Z-522 REV 5/8

DU PONT

ESTABLISHED 1802

E. I. DU PONT DE NEMOURS & COMPANY

INCORPORATED

WILMINGTON, DELAWARE 19898

POLYMER PRODUCTS DEPARTMENT
CHESTNUT RUN

August 30, 1988

Richard C. Wilson
U. S. Nuclear Regulatory Commission
1 Whiteflint North - 9D4
Washington, DC 20555

Dear Dick:

After a bit more trying, I was able to locate some further information for you. I have enclosed a brochure entitled "Helpful Hints for Handling Wire and Cable Insulated with KAPTON* Polyimide Film." This brochure discusses most of the points listed in the July 24th article insert. Though this brochure was prepared for the benefit of the aerospace industry, the information contained here would be applicable for the use of KAPTON polyimide film as an insulating material within the nuclear electric utility industry as well.

I will be happy to assist you in any way that I can in the future. Please don't hesitate to call. If you are unable to reach me, I will be travelling next week, you may contact Jim Harris. Jim is the DuPont market manager for high performance wire and cable products such as KAPTON. You can reach Jim at 302-992-3936.

Best regards,

Bill

L. William Buxton
Technical Specialist

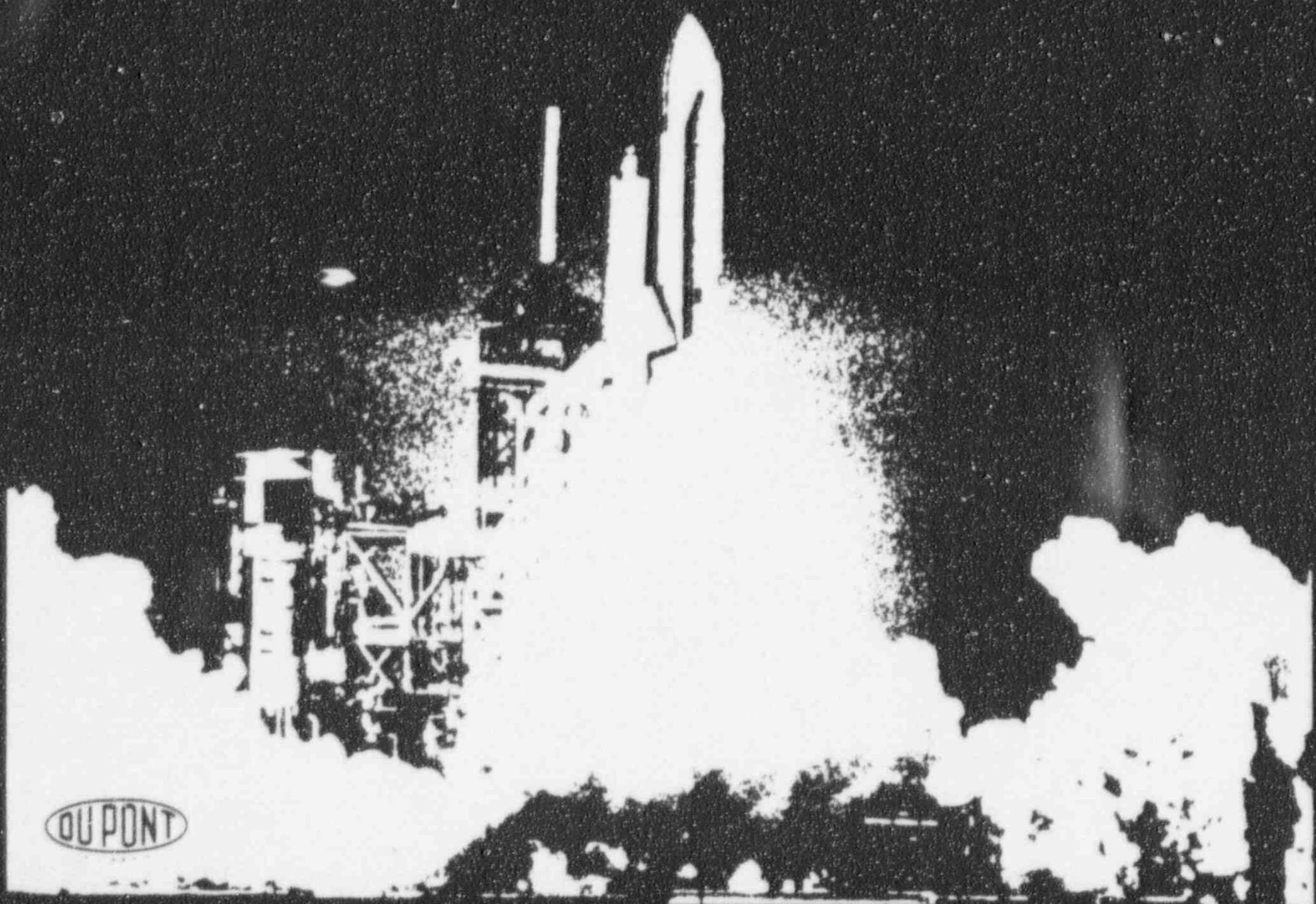
Enclosure
NRC2.txt

*KAPTON is a registered trademark of Du Pont for its polyimide film

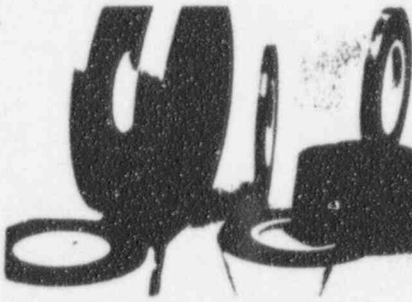
B/13

Helpful hints for handling wire and cable insulated with KAPTON®

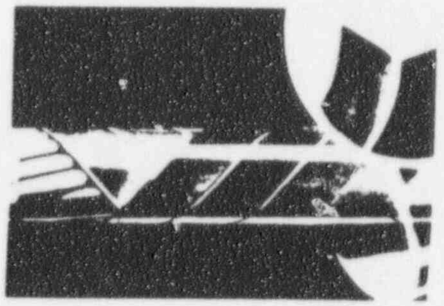
POLYIMIDE FILM



1 KAPTON® Polyimide Film— The Aerospace Industry Standard for Wire and Cable Insulation



KAPTON polyimide film comes in rolls of various widths*



The wire conductor receives two wraps of KAPTON polyimide film, one wrap in each direction*

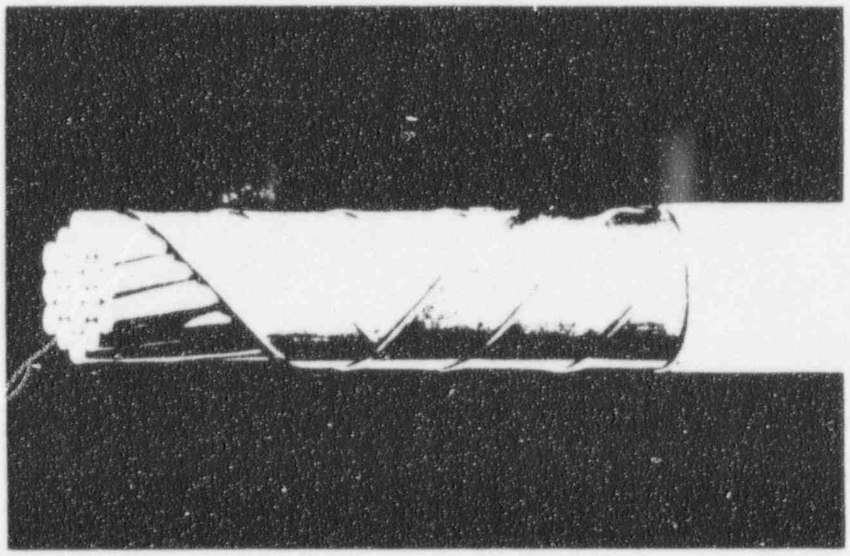
