
American
Polywater®
Corporation
2010
Product
Catalog
Revision 10125

Navigating and Searching the Polywater Catalog and Website

There are several features of Adobe Reader that can help you find information in the Polywater Catalog.

Bookmark Use: Activate the “Bookmarks” tab. The bookmarks are organized by product and function and can lead you to the literature for a specific product. Click the plus sign (+) next to a general bookmark to expand it and see the specific documents that are available under that heading.

Adobe Reader Search: The Reader search function will search for words in the text of all the documents in the catalog. To start a search, click on the Search tool or choose Edit > Search. Enter the word or phrase you want to search. The results appear in page order showing a few words of the context in which the search word appears. You can click on any item from the list to view the source document.

Product Number Search: Using the search function described above, you can search for the specific product associated with a Polywater® product number. Please enter the product number in its proper format, which should have a hyphen (example: D-640)

Polywater Website Search: Polywater’s website contains support and technical information not included in the catalog. You can initiate a search of Polywater’s website through the link: www.polywater.com/startsearch.asp

Catalog Numbers

Alphabetical Listing of Valid Polywater® Catalog Numbers
Linked to the Appropriate Product Flyer

Catalog #	Status	Trade Name & Description	Link to Product Flyer	
A-32	Stock Item	Polywater® A Lubricant Quart	PDF on CD	HTML on Web
A-128	Stock Item	Polywater® A Lubricant Gallon	PDF on CD	HTML on Web
A-640	Stock Item	Polywater® A Lubricant 5-Gallon	PDF on CD	HTML on Web
A-DRUM	Special Order	Polywater® A Lubricant 55-Gallon	PDF on CD	HTML on Web
AR-KIT	Special Order	AirRepair® Leak Sealant Kit	PDF on CD	HTML on Web
AR-PRIMER	Special Order	AirRepair® Primer for Plastic	PDF on CD	HTML on Web
AR-STICK	Special Order	AirRepair® Putty Stick	PDF on CD	HTML on Web
B-1	Stock Item	Boom™ Wipes	PDF on CD	HTML on Web
B-D72	Stock Item	Boom™ Wipes Canister	PDF on CD	HTML on Web
BRK-KIT	Stock Item	PowerPatch® Pad n Pole™ Repair Kit	PDF on CD	HTML on Web
BRK-KITG	Stock Item	PowerPatch® Pad n Pole™ Repair Kit w/TOOL	PDF on CD	HTML on Web
BRK-KITB6	Stock Item	PowerPatch® Pad n Pole™ Repair Bulk Kit	PDF on CD	HTML on Web
BRK-KITB6G	Stock Item	PowerPatch® Pad n Pole™ Repair Bulk Kit w/TOOL	PDF on CD	HTML on Web
BRK-TOOL50	Stock Item	PowerPatch® Pad n Pole™ Repair Dispensing Tool	PDF on CD	HTML on Web
BT-CART12PK	Special Order	BonDuit® Adhesive Cartridges	PDF on CD	HTML on Web
BT-KIT	Stock Item	BonDuit® Adhesive Kit	PDF on CD	HTML on Web
BT-KITG	Stock Item	BonDuit® Adhesive Kit w/Tool	PDF on CD	HTML on Web
BT-KITB6	Stock Item	BonDuit® Adhesive Kits	PDF on CD	HTML on Web
BT-KITB6G	Stock Item	BonDuit® Adhesive Kits w/Tool	PDF on CD	HTML on Web
BT-TOOL	Stock Item	BonDuit® Dispensing Tool	PDF on CD	HTML on Web
BT-10NOZZLE	Stock Item	BonDuit® Mixing Nozzles	PDF on CD	HTML on Web
BWC-128	Special Order	Boom™ Wash Concentrate Gallon	PDF on CD	HTML on Web
CAV-1	Stock Item	Lubricant Application Video		HTML on Web
CCV-1	Stock Item	Cable Cleaning Video		HTML on Web
CF-35	Stock Item	CableFree® Loosener Quart	PDF on CD	HTML on Web
CF-128	Stock Item	CableFree® Loosener Gallon	PDF on CD	HTML on Web
CF-640	Stock Item	CableFree® Loosener 5-Gallon	PDF on CD	HTML on Web
CFO-1	Stock Item	Fiber Lubricant Video		HTML on Web
CG-13	Stock Item	Type CG™ Cold Gavanizing Spray	PDF on CD	HTML on Web
CIEV-1	Stock Item	Cable Installation Video		HTML on Web
CLR-35	Stock Item	Polywater® CLR Lubricant Quart	PDF on CD	HTML on Web
CLR-128	Stock Item	Polywater® CLR Lubricant Gallon	PDF on CD	HTML on Web
CLR-640	Special Order	Polywater® CLR Lubricant 5-Gallon	PDF on CD	HTML on Web
CWS-22	Stock Item	CableWash™ Solution 22-Ounce Sprayer/Scrubber	PDF on CD	HTML on Web
CWS-128	Stock Item	CableWash™ Solution Gallon	PDF on CD	HTML on Web
CWS-D72	Special Order	CableWash™ 72-Count Scrub Canister	PDF on CD	HTML on Web
D-19	Special Order	Dyna-Blue® Lubricant Pouch	PDF on CD	HTML on Web
D-35	Stock Item	Dyna-Blue® Lubricant Quart	PDF on CD	HTML on Web
D-128	Stock Item	Dyna-Blue® Lubricant Gallon	PDF on CD	HTML on Web
D-640	Stock Item	Dyna-Blue® Lubricant 5-Gallon	PDF on CD	HTML on Web
D-DRUM	Stock Item	Dyna-Blue® Lubricant 55-Gallon	PDF on CD	HTML on Web
D-RACK	Stock Item	Display Rack for Distributors		HTML on Web
DT-69	Stock Item	SpliceMaster® Dry Towels 6"x9"	PDF on CD	HTML on Web
DT-D50	Stock Item	FiberKleen™ Dry Towels Canister	PDF on CD	HTML on Web
DT-1212	Stock Item	SpliceMaster® Dry Towels 12"x12"	PDF on CD	HTML on Web
DT-D65	Stock Item	Dispensing canister of 65 8" x 12" dry wipes	PDF on CD	HTML on Web
EP-KIT11	Stock Item	PowerPatch® Repair Kit	PDF on CD	HTML on Web
EP-KIT51	Stock Item	PowerPatch® Repair Kits	PDF on CD	HTML on Web
EP-KITB6	Stock Item	PowerPatch® Repair Kits	PDF on CD	HTML on Web
EP-KITB12	Stock Item	PowerPatch® Repair Kits	PDF on CD	HTML on Web
EP-STICK2	Stock Item	PowerPatch® Putty Stick	PDF on CD	HTML on Web
EP-STICK4	Stock Item	PowerPatch® Putty Stick	PDF on CD	HTML on Web
F-35	Stock Item	Polywater® F Lubricant Quart	PDF on CD	HTML on Web
F-128	Stock Item	Polywater® F Lubricant Gallon	PDF on CD	HTML on Web

Catalog Numbers

Alphabetical Listing of Valid Polywater® Catalog Numbers
Linked to the Appropriate Product Flyer

Catalog #	Status	Trade Name & Description	Link to Product Flyer	
F-320	Stock Item	Polywater® F Lubricant 2½-Gallon	PDF on CD	HTML on Web
F-640	Stock Item	Polywater® F Lubricant 5-Gallon	PDF on CD	HTML on Web
F-DRUM	Stock Item	Polywater® F Lubricant 55-Gallon	PDF on CD	HTML on Web
FC-2LP	Stock Item	Type FC™ 2-Ounce Spray		HTML on Web
FC-PEN	Stock Item	Type FC™ Pump Tip Pen		HTML on Web
FC-KIT2	Stock Item	Type FC™ Cleaning Kit		HTML on Web
FD-9	Stock Item	Type FD™ Cleaner Spray	PDF on CD	HTML on Web
FD-16LF	Stock Item	Type FD™ Cleaner Pint	PDF on CD	HTML on Web
FD-35LF	Stock Item	Type FD™ Cleaner Quart	PDF on CD	HTML on Web
FD-128	Stock Item	Type FD™ Cleaner Gallon	PDF on CD	HTML on Web
FD-640	Stock Item	Type FD™ Cleaner 5-Gallon	PDF on CD	HTML on Web
FD-DRUM	Stock Item	Type FD™ Cleaner 55-Gallon	PDF on CD	HTML on Web
FO-1	Stock Item	Type FO™ Alcohol Wipe	PDF on CD	HTML on Web
FO-16	Stock Item	Type FO™ Alcohol Pint	PDF on CD	HTML on Web
FO-32	Stock Item	Type FO™ Alcohol Quart	PDF on CD	HTML on Web
FO-128	Stock Item	Type FO™ Alcohol Gallon	PDF on CD	HTML on Web
FST-180	Stock Item	FST™ Foam Duct Sealant	PDF on CD	HTML on Web
FST-180-KIT	Stock Item	FST™ Foam Duct Sealant Kit	PDF on CD	HTML on Web
FST-180-KITS	Stock Item	FST™ Foam Duct Sealant Kit	PDF on CD	HTML on Web
FST-250	Stock Item	FST™ Foam Duct Sealant Kit	PDF on CD	HTML on Web
FST-250-KIT	Stock Item	FST™ Foam Duct Sealant Kit	PDF on CD	HTML on Web
FST-TOOL250	Stock Item	FST™ Foam Duct Sealant Tool	PDF on CD	HTML on Web
FST-DAM	Stock Item	FST™ Foam Duct Sealant Dam	PDF on CD	HTML on Web
FST-TOOL	Stock Item	FST™ Foam Duct Sealant Tool	PDF on CD	HTML on Web
FTTx-35LR	Stock Item	Polywater® FTTx Lubricant Quart	PDF on CD	HTML on Web
FTTx-D20	Stock Item	Polywater® FTTx Lubricant Wipe	PDF on CD	HTML on Web
FTTx-128	Special Order	Polywater® FTTx Lubricant Gallon	PDF on CD	HTML on Web
FTTx-640	Special Order	Polywater® FTTx Lubricant 5-Gallon	PDF on CD	HTML on Web
G-27	Stock Item	Polywater® G Lubricant Quart Bag	PDF on CD	HTML on Web
G-35	Stock Item	Polywater® G Lubricant Quart	PDF on CD	HTML on Web
G-55	Stock Item	Polywater® G Lubricant ½-Gallon Bag	PDF on CD	HTML on Web
G-128	Stock Item	Polywater® G Lubricant Gallon	PDF on CD	HTML on Web
G-640	Stock Item	Polywater® G Lubricant 5-Gallon	PDF on CD	HTML on Web
GP-1	Stock Item	Type GP™ Cleaner Wipe	PDF on CD	HTML on Web
GP-8	Special Order	Type GP™ Cleaner ½-Pint	PDF on CD	HTML on Web
GP-16LF	Stock Item	Type GP™ Cleaner Pint	PDF on CD	HTML on Web
GP-35LF	Stock Item	Type GP™ Cleaner Quart	PDF on CD	HTML on Web
GP-128	Stock Item	Type GP™ Cleaner Gallon	PDF on CD	HTML on Web
GP-640	Stock Item	Type GP™ Cleaner 5-Gallon	PDF on CD	HTML on Web
GP-T369	Stock Item	Type GP™ Cleaner Prep Kit	PDF on CD	HTML on Web
GP-T369/S	Stock Item	Type GP™ Cleaner Prep Kit w/Sandpaper	PDF on CD	HTML on Web
GSQ-128	Stock Item	GrandSlam™ Pipe Lubricant Gallon		HTML on Web
GSQ-448	Stock Item	GrandSlam™ Pipe Lubricant 3½-Gallon		HTML on Web
GSQ-640	Stock Item	GrandSlam™ Pipe Lubricant 5-Gallon		HTML on Web
GWQ-128	Stock Item	GrandSlam™ Pipe Lubricant Gallon		HTML on Web
GWQ-448	Stock Item	GrandSlam™ Pipe Lubricant 3½-Gallon		HTML on Web
GWQ-640	Stock Item	GrandSlam™ Pipe Lubricant 5-Gallon		HTML on Web
HP-1	Stock Item	SpliceMaster® Type HP™ Cleaner Wipe	PDF on CD	HTML on Web
HP-16LF	Stock Item	SpliceMaster® Type HP™ Cleaner Pint	PDF on CD	HTML on Web
HP-16LFR	Special Order	SpliceMaster® Type HP™ Cleaner Pint w/Sprayer	PDF on CD	HTML on Web
HP-16LR	Special Order	SpliceMaster® Type HP™ Cleaner Pint w/Sprayer	PDF on CD	HTML on Web
HP-35LF	Stock Item	SpliceMaster® Type HP™ Cleaner Quart	PDF on CD	HTML on Web
HP-35LR	Special Order	SpliceMaster® Type HP™ Cleaner Quart w/Sprayer	PDF on CD	HTML on Web
HP-128	Stock Item	SpliceMaster® Type HP™ Cleaner Gallon	PDF on CD	HTML on Web

Catalog Numbers

Alphabetical Listing of Valid Polywater® Catalog Numbers
Linked to the Appropriate Product Flyer

