DYNACON, INC.
WINCHES-HANDLING SYSTEMS

TuffCoat Marine Lubricant
TuffTool Applicator

The system solution for cable, wire rope and umbilical protection

DYNACON, Inc.
831 Industrial Blvd.
Bryan, Texas 77803, USA
Phone: +1-979-823-2690
Fax: +1-979-823-0947
www: http://www.dynacon.com

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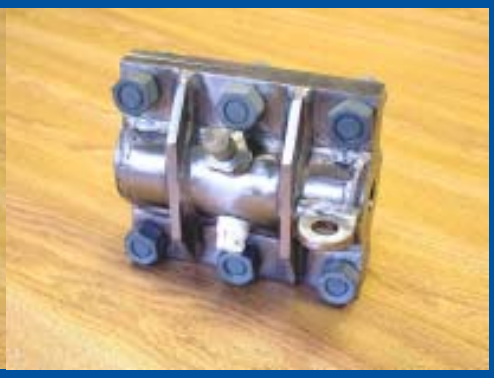
The Tuff Tool Family

The TuffTool lubricator developed by DYNACON is used to inject TUFFCOAT-M lubricant into umbilicals and cables while spooling these onto winches under tension. *TuffTool* is an effective lubricator able to apply the lubricant in a wide range of cable and rope profiles. This includes helical lay wire ropes in which the strand cross-sectional profile prevents efficient application of the lubricant with typical smooth bore seals.The robust design of the tool and the unique seal design allow the lubricant to be injected into the cable under pressures required (pressures exceeding 124 bar (1,800 psi, 12,410 kPa) are possible) to ensure total lubricant penetration with minimal product loss.

Tuff Tool

Tuff Tool Junior



Rotating Tuff Tool

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Tuff Tool

For more information contact:

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PROPER LUBRICATION OF ARMORED UMBILICALS TO INCREASE SERVICE LIFE

Service life of wire ropes, armored cables, and umbilicals can be increased proportionally to the effectiveness of the lubricant applied and the amount of lubricant reaching the working parts.

What makes an effective lubricant ?

A proper lubricant must have the following characteristics:

- must reduce friction
- must protect against corrosion
- must be pliable and adhere to the wire when it is cold and not melt off when it is warm
- must resist washout by water
- must be safe to personnel and the environment

What makes an effective lubricant applicator?

A proper lubricant application must have the following characteristics:

- must introduce the lubricant to all the working parts of the cable and displace any water or contaminates
- must deliver the lubricant with a minimum of product loss
- must be able to apply the lubricant on a wide range of cable and rope profiles

DYNACON has developed a "total" lubrication system that offers a solution to both the lubricant and application requirements.

The Lubricant – "TUFF COAT-M"

"TUFF COAT–M" cable coating was developed by **Royal Purple, Inc.** exclusively for **DYNACON, Inc.** **"TUFF-COAT-M"** is a non-hazardous synthetic lubricant composed of multi-synthetic base oil with synthetic additives which possess the following physical properties:

• Chemical family:	Synthetic Lubricants
• DOT Hazard Class:	Non-hazardous
• Physical State:	Grease
• Appearance:	Blue
• Solubility in Water:	Negligible
• Vapor Pressure:	less than 0.1 mm Hg@20ºC
• Vapor Density:	greater than air (air = 1)
• Pour Point:	> 700 degrees F
• Boiling Point:	N/A
• Evaporation Rate:	Negligible
• Specific Gravity:	Greater Than 0.91
• Odor:	Lube Oil

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Features or performance characteristics of "TUFF COAT-M"

- **Effective at reducing friction**

  "TUFF COAT-M" has a very high lubricity. Synthetic oils are produced with better (perfect) molecules resulting in high lubricity characteristics as demonstrated in the synthetic oils used in today's high performance cars and racing vehicles.

- **Superior protection against corrosion**

  "TUFF COAT-M" forms an ionic bond to the wire. This ionic bond results in a tenacious film that displaces water from the metal surface. These properties were demonstrated in a Salt Spray Exposure Test (ASTM B117) in which a cable sample coated with **"TUFF COAT-M"** and an un-coated control sample were exposed to salt spray for a period of 800 hours. On conclusion of the test the **"TUFF COAT–M"** sample received a final rating of "8" (described as," few isolated corroded areas, less than 0.1% of surface corroded) in accordance with the ASTM D610 grading scheme. The control sample received a final rating of "0" (described as," approximately 100% of the surface corroded") .