Industry experience of over 16 years has shown that wire and cable insulated with KAPTON polyimide film offers the high reliability and superior performance required in aerospace applications. This is due to its light weight, space savings, excellent [illegible] and low temperature characteristics, and the fact that it does not propagate flame and has the lowest smoke emission of any aerospace wire insulation on the market. As with any high technology product, there are a number of shop and field practices that should be followed for best results. These practices will result in the full benefits of KAPTON being realized in aerospace applications.

KAPTON polyimide film is manufactured by E.I. du Pont de Nemours & Company, Inc. It is then sold in narrow rolls to a number of wire processors who wrap it onto aerospace wiring to serve as the insulating material. The film is typically wrapped at an angle with approximately 50% overlap. Thus, the first wrap actually consists of two layers of film. The second wrap is then applied in the opposite direction and also with a 50% overlap. So now there are four layers of film on the conductor. A thin layer of Teflon* FEP is applied to one or both sides of the film. After wrapping, the conductor is heated, thus melting the Teflon* and sealing the tape in place.

The wire, as insulated with KAPTON film, is amber color and transparent. To provide other colors of wire, and to provide a surface which will readily take and retain wire printing, one of several top-coat materials will normally be applied.

Wire and cable insulated with KAPTON has been used for sixteen years in over 70 aerospace programs. These have included the Lunar Lander and the Space Shuttle. Helicopters and fixed wing aircraft in both military and commercial applications use wire insulated with KAPTON. Recent products which make extensive use of wire insulated with KAPTON include the Bell AH-1S Helicopter, the F-16 and F-18 fighter aircraft, and the Boeing 757 and 767 airliners. European usage has included the Concorde SST, the A300 Airbus, and several Aerospatiale helicopters.