Catalog #	Status	Trade Name & Description	Link to Product Flyer	
HP-640	Stock Item	SpliceMaster® Type HP™ Cleaner 5-Gallon	PDF on CD	HTML on Web
HP-D72	Stock Item	SpliceMaster® Type HP™ Cleaner Wipes Canister	PDF on CD	HTML on Web
HP-DRUM	Stock Item	SpliceMaster® Type HP™ Cleaner 55-Gallon	PDF on CD	HTML on Web
HP-P63	Stock Item	SpliceMaster® Type HP™ Cleaner Wipes Prep Kit	PDF on CD	HTML on Web
HP-P158ID	Stock Item	SpliceMaster® Type HP™ Tandem Pack™ Wipe	PDF on CD	HTML on Web
HP-P369	Special Order	SpliceMaster® Type HP™ Cleaner Wipes Pouch	PDF on CD	HTML on Web
HP-T369	Stock Item	SpliceMaster® Type HP™ Cleaner Wipes Prep Kit	PDF on CD	HTML on Web
HP-T369/S	Stock Item	SpliceMaster® Type HP™ Cleaner Wipes Prep Kit w/Sandpaper	PDF on CD	HTML on Web
HP-T369/SD	Stock Item	SpliceMaster® Type HP™ Prep Kit w/Sandpaper & Dry Towel	PDF on CD	HTML on Web
HPY-12	Stock Item	SpliceMaster® Type HP™ Cleaner Aerosol	PDF on CD	HTML on Web
HS-1	Stock Item	HydraSol® Cable Gel Remover Wipe	PDF on CD	HTML on Web
HS-16LR	Stock Item	HydraSol® Cable Gel Remover Pint w/Sprayer	PDF on CD	HTML on Web
HS-32	Stock Item	HydraSol® Cable Gel Remover Quart w/Flip Top	PDF on CD	HTML on Web
HS-32LR	Stock Item	HydraSol® Cable Gel Remover Quart w/Sprayer	PDF on CD	HTML on Web
HS-96	Stock Item	HydraSol® Cable Gel Remover 3-Quart	PDF on CD	HTML on Web
HS-128	Stock Item	HydraSol® Cable Gel Remover Gallon	PDF on CD	HTML on Web
HS-384	Stock Item	HydraSol® Cable Gel Remover 3-Gallon	PDF on CD	HTML on Web
HS-640	Stock Item	HydraSol® Cable Gel Remover 5-Gallon	PDF on CD	HTML on Web
HS-D72	Stock Item	HydraSol® Cable Gel Remover Wipes Canister	PDF on CD	HTML on Web
HS-DRUM	Stock Item	HydraSol® Cable Gel Remover 55-Gallon	PDF on CD	HTML on Web
HTC-1	Stock Item	Grime-Away™ Tool Cleaner Individual Wipe	PDF on CD	HTML on Web
HTC-D72	Stock Item	Grime-Away™ Tool Cleaner Wipes Canister	PDF on CD	HTML on Web
IS-3	Stock Item	3-Gal Industrial Sprayer for Polywater® SPY & WSPY	PDF on CD	HTML on Web
J-19	Special Order	Polywater® J Lubricant Pouch	PDF on CD	HTML on Web
J-27	Stock Item	Polywater® J Lubricant Quart Bag in Box	PDF on CD	HTML on Web
J-35	Stock Item	Polywater® J Lubricant Quart Bottle	PDF on CD	HTML on Web
J-55	Stock Item	Polywater® J Lubricant ½-Gallon Bag in Box	PDF on CD	HTML on Web
J-99	Stock Item	Polywater® J Lubricant Quart Bag in Pail	PDF on CD	HTML on Web
J-110	Stock Item	Polywater® J Lubricant ½-Gallon Bag in Pail	PDF on CD	HTML on Web
J-128	Stock Item	Polywater® J Lubricant Gallon Pail	PDF on CD	HTML on Web
J-640	Stock Item	Polywater® J Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
J-DRUM	Stock Item	Polywater® J Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
KC-4	Stock Item	Type KC™ Cleaner 6-oz. Aerosol	PDF on CD	HTML on Web
KC-16	Stock Item	Type KC™ Cleaner 16-oz. Aerosol	PDF on CD	HTML on Web
LL-35	Special Order	Economy Loop™ Lubricant Quart Bottle		HTML on Web
LL-128	Stock Item	Economy Loop™ Lubricant Gallon Jug		HTML on Web
LL-640	Stock Item	Economy Loop™ Lubricant 5-Gallon Pail		HTML on Web
LL-DRUM	Special Order	Economy Loop™ Lubricant 55-Gallon Drum		HTML on Web
LP-3	Stock Item	Polywater® Lubricant Pump--Hand Operated	PDF on CD	HTML on Web
LP-D5	Stock Item	Polywater® Lubricant Pump--Drill Operated	PDF on CD	HTML on Web
LZ-35	Stock Item	Polywater® LZ Lubricant Quart	PDF on CD	HTML on Web
LZ-128	Stock Item	Polywater® LZ Lubricant Gallon	PDF on CD	HTML on Web
LZ-384	Special Order	Polywater® LZ Lubricant 3-Gallon	PDF on CD	HTML on Web
LZ-640	Stock Item	Polywater® LZ Lubricant 5-Gallon	PDF on CD	HTML on Web
LZ-DRUM	Stock Item	Polywater® LZ Lubricant 55-Gallon	PDF on CD	HTML on Web
NB-35	Special Order	Polywater® Plus Silicone™ Type NB Lubricant Quart Bottle	PDF on CD	HTML on Web
NB-128	Stock Item	Polywater® Plus Silicone™ Type NB Lubricant Gallon Pail	PDF on CD	HTML on Web
NB-320	Stock Item	Polywater® Plus Silicone™ Type NB Lubricant 2½-Gallon Jug	PDF on CD	HTML on Web
NB-640	Stock Item	Polywater® Plus Silicone™ Type NB Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
NB-DRUM	Special Order	Polywater® Plus Silicone™ Type NB Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
NF-T369	Stock Item	SpliceMaster® Type NF™ Cleaner Wipes Prep Kit	PDF on CD	HTML on Web

Catalog Numbers

Alphabetical Listing of Valid Polywater® Catalog Numbers Linked to the Appropriate Product Flyer

Catalog #	Status	Trade Name & Description	Link to Product Flyer	
NF-T369/S	Stock Item	SpliceMaster® Type NF™ Cleaner Wipes Prep Kit w/Sandpaper	PDF on CD	HTML on Web
NL-128	Stock Item	Network Loop™ Lubricant Gallon Jug	PDF on CD	HTML on Web
NL-640	Stock Item	Network Loop™ Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
NN-35	Stock Item	Polywater® Plus Silicone™ Type NN Lubricant Quart Bottle	PDF on CD	HTML on Web
NN-128	Stock Item	Polywater® Plus Silicone™ Type NN Lubricant Gallon Pail	PDF on CD	HTML on Web
NN-320	Special Order	Polywater® Plus Silicone™ Type NN Lubricant 2½-Gallon Jug	PDF on CD	HTML on Web
NN-640	Stock Item	Polywater® Plus Silicone™ Type NN Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
NN-DRUM	Special Order	Polywater® Plus Silicone™ Type NN Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
P-35	Stock Item	Polywater® Prelube 2000™ Blowing Lubricant Quart Bottle	PDF on CD	HTML on Web
P-128	Stock Item	Polywater® Prelube 2000™ Blowing Lubricant Gallon Jug	PDF on CD	HTML on Web
P-640	Stock Item	Polywater® Prelube 2000™ Blowing Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
P7-12	Stock Item	Type P7™ Penetrating Oil Aerosol	PDF on CD	HTML on Web
PB-5	Special Order	Pump Sprayer for Polywater® SPY & WSPY	PDF on CD	HTML on Web
PFL-16	Stock Item	Pflubber Duct Block, 1.25 inch by .25 inch by 16 inches		HTML on Web
PJ-35	Special Order	Polywater® PJ Lubricant Quart Bottle	PDF on CD	HTML on Web
PJ-128	Stock Item	Polywater® PJ Lubricant Gallon Pail	PDF on CD	HTML on Web
PJ-320	Stock Item	Polywater® PJ Lubricant 2½-Gallon Jug	PDF on CD	HTML on Web
PJ-640	Stock Item	Polywater® PJ Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
PJ-DRUM	Stock Item	Polywater® PJ Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
PL-3	Stock Item	PL-3™ Pump Packing Lubricant Quart Bottle		HTML on Web
PL-5	Special Order	PL-5™ Pump Packing Lubricant Quart Bottle		HTML on Web
PM-8	Stock Item	Polywater® Prelube 5000™ Microcable Blowing Lubricant 8-oz. Bottle	PDF on CD	HTML on Web
PP-3000	Stock Item	Pull-Planner™ Cable Pulling Software (latest version)	PDF on CD	HTML on Web
PR-128	Special Order	Polywater® PR Lubricant Gallon Jug	PDF on CD	HTML on Web
PR-320	Special Order	Polywater® PR Lubricant 2.5 Gallon Jug	PDF on CD	HTML on Web
PR-640	Special Order	Polywater® PR Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
PR-DRUM	Special Order	Polywater® PR Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
PR-TOTE275	Special Order	Polywater® PR Lubricant 275-Gallon Tote	PDF on CD	HTML on Web
QC-2LP	Stock Item	QuicKleen™ 2oz pump-spray plastic bottle	PDF on CD	HTML on Web
QC-KIT2	Stock Item	QuicKleen™ Kit (Contains 2 DT-D50, 1 QC-2LP and 1 SWB-250F100, all in a handy nylon bag)	PDF on CD	HTML on Web
RBG-1	Stock Item	Rubber Goods Cleaner Saturated Wipe	PDF on CD	HTML on Web
RBG-35LR	Stock Item	Rubber Goods Cleaner Quart Spray Bottle	PDF on CD	HTML on Web
RBG-128	Stock Item	Rubber Goods Cleaner 1-Gallon Jug	PDF on CD	HTML on Web
RBG-640	Stock Item	Rubber Goods Cleaner 5-Gallon Pail	PDF on CD	HTML on Web
RBG-D72	Stock Item	Rubber Goods Cleaner Wipes Canister	PDF on CD	HTML on Web
RL-35	Stock Item	Premise Loop™ Lubricant Quart Bottle	PDF on CD	HTML on Web
RL-128	Stock Item	Premise Loop™ Lubricant Gallon Jug	PDF on CD	HTML on Web
S-1	Stock Item	S-1™ Hot Stick Cleaning Wipe	PDF on CD	HTML on Web
SB-128	Special Order	HoleShot™ B HDD Fluid Additive Gallon Pail	Call for details	
SB-640	Special Order	HoleShot™ B HDD Fluid Additive 5-Gallon Pail	Call for details	
SG-6	Stock Item	SureGrip™ Cable Pulling Gloves 6-pair		HTML on Web
SG-12	Stock Item	SureGrip™ Cable Pulling Gloves 12-pair		HTML on Web
SMP-5	Special Order	SpliceMaster® Solvent Pump		HTML on Web
SP-ROLL	Stock Item	SpliceMaster® Sanding Cloth 50-Yard Roll	PDF on CD	HTML on Web
SPY-35LR	Stock Item	Polywater® SPY Lubricant Quart Spray Bottle	PDF on CD	HTML on Web
SPY-128	Stock Item	Polywater® SPY Lubricant 1-Gallon Jug	PDF on CD	HTML on Web
SPY-640	Stock Item	Polywater® SPY Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
SPY-D20	Stock Item	Polywater® SPY Lubricant Saturated Wipes Canister	PDF on CD	HTML on Web
ST-1	Special Order	SpliceMaster® Labeled Bottle 16-oz. Empty	PDF on CD	HTML on Web

Catalog Numbers

Alphabetical Listing of Valid Polywater® Catalog Numbers
Linked to the Appropriate Product Flyer

