ 28.49	+ 39.28
2 wks.	3900	660	850	1400	+ 28.81	+ 39.93
4 wks.	3800	630	850	1400	+ 32.80	+ 40.30
ASTM Oil #1 @ 100°C						
after 70 hrs.	4800	690	1100	1800	- 0.31	+ 0.22
2 wks.	4200	720	1100	1800	+ 0.41	+ 0.48
4 wks.	3325	620	1125	1750	+ 0.35	+ 1.25
ASTM Oil #3 @ 100°C						
after 70 hrs.	5000	740	950	1700	+ 13.63	+ 15.82
2 wks.	3700	780	1000	1600	+ 15.34	+ 18.06
4 wks.	2600	650	1000	1550	+ 16.95	+ 19.84
Perchloroethylene 1 week @ R. T.	3900	680	900	1500	+ 77.81	+ 59.64
Trichloroethylene 1 week @ R. T.	2900	520	800	1500	+ 198.07	+ 168.83

(1) ASTM Procedure D-471

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