This booklet will briefly describe the recommended shop and field practices for the effective and efficient handling of wire insulated with KAPTON.



The wire is then [illegible] by applying an opaque topcoat which makes the wire smooth and which can be printed.

2 Printing of Wire Insulated with KAPTON*

Aerospace wire and cable are printed with markings to identify

- Wire type and size
- The manufacturer of the wire
- The circuit and function of each wire to aid in correct wire routing and troubleshooting

There are two common ways being used at the present time to mark wire insulated with KAPTON. These are **hot stamp marking** and **ink jet marking.** The most frequently used method in manufacturing shops, as well as in repair shops, is **hot stamp marking.** This method uses a dye-type foil that makes a permanent mark on the topcoat.

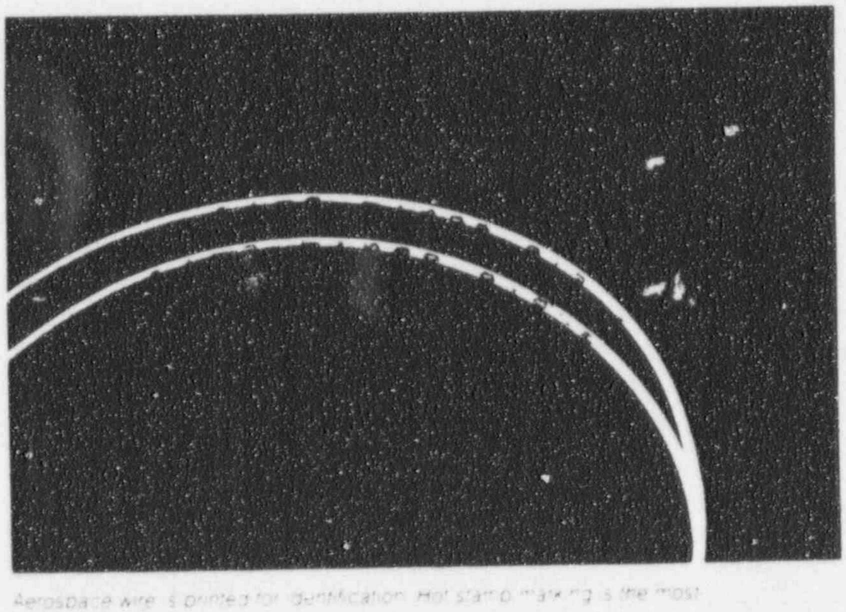
For the mustard color topcoat you should use a dark purple dye-type foil such as Kingsley K-496 or Howmet #8509. Topcoat colors such as black, brown, red, orange, yellow, and green will probably also mark well with the dye-type foil. Other colors will probably require Teflon* FEP or nylon marking foils.

For permanent markings without damage to the wire, use the proper machine settings.

- **Set temperature at 500-550°F.** This is essential for **permanent marking.** The higher temperature will not damage the topcoat or the KAPTON insulation.
- **Set air pressure at 20 to 30 PSIG.** Use **minimum** air pressure needed to obtain a good mark with properly aligned wire and type.
- **Set minimum dwell time.** Although dwell time is not critical, some dwell is needed for proper operation of the wire transport and stamping machine. Scuffing of the topcoat can occur if the dwell is too short.

Ink Jet Marking

Some larger harness shops are now taking advantage of the higher production speed of ink jet marking. It is effective and has less chance of wire damage. In this method, ink dots are sprayed on the moving wire to form the numbers and letters. Ink jet marking systems can be set up to mark, measure, cut, and coil wire using computer controls.



Aerospace wire is printed for identification. Hot stamp marking is the most common method.

3 Stripping of Wire and Cable Insulated with KAPTON*

Table I
Ideal Stripmaster* Identification

Insulation Wall Thickness (Nominal)	ASW Gauge	Stripper Assy No	Blade Set No
8.4 Mil (Mil-W-81381A 11 12 13 14 22)	16-26 10-14	45-1654 45-1608	45-1654-1 45-1608-1
5.8 Mil (Mil-W-81381A 7 8 9 10 21)	16-26 10-14	45-1551 45-1609	45-1551-1 45-1609-1
4.6 Mil (Mil-W-81361A 17 18 19 20)	16-26	45-1672	45-1672-1

Note: Specification Mil-W-81381A and the various commercial specifications used for procuring aerospace wire insulated with KAPTON provide for various wall thicknesses of insulation. The stripper part numbers in Table I identify the strippers and blades for each variation. If you are not sure of the type of wire used in your aircraft or vehicle contact your Technical Representative, or contact Ideal Industries with samples of your wire and your aircraft model number for assistance.