Catalog #	Status	Trade Name & Description	Link to Product Flyer	
ST-R	Stock Item	SpliceMaster® Trigger Spray Head for Pint & Quart Bottles	PDF on CD	HTML on Web
SWB-125F10	Stock Item	1.25mm FiberKleen™ Foam Swabs (10pack)	PDF on CD	HTML on Web
SWB-250F100	Stock Item	2.5mm FiberKleen™ Foam Swabs (100pack)	PDF on CD	HTML on Web
SWB-C100	Stock Item	FiberKleen™ cotton swab (100 pack)	PDF on CD	HTML on Web
SWB-M100	Stock Item	Mirror FiberKleen™ foam swab (100 pack)	PDF on CD	HTML on Web
SWB-V100	Stock Item	V Groove FiberKleen™ foam swab (100 pack)	PDF on CD	HTML on Web
TC-1	Stock Item	SqueekyKleen™ Communications Cleaner Wipe	PDF on CD	HTML on Web
TC-1D42	Stock Item	42 TC-1 in a dispenser pack	PDF on CD	HTML on Web
TC-16LF	Stock Item	SqueekyKleen™ Communications Cleaner Pint	PDF on CD	HTML on Web
TC-16LR	Stock Item	SqueekyKleen™ Communications Cleaner Pint w/Sprayer	PDF on CD	HTML on Web
TC-35LF	Stock Item	SqueekyKleen™ Communications Cleaner Quart	PDF on CD	HTML on Web
TC-35LR	Stock Item	SqueekyKleen™ Communications Cleaner Quart w/Sprayer	PDF on CD	HTML on Web
TC-128	Stock Item	SqueekyKleen™ Communications Cleaner Gallon	PDF on CD	HTML on Web
TC-384	Stock Item	SqueekyKleen™ Communications Cleaner 3-Gallon	PDF on CD	HTML on Web
TC-640	Stock Item	SqueekyKleen™ Communications Cleaner 5-Gallon	PDF on CD	HTML on Web
TC-96	Stock Item	SqueekyKleen™ Communications Cleaner 3 Quart	PDF on CD	HTML on Web
TC-D65	Stock Item	SqueekyKleen™ Communications Cleaner 65-Count Wipe Canister	PDF on CD	HTML on Web
TC-D65DRY	Stock Item	SqueekyKleen™ Communications Cleaner 65-Count Dry Wipe Canister	PDF on CD	HTML on Web
TC-DRUM	Stock Item	SqueekyKleen™ Communications Cleaner 55-Gallon Drum	PDF on CD	HTML on Web
TR-1	Stock Item	SpliceMaster® Type TR™ Cleaner Wipe	PDF on CD	HTML on Web
TR-1L	Stock Item	SpliceMaster® Type TR™ Cleaner Wipe Large	PDF on CD	HTML on Web
TR-16	Stock Item	SpliceMaster® Type TR™ Cleaner Aerosol	PDF on CD	HTML on Web
TR-KIT	Special Order	SpliceMaster® Type TR™ Cleaner Wipe Kit	PDF on CD	HTML on Web
TR-P63	Stock Item	SpliceMaster® Type TR™ Cleaner Wipe Prep Kit	PDF on CD	HTML on Web
W-1	Stock Item	W-1™ Wax & Buff Wipe	PDF on CD	HTML on Web
W-16	Stock Item	W-1™ Live-Line Tool Wax Pint	PDF on CD	HTML on Web
WB-8	Stock Item	IceFree™ Chemical Duct Block	PDF on CD	HTML on Web
WF-35	Stock Item	Polywater® WF Lubricant Quart Bottle	PDF on CD	HTML on Web
WF-128	Stock Item	Polywater® WF Lubricant Gallon Jug	PDF on CD	HTML on Web
WF-320	Stock Item	Polywater® WF Lubricant 2½-Gallon Jug	PDF on CD	HTML on Web
WF-640	Stock Item	Polywater® WF Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
WF-DRUM	Stock Item	Polywater® WF Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
WH-1	Special Order	IceFree™ Insertion Hose	PDF on CD	HTML on Web
WJ-27	Stock Item	Polywater® WJ Lubricant Quart Bag in Box	PDF on CD	HTML on Web
WJ-35	Stock Item	Polywater® WJ Lubricant Quart Bottle	PDF on CD	HTML on Web
WJ-55	Stock Item	Polywater® WJ Lubricant ½-Gallon Bag in Box	PDF on CD	HTML on Web
WJ-99	Stock Item	Polywater® WJ Lubricant Quart Bag in Pail	PDF on CD	HTML on Web
WJ-110	Stock Item	Polywater® WJ Lubricant ½-Gallon Bag in Pail	PDF on CD	HTML on Web
WJ-128	Stock Item	Polywater® WJ Lubricant Gallon Pail	PDF on CD	HTML on Web
WJ-640	Stock Item	Polywater® WJ Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
WJ-DRUM	Stock Item	Polywater® WJ Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
WLZ-35	Stock Item	Polywater® WLZ Lubricant Quart	PDF on CD	HTML on Web
WLZ-128	Stock Item	Polywater® WLZ Lubricant Gallon	PDF on CD	HTML on Web
WLZ-384	Special Order	Polywater® WLZ Lubricant 3-Gallon	PDF on CD	HTML on Web
WLZ-640	Stock Item	Polywater® WLZ Lubricant 5-Gallon	PDF on CD	HTML on Web
WLZ-DRUM	Stock Item	Polywater® WLZ Lubricant 55-Gallon	PDF on CD	HTML on Web
WNB-128	Stock Item	Polywater® Plus Silicone™ Type WNB Lubricant Gallon Pail	PDF on CD	HTML on Web
WNB-640	Stock Item	Polywater® Plus Silicone™ Type WNB Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
WNN-128	Stock Item	Polywater® Plus Silicone™ Type WNN Lubricant Gallon Pail	PDF on CD	HTML on Web
WNN-640	Stock Item	Polywater® Plus Silicone™ Type WNN Lubricant 5-Gallon Pail	PDF on CD	HTML on Web

Catalog Numbers

Alphabetical Listing of Valid Polywater® Catalog Numbers
Linked to the Appropriate Product Flyer

Catalog #	Status	Trade Name & Description	Link to Product Flyer	
WP-35	Stock Item	Polywater® Prelube 2000™ Blowing Lubricant for Winter Quart Bottle	PDF on CD	HTML on Web
WP-128	Stock Item	Polywater® Prelube 2000™ Blowing Lubricant for Winter Gallon Jug	PDF on CD	HTML on Web
WP-640	Stock Item	Polywater® Prelube 2000™ Blowing Lubricant for Winter 5-Gal Pail	PDF on CD	HTML on Web
WPJ-128	Stock Item	Polywater® WPJ Lubricant Gallon Pail	PDF on CD	HTML on Web
WPJ-320	Stock Item	Polywater® WPJ Lubricant 2½-Gallon Jug	PDF on CD	HTML on Web
WPJ-640	Stock Item	Polywater® WPJ Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
WPJ-DRUM	Stock Item	Polywater® WPJ Lubricant 55-Gallon Drum	PDF on CD	HTML on Web
WS-640	Special Order	IceFree™ Antifreeze Gel 5-Gallon Pail	PDF on CD	HTML on Web
WS-DRUM	Special Order	IceFree™ Antifreeze Gel 55-Gallon Drum	PDF on CD	HTML on Web
WSB-128	Special Order	HoleShot™ B HDD Fluid Additive for Winter Gallon Pail	Call for details	
WSB-640	Special Order	HoleShot™ B HDD Fluid Additive for Winter 5-Gallon Pail	Call for details	
WSPY-35LR	Stock Item	Polywater® WSPY Lubricant Quart Spray Bottle	PDF on CD	HTML on Web
WSPY-128	Stock Item	Polywater® WSPY Lubricant 1-Gallon Jug	PDF on CD	HTML on Web
WSPY-640	Stock Item	Polywater® WSPY Lubricant 5-Gallon Pail	PDF on CD	HTML on Web
WSPY-D20	Special Order	Polywater® WSPY Lubricant Saturated Wipes Canister	PDF on CD	HTML on Web
WX-35	Stock Item	Polywater® WX Lubricant Quart Bottle		HTML on Web
WX-128	Stock Item	Polywater® WX Lubricant Gallon Pail		HTML on Web
WX-640	Stock Item	Polywater® WX Lubricant 5-Gallon Pail		HTML on Web
WX-DRUM	Discontinued	Polywater® WX Lubricant 55-Gallon Drum		HTML on Web

American Polywater® Corporation

11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

Certification of Compliance with ARRA Buy American Provisions

The undersigned certify that the following provisions of the American Recovery and Reinvestment Act of 2009 have been achieved as provided in 48 CFR:

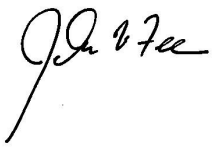
25.602 Policy.

Except as provided in 25.603—
(a) None of the funds appropriated or otherwise made available by the Recovery Act may be used for a project for the construction, alteration, maintenance, or repair of a public building or public work (as defined at 22.401) unless—
(1) The public building or public work is located in the United States; and
(2) All of the iron, steel, and other manufactured goods used as construction material in the project are produced or manufactured in the United States.
(i) Production in the United States of the iron or steel used as construction material requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives. These requirements do not apply to steel or iron used as components or subcomponents of other manufactured construction material.
(ii) There is no requirement with regard to the origin of components or subcomponents in other manufactured construction material, as long as the manufacture of the construction material occurs in the United States.
(b) Use only domestic unmanufactured construction material, as required by the Buy American Act.

This policy incorporates the following definitions:

25.601 Definitions.

As used in this subpart—
Domestic construction material means—
(1) An unmanufactured construction material mined or produced in the United States; or
(2) A construction material manufactured in the United States.
Foreign construction material means a construction material other than a domestic construction material.
Manufactured construction material means any construction material that is not unmanufactured construction material.
Recovery Act designated country means a World Trade Organization Government Procurement Agreement country, a Free Trade Agreement country, or a least developed country.
Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements.
Unmanufactured construction material means raw material brought to the construction site for incorporation into the building or work that has not been—
(1) Processed into a specific form and shape; or
(2) Combined with other raw material to create a material that has different properties than the properties of the individual raw materials.



John Fee
President
American Polywater Corp.

American Polywater® Corporation Environmental Statement

American Polywater manufactures specialty chemical products used in electrical and communications construction and maintenance. Polywater® products are designed and tested for specific field functions. This targeted approach makes Polywater® products both effective and efficient.

Product design and development at Polywater includes both safety and environmental considerations. Products are packaged for safe use and to avoid waste. While the use of Polywater® products does not require special equipment or knowledge, extensive instructional literature is available to promote best practices.

American Polywater® products:

- **Minimize end-user exposure**
- **Minimize release of volatile organics (global warming)**
- **Minimize waste and pollution**
- **Reduce energy and material consumption**
- **Use recycled and recyclable content**

Please see information specific to each technology

Cable Installation Lubricants

Adhesive Sealants

Cleaners

Cable Installation Lubricant Technology
Environmental Statement

Polywater® Lubricants are used to install cable that is pushed, pulled, or blown into conduit. Polywater® Lubricants are typically water-based compounds and many of the primary ingredients come from natural and renewable resources. Polywater® Lubricants contain minimal volatile organic content. Polywater® Lubricants are biodegradable and do not contain toxic components.

Polywater® Lubricants are extremely efficient. Polywater® Lubricants can reduce cable damage and loss during installation.

Resources:

Individual Product MSDS

Each MSDS contains information on VOC Content in Section 9, Physical Data

RoHS Statement

Polywater® Lubricants meet RoHS guidelines. Full statement is available.

LEED® or Green Seal Certification

Certification for this specific product category has not been established. Using typical lubricant criteria, Polywater® Lubricants would pass certification tests.

CARB and EPA Air Quality Standards

Polywater® Lubricants have limited VOC content. These products meet CARB and EPA air standards.

Other Information

Please contact American Polywater Corporation with other questions or requirements.

American Polywater® Corporation

5630 Memorial Ave. Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

RoHS Compliance

American Polywater Corporation is compliant with the European Union's Directive 2002/95/EC, Restrictions of Hazardous Substances (RoHS Directive).

Restricted Materials:

Quantity limit 0.1% by weight, (1000ppm):

1. Lead (Pb)
2. Mercury (Hg)
3. Hexavalent Chromium (Cr VI)
4. Flame retardants Polybrominated Biphenyls (PBB) and Polybrominated Diphenyl Ethers (PBDE)

Quantiy limit 0.01% by weight (100 ppm)

1. Cadmium (Cd)

American Polywater products do not contain restricted materials. They are in compliance with the RoHS Directive.

American Polywater® Corporation

5630 Memorial Ave. Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

Polywater® J Lubricant
Environmental Statement

- **Use for Green Certified Projects**

Polywater® J meets typical LEED® and Green Seal criteria. This lubricant is appropriate for use during cable installation on Green Certified projects.

- **Low VOC Content; Meets CARB**

Polywater® J complies with CARB regulations. It is water-based and does not contain solvents. The VOC content is 10 grams/Liter.

- **Non-Toxic, Safe to Use**

Polywater® J Lubricant is non-toxic and has an estimated LD_{50} greater than 50 gms/Kg. It does not contain carcinogens or reproductive toxins. It is not a skin sensitizer and will not cause skin or eye irritation. It does not contain ozone depleting compounds, heavy metals, phthalates, phosphates or alkyl phenol ethoxylates. Polywater® J Lubricant is non-combustible and safe to use.

- **Low Environmental Impact Packaging**

Polywater® J Lubricant is packaged in recyclable polyethylene containers. One-gallon pail packaging meets California Title 14 with 20% source reduction.

Proven

Polywater®

Lubricant J

High Performance Cable Lubricant For Heavy Cable Installations

- Maximum Friction Reduction
- Compatible With Most Cables*
- Temperature Stable
- Non-Combustible Residue
- Specification Grade

- Clean and Non-Staining
- High Cling Factor
- Application System
- UL & CSA Listed
- Available in cold weather (non-freezing) formula

**Not recommended for use with LSZH,LSHF jackets unless specifically tested.*
(see www.polywater.com/LSZH.asp for current information)

Polywater® Cable Lubricant J

Polywater® Lubricant J is a high performance, clean, slow-drying, water-based gel lubricant. Lubricant J provides maximum tension reduction in all types of cable pulling. It is especially recommended for long pulls, multiple-bend pulls and pulls in a hot environment. Lubricant J dries to form a thin lubricating film that retains its lubricity for months after use.

Polywater® J is a specification-grade lubricant that does not promote flame propagation when used with fire-retardant cables and systems. It is harmless to humans, environmentally safe, compatible with all cable jacket materials, and can be easily applied as part of the unique Polywater® Lubricant Application System.

Polywater® Lubricant WJ (winter grade) has the same characteristics as Polywater® Lubricant J and is specially formulated for use in temperatures as low as -20°F (-30°C).

Front End Pack™ is a conduit-sized polyethylene bag of lubricant. The Front End Pack™ travels through the conduit on the winch line prelubricating the conduit ahead of the cable being pulled.

Package Size	Lubricant J Product #	Winter Grade Lubricant WJ Product #
55-gal drum (208 ℓ)	J-Drum	WJ-Drum
5-gal pail (18.9 ℓ)	J-640	WJ-640
1-gal pail (3.9 ℓ)	J-128	WJ-128
½-gal Front End Pack™ (1.9 ℓ) (in 5-gal. pail)	J-110	WJ-110
1-qt Front End Pack™ (0.95 ℓ) (in 5-gal pail)	J-99	WJ-99
½-gal Front End Pack™ (1.9 ℓ) (in corrugated carton)	J-55	WJ-55
1-qt (0.95 ℓ) squeeze bottle	J-35	WJ-35
1-qt Front End Pack™ (0.95 ℓ) (in corrugated carton)	J-27	WJ-27

SPECIFICATIONS

1. **Lubricity:** PVC or LDPE jacketed cable on PVC conduit at 200 lbs/ft (2.91 kN/m) normal pressure; coefficient of dynamic friction <0.15. PVC or LDPE jacketed cable on HDPE innerduct at 200 lbs/ft (2.91 kN/m) normal pressure; coefficient of dynamic friction <0.15.
2. **Percent non-volatile solids:** 3.5 – 5.5%
3. **Appearance:** Thick, cream-colored gel material
4. **Wax, grease, and silicone content:** none
5. **Temperature use range:** 20˚F to 120˚F (-5˚C to 50˚C) for Polywater® Lubricant J, -20˚F to 120˚F (-30˚C to 50˚C) for Polywater® Lubricant WJ (winter grade)
6. **pH:** 7.5 – 9.0
7. **Cable compatibility:** Passes IEEE 1210 physical and electrical testing on a wide variety of cable materials.
8. **Polyethylene stress cracking:** No stress cracking on LDPE cable jacket when tested by ASTM D1693
9. **Cling factor:** Twelve inches of a one-inch diameter cable will hold at least 75 grams of lubricant for one minute when held vertically (at 70˚F/20˚C).
10. **Temperature stability:** No phase-out after five freeze/thaw cycles or 24-hour exposure at 120˚F (50˚C).
11. **Toxicity:** Non-toxic and non-sensitizing. Industrial use only.
12. **Clean-up:** Complete clean-up possible with water.
13. **Flammability:** Lubricant has no flash point and dried residue will not support or spread flame.