- **Highly stable, staying pliable and adhering to the wire when it is cold and not melt off even at extreme temperatures**

  "TUFF COAT-M" is an extremely stable lubricant that retains its physical state and properties throughout a very wide temperature range. Thermal decomposition may occur at temperatures above 800º F. This extremely high temperature range makes it uniquely suitable for applications such as ROV umbilicals experiencing heating due to high power transfer and down-hole drilling applications where extreme temperatures are encountered.

- **Highly resistant to washout by water**

  "TUFF COAT-M" is hydrophobic(lacking an affinity for water). Results of a Water Washout Test (ASTM D1264) performed at 38ºC and 78ºC were as follow:

  @ 38ºC % loss was 0.19%
  @ 78ºC % loss was 0.94%

- **Non-hazardous and inert substance that is safe to personnell and the environment**

  "TUFF COAT-M" is non-hazardous which will not sheen the water. In a study to determine the toxicity of **"TUFF COAT-M"** a 24-hour acute test was performed on *Mysidopsis Bahia* in accordance with U.S. Environmental Protection Agency (EPA/600/4-90/027F)(1993). The product passed the EPA requirements with a 100% survival rate of the *M. Bahia* in a 100% test concentration of **"TUFF COAT-M".**

The applicator –"TUFF TOOL"

The **"TUFF TOOL"** lubricator was originally designed and developed by **DYNACON** to inject the **"TUFF COAT-M"** lubricant into umbilicals and cables, while spooling these cables onto **DYNACON** winches under tension at our facility in Bryan, Texas. Continued development of the tool has resulted in a dependable applicator system suitable for applying **"TUFF COAT-M"** where-ever cables are being worked or spooled.

The tool is constructed of stainless steel and machined for installation of o-ring seals that ensure proper sealing allowing the assembly to contain the lubricant under high internal injection pressures. The typical two-piece body and unique split seal design allows the tool to be installed anywhere along the length of the cable. Fluid disconnects on each half of the tool allow lubricant to be pumped into the injection chamber from opposite sides of the tool to ensure complete distribution of the lubricant in the chamber. A pressure gauge allows injection chamber pressure to be monitored.

The lubricant is supplied to the tool from an air motor driven RAM pump that transfers the lubricant from the shipping container into the tool under pressure. Two sizes are currently available allowing the lubricant to pumped directly from either the 19 liter (5 gallon) or 208 liter (55 gallon) product containers.

Features or performance characteristics of "TUFF TOOL"

- **Introduces the lubricant to all the working parts of the cable**

  The robust design of the tool and the unique seal design allow the lubricant to be injected into the cable under pressures required (pressures exceeding 1800 psi are possible) to ensure total lubricant penetration with minimal product loss.

  Construction of the armor strands when the cable or rope is under tension restricts flow of high viscosity lubricants into the inner lays. The ability to generate high injection pressures coupled with the thixotropic property (property of various gels of becoming fluid when under pressure) of **"TUFF COAT-M"** results in total penetration throughout the volume of the armor and wires displacing all water and filling any void spaces with the highly effective lubricant.

- **Capable of delivering the lubricant with a minimum of product loss**

  The same unique design properties of the tool body and seals that allow containment of high injection pressures within the tool minimizes the amount of product loss during application to cables and umbilicals.

  The thin uniform coating on the exterior of the cables and the clear blue color of the **"TUFF COAT-M"** makes for ease of visual inspection of the outer armor wires.

- **Able to apply the lubricant on a wide range of cable and rope profiles**

  The original tool design has demonstrated excellent performance in applying. **"TUFF COAT-M"** on a variety of cable and umbilical designs with diameters ranging from .322 inches to 1.85 inches. However, to date, nearly all of these cables and umbilicals have had concentric and relatively smooth outer armors.

  DYNACON has received several requests from customers desiring an effective lubricator for helical lay wire ropes in which the strand cross-sectional profile prevents efficient application of the lubricant with typical smooth bore seals. In response to these needs, **DYNACON** has developed a new generation of the **"TUFF TOOL"** that allows the cable seals to rotate around the axis of the rope. The rotating tool design (patent pending) permits the seals which have a bore formed to the lay profile of the wire rope, to follow the lay of the rope as it is passed through the lubricator.