The most important practice in working with wire and cable insulated with KAPTON is to use the proper tools and methods for stripping wire ends. The following recommendations should be carefully followed.

The most common precision stripping tool for single wires insulated with KAPTON is the "Ideal Custom Stripmaster*". It is important to use the correct Part Numbers as shown in Table I. These tools have been carefully designed to remove insulation of KAPTON quickly and completely. These tools are manufactured by Ideal Industries and are available by **special order through your Ideal electrical distributor. (They are not listed in the Ideal catalog.)** If you have difficulty in obtaining the correct strippers or cutting blades for KAPTON, contact:

Ideal Industries
Becker Place
Sycamore, Illinois 60178
Telephone: 815-895-5181

*Trademark of Ideal Industries.

For removing outer jackets of KAPTON from cables, the following guidance will be helpful:

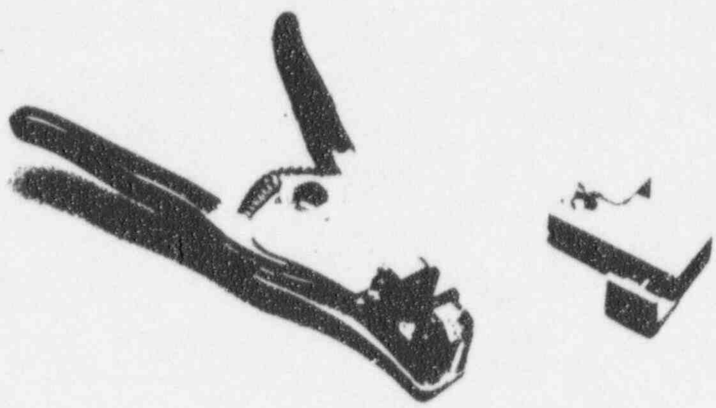
- Use the Reon Model R-720 Outer Jacket Cutter. **These are distributed only by direct factory sales.** For orders and inquiries, contact:

Reon Manufacturing Company
P.O. Box 1317
Nevada City, CA 95959
Telephone: 916-265-4848

These tools can be equipped with cutters for 4, 6, and 8 mil jackets. Be sure to specify your needs when ordering. (Reon has plans to color-code these 3 cutter sizes in the near future.)

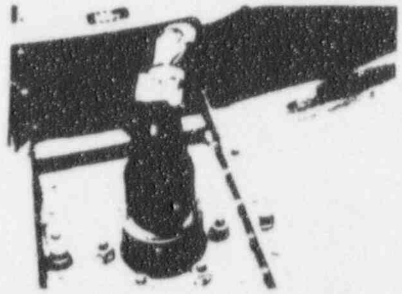
- Nick the jacket slightly over one-half the jacket thickness.
- Flex the cable at the nick (approximately 45°). The jacket should separate all around the circumference.
- Grasp the slug with a rubber gripper pad and pull it off, using firm and steady pull.

For cutting wire, be sure to use shear type cutters, i.e., Ideal P/N 45-123, rather than pinching or crushing type cutters such as diagonal pliers. Shear type cutters will prevent flattening and splaying of wires so stripping and terminating will be easier.



The Reon end stripper Model R720A (right) and The Ideal Custom Stripmaster (left) can both be used for stripping wire insulated with KAPTON. The Reon R720 which is similar in appearance, but with 3 cutters, is used for cutting cable jackets of KAPTON.

4 A Proper Harness Installation Will Help



Strain relief devices are often provided to stabilize and protect wires leading from a connector

A good harness installation in the aircraft will result in a reliable harness and easier maintenance on the electrical wiring. The following tips will be helpful.

- **Routing and Tying:** Harnesses should be routed and supported well so they will stay in position and not contact installed equipment c structural cutouts. Supports should provide stand-off capability, particularly where crossing other harnesses or lines at right angles. Breakouts should be gentle and well supported. Ties should be spaced close enough to hold the harness together, preventing splaying where the harness bends.
- **Harness Twist:** Harness flexibility is greatly improved if the wires are twisted (one to two turns per foot) prior to tying and or over-braiding. Twisting is particularly effective the harness branches where flexibility is most helpful. (This can be done with little increase in weight due to greater wire length.) Twisting allows the harness to bend by a rotational motion of the wires, rather than by trying to stretch the wires.
- **Hinge Areas:** Harnesses which must cross areas of relative motion, i.e. wing fold mechanisms and landing gear, should be mounted so that the harness will twist, rather than bend, when the joint moves. Usually a segment of the harness is laid parallel to the hinge joint and supported at both ends of the parallel sections, but on opposite sides of the hinge. Care must be taken to insure the harness does not bind or pinch during motion of the hinge.

Connector Strain Relief: Strain relief supports are provided by the designer on certain connectors where experience shows they are necessary to prevent broken wires and side loads on the connectors. They are usually in the form of a support on the back shell of the connector. It is important that the strain relief supports be reinstalled where intended after maintenance, and that the wire be properly routed and supported by them.