To view technical information on our website, go to:
Cable Manufacturer Approvals: www.polywater.com/elecapprovals.pdf
Usage and compatibility: www.polywater.com/lubeinfo.asp

LIT-JFlyer/3-07?C1000(3-07)

American Polywater® Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com fax 1-651-430-3634

Polywater® J
High Performance Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Polywater® Lubricant J is a high-performance cable pulling lubricant proven in the installation of millions of feet (meters) of cable over the last 20 years. Lubricant J provides excellent tension reduction in underground and industrial cable pulls. It is recommended for both communications and electrical cable. Polywater® J has excellent shear resistance for effective lubrication under high cable sidewall pressure in conduit bends.

The residue from Polywater® J does not propagate flame when used with fire-retardant cable systems. Lubricant J is slow drying. The residue is a thin, slippery film that retains its lubricity for months after use. Its dried residue is non-conductive and non-combustible.

Polywater® Lubricant J is a stringy gel. It can be applied by hand or using Polywater's LP Pumps. It is also available in the unique Front End Pack™ pre-lubrication bags.

Friction Testing:

Lubricity: Polywater® J Lubricant shows superior friction reduction on a variety of jacket types. Typical friction coefficients at 200 lbs/ft (2.91 kN/m) normal pressure are shown. Test results are based on the method described in the white paper, "Coefficient of Friction Measurement on Polywater's Friction Table, 2007" (polywater.com/FTable.pdf). Values are averages based on cable jacket and conduit materials from multiple manufacturers.

Cable Jacket	Conduit Type HDPE	PVC	Steel	FRP	EMT
XLPE	.14	.11	.13	.16	.21
LLDPE	.10	.11	.16	.13	.13
PVC	.11	.11	.13	.16	.11
CPE	.14	.11	.21	.24	.08
HDPE	.05	.09	.13	.13	.13

Coefficient of friction data on additional or specific cable jackets or conduits came be obtained from American Polywater Corporation.

Product Benefits:

- Specification grade
- Excellent friction reduction
- High cling factor
- Non-combustible residue
- Clean and non-staining
- Temperature stable

End Use:

Suitable for many types of cable installations, including:

- Heavy, underground installations
- Multiple-bend pulls
- Long pulls
- High conduit fill situations

Official Approvals:

UL Approved
CSA Listed

Cable Compatibility:

Polyethylene Stress Cracking:
Polywater® J shows no stress cracking on LDPE, LLDPE, MDPE, or HDPE cable jacket when tested per IEEE Standard 1210[1].

Tensile and Elongation Effects:
LLDPE, XLPE, CPE, PVC and EPR cable jacket materials aged in Polywater® Lubricant J per IEEE Standard 1210[1] meet the tensile and elongation retention requirements of that standard.

Volume Resistivity:
There are no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when volume resistivity is tested according to IEEE Standard 1210[1].

Building Wire Testing:
THHN and XHHW building wire meet UL tensile, elongation, and voltage withstand requirements after exposure to Polywater® J Lubricant as tested by UL requirements[2].

Nuclear Approval:
Polywater® J Lubricant does not contain halogenated compounds, sulfur compounds, or low melting point metals.[3]

Cable Approvals:
Polywater® J Lubricant is approved by most cable manufacturers. Contact American Polywater for details.

[1] *IEEE Std 1210-2004; IEEE Standard Tests for Determining Compatibility of Cable Pulling Lubricants with Wire and Cable.*

[2] *UL Subject 267, Investigation for Wire-Pulling Compounds.*

[3] *Nuclear Test Methodology: Leachable Chlorides (ASTM D 512-88), Water Leachable Bromides (ASTM D 1246-88) Halogenated Compounds (ASTM D 808-87) Water Leachable Iodides (ASTM D 1246-88) Sulfur (ASTM D 129-78) Water Leachable Fluorides (ASTM D 1179-88)*

Performance Properties

Cling Factor:
Cling factor is a measure of the ability to apply the lubricant and have it stay on the jacket while the cable enters the conduit.

A six-inch length (152 mm) of a one-inch (25 mm) diameter cable will hold at least 50 grams of Polywater® Lubricant J for one minute when held vertically at 70° F (21° C).

Coatability:
Coatability is a measure of the lubricant's ability to coat the cable jacket as a thin film for continued lubricity on longer pulls.

Polywater® J will wet out evenly on cable jacket surfaces. It will not bead up or rub off of the jacket sample. A one-inch (25 mm) diameter XLPE cable dipped six inches (152 mm) into Polywater® J, then withdrawn and held vertically, will retain at least 30 grams of Polywater® Lubricant J for one minute at 70° F (21° C).

Combustibility:
Combustibility is a measure of combustion properties of the lubricant residue in a fire situation (with an impinging heat flux).

Polywater® J has no flash point and its dried residue will not support combustion and spread flame. A 200-gram sample of the J Lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105°C, will not ignite and spread a flame more than three inches beyond a point of ignition when subjected to a continuous heat flux of 40 kW/m^2. The total test time was one-half hour.

Test method described in "Fire Parameters and Combustion Properties of Cable Pulling Compound Residues," presented to the International Wire & Cable Symposium, 1987.

Physical Properties:

Property	Result
Appearance:	Cream-colored, stringy gel
Wax, Grease and Silicone Content:	None
Percent Non-Volatile Solids:	4.3
VOC Content:	10 gms/liter 200 gms/liter (wintergrade)
Viscosity:	25,000 – 40,000 cps @10rpm
pH:	7.5 – 9.0

Application Properties:

Application Systems:
Polywater® J has a stringy gel consistency that makes it easy to lift, carry and hand apply.

Polywater® J can also be pumped directly into the conduit or onto a cable using the Polywater® LP-3 or LP-D5 specialty lubricant pumps. Pumps allow hands-free transfer and consistent application of lubricant. Polywater's low-shear pumps will not change the gel character of Polywater® J lubricant. The LP-3 and LP-D5 pumps support lubricant application rates of 1 to 3 gallons (4 to 11 liters) per minute.

Polywater® LZ Front End Packs™ are bag packages that "pre-lubricate" the head end of the cable during the pull. The Front End Pack™ attaches to the winch line and pre-lubricates as it goes through the conduit. Two sizes are available to fit 2" and larger conduits.

Pull-Planner™ Tension Calculation Software is available from Polywater. Pulling tension estimations can ensure the use of appropriate pulling equipment and that the cable is installed within safe limits.

Polywater® J is also available in a pourable version (lower viscosity) called Polywater® PJ. PJ is primarily for use in underground work where pouring the lubricant into a cable feeder tube is a convenience.

Temperature Use Range:
Polywater® J:
20°F to 120°F (-5°C to 50°C).
Polywater® WJ (wintergrade version):
-20°F to 120°F (-30°C to 50°C).

Temperature Stability:
Polywater® J will not phase-out or separate after five freeze/thaw cycles or 5-day exposure at 120°F (50°C).

Clean-Up:
Polywater® J is non-staining. Complete clean-up is possible with water.

Storage and Shelf Life:
Store Polywater® J in a tightly sealed container away from direct sunlight. Lubricant shelf life is one year.

Directions for Use:

Polywater® J Lubricant can be hand applied or pumped onto the cable as it enters the conduit. Polywater® PJ is a thinner gel and can be poured.

For long pulls, place approximately two-thirds of the recommended quantity of lubricant into the conduit using the Front End Packs™ or by pumping.

For Front End Pack™ use, attach the packs of Polywater® J to the winch line or pulling rope in front of the cable using tape or cable ties. Start the pull and slit open the entire length of the pack(s) with a sharp knife as it enters the conduit.

Supplement with direct jacket lubrication as the cable enters the conduit.

Clean-up by wiping off any excess lubricant with a rag.

Recommended Lubricant Quantity

$$Q = k \times L \times D$$

Where:
Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
k = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and stiffness
(Increase quantity for stiff, heavy cable)

Conduit condition
(Increase quantity for old, dirty or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Pulling environment
(Increase quantity for high temperatures)

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Polywater® J Lubricant. The lubricant shall be UL (or CSA) listed. The lubricant shall contain **no** waxes, greases, silicones, or polyalkylene glycol oils or waxes. Lubricant manufacturer must provide cable manufacturer approvals upon request.

Cable jacket compatibility shall be tested by the IEEE 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable. It shall pass physical compatibility tests on LLDPE, XLPE, CPE, PVC and EPR cable jacket or sheath materials. It shall not stress crack polyethylene per ASTM Standard 1693. There shall be no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when the lubricant's effect on volume resistivity is tested according to IEEE Standard 1210.

A 200-gram sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105 degrees C, shall not spread a flame more than three inches beyond a point of ignition at a continued heat flux of 40 kW / meter^2. Total time of test shall be one-half hour.

Order Information:

Cat #	Package Description
	Regular
J-35	1-quart squeeze bottle (0.95 liter)
J-128	1-gallon pail (3.78 liter)
J-640	5-gallon pail (18.9 liter)
J-27	1-quart bag (0.95 liter)
J-99	1-quart bag (0.95 liter) in a pail
J-55	½-gallon bag (1.9 liter)
J-110	½-gallon bag (1.9 liter) in a pail
J-Drum	55-gallon drum (208 liter)
	Pourable
PJ-128	1-gallon pail (3.78 liter)
PJ-320	2 ½- gallon jug (9.6 liter)
PJ-640	5-gallon pail (18.9 liter)
PJ-Drum	55-gallon drum (208 liter)
	***Wintergrade version Polywater® PJ available (WPJ)*
	Wintergrade
WJ-35	1-quart squeeze bottle (0.95 liter),
WJ-55	½-gallon bag (1.9 liter)
WJ-110	½-gallon bag (1.9 Liter) in a pail
WJ-128	1-gallon pail (3.78 liter)
WJ-640	5-gallon pail (18.9 liter)
WJ-Drum	55-gallon drum (208 liter)

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 3000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
www.polywater.com (URL) custserv@polywater.com (e-mail)

POLYWATER® WJ WINTER GRADE LUBRICANT

SPECIFICATION SHEET

1) **LUBRICITY:** PVC or LDPE-jacketed cable on PVC conduit at 200 lbs./ft. (2.92kN/m) normal pressure; coefficient of dynamic friction <.15, coefficient of static friction <.18.

   PVC or LDPE-jacketed cable on Polyethylene innerduct at 200 lbs./ft. (2.91 kN/m) normal pressure; coefficient of dynamic friction <.18, coefficient of static friction <.20.

(2) **PERCENT NON – VOLATILE SOLIDS:** 4.5 – 5.5%

(3) **APPEARANCE:** Thick, cream-colored gel material

(4) **WAX, GREASE AND SILICONE CONTENT:** None

(5) **TEMPERATURE USE RANGE: -**20ºF to 120ºF (-5ºC to 50ºC)

(6) **pH:** 7.5 – 9.5

(7) **CABLE COMPATIBILITY:** Passes IEEE 1210 physical and electrical testing on a wide variety of cable materials.

(8) **POLYETHYLENE STRESS CRACKING:** No stress cracking on LDPE cable jackets when tested by ASSTM D1693.

(9) **TEMPERATURE STABILITY:** No more than a 20% change in Brookfield viscosity from 40ºF to 100ºF (5ºC to 40ºC). No phase-out after five freeze/thaw cycles or 24–hour exposure at 120ºF (50ºC).

(10) **TOXICITY:** Non-toxic and non-sensitizing. Industrial use only.

(11) **CLEANUP:** Complete cleanup possible with water.

(12) **FLAMMABILITY:** Lubricant has no flash point and dried residue is non-flammable.

View the Polywater® Lubricant WJ flyer online at
http://www.polywater.com/polyj.html

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-651-430-2270
fax 1-651-430-3634

LIT-SPEC-WJ(2-07)/INTERNAL/2-07

American Polywater® Corporation

5630 Memorial Ave, Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270, 800-328-9384
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

POLYWATER LUBRICANTS
Electrical Cable Manufacturers' Approvals

Visit this web address for a free, pre-written model performance spec on Polywater J that is suitable for inclusion in an overall electrical project specification. We've done the work for you!

http://www.polywater.com/modelspc.html

A number of cable manufacturers evaluate and/or approve pulling compounds on compatibility with their cable jacket types. Some of these manufacturers maintain written lists of approved products in their applications literature, while others only provide information in response to inquiries.

Cable manufacturer technical contacts who favor American Polywater cable lubricants are provided. Polywater® J cable manufacturer approval letters are available upon request.