  Nearly every wire rope or cable product manual accurately describes wire ropes and cables as "machines". They are complex machines whose useful life and performance depend directly on the level of care and maintenance received.

  Development of higher performance ropes and cables demands superior lubricants and application techniques. TUFF COAT-M cable coating and TUFF TOOL lubricator meet these demands.

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DYNACON, INC.
WINCHES – HANDLING SYSTEMS

Cable, Wire Rope and Umbilical Lubrication System

Specifications

TuffCoat-M Marine Lubricant

Chemical Family	Synthetic lubricant
DOT Hazard Class	Non-hazardous
Physical State	Grease
Pigmentation	Light blue
Specific Gravity	> 0.91
Pour Point	> 370º C (700º F)
Salt Spray Test	> 0.1% surface corrosion after 800 hour exposure
Solubility in Water	Negligible

TuffTool Lubricant Applicator

Umbilical, Cable or Wire Rope Diameters	12.70 mm (0.50 in.) to 50.80 mm (2.0 in.)
Maximum Injection Pressure	124 Bar (1,800 psi)
Construction	304-L Stainless Steel

Standard Features

TuffCoat-M Lubricant

- Lubricant is non-toxic, is hydrophobic, will not wash out and will not leave a sheen on water surface
- Lubricant is high viscosity, will not harden
- 700º F pour point provides protection for hot, high power ROV umbilical
- Easily cleans up with mineral spirits or citrus-based solvent for environmental protection
- Will not build up on sheaves or levelwind rollers

TuffTool Applicator

- High pressure injection ensures thorough penetration and ejection of existing debris
- Lateral chamber seals constructed according to cable diameter
- Easy installation
- Utilizes ram-air pump to transfer lubricant from 208 liter (55 gal.) drum or from 19 liter (5 gal.) containers
- Quick disconnect couplings for easy installation

Contact us for pricing, terms, warranty information, lease arrangements and delivery
831 Industrial Blvd. - Bryan, Texas 77803
Telephone: (979) 823-2690 - Facsimile: (979) 823-0947
World Wide Web: http://www.dynacon.com

Royal Purple, Ltd.

Material Safety Data Sheet

I. Product Name: **Tuff Coat M**
Chemical Family: Synthetic based lubricant
Use: Lubricant and sealant
Manufacturer: Royal Purple, Ltd.
Address: 1 Royal Purple Lane, Porter, Texas 77365 USA
Phone: 281-354-8600 Emergency Phone: 281-354-8600 Fax: 281-354-7600

II. Components:
- Base Oil (synthetic) — Synthetic additives with iso-paraffinic diluents and silicon dioxide thickener.
- The precise composition of this oil is proprietary. A more complete disclosure will be provided to a physician or nurse in the event of a medical emergency.
- All components of this product are listed on the U.S. TSCA inventory.
- This product contains no hazardous substances within the definition of OSHA Regulation 29 CFR 1910.1200.
- Royal Purple certifies that this product has been evaluated for RCRA characteristics and does not meet the criteria of a hazardous waste if discarded in its purchased form.

III. Main Hazards / Health Effects:
Eyes: May cause irritation.
Inhalation: Viscous nature may block breathing passages if inhaled.
Ingestion: May cause diarrhea.
Skin: May irritate the skin after prolonged periods of contact.

IV. First Aid:
Eyes: Flush with water until all residual material is gone. If irritation persists, seek medical help.
Inhalation: Clear air passage. If respiratory difficulty continues, seek medical help.
Ingestion: Consult physician.
Skin: Wash thoroughly with hand cleanser, followed by soap and water. Contaminated clothing should be dry cleaned before reuse.

V. Extinguishing Media:
Suitable: Foam, dry powder, Halon®, carbon dioxide, sand, earth and water mist.
Unsuitable: Water jet.
Protective Equipment for Fire Fighting: Self-contained breathing apparatus.

VI. Accidental Release Measures:
Personal Precautions: Wear gloves and protective overalls.
Environmental Precautions: Avoid disposal into drains.
Spillage: Scrape up bulk, wipe up remainder with cloth and pick up remaining residue with diatomaceous earth.

VII. Handling and Storage:
Handling: No special handling precautions necessary.
Storage: Do not store at elevated temperatures.