Slack and Bends: When installing wires insulated with KAPTON* it is important to have sufficient slack in the wiring, with bends as generous as possible. Benefits include:

- Ease of making connections and doing maintenance.
- Provides enough wire to strip and re-terminate in case a wire is broken.
- Avoids strain on wires and harnesses as the structure flexes.
- Reduces likelihood of wrinkles forming in the insulation.

Benefits of Wire Stiffness. Wire insulated with KAPTON has a greater stiffness than other types of wire. This is helpful when working with the wiring because:

- Wire resists kinking while being formed into harnesses and while being routed in the aircraft.
- Rear release connector pins can be pushed into place without the need of an insertion tool — a big time saver. (A drop or two of isopropyl alcohol on the grommet hole will provide lubrication for inserting the pin.)
- Wires and cables can often be pushed through tight areas, eliminating need for using "fish" and other wire pulling techniques.

A well-routed harness is tied securely, has gentle bends, and is supported and protected at structural cutouts.

Kapton
POLYIMIDE FILM

The Boeing 767 commercial airliner

DuPont Company
Polymer Products Department
Industrial Films Division
Wilmington, DE 19898

DU PONT

E-51481

Printed in U.S.A.

9/20 DRAFT

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

SEPTEMBER , 1988

NRC INFORMATION NOTICE NO. 88-XX: IMPROPER APPLICATION OF KAPTON ELECTRICAL INSULATION

Addressees:

All nuclear power reactor facilities holding an operating license or a construction permit.

Purpose:

This notice is being provided to alert licensees to a potentially generic safety problem involving Kapton aromatic polyimide electrical insulation. Kapton is used extensively in nuclear plants as wire insulation in containment penetrations and cable entrance seals manufactured by Conax Buffalo Corporation, and may be used for other applications such as motor insulation systems in products supplied by other vendors. Kapton is a registered trademark of E. I. du Pont de Nemours and Company.

It is expected that recipients will review this information for applicability to their facilities and consider actions, if applicable, to prevent or identify this and similar problems at their facilities. Suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required. The NRC staff is continuing to evaluate this matter. If specific action is determined to be necessary, a separate notification will be issued.

B/14

Description of Circumstances:

Problems involving Kapton insulation have been identified at nuclear power plants and elsewhere as described below, although the only significant event in the nuclear industry is the San Onofre 1 event.

San Onofre Nuclear Generating Station Unit 1:

On June 15, 1987 Southern California Edison Co. advised the NRC of a problem involving damaged insulation on containment penetration electrical circuits in San Onofre Unit 1. During electrical testing of control rod drive equipment circuits to determine if previous cooling fan malfunctions had caused any damage, unacceptably low insulation resistances were found on 35 circuits. In one penetration assemble alone, 11 circuits tested below one megohm and 11 others below 100 Megohms. A total of 35 cables were replaced because of low insulation resistance. The licensee then proceeded with a visual inspection of the approximately 5000 penetration leads in the plant, and discovered nicked insulation in 52 cables covering close to 200 circuits. All of the defects were outside containment except for 15 nicked leads inside containment.

The licensee also sent two damaged leads to a laboratory for analysis. Both defects were similar. The insulation showed no signs of electrically induced damage, and the insulation edges at the breaks were smooth (suggesting moderate

chemical attack). Some insulation delamination had occurred, with a white powder on the layers that contained principally sodium and oxygen. An underlying greenish powder contained sodium, chlorine, and copper, and the copper conductor at the break covered with was blackened copper oxide. The damage sites were highly localized; adjacent insulation showed no degradation. The analysis indicated moderate chemical attack, primarily on the copper conductor.

As short-term corrective action, the licensee replaced all wires showing any signs of degradation or damage. Study of long-term actions to provide additional protection was initiated.

Other Kapton Concerns:

1. Information Notice 87-08 (reference 1) describes 1986 failures of motorized valve operators because of short circuits of wires insulated with Kapton and Nomex. The Kapton was a 0.0012 inch layer overlapped 50 percent. These wires were subjected to abrasion damage during wiring of the valve operators.

2. Information Notice 87-16 (reference 2) describes 1987 degradation of Kapton diaphragms in pressure switches caused by chemical attack by ammonia contained in the process fluid.

3. In 1984 Gulf States Utilities filed a 10 CFR 50.55 (e) report concerning a short circuit between two Kapton-insulated wires from Conax penetration assemblies at River Bend Station Unit 1. The condition occurred during plant construction, and inspection showed 15 of 201 conductors to have nicked or otherwise damaged insulation. Investigation showed that degradation was generally attributable to scuffs, gashes, and related damage aggravated by the presence of water.