Aetna Insulated Wire Co	Dawn Zhoa	757-460-3381 x52
Alcan Cable	Larry Watkins	770-394-9886
American Insulated Wire	Lowell Lisker	401-726-0700
General Cable/BICC Utility Prod	Dan Mainstruck	860-465-8798
Draka Cableteq USA-BIW Cables	Matt Bodziony	800-333-4248 x2321
Brugg Cable	Leonardo di Iulio	41-56-4603-245
Conductores Monterrey (Viakon)	Candelario Saldivar	011-5281-8030-8000
Condumex	Ricardo Marquez	011-5255-587-7011
Hendrix Cable	Ed Laughlin	603-249-1214
Kerite Cable	Robert Fleming	203-881-5380 x458
Nexans Canada Inc.	Douglas Reith	905-944-4335
Okonite Cable	Jim Fitzgerald	201-825-0300 x4337
Pirelli Power Cable Systems	Frank Kuchta	803-951-4010
Rockbestos Surprenant	Robert Konnik	860-653-8340
Southwire Company	Dave Mercier	770-832-4522
Southwire Company	Nick Ware	770-832-5058
Superior Essex Electrical Product	Tim West	770-657-6870

The list above does not include all electrical cable manufacturers. Ask your cable manufacturer if they maintain a list of lubricants approved with their cable.

American Polywater has extensive lubricant compatibility data tested to various NEMA, ICEA, UL and IEEE standards. Please call our Technical Service Department toll-free at 1-800-328-9384 for details, or e-mail us at custserv@polywater.com

American Polywater® Corporation

5630 Memorial Ave, Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270, 800-328-9384
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com
custserv@polywater.com (e-mail)

Recommended Lubricant Quantity

Our recommendation on the amount of Polywater® Cable Lubricant to use is dependent only on the size and length of the conduit system. Our research indicates that the following equation predicts a satisfactory quantity of Polywater® Lubricant for an average cable pull.

$$Q = .0015 \times L \times D$$

Where: Q = Quantity needed in gallons
L = Length of conduit in feet
D = nominal ID of conduit in inches

The appropriate quantity for use on any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

- **Cable weight and jacket hardness**
  (increase quantities for stiff, heavy cable)
- **Conduit Type and Condition**
  (Increase quantities for old, dirty, or rough conduits)
- **Conduit Fill**
  (Increase quantities for high percent conduit fill)
- **Number of Bends**
  (Increase quantities for pulls with several bends)
- **Pulling Environment (heat, water, etc)**
  (Increase quantities for high temperatures)

The following chart indicates approximate pulling lubricant requirements for various cable pulls, based on the formula above.

Lubricant Quantities in Gallons

		Conduit ID in Inches			
		1”	**2”**	**3”**	**4”**
Pull Length in Feet	200	.3	.6	.9	1.2
	400	.6	1.2	1.8	2.4
	600	.9	1.8	2.7	3.6
	800	1.2	2.4	3.6	4.8
	1000	1.5	3.0	4.5	6.0

For cable pulling tips and research, visit our Engineer’s Corner online at
http:www.polywater.com/engineer.asp

American Polywater® Corporation

5630 Memorial Ave, Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270, 800-328-9384
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com
custserv@polywater.com (e-mail)

TO: **Consulting Electrical Engineers**

SUBJ: **Cable Pulling Lubricant Specification**

WHY SPECIFY A CABLE LUBRICANT?

Why specify something that is not a functioning part of an electrical system, such as a cable pulling lubricant? "All cable lubricants are the same!" ***Or, are they?***

LUBRICANT'S SIGNIFICANCE!

The **differences** between lubricant types can affect both cable life and the safety of the projects you engineer.

- *Wax emulsions can damage certain types of insulation and high voltage shields.*
- *The residue from wax emulsions is combustible and can propagate flame.*
- *The residue left after a wax emulsion dries can hinder future cable removal or pulls.*

American Polywater Corporation is the recognized leader in the technology of polymeric cable lubricants. Our premier, high-performance electrical cable lubricant**, Polywater® J** is a safe, water-based product without the drawbacks of a wax emulsion**. Polywater® J** has been specified and used extensively in construction, based on its proven effectiveness, compatibility, safety, and application properties.

POOR INSTALLATION CAUSES FAULTS!

Cable manufacturers agree that **most cable faults** occur because of mechanical stress on the cable jacket during installation. **Polywater® J** has a low friction coefficient, which will minimize such mechanical stress.

ADDITIONAL INFORMATION?

In addition to the technical data in this catalog, we have available a formal presentation and video covering "Cable Installation Engineering." Topics covered are:

1. *Friction theory and its effect on cable installation tension.*
2. *Accurate coefficient of friction determination and its use in planning conduit systems.*
3. *Use of a personal computer with the Pull-Planner™ 2000 Software Program to easily design conduit systems.*
4. *Lubricant performance differences.*

A pre-written model lube specification is available online at
http://www.polywater.com/modelspc.html

To schedule a presentation on this subject, go to:
www.polywater.com/seminar.pdf

For additional technical information, please call us toll free at 1-800-328-9384.

American Polywater® Corporation

5630 Memorial Ave. Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

Combustible Cable Pulling Lubricant Residue Can Spread Fire!

Background

Well over a decade ago, fires at the Brown's Ferry Nuclear Plant in Alabama and the World Trade Center in New York City focused the attention of cable manufacturers and design engineers on the spread of fire through cabling systems. Today's fire-retardant cables are made from specially-formulated, fire-resistant materials. They are tested to special industry specifications. These state-of-the-art, fire-retardant cables show little tendency to ignite and propagate flame, and, thus, do not support the spread of fire.

It is common practice to specify fire-retardant cables, as well as "fire stop" materials, to prevent flame from spreading through electrical penetrations in fire-resistant walls, etc. The prevention of fire spread is addressed in the National Electrical Code (Sec. 300-21), as well as numerous building codes and industrial standards. Prevention of flame spread is also desirable for cable pulling compound residue, since they, too, can be present throughout a conduit system.

Cable Pulling Compounds
Cable pulling compounds (lubricants) reduce tension on cable as it's installed. In use, the lubricant is liberally applied to the cable jacket and/or conduit inner walls.

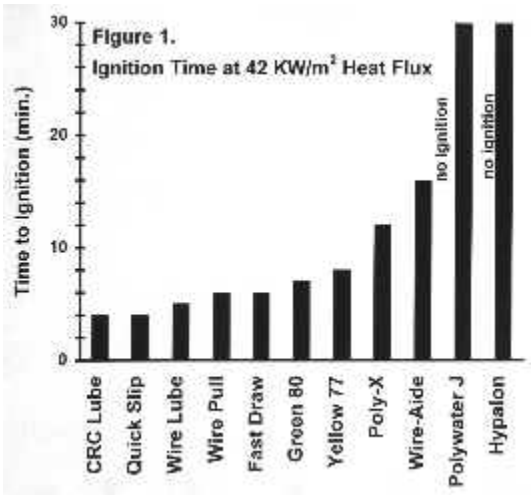
Once the cable is installed, the lubricant (or actually the dried lubricant residue) remains dispersed throughout the conduit. Actual quantities of lubricant depend on pull difficulty, pull length, and conduit size. As little as one quart or as much as five gallons could be present in a conduit system.

Pulling Lubricant Combustibility
Until recently, the fire parameters of cable lubricants had not been extensively studied. Only the nuclear industry has done any testing, initiated in part by a Nuclear Regulatory Commission finding that a combustible wax residue in a conduit could be a deficiency if it negated the flame suppression effectiveness of the cable.

Originally designed to test flammability of cables, the IEEE 383 vertical flame tray test was modified to evaluate lubricants. These flame-tray-type tests often produced questionable results. The wax-based lubricants would melt and drip down the cable and into the flame. This was obviously quite different from what would happen in a conduit.

Even with the limitations of flame tray testing, American Polywater's High-Performance Cable Lubricant, Polywater® J, showed superior combustion resistance. This flame resistance, combined with an inherently low coefficient of friction and universal cable compatibility, resulted in the extensive specification and use of Polywater® J in nuclear electrical construction.

Research on Lubricant Fire Parameters
At the International Wire & Cable Symposium held in November 1987, a research paper presented some startling new data on cable lubricant residue combustibility.



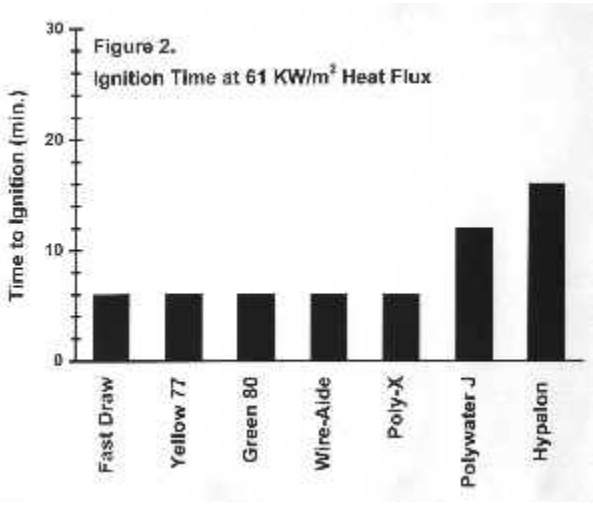
The paper, entitled "Fire Parameters and Combustion Properties of Cable Pulling Compound Residues," showed significant differences in lubricant residue combustibility. "Wax-type" lubricants were found to melt, ignite easily, burn vigorously, and carry flame throughout a conduit.

Certain other "polymer" lubes also ignited, burnt, and spread flame.

Only one lubricant tested was significantly less combustible than a fire-retardant cable jacket control sample. That lubricant was Polywater® J.

Research Synopsis
The research done on cable lubricant combustibility is summarized below. Copies of the full paper are available on request. This subject is also covered in our "Cable Installation Engineering Video".

Testing Method
The lubricant residue samples were tested in a piece of split metal conduit (blocked at both ends). A flow meter was used to control the volume of gas burnt beneath the conduit. Fires of varying intensities could be simulated with this method. Observations of ignition, time to ignition, flame spread, and burn time were made with and without a continued external heat flux. The evaluation procedure was developed by Factory Mutual in Norwood, Massachusetts, and used in testing cable jackets.[1]



Lubricants Evaluated
Only commercially available lubricants were evaluated. Among these were:

Combustion-Resistant, Proprietary Formula
Polywater® J from American Polywater

Wax/Wax-Soap Types
Yellow 77® from Ideal Industries

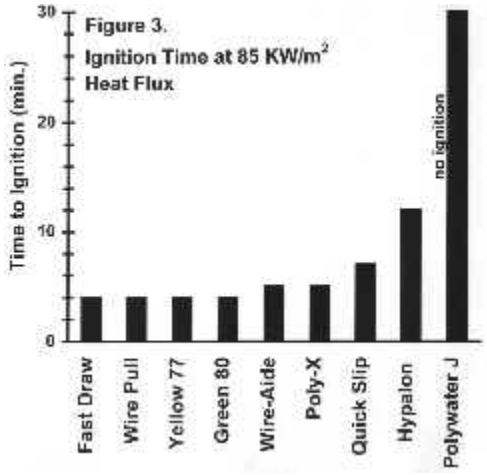
Wire-Aide™ from Gardner Bender (GB Electrical)

Green 80® from Greenlee Tool

Wire Lube® from Ideal Industries

Fast Draw® from Blackburn Division of FL Industries

Wire Pull® from MAC Products



Polymer/Water Types
Quick Slip® from Buchanan

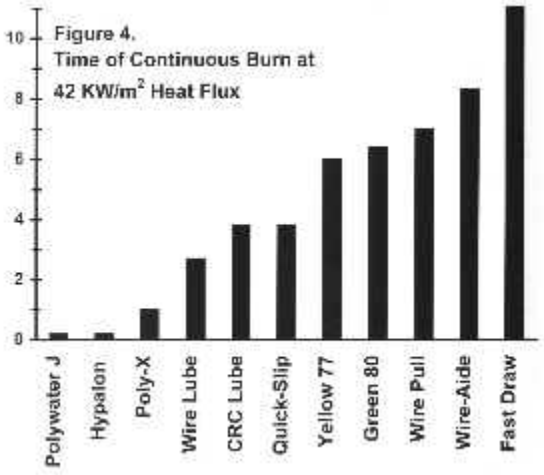
CRC® Wire Pulling Lube from CRC

Poly-X® from American Colloid

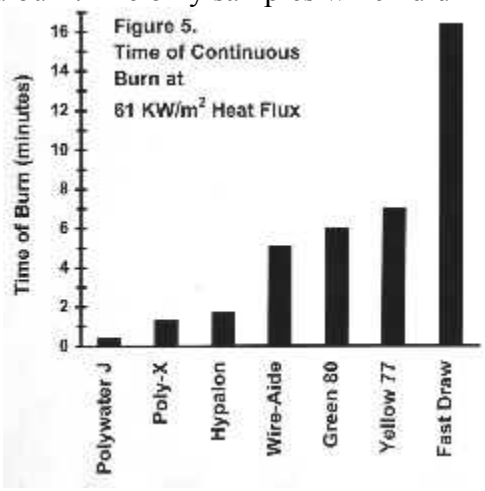
A fire-retardant, Hypalon® cable jacket, which meets requirements of the IEEE 383 vertical flame tray test, was used as a control during the tests.

Ignition
The heating time required for a sample to ignite, with a pilot flame, was measured at three heat flux rates. Data is shown in Figures 1, 2 and 3.

Heat flux represents the intensity of the outside fire source. As reference, the temperature of the inner wall of the conduit after one-half hour was roughly 570° (300°) at the 42 KW/m² heat flux, 670° (350°) at the 61 KW/m² heat flux, and 750° (400°) at the 85 KW/m² heat flux. These are common temperatures in any significant fire.