VIII. Exposure Control / Personal Protection:
Respiratory Protection: None needed.
Hand Protection: Protective gloves for hypersensitive persons.
Eye Protection: Glasses, if applied to parts in motion.
Body Protection: Overalls.

IX. Physical and Chemical Properties:
Physical State: Semi-solid fiberous
Color: Medium blue
Odor: Mild
pH: Neutral
Boiling Range / Point ˚F (˚C): >600 (>316)
Pour Point ˚F (˚C): None
Flash Point (COC) ˚F (˚C): >400 (>204)
Autoignition Temperature ˚F (˚C): >500 (>260)
Explosive Properties LEL: UN UEL: UN

Evaporation Rate (Butyl Acetate): <0.01
Partition Coefficient (Loq Pow): N/A
Vapor Pressure (kPa): <0.01
Percent Volatiles: None
Density (g/cm^3): 0.88
Flammability: Not flammable at ambient temp.
OAR Value: N/A (no volatiles)
Oxidizing Properties: None
Water Soluability: Insoluable
Vapor Density: >5

X. Stability and Reactivity:

Stability: Chemically stable under normal conditions. No photoreactive agents.
Conditions to Avoid: Powerful sources of ignition and extreme temperatures.
Materials to Avoid: Strong inorganic and organic acids, oxidizing agents.
Hazardous Decomposition Products: Burning generates smoke, airborne soot, hydrocarbons and oxides of carbon. Residue mainly comprised of soot and mineral oxides.

XI. Toxicological Information:

Acute Toxicity: Not known
Irritancy-Skin: Very mild
Skin Sensitization: Not known
Subacute / Sub-chronic Toxicity: Not known
Genotoxicity: None known
Chronic Toxicity: None known

California Prop 65: None
Carcinogen: NTP: No
IARC: No
OSHA: No
EC Classification (67 / 548 / EEC): No
LC-50: >4000mg/kg - extrapolated from component data
LD-50: N/A

XII. Ecological Information:

Possible Effects: None
Behavior: Relatively well behaved. Bioaccumulation potential nil.
Environmental Fate: Highly unlikely to cause contamination. Nontoxic to marine or land organisms.

XIII. Waste and Container Disposal:

Waste Disposal: Contact a waste disposal company or local authority for advice.
Container Disposal: Pails without liner see "Waste Disposal" above. Pails with a plastic liner can only be disposed via standard waste disposal services, recycled or reused.
Liner: See "Waste Disposal" above.

XIV. Transport Information:

DOT: Nonhazardous
UN No.: N/A
DOT: Nonhazardous

Air Transport (ICAO, IATA): N/A
Sea Transport (IMO, IMDG): N/A
Road and Rail Transport (ADR / RID): N/A

XV. Regulatory Information:

Labeling Information: None needed
EC Annex 1 Class.: N/A
R Phrases: R22 harmul if swallowed (could block passages)
SARA 311 / 312: None
S Phrases: None applicable, as known.
Ozone Depleting Chemicals: N/A

CERCLA: Nonhazardous
TSCA: All components are listed
WHMIS (Canada): Not regulated
Canadian DSL: All components are listed
40 CFR Part 372 (SARA Section 313): N/A
RCRA Hazard Class: Nonhazardous
TSCA 12B Components: None

XVI. Other Information:

Signature: A.J. Gustavsen

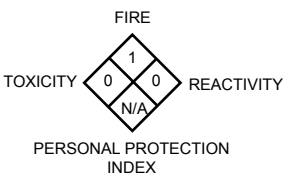
Prepared By: A.J. Gustavsen, Ph.D.

Date Issued: August 16, 2001

LEGEND

I. Identification of the Substance / Preparation and Company
II. Composition Information on Ingredients
III. Hazards Identification
IV. First Aid Measures
V. Fire Fighting Measures
VI. Accidental Release Measures
VII. Handling and Storage
VIII. Exposure Control / Personal Protection
IX. Physical and Chemical Properties
X. Stability and Reactivity
XI. Toxicological Information
XII. Ecological Information
XIII. Waste Disposal
XIV. Transport Information
XV. Regulatory Information
XVI. Other Information