4. In several instances anomalies have occurred during qualification type testing of Kapton-insulated pigtail wires on Conax products or of other equipment such as transmitters with cable entrances sealed by Conax seals. The anomalies have been attributed to handling and stresses not typical of plant installations; e.g., shipment from a radiation test facility to a LOCA test facility. Only a few wires showed degradation in each instance, whereas multiple wires not subject to abnormal handling have successfully completed type test sequences.

5. In response to Information Notices 87-08 and 87-16, du Pont wrote to the NRC to caution that when Kapton is used in nuclear power plants where environmental qualification is required, engineered designs which protect Kapton from direct exposure to loss of coolant accident sprays are required. This is because Kapton tends to degrade when exposed to high temperature steam or certain volatile chemicals such as sodium hydroxide.

6. The Naval Research Laboratory (NRL) has published or presented several papers (reference 3, 4) describing failures of Kapton-insulated wires during laboratory testing. The NRL work has carefully examined potential problems with Naval aircraft service. As a result, The Navy intends to end procurement of aircraft using Kapton-insulated wire, and the other military services are studying possible implementation of restrictions. Several magazine and newspaper articles have been published with respect to the use of Kapton-insulated wire in both military and commercial aircraft, where it is used extensively because of its light weight and low bulk.

The NRL work, in conjunction with other available information, shown that Kapton wire insulation is subject to damage from four causes:

a. Bullet or projectile damage to energized multiple-wire bundles in which mechanical damage and electrical energy interact to produce very high temperatures and flames, causing a chain reaction of destruction to the wires.

b. Direct chemical attack by strong alkaline solutions, which dissolve Kapton. Naval aircraft cleaning solutions are of this nature.

c. A complex hydrolysis process involving the synergistic interaction of temperature, moisture, and mechanical strain, with a strong nonlinear dependence on all three. du Pont (reference 5) has suggested a fifth-power humidity dependence. Wolfe (reference 6) reported a strong dependence on strain, and there may be a minimum strain of 3 to 4 percent below which degradation does not occur. Temperature dependence is roughly exponential. This process is almost fully reversible provided that actual cracking has not occurred, in that "annealing" in the vicinity of 200° C can reverse the changes in mechanical properties. du Pont has pointed out that Arrhenius techniques commonly used to address accelerated aging of materials may not apply to Kapton hydrolysis because the reaction process is reversible. (Very briefly, the hydrolysis process is believed to consist of breaking of long-chain Kapton molecules at defect centers created during the manufacture of the material; this can reduce the tensile strength and elongation to below the crack initiation threshold at a region subjected to bending stress).

d. Mechanical nicking or gouging. The bullet or projectile impact on energized wires in a bundle is capable of directly destroying the bundle. In the other cases it is necessary for the damage to expose at least one wire's conductor, and an electrical path

to an adjacent metallic conductor must be formed by either a conductive solution or direct metal-to-metal contact. The integrity of affected circuits would then be compromised.

The Navy has studied aircraft maintenance records and inspected wiring on airplanes. Several instances of failure have occurred. The failures are preferentially in the wingfold area, where wire bundles are flexed and possibly abraded against adjacent structural metal, and where they may be exposed to caustic cleaning solutions. Conduits and protective sleeving are not used. These conditions do not apply to commercial nuclear power plant applications.

7. Another concern with Conax penetration assemblies that does not involve Kapton was experienced at the Tennessee Valley Authority's Watts Bar Nuclear Plant Unit 1 in February 1986 and at Sacramento Municipal Utility Districts Rancho Seco plant in April 1985. This concern consists of cracking and crazing of polysulfone seals that form pressure barriers around the Kapton-insulated wires, caused by organic chemical attack on the polysulfone. Conax installation instructions specify acceptable cleaning and solvent solutions, and specifically caution against exposing the polysulfone to numerous named organic solvents. Conax provides instructions for repairing such damage.

Elaboration:

Kapton is an unusual plastic. It has excellent electrical properties over a temperature range from -269° C to +400° C according to the manufacturer, du Pont. The mechanical and electrical properties are only moderately affected by a radiation dose of one thousand megarads.

The resistance to cutthrough and cold flow is high, making Kapton suitable for compressive pressure seals in the Conax products. Kapton is much less flammable than most wire insulations, its differential thermal expansion coefficient is close to copper's, and it is resistant to most chemicals (but not concentrated sodium hydroxide) at high temperatures.