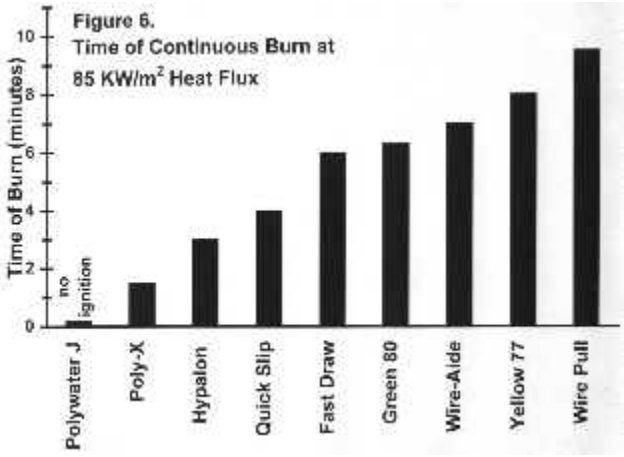
Note that a majority of the samples would ignite and burn. The only samples which did not ignite were Polywater® J and the Hypalon® cable jacket control at the lower heat flux, and Polywater® J at the highest heat flux. We gain more perspective on this data by looking at the samples' burning behavior once ignited.



Burn Times

Once a sample had ignited, the time that it continued to flame was measured. Samples would eventually burn out for one of two reasons: they were not very combustible and would self-extinguish, or they would consume all of the available fuel. Data on burn times is presented in Figures 4 thru 6.

All but a few of the samples burned for significant periods. Polywater® J, the only time it did ignite (at the 61 KW/m² heat flux), self-extinguished in less than 30 seconds. The Hypalon® jacket control also showed short burn times; however, they were considerably longer than the Polywater® J burn times.



Additional experiments showed that the burn character of the wax or polymer lube residues was not dependent on the continued presence of a heat flux. Once ignited, the combustion produced sufficient heat to support itself. Most cable flammability specifications determine if and when a burning cable extinguishes, and how far the flame progressed during the burn. The ability to "self-extinguish" is a key feature of fire-retardant cable, and should be equally important in a "flame-retardant" lubricant.

Flame Spread

When samples burned for lengthy periods, they did so because the flame would spread from the point of ignition throughout the whole sample. The observations on flame spread are in Table 1 below.

TABLE 1

	Flame Propagation at Various Fluxes		
Lubricant	**Flame Spread @42 KW/m²?**	**Flame Spread @61 KW/m²?**	**Flame Spread @85 KW/m²?**
Polywater® J	**No**	**No**	**No**
Yellow 77®	Yes	Yes	Yes
Fast Draw®	Yes	Yes	Yes
Wire Pull®	Yes	NT	Yes
Quick Slip®	Yes	NT	Yes
Wire Lube®	Yes	NT	NT
CRC® Lube	Yes	NT	NT
Green 80®	Yes	Yes	Yes
Wire-Aide™	Yes	Yes	Yes
Poly-X®	Yes	Yes	Yes
Hypalon® Cable Jacket Control	**No**	**No**	**No**

NT = Not tested because insufficient sample available.

Note that the wax, wax/soap, and higher solids "polymer" lubes all spread the flame. Polywater® J and the Hypalon® control did not.

Conclusions
All of the wax, wax/soap, and polymer-type lubricants tested had residues significantly more combustible then fire-retardant cable jacket. Only one lubricant tested, Polywater® J, showed little tendency to burn or spread fire. **Polywater® J was less combustible** than the fire-retardant cable jacket control!

Recommendations
Where the spread of fire is concern, and when fire-retardant cable is placed in conduit, the presence of cable pulling compound residue should not negate the fire suppression effectiveness of the cable. Lubricants that are less combustible than the cable itself, such as Polywater® Lubricant J, should be specified.

Lubricant fire parameters can only be determined by testing. Tests and performance specifications for lubricant residues should include ignition, burn time, and flame propagation character.

Suggested Specifications Are:

1. A 200 gm sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105°, shall not ignite with a pilot flame and continuously burn for more than one minute at a continued 40 KW/m² heat flux. Total time of test shall be one-half hour.
2. A 200 gm sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105°, shall not spread a flame more than three inches beyond a point of ignition at a continued heat flux of 40 KW/m².
3. A sample of the lubricant, when fully dried for 24 hours at 105°, shall not melt or flow at temperatures below 500° (270°).

American Polywater® Corporation

FRONT END PACK™
Cable Lubricating System

POLYWATER® Front End Packs™ lubricate ahead of the cable during the pull. They eliminate the need for hand lubrication in many pulls. Proper Front End Pack™ use lubricates far down the conduit where normal lubrication is inadequate.

Sizes

Two different sizes; a 1-quart pack (J-27/J-99) and a 1/2-gallon pack (J-55/J-110) are available.

The 1-quart pack is 1¾" in diameter by 24" long and is used in 2" and 3" conduit.
The ½ -gallon pack is 3" in diameter by 14" long and is used in 3½" and larger conduit.

Ordering Information

Part #	Winter-Grade Part #	Pack Size	Units per Package/Container
J-27	WJ-27	1-Qt Pack (Bag)	12 Packs in a Carton
J-99	WJ-99	1-Qt Pack (Bag)	16 Packs in a 5-Gal Pail
J-55	WJ-55	½-Gal Pack (Bag)	6 Packs in a Carton
J-110	WJ-110	½-Gal Pack (Bag)	10 Packs in a 5-Gal Pail

Quantity Formula

When only Front End Packs™ are used for a pull, the number of packs recommended for a pull is:

$$N = 0.003 \times T \times L \times D$$

N = Number of packs required
T = (1) for J-55/J-110 packs or (2) for J-27/J-99 packs
L = Length of pull in feet
D = Nominal I.D. of conduit in inches

The quantity appropriate for a difficult pull may be up to +50% above this average, depending on conduit fill, conduit type and condition, number of bends, and pulling environment.

Optional Use Method:

For horizontal runs with HIGH conduit fill:

(1) Cut the end off the pack behind the metal clip
(2) Slide the pack into the conduit (open end first) in front of the cable
(3) Cut the back end wide open
(4) Repeat with as many packs as needed
(5) Start the pull. The advancing cable will push the packs through the conduit.

Front End Packs™ may be used for direct lubrication by poking a hole in the pack and squeezing lubricant directly onto the moving cable.

For long, difficult pulls, Front End Packs™ should be supplemented with direct lubrication on the middle portion of the cable.

Instructions for Use:

Visit American Polywater's website which features:

GENERAL INFORMATION (www.polywater.com/lubeinfo.asp)
WRITTEN INSTRUCTIONS (www.polywater.com/Frontend.html)
STREAMING VIDEO (www.polywater.com/MultiMedia/FEPVideo.asp)
NARRATED SLIDE SHOW (www.polywater.com/MultiMedia/FEPsld1.asp)

Also available:

LUBRICATION APPLICATION VIDEO (www.polywater.com/videocav.html)
free on-line viewing or available in CD and VHS format.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

800-328-9384
custserv@polywater.com(e-mail)
1-651-430-2270
http://www.polywater.com(URL)
fax 1-651-430-3634

Lit-FEPFlyer(3-07)MARU/3-07

Now Available in Pourable Formula

Polywater® PJ Pourable Lubricant

Polywater® PJ Pourable Lubricant is a pourable version of the popular Polywater® J High Performance Pulling Lubricant. “PJ” offers the same proven features as “J” in such key areas as lubricity, cable compatibility, residue fire resistance, and ease of cleanup—yet it’s easier to apply where pouring is practical.

Why a Pourable Lubricant? Application! Convenience!!

- For the horizontal pulls typical in underground construction, **Polywater® PJ** pours directly into the feeder or guide funnel, avoiding the mess of hand application. No need to touch or handle the lube . . . less cleanup time!
- **Polywater® PJ Lubricant’s** viscosity makes it easier to spread the lubricant throughout a conduit, providing effective lubrication at all friction points.

Product Number	Package Size
PJ-DRUM	55-gallon drum (208ℓ)
PJ-640	5-gallon pail (18.9ℓ)
PJ-320	2½-gallon jug (9.6ℓ) (2/cs)
PJ-128	1-gallon jug (3.8ℓ) (4/cs)

***Also available in a winter-grade formula**

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product’s use, regardless of the legal theory asserted.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mai) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-PJFLYER/1-07/MARU(1-07)

POLYWATER® LUBRICANT PJ

SPECIFICATION SHEET

1. **LUBRICITY**: PVC or LLDPE-jacketed cable on PVC conduit at 200 lbs/ft (2.92kN/m) normal pressure; coefficient of dynamic friction <.15, coefficient of static friction <.18

2. **PERCENT NON-VOLATILE SOLIDS:** 1.7-2.3%

3. **APPEARANCE:** Pourable, cream-colored stringy liquid

4. **WAX, GREASE AND SILICONE CONTENT:** None

5. **TEMPERATURE USE RANGE:** 20° F to 110° F (-5° to 45° C)

6. **pH:** 7.5-9.0

7. **CABLE COMPATIBILITY:** No deleterious effects on physical or electrical properties of cable jackets.

8. **POLYETHYLENE STRESS CRACKING:** No stress cracking on LDPE cable jackets when tested by ASTM D1693.

9. **TEMPERATURE STABILITY:** No more than a 10% change in Brookfield viscosity from 40°F to 100° F (5°C to 40°C). No phase-out after five freeze/thaw cycles or 24-hour exposure at 120° F (50°C).

10. **TOXICITY:** Non-toxic and non-sensitizing. Industrial use only.

11. **CLEAN-UP:** Complete clean-up possible with water.

12. **FLAMMABILITY:** Lubricant has no flash point and dried residue is non-flammable.

Silicone-based

Polywater® Silicone™

Cable Pulling Lubricants

YOUR BEST CHOICE FOR WATER-FILLED CONDUITS!

- Excellent lubricant when pulling cable through water. HIGH CLING FACTOR!
- Optional, Small Frictionless Rollers
- Available in Regular and Winter Grade
- Compatible with most Cable Jackets
- Superior Friction Reduction
- Suitable for Silicone-lined and Prelubricated Ducts
- Temperature Stable
- Clean and Non-staining

Polywater® Plus Silicone™

Type NN™ is a clean, slow-drying, silicone-based cable pulling lubricant. Type NN™ offers superior friction reduction and is ideally suited for use with silicone-lined and prelubed duct. Non-stringy Type NN™ pours and pumps easily, and is suitable for use with all common cable jacket types.

Type WNN™ is a winter-grade Type NN™.

Type NB™ is Type NN™ with small frictionless rollers added.

Type WNB™ is winter-grade Type NB™.

Package Size	Type NN Cat. #	Type WNN Cat. #	Type NB Cat. #	Type WNB Cat. #
55-gallon drum (208 liters)	NN-Drum	WNN-Drum	NB-Drum	WNB-Drum
5-gallon pail (18.9 liters)	NN-640	WNN-640	NB-640	WNB-640
2 1/2-gallon jug (9.6 liters)	NN-320	WNN-320	NB-320	WNB-320
1-gallon jug (3.8 liters)	NN-128	WNN-128	NB-128	WNB-128
1-quart bottle (0.95 liter)	NN-35	WNN-35	NB-35	WNB-35

SPECIFICATIONS

1. **General Description:** Viscous, lubricant contains polydimethylsiloxane (silicone oil). Exhibits low coefficients of friction at both low and high sidewall pressures. Types NB™ and WNB™ also contain small frictionless rollers.

2. **Lubricity:** PVC or LDPE-jacketed cable on PVC conduit at 200 lbs/ft (2.91 kN/m) normal pressure; coefficient of dynamic fiction <.15, coefficient of static friction<.18.

3. **Percent non-volatile solids:** 3.0 - 5.0% for Types NN™ and WNN™ 5.0 - 7.0% for Types NB™ and WNB™.

4. **Appearance:** Types NN™, NB™, WNN™ and WNB™ are cream-colored materials. All have pourable viscosity. Types NB™ and WNB™ contain small, frictionless rollers.

5. **Wax and Grease Content:** None

6. **Temperature use range:** 20°F to 110°F (-5°C to 45°C) for Types NN™ and NB™, -20°F to 110°F(-30°C to 45°C) for Types WNN™ and WNB™.

7. **pH:** 7.5 to 9.0 for Types NN™, NB™, WNN™ and WNB™.

8. **Cable Compatibility:** Passes IEEE 1210 physical and electrical testing on a wide variety of cable materials.

9. **Polyethylene Stress Cracking:** No stress cracking on polyethylene cable jackets when tested by ASTM D1693.

10. **Temperature Stability:** No phase-out after five freeze/thaw cycles or 24-hour exposure at 120°F (50°C).

11. **Toxicity:** Non-toxic and non-sensitizing. Industrial use only.

12. **Clean-up:** Complete clean-up possible with water.

13. **Flammability:** Lubricant has no flash point.

To view additional information on our website, go to:
www.polywater.com/lubeinfo.asp www.polywater.com/NBspec.pdf
www.polywater.com/NNspec.pdf www.polywater.com/Techta12.html

Lit-nn.nbflyer/3-07/C1000/(3-07)

American Polywater® Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A
custserv@polywater.com(e-mail)
http://www.polywater.com(URL)
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

Polywater® Plus Silicone™ NN Enhanced Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Polywater® Plus Silicone™ NN Lubricant is a high-performance, specification-grade, cable pulling lubricant. Lubricant NN provides superior tension reduction and is suitable for all types of cable pulling. It has primarily been used for long pulls of heavy cable. In this type of pulling, its superior tension reduction and continued lubrication while pulling through water are well documented.

Polywater® Plus Silicone™ NN is suitable for use with factory lubricated duct. It continues to lubricate under high sidewall pressure forces in conduit bends. Lubricant NN is slow drying. The residue is a thin, slippery film that retains its slip for months after use.

Polywater® Plus Silicone™ NN is a semi-gel that pours thickly. While it can be applied by hand, it is best to pour or pump the lubricant into the duct system.

Friction Testing:

Lubricity: Polywater® Plus Silicone™ NN Lubricant shows superior friction reduction on a variety of jacket types. Typical friction coefficients at 200 lbs/ft (2.91 kN/m) normal pressure are shown. Test results are based on the method described in the white paper, "Coefficient of Friction Measurement on Polywater's Friction Table, 2007" (polywater.com/FTable.pdf). Values are averages based on cable jacket and conduit materials from multiple manufacturers.