NFPA SYMBOL



HMIS SYMBOL

HEALTH	0
FLAMMABILITY	1
REACTIVITY	0
PPI	N/A

DYNACON, INC.
WINCHES-HANDLING SYSTEMS

Lubrication System Components

*19 liter (5 gal.) container of Tuffcoat-M lubricant

*208 liter (55 gal.) drum of Tuffcoat-M lubricant

*19 liter (5 gal.) Pump System

Including hoses and stainless steel quick disconnect couplings

*208 liter (55 gal.) Pump System

Including hoses and stainless steel quick disconnect couplings

*Lubricator Injector Tool

*Seal Sets for Lubricator Injector Tool

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DYNACON LUBRICATOR AND ACCESSORIES PRICE LIST

ACCESSORIES

55 Gallon RAM Pump with Stand
Price includes hoses and Stainless Steel QD's
5 Gallon RAM Cart
Price includes hoses and Stainless Steel QD's
DYNACON Lubricator (Lubricant Injector)
DYNACON Lubricator Tool Seal Set
(Specify cable size)

55 Gallon Drum of TuffCoat-Marine Lubricant
5 Gallon Drum of TuffCoat-Marine Lubricant

SPARES

3000psi Pressure Gauge
Stainless Steel Quick Disconnect (Coupler)
Stainless Steel Quick Disconnect (Nipple)
108 in. 3000psi Product Hose
(12BXX HY12-0812-12)
24 in. 3000psi Product Hose
Polyurethane Dust Caps
(Male & Female Set)

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DYNACON, INC. TUFF-TOOL CABLE LUBRICATOR SYSTEM
Installation & Operational Instructions

Your new Dynacon, Inc. Tuff-Tool is shipped to you with all the hoses, fittings, & hardware necessary for use. The seals are made according to cable diameter and should be ordered to fit your individual application. The standard Tuff-Tool will accommodate umbilical cables up to 2" in diameter. Larger tools can be made upon request. The Tuff-Tool System will also include a Graco brand pneumatic pump for delivery of the TuffCoat-M cable lubricant to the Tuff-Tool. The operational procedures of the pump are outlined in the Graco manual supplied with the pump.

System Assembly

As previously mentioned, all components for use are included. You need only attach the JIC fitting on the Tuff-Tool hose assembly to that on the pump outlet to complete the delivery system.

Operational Instructions

1. The first step when using your new Tuff-Tool is to identify the cable diameter. This can be done with a pair of calipers if the size is not known. Once the diameter is determined, select the proper size seals.

2. The next step is to prepare your work area and locate the necessary tools required to assemble your Tuff-Tool. It is a good idea to put a plastic sheet or a container under the lubricator to catch any pre-existing lubricant that may be displaced from the cable due to injection of Tuff-Coat-M. Tools needed include a 15/16" wrench, a 15/16" socket, a ratchet or impact wrench, anchor chains and rags for clean up.

3. It is very important that the cable be under tension when the Tuff-Tool is assembled around it. This will help equalize any slack strands in the armor, so that the slack is not simply pushed up the cable by the gripping force of the lubricator. Be sure to set up the Tuff-Tool where it can be anchored, by means of chains, turnbuckles, or similar suitable devices, to a fixed object capable of withstanding approximately 1,000–2,000 lbs. of tension. It is also very important that the tool runs straight and not at an angle to the cable, as this will cause premature seal wear.

4. To install the Tuff-Tool, take the seal sets and place them around the cable so that the concave ends are facing each other and spaced so that they will fit inside the pressure chamber. Orient the seals so that the split between the two halves is at 90 degrees to that of the Tuff-Tool. Make sure that the O-ring seal on the tool face is in place and is not damaged. Once you have the seals on the cable, bolt the two halves of the Tuff-Tool around the cable with the 5/8" bolts and washers provided (15/16" wrench), so that the seals are in their proper slots. After the tool is installed, secure it to the pre-determined anchor location with the chains, etc. **Again, make sure that the tool tracks parallel to the cable path.**

5. After the Tuff-Tool is installed, connect the two quick-disconnects on the hose assembly to those on the Tuff-Tool. The system is now ready for use.

6. To begin lubricating, you must first load a bucket of TuffCoat-M into the pump. **Note: Read and follow all manufacturer's directions when using the Graco pump.**

7. After the bucket is loaded, turn air regulator to its lowest setting and connect air line. Slowly increase air pressure until the pump starts to cycle. Once it starts to pump, continue pumping until the Tuff-Tool pressure chamber is full. This is evidenced by the pressure rise on the gauge on the Tuff-Tool. You are now ready to lubricate the cable.