Conax uses Kapton-insulated wire constructed as follows. Two wraps of type FN Kapton film are spiral wrapped around the copper conductor in opposite directions. The film consists of a 0.001 inch Kapton layer coated on each side with a 0.0005 inch thickness of Teflon (a du Pont trademark for FEP fluorocarbon). The wire is briefly annealed at a temperature sufficient to melt and fuse the Teflon, which is used because Kapton does not bond to itself. Since each of the two layers of Kapton film is overlapped 50% the wire insulation consists of 0.004 inch of Kapton and 0.004 inch of Teflon (wire sizes below

No. 1 use an inner wrap of 0.002 inch Kapton with Teflon). For comparison, the MIL-W-81381/11 wire used by the Navy is similar except that a 0.002 inch dispersed Kapton topcoat is added, primarily to facilitate marking.

Conax normally uses a solid copper conductor. MIL-W-81381/11 wire has a stranded copper conductor. The faulted wires at San Onofre 1 were unusual in the nuclear industry because they had stranded conductors. The San Onofre 1 penetration assemblies were replacement units installed in 1986. To facilitate plant wiring, the licensee had Conax splice pigtail leads up to 20 feet long to the solid-conductor leads integral with the penetrations, and the additional leads were of the more flexible stranded conductor type.

Conax normally supplies a heat shrinkable polyolefin jacket for mechanical protection of Kapton insulation*, and specifies additional mechanical protection in the form of conduit (specified in installation manual IPS-725 for seal assemblies) or junction boxes (mounted on penetration assemblies). However, some of a

* EPRI NP-5000 (reference 7) also notes the desirability of mechanically protecting Kapton pigtails.

group of Conax installation manuals reviewed by the NRC did not specifically caution against damaging Kapton. IPS-725 also specifies minimum bend radii large enough to produce strains below the 4 percent hydrolysis threshold, and in practice bends are not usually that sharp. The replacement penetration assemblies at San Onofre 1 had polyolefin sleeves installed over small groups of Kapton-insulated pigtails, but did not have conduit or junction box protection for their full length. It is likely that Kapton insulation at San Onofre 1 was nicked when polyolefin sleeves were cut.

Current Conax manuals emphasize the importance of providing protection against mechanical damage to Kapton. At the request of the NRC Conax examined records of shipment during the 1973-81 time frame covering seals, penetration assemblies, and penetration replacement adapters. Of 23 affected plants, the only case where significant mechanical protection was not afforded for Kapton pigtails was a 1977 shipment of penetration assemblies to a three-unit BWR site.

With respect to accident conditions, numerous qualification type tests of Conax seals, penetration assemblies, and module adapters have been performed and have been reviewed by licensees and the NRC. The prototype tests required by the Conax IPS-30 wire specification

provide additional confidence in the wire, particularly an immersion test of 20 hours in pH 9.5 sodium hydroxide solution followed by a bend and reverse-bend test on a small-diameter mandrel (e.g., 3/8 inch diameter for #16 wire).

Environmental qualification test sequences may artificially enhance the performance of Kapton-insulated wire during simulated high energy line break testing. Early in the type test sequence an accelerated thermal aging test is performed at temperatures near 150° to 250°C. The aging test could have the effect of "annealing" hydrolytic degradation of the Kapton prior to the steam test. However, the wires are very likely to be subjected to additional bending between the aging and steam tests, and strain from these bends would not be alleviated by the earlier test. Further, the aging test would have no effect on the two main degradation mechanisms, mechanical damage and alkaline attack.

Summarizing, nuclear power plant experience with Kapton during normal plant operation over a period of nearly 20 years has been satisfactory with the single exception of the San Onofre 1 event. Several unusual aspects apply to the Onofre 1 event:

a) The replacement nature of the installation contributed to unusual exposure to the environment of significant lengths of bare Kapton-insulated wire.

b) The replacement nature of the installation also contributed to an unusual degree of nicking of Kapton insulation at points other than the ends of wires as the polyolefin sleeves were cut.

c) The replacement nature of the installation may have subjected the pigtails to unusual handling.

d) The open construction of the reactor building and oceanfront location exposed the outside-containment pigtails to moist salty air, even to the extent of condensation.

e) The faulted pigtails were stranded rather than solid conductor (the significance of the difference is not obvious).

f) The failures were detected only about one year after installation, during an inspection not typical of other plants and with acceptance criteria also not typical of other plants.

du Pont has several publications describing Kapton and its use. These may be obtained by contacting:

Paul Wyche
E. I. du Pont de Nemours and Co., Inc.
External Affairs Dept. N-2526
Wilmington, DE 19898
(301) 774-1942

Discussion:

Despite the plant-specific aspects of the San Onofre 1 event, the generic lesson is that the performance of numerous Kapton-insulated wires degraded considerably after only one year in a quite mild environment. Nicking of the Kapton insulation combined with exposure to condensation of moist salty air appears to be the root cause of the degradation. Available information indicates that nicking combined with exposure to any type of conductive solution could produce unacceptable degradation.