Cable	Conduit			
Jacket	HDPE	PVC	Steel	FRP
LLDPE	.05	.11	.13	.13
PVC	.08	.09	.13	.10
CPE	.08	.10	.20	.15
XLPE	.07	.08	.13	.14
PP	.07	.05	.07	.10

Coefficient of friction data on additional or specific cable jackets or conduits came be obtained from American Polywater Corporation.

Product Benefits:

- Lubricates through water-filled duct
- Superior friction reduction
- Suitable for factory lubricated conduits
- Clean and non-staining
- Temperature stable
- Specification grade

End Use:

Suitable for all types of cable installations, including:

- Water-filled ducts
- Multiple bends, high sidewall pressure
- Heavy transmission cable
- Long underground pulls
- High conduit fill

Cable Compatibility:

Tensile and Elongation:
LLDPE, HDPE, PP, XLPE, CPE, and PVC cable jacket materials aged in Polywater® Plus Silicone™ NN per IEEE Standard 1210[1] meet the tensile and elongation retention requirements of that standard.

Polyethylene Stress Cracking:
Polywater® Plus Silicone™ NN shows no stress cracking on LLDPE, MDPE, or HDPE cable jacket when tested per IEEE Standard 1210[1].

Volume Resistivity:
There are no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when volume resistivity is tested according to IEEE Standard 1210[1].

Cable Approvals:
Polywater® Plus Silicone™ NN is approved and used by many cable manufacturers. Contact American Polywater for further information.

Field Data:
Polywater® Plus Silicone™ NN has been specified and used on many long, heavy cable installations. Side-by-side comparison pull tension data is available. Contact American Polywater for details.

[1] *IEEE Std 1210-2004; IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.*

Physical Properties:

Property	Result
Appearance:	Cream-colored, thickly pourable gel
Wax and Grease Content:	None
Non-Volatile Solids (%):	3.5
VOC Content:	10 gms/L 200 gms/L (wintergrade)
Viscosity:	13,000 – 20,000 cps @10rpm
pH:	7.5 – 9.0

Performance Properties:

Coatability:
Coatability is a measure of the lubricant's ability to coat the jacket as a thin film for continued lubricity on longer pulls.

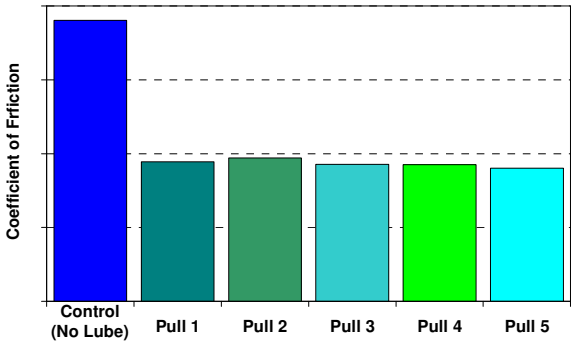
Polywater® Plus Silicone™ NN will wet out evenly on cable jacket surfaces. It will not bead up or rub off of the jacket sample. A one-inch (25 mm) diameter XLPE cable dipped six inches (152 mm) into the Polywater® Lubricant NN, then withdrawn and held vertically, will retain at least 15 grams of Polywater® Lubricant NN for one minute at 70° F (21° C).

Friction Reduction through Water:
Friction Reduction through Water is a measure of a lubricant's function through water.

Polywater® Plus Silicone™ NN will not show a significant increase in friction coefficient when tested with five water change cycles as described below.

A cable coated with Polywater® Plus Silicone™ NN Lubricant shall be pulled through HDPE duct wrapped 420° around a three-foot diameter cylinder[2]. The conduit shall be filled with tap water. Twenty-five pounds of back tension shall be put on the cable and the pulling tension measured and friction coefficient calculated as described in the Telcordia test procedure[2]. After each pull (cycle) the conduit shall be cleaned and the water changed. The same cable shall be used for the following cycle. The cable shall not be re-lubricated between cycles.

Polywater® Plus Silicone™ NN Water Cycle Test



Actual data from the test (above) shows no change in friction coefficient through five water change cycles.

[2] *Telcordia test procedure TR-TSY-00356 Sections 4.1.3 and 4.1.4*

Application Properties:

Application Systems:
Polywater® Plus Silicone™ NN Lubricant has a semi-gel consistency and can be thickly poured into the conduit or feeder tube.

Polywater® Plus Silicone™ NN can also be pumped directly into the conduit or onto the cable using the Polywater® LP-3 or LP-D5 specialty lubricant pumps. Pumps allow hands-free transfer and consistent application of lubricant. Polywater's low-shear pumps will not change the gel character of NN lubricant. The LP-3 and LP-D5 pumps support lubricant application rates of 1 to 3 gallons (4 to 11 liters) per minute.

Pull Planner™ Tension Calculation Software is available from Polywater. Pulling tension estimations can ensure the use of appropriate pulling equipment and that the cable is installed within safe limits.

A wintergrade version (WNN) *is also available for use during installation work below freezing.*

Temperature Use Range:
Polywater® NN:
20° F to 120° F (-5° C to 50° C).
Polywater® WNN (wintergrade version):
-20° F to 120° F (-30° C to 50° C)

Temperature Stability:
Polywater® NN (or WNN) will not phase-out after five freeze/thaw cycles or 5-day exposure at 120°F (50°C).

Clean-Up:
Polywater® NN (or WNN) is non-staining. Complete clean-up possible with water.

Storage and Shelf Life:
Store Polywater® NN (or WNN) in a tightly sealed container away from direct sunlight. Lubricant shelf life is one year.

Directions for Use:

Polywater® Plus Silicone™ NN Lubricant can be poured or pumped directly onto the cable as it enters the conduit.

To prelubricate for long or difficult pulls, pour Polywater® Plus Silicone™ NN Lubricant into the conduit before the pull begins and spread with a mandrel or a swab on the winch line during the pull. For long horizontal pulls, place as much as two-thirds of the recommended quantity of lubricant into the conduit for prelubrication.

Directly lubricate the cable jacket as it enters the conduit for the entire length of the pull.

Clean-up by wiping off any excess lubricant with a rag.

Recommended Lubricant Quantity

$$Q = K \times L \times D$$

Where:
Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
K = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and jacket hardness
(Increase quantity for stiff, heavy cable)

Conduit type and conditions
(Increase quantity for old, dirty, or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Pulling environment
(Increase quantity for high temperatures)

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Polywater® Plus Silicone™ NN Lubricant. The cable pulling lubricant shall provide a low coefficient of friction on a wide variety of cable jacket materials. The lubricant shall leave a low solids residue of less than 4.0%.

The lubricant shall be compatible with the cable jacket material. Cable jacket compatibility shall be tested by the IEEE 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable. The lubricant shall not stress crack polyethylene per ASTM Standard 1693. There shall be no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when the lubricant's effect on volume resistivity is tested according to IEEE Standard 1210.

The lubricant shall not show a significant increase in friction coefficient over five water change cycles when tested through a water-filled duct via Telcordia test procedure TR-TSY-00356 Sections 4.1.3 and 4.1.4. The cable shall not be re-lubricated during the test.

Order Information:

Cat #	Package Description
	Regular
NN-35	1-quart squeeze bottle (.95 liter)
NN-128	1-gallon pail (3.78 liter)
NN-320	2 ½-gallon jug (9.6 liter)
NN-640	5-gallon pail (18.9 liter)
	Wintergrade
WNN-35	1-quart squeeze bottle (.95 liter)
WNN-128	1-gallon pail (3.78 liter)
WNN-320	2 ½-gallon jug (9.6 liter)
WNN-640	5-gallon pail (18.9 liter)

Lit-NNTech/9-08/Internal/9-08

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 3000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-612-430-3634
www.polywater.com(URL) custserv@polywater.com(e-mail)

POLYWATER® PR

POWER CABLE LUBRICANT

- **Universal Lube used to lubricate:**
  - **Signal Cable**
  - **Distribution Cable**
  - **Medium Voltage Cable**
  - **Control Cable**
  - **Ducts & Feeder Tubes**

- Complex Polymer **Liquid** Lubricant provides excellent friction reduction. Can be poured or pumped into duct. Pumps LP-D5 or LP-3 available
- High shear resistance allows friction reduction even under high sidewall pressure in bends. Great for HDPE conduits!
- Lubricant PR is slow drying. The residue is a thin, slippery film that retains lubricity for months after use.

Ordering Information

Catalog #	Description	Case qty
PR-128	1-gal jug Polywater® PR	4 gal /cs
PR-320	2.5-gal jug Polywater® PR	2 /cs
PR-640	5-gal pail Polywater® PR	1 ea
PR-DRUM	55-gal drum Polywater® PR	1 ea
PR-TOTE275	275-gal tote Polywater® PR	1 ea
Winter-grade available upon request		

For more information: www.polywater.com/polypr.asp
www.polywater.com/PumpLPD5.asp **or** www.polywater.com/PumpLP3.asp

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

American Polywater® Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mai) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-PRFLYER/12-08internal(12-08)

Specification for
Polywater® PR Power Cable Lubricant

Description:

Polywater® Lubricant PR is a high performance, liquid cable pulling lubricant. Lubricant PR's silicone enhancement provides excellent tension reduction in all types of cable pulling. Its high shear resistance allows friction reduction even under high sidewall pressure in bends. Lubricant PR is slow drying. The residue is a thin, slippery film that retains lubricity for months after use.

Polywater® Lubricant PR is a stringy, silicone-enhanced liquid that can be poured or pumped into duct. It is recommended for underground, power cable pulling. The lubricant is suitable for transmission and distribution cable.

Performance Properties:

Lubricity: Typical values at 200 lbs/ft (2.91 kN/m) normal pressure. Results are based on the Friction Table Method described in the IEEE paper, Friction Theory and Lubrication Techniques for Improved Cable Pulling, 1985.

Cable Jacket Materials	Conduit/Innerduct	Kinetic Coefficient of Friction
XLPE	PVC	0.13
Hypalon	PVC	0.15
LLDPE	PVC	0.13

Coefficient of friction data is available on additional cable jackets and conduit substrates from American Polywater Corporation.

Coatability: Material will wet out evenly on all surfaces. It will not bead up or rub off of the cable jacket.

Combustibility: Lubricant has no flash point and is non-flammable.

Corrosivity: Lubricant is non-corrosive to steel, copper, or aluminum.

Pourability: A five-gallon pail of Polywater® Lubricant PR will empty from a Reike® spout without a notched air hole in lid in 1 minute 18 seconds and with a notched air hole in lid in 34 seconds.

Physical Properties:

Appearance:	Pourable, white, stringy liquid with no odor
Clay, Wax and Grease Content:	None
Percent Non-Volatile Solids:	<2 %
VOC Content:	None
Viscosity:	1,000 - 3,000 cps @ 10rpm
pH:	6.5 – 7.5
Toxicity:	Non-toxic and non-sensitizing

Cable Compatibility:

Polyethylene Stress Cracking: No stress cracking on DYNK (an untreated polyethylene prone to stress cracking) and LDPE cable jackets when tested by ASTM D1693.

Tensile and Elongation Effects: Cable jacket materials LLDPE, XLPE, HDPE, and Hypalon heat aged in Polywater® Lubricant PR pass tensile and elongation compatibility requirements from IEEE Standard 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.

Volume Resistivity: There are no significant changes in the conductive properties of XLPE semi-conducting compounds when volume resistivity is tested according to IEEE Standard 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.

Application Properties:

Package Availability: Multiple packages available for use: gallons, 5-gallon pails, and 330-gallon totes.

Application Systems: Application systems includes manual and automatic pumps and gravity-feed systems. Cable tension calculation software (Pull Planner™ 2000 for Windows™) available.

Temperature Use Range: 20°F to 120°F (-5°C to 50°C).

Temperature Stability: No phase-out after five freeze/thaw cycles or 24 hour exposure at 120°F.

Clean-Up: Non-staining. Complete clean-up possible with water.

Model Specification:

The cable pulling lubricant shall be Polywater® Lubricant PR. It shall produce a low coefficient of friction on a wide variety of cable jacket materials and shall conform to the physical and electrical requirements of IEEE 1210. The lubricant shall be silicone-enhanced, have a low solids content and the residue shall retain its slippery character. It shall not have a flash point.

No substitutions are permitted without certification from an officer of the manufacturer that the substitute product meets all of the requirements of this specification.

Test data and application information available upon request. Please call 800-328-9384.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

LOWEST COST

Dyna-Blue®

Heavy Duty Cable Lubricant

With Clingability

- Clean-Easy to use
- Stays slippery-Won't dry out
- Lower cost
- Temperature stable–No waste
- Safe-Use with most cables
- UL listed

Dyna-Blue® Cable Lubricant

Dyna-Blue® Lubricant is a clean, slow-drying, and easy to apply gel lubricant. It is a thick gel with "clingability" for easy handling and application. Dyna-Blue® combines effectiveness with economy. It is a good lubricant for everyday use in general electrical applications.

Dyna-Blue® Lubricant is harmless to humans, environmentally safe, compatible with cable jacket materials and exceptionally easy to work with.

Dyna-Blue® is UL listed.