8. Start by pulling the cable slowly through the lubricator, while increasing air pressure to the pump, until the desired speed is reached. Remember that the volume of material in the pressure chamber affects chamber pressure. The faster the cable is moving, the more material is being used and, therefore, air pressure must be increased to maintain chamber volume and pressure. Conversely, air pressure should be turned off when the cable is stopped to prevent higher than desired pressures and waste of product.

Note: Pressure requirements can vary depending on the cable you are lubricating. In general, 300-500 psi in the lube chamber is sufficient to force lubricant to the core of a new, un-lubricated cable. If the cable is used, more pressure may be necessary to displace any material existing in the voids of the armor strands. Other factors such as cable size, "tightness" of the armor strands, rust or scale in the cable, and the condition of existing materials in the cable, can all affect pressure requirements. Obviously, hardened materials that are too big to pass between the strands of armor cannot be expelled, but the voids will be filled With TuffCoat-M, lubricating and preventing corrosion in the cable. As a rule, pressure is sufficient when lubricant can be seen trying to push out between the armor strands on the exit side of the Tuff-Tool. This indicates that there is lubricant pressure inside the cable, and there are no voids left to fill.

9. To replace an empty bucket, turn the ram director on the Graco pump to the "up" position, while simultaneously pressing the air bleeder valve. This will raise the follower plate while keeping the bucket on the floor. The bucket can now be exchanged with a new one.

10. To remove the Tuff-Tool from the cable after lubricating is completed, first disconnect the pump hoses at the quick-disconnects on the Tuff-Tool. If the Q-D's will not disconnect, there is still pressure in the chamber. **Do not unbolt the pressure chamber halves until the pressure has reduced enough to allow disconnection of the Q-D's.** Then, remove the 5/8" bolts and remove the tool in reverse order of installation. It's a good idea to have a container of solvent nearby to put the tool in for easy cleanup. Any mineral solvent (mineral spirits, diesel, Varsol, etc) can be used, as well as the various citrus-based cleaners. There is no need to purge the pump or the hoses, as TuffCoat-M will not harden or degrade in the system. If the Tuff-Tool is to be stored in solvent, remove the pressure gauge to prevent infiltration of solvent into the gauge over time.

DYNACON, INC.
WINCHES-HANDLING SYSTEMS

Lubrication System

Selected Customer References

C&C Technologies

Hard Suits, Inc.

Naval Oceanographic Office

NSW

Oceaneering International, Inc.

Perry Slingsby Systems

Sonsub International

Stolt Comex Seaway

Thales Geosolutions

Transoceanic Cableship Company

Tycom, Inc.

Tyco Submarine Systems

United States Navy Deep Submergence Unit

Woods Hole Oceanographic Institution

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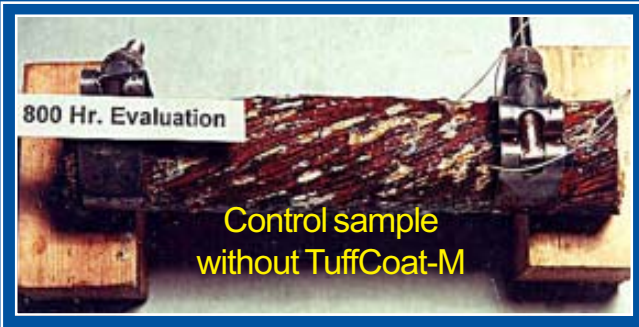
The following photos are prime examples of the various lubricants used to coat cable in the industry today.

Polymer lubricants exposed to extreme cold or heat, tend to crack and peel increasing cable friction.
Standard lubricants applied to cable surfaces cannot resist washout by water.
Tuff Coat-M forms an ionic bond to the wire and results in a tenacious film that displaces water from the metal surface.

Polymer lubricant applied to cable surface

Standard lubricant applied to cable surface

Salt spray exposure test



Salt Spray Exposure Test (ASTM B117) in which a cable sample coated with **"Tuff Coat-M"** and an un-coated control sample were exposed to salt spray for a period of 800 hours. **"Tuff Coat–M"** sample received a final rating of "8" (described as," few isolated corroded areas, less than 0.1% of surface corroded) in accordance with the ASTM D610 grading scheme. The control sample received a final rating of "0" (described as," approximately 100% of the surface corroded") .

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Tuff Coat-M

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