Although Kapton-insulated pigtails have successfully completed several accident qualification type tests, the test specimens are believed to have been free from nicks in the insulation; further, test anomalies occurred in some cases where the pigtails were subjected to abnormal handling. The lesson is that preaccident damage (mechanical, chemical, hydrolytic) can lead to failure of Kapton-insulated wires during or after accidents.

Licensees are alerted that the following conditions may breach the integrity of Kapton insulation, leading to possible failures under either normal or accident conditions:

(a) Mechanical damage such as nicks, cuts, and abrasion

(b) Prolonged contact with alkaline solutions

(c) Mechanical strain (e.g., from bending) combined with prolonged exposure to moisture (including humidity)

Licensees are also reminded that excessive handling of wiring is undesirable. In view of the industry's favorable operating experience with Kapton, it is suggested that any actions that licensees may elect to take in this regard should begin with review of procedures and designs to determine whether any of the conditions cited above may exist. Caution is also suggested with any future maintenance or installation activity involving Kapton.

Virtually all commercial nuclear power plants contain Kapton-insulated wires. Commonly-used Conax products in the nuclear power industry include containment electrical penetration assemblies, penetration replacement adapter module assemblies, electrical conductor seal assemblies (ECSAs), and PL-type gland seals. Rosemount, Inc. model 353C conduit seals use Kapton-insulated wires, and Kapton is also used in quite sheltered locations in some motor insulation systems. The penetrations and seals are commonly used in Class 1E circuits and in applications requiring environmental qualification to 10 CFR 50.49. Failure of Kapton insulation during either normal plant operation or accident conditions could render associated safety-related equipment inoperative.

No specific action or written response is required by this information notice. If you have any questions about this matter, please contact the technical contact listed below or the Regional Administrator of the appropriate regional office.

Charles E. Rossi, Director
Division of Operational Events Assessments
Office of Nuclear Reactor Regulation

Technical Contact: Richard C. Wilson, NRR
(301) 492-0997

Attachments:
1. References
2. Recently Issued NRC Information Notices

*Transmitted by dated ______________________

VIB:DRIS:NRR	VIB:DRIS:NRR	RPB:ARM	C:VIB:DRIS:NRR	D:DRIS:NRR
RCWilson	UPotapovs	TechEd	EWBrach	BKGrimes
/ /88	/ /88	/ /88	/ /88	/ /88

C:OGCB:DOEA:NRR	D:DOEA:NRR
CHBerlinger	CERossi
/ /88	/ /88

Attachment 1
IN 88-
October , 1988

f'6

<u>REFERENCES</u>

1. I. E. Information Notice No. 87-08: Degraded Motor Leads in Limitorque dc Motor Operators, February 4, 1987

2. IE Information Notice No. 87-16: Degradation of Static "O" Ring Pressure Switches, April 2, 1987

3. F. J. Campbell, "Temperature Dependence of Hydrolysis of Polyimide Wire Insulation," IEEE Transactions on Electrical Insulation Vol. EI-20 No. 1, February 1985

4. A. M. Bruning, "Predictive Life Measurements of Naval Aircraft Wiring," Proceedings: Workshop on Power Plant Cable Condition Monitoring, EPRI EL/NP/CS-5914SR, July 1988

5. J. O. Punderson and J. F. Heacock, "Poylimide Film Insulation for Aerospace Wire and Cable: Why Long-Term Performance Exceeds Some Limited Laboratory Projections, " presented at the 34th International Wire and Cable Symposium, Cherry Hill, NJ, November 19-21, 1985 (available from the du Pont contact cited above)

6. C. J. Wolf, D. L. Fanter, and R. S. Soloman, "Environmental Degradation of Aromatic Polyimide-Insulated Electrical Wire," IEEE Transactions on Electrical Insulation Vol. EI-19 No. 4, August 1984

7. J. F. Gleason, "Sealing of Nuclear Plant Electrical Equipment," EPRI NP-5000, Project 1707-12 Final Report, January 1987

Document Name:
KAPTON RPT

Requestor's ID:
MCALLIST

Author's Name:

Document Comments:

Telecon to Bill Buxton, du Pont 302/999-5936 10^{00} 9/14/88

Need contact for literature to be named in IN

Buxton in Europe all week.

Kapton expert is —

P[illegible] [illegible]e Corp
Circleville, Ohio [illegible]
614/474-0331

He's out today, back tomorrow. Left word.

9^{30} am 9/15

~~[illegible]~~

will send - du Pont response to Aerospace claims
Heacock will have another paper in ~1 mo - will send then

Believe the 4 refs I've named look good —
will double check + also call back with contact
(probably Jim Harris)

Helpful hints ... E-53481
Punderson/Heacock paper (Nov 85)
Rad resistance brochure E-62313
Summary of properties E-93189

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Telecon, Phil [illegible], Du Pont 2[30] pm 9/16/8[illegible]

George [illegible] list [illegible] proposed for sending to [illegible] [illegible]

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