Package Size	Dyna-Blue® Product Number
55-gallon drum (208 Liter)	**D-Drum**
5-gallon pail (18.9 Liter)	**D-640**
1-gallon pail (3.78 Liter) 4/case	**D-128**
1-quart squeeze bottle (.95 Liter) 12/case	**D-35**

Specifications

1. Lubricity: PVC or XLP-jacketed cable on PVC conduit at 200 lbs/ft (2.9 kN/m) normal pressure; coefficient of dynamic friction <.15
   PVC or XLP-jacketed cable on EMT conduit at 200 lbs/ft (2.9 kN/m) normal pressure; coefficient of dynamic friction <.15
2. Percent Non-Volatile Solids: 3.5%
3. Appearance: Thick, light-blue gel material
4. Wax, Grease and Silicone Content: None
5. Temperature Use Range: 20ºF - 140ºF (-5ºC - 60ºC)
6. pH: 6.5 to 8.5
7. Cable Compatibility: Passes IEEE 1210 physical and electrical testing on a wide variety of cable materials.
8. Polyethylene Stress Cracking: No stress cracking on LDPE cable jacket when tested by ASTM D1693.
9. Cling Factor: 12 inches (30 cm) of a 1 inch (2.5 cm) diameter cable will hold at least 75 grams of lubricant for one minute when held vertically (at 70ºF/20ºC)
10. Temperature Stability: No phase-out after five freeze/thaw cycles or 24-hour exposure at 120ºF (50ºC).
11. Toxicity: Non-toxic and non-sensitizing. Industrial use only
12. Clean-up: Complete cleanup possible with water.
13. Flammability: Lubricant has no flash point and dried residue is non-flammable.

To view technical information on our website, go to:

Usage information: www.polywater.com/lubeinfo.asp

MSDS: www.polywater.com/dbmsds.html

American Polywater® Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

Dyna-Blue®
Heavy Duty Cable Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Dyna-Blue® Cable Pulling Lubricant is a clean, slow-drying, easy-to-apply gel lubricant. This thick gel lubricant was developed with "clingability" for easy handling and hand application. Dyna-Blue® Lubricant is a good lubricant for everyday use in general electrical and communication applications.

Dyna-Blue® Lubricant is popular for commercial and institutional pulling because it is non-staining and easy to clean up in these environments.

Dyna-Blue® Cable Pulling Lubricant is slow drying. It effectively reduces friction and continues to lubricate for the full length of the pull. Its dried residue is non-conductive and non-combustible.

Dyna-Blue® Cable Pulling Lubricant is harmless to humans, environmentally safe, compatible with cable jacket materials and easy to handle.

Friction Testing:

Lubricity: Dyna-Blue® Lubricant shows good friction reduction across a broad class of jacket types. Typical values at 200 lbs/ft (2.91 kN/m) normal pressure are shown. Test results are based on the method described in the white paper, "Coefficient of Friction Measurement on Polywater's Friction Table, 2007" (polywater.com/FTable.pdf). Values are compiled from testing on multiple cable jacket and conduit materials from multiple manufacturers.

	Conduit Type		
Cable Jacket	EMT	PVC	Steel
XLPE	.18	.08	.18
LLDPE	.14	.11	.17
PVC	.11	.11	.19
CPE	.23	.21	.24
THHN	.23	.09	.21

Coefficient of friction data on additional or specific cable jackets or conduits can be obtained from American Polywater Corporation.

Product Benefits:

- Excellent cling for easy hand application
- Clean and non-staining
- Good friction reduction
- Compatible with cable jacket materials
- Temperature stable
- Combines effectiveness with economy

End Use:

Use for all types of cable installations, including:

- General electrical or communication use
- Overhead and vertical installations
- Indoor or building construction
- Heavy cable

Official Approvals:

UL Approved
CSA Listed

Cable Compatibility:

Tensile and Elongation Effects:
XLPE, LLDPE, VLDPE, PVC, and CPE cable jacket materials aged in Dyna-Blue® Lubricant per IEEE Standard 1210[1] meet the tensile and elongation retention requirements of that standard.

Polyethylene Stress Cracking:
Dyna-Blue® Lubricant shows no stress cracking on LLDPE, MDPE, or HDPE cable jacket when tested per IEEE Standard 1210[1].

Volume Resistivity:
There are no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when volume resistivity is tested according to IEEE Standard 1210[1].

Building Wire Testing:
THHN and XLPE building wire meet UL tensile, elongation, and voltage withstand requirements after exposure to Dyna-Blue® Lubricant as tested by UL requirements[2].

Cable Approvals:
Dyna-Blue® Lubricant is approved by most cable manufacturers. Contact American Polywater for further information.

[1] *IEEE Std 1210-2004; IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.*

[2] *UL Subject 267, Investigation for Wire-Pulling Compounds.*

Performance Properties:

Cling Factor:
Cling factor is a measure of the ability to apply the lubricant and have it stay on the jacket while the cable enters the conduit.

A six-inch length (152 mm) of a one-inch (25 mm) diameter cable will hold at least 75 grams of Dyna-Blue® Lubricant for one minute when held vertically at 70°F (21°C).

Coatability:
Coatability is a measure of the lubricant's ability to coat the jacket as a thin film for continued lubricity on longer pulls.

Dyna-Blue® Lubricant will wet out evenly on cable jacket surfaces. It will not bead up or rub off of the jacket sample. A one-inch (25 mm) diameter XLPE cable dipped six inches (152 mm) into the Dyna-Blue®, then withdrawn and held vertically, will retain at least 25 grams of Dyna-Blue® Lubricant for one minute at 70°F (21°C).

Combustibility: Lubricant has no flash point and dried residue is non-flammable.

Physical Properties:

Property	Result
Appearance:	Thick, light blue gel
Wax, Grease and Silicone Content:	None
Non-Volatile Solids (%):	3.0%
VOC Content:	0 gms/L
Viscosity:	70,000 – 110,000 cps @10rpm
pH:	6.5 – 8.5

Application Properties:

Application Systems:
Dyna-Blue® Lubricant has a thick gel consistency that makes it easy to hand apply.

Dyna-Blue® Lubricant can also be pumped directly into the conduit or onto the cable using the Polywater® LP-3 or LP-D5 specialty lubricant pumps. Pumps allow hands-free transfer and consistent application of lubricant. However, the thick gel consistency limits the length of the discharge hose and the pumping rate. The LP-3 supports Dyna-Blue® Lubricant application rates up to 0.9 gallon (3.5 liters) per minute and LP-D5 supports Dyna-Blue® Lubricant application rates of 0.1 to 0.3 gallon (0.4 to 1.2 liters) per minute.

Pull-Planner™ Tension Calculation Software is available from Polywater. Pulling tension estimations can ensure the use of appropriate pulling equipment and that the cable is installed within safe limits.

Temperature Use Range:
20° F to 120° F (-5° C to 50° C).

Temperature Stability:
No phase-out after five freeze/thaw cycles or 5-day exposure at 120° F (50° C).

Clean-Up:
Dyna-Blue® Lubricant is non-staining. Complete clean-up is possible with water.

Storage and Shelf Life:
Store Dyna-Blue® Lubricant in a tightly sealed container away from direct sunlight. Lubricant shelf life is one year.

Directions for Use:

Dyna-Blue® Lubricant can be squeezed, pumped or hand applied directly onto the wire or cable. The thick clingy gel character allows Dyna-Blue® to be applied to vertical installations. Conduit should be clean and continuous.

To prelubricate for long or difficult pulls, squirt a liberal amount of Dyna-Blue® Lubricant into the conduit before the pull begins and use a mandrel or a swab on the winch line to spread the lubricant during the pull.

Clean-up by wiping off any excess lubricant with a rag.

Recommended Lubricant Quantity

$$Q = k \times L \times D$$

Where:
- Q = quantity in gallons (liters)
- L = length of conduit in feet (meters)
- D = ID of the conduit in inches (mm)
- k = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and jacket hardness
(Increase quantity for stiff, heavy cable)

Conduit type and conditions
(Increase quantity for old, dirty or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Pulling environment
(Increase quantity for high temperatures)

Model Engineering Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Dyna-Blue® Lubricant. The cable pulling lubricant shall produce a low coefficient of friction on a wide variety of cable jacket materials. The lubricant shall be UL listed. It shall be easy to handle and adhere well to the cable.

The lubricant shall pass the IEEE 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable. It shall pass physical compatibility tests on LLDPE, XLPE, CPE, and PVC cable jacket or sheath materials. It shall not stress crack polyethylene per ASTM Standard 1693. There shall be no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when the lubricant's effect on volume resistivity is tested according to IEEE Standard 1210.

Order Information:

Cat #	Package Description
D-35	1-quart squeeze bottle (0.95 liter)
D128	1-gallon pail (3.78 liter)
D-640	5-gallon pail (18.9 liter)
D-Drum	55-gallon drum (208 liter)

Lit-DBTech/9-08/Internal/9-08

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 300 Software

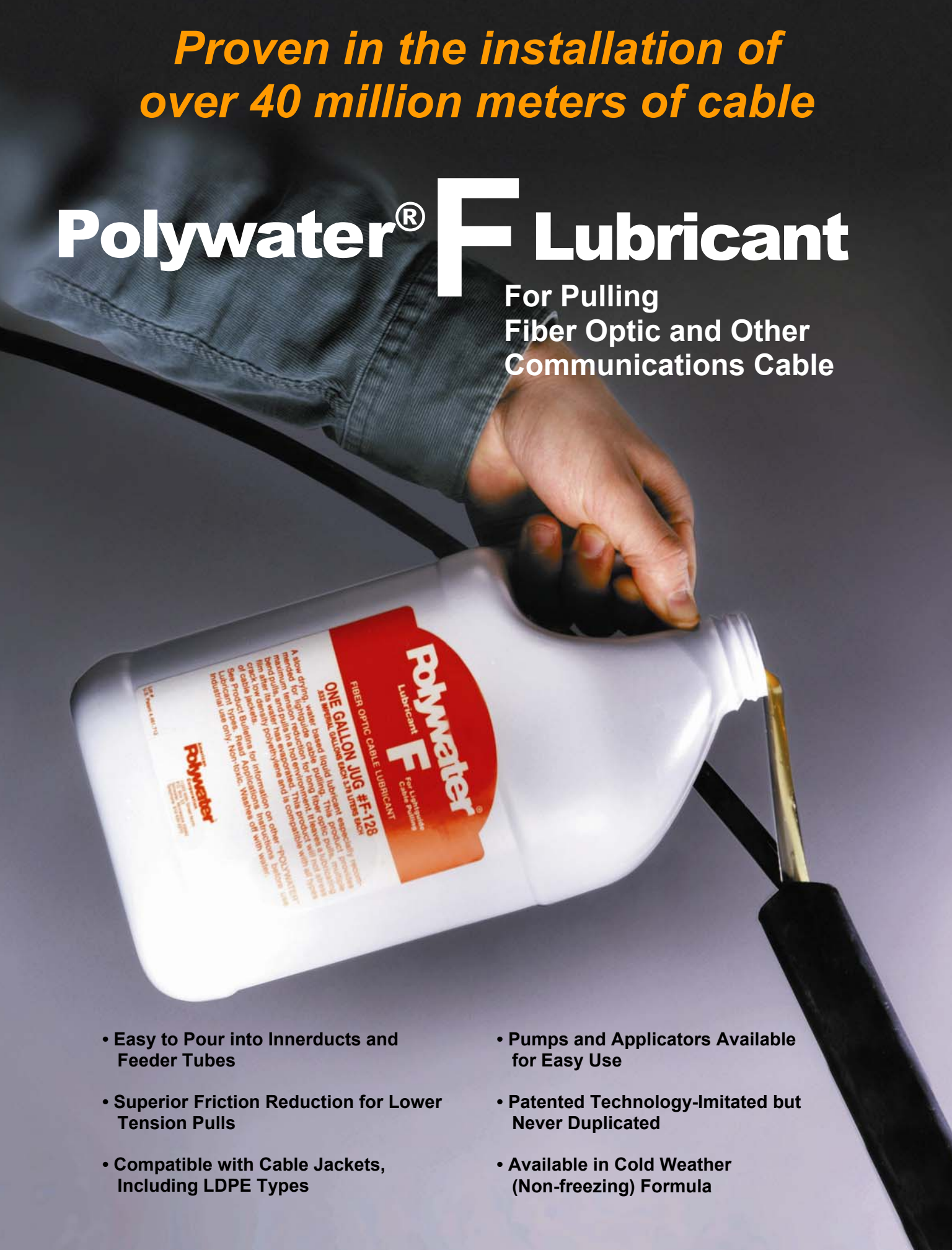
American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-612-430-3634
www.polywater.com(URL) custserv@polywater.com(e-mail)

Proven in the installation of over 40 million meters of cable

Polywater® F Lubricant

For Pulling Fiber Optic and Other Communications Cable



- Easy to Pour into Innerducts and Feeder Tubes
- Superior Friction Reduction for Lower Tension Pulls
- Compatible with Cable Jackets, Including LDPE Types
- Pumps and Applicators Available for Easy Use
- Patented Technology-Imitated but Never Duplicated
- Available in Cold Weather (Non-freezing) Formula

Polywater® Cable Lubricant F

Polywater® Lubricant F is a high performance, pourable liquid, cable pulling lubricant recommended for outside plant fiber optic cable pulls. It is also suitable for use on other types of communications cable, including coaxial and copper pair.

Polywater® F is slow drying and leaves a lubricating film after its water-base has evaporated. Lubricant F uniquely wets out and coats cable for complete lubrication over long distance pulls. It is compatible with a broad range of cable jackets, including polyethylene types.

Polywater® Lubricant WF (winter grade) has the same characteristics as Polywater® Lubricant F and is specially formulated for use in temperatures as low as -20°F (-30°C).

Package Size	Lubricant F Product #	Winter Grade Lubricant WF Product #
55-gal drum (208 ℓ)	F-Drum	WF-Drum
5-gal pail (18.9 ℓ)	F-640	WF-640
2½-gal jug (9.6 ℓ)	F-320	WF-320
1-gal jug (3.8 ℓ)	F-128	WF-128
1-qt squeeze bottle (0.95 ℓ)	F-35	WF-35

SPECIFICATIONS

1. **Lubricity:** LDPE-, MDPE- and HDPE jacketed cable on HDPE and PVC innerduct at 200 lbs./ft. (2.91 kN/m) sidewall force, coefficient of kinetic friction < 0.12
2. **Percent non-volatile solids:** 4.5 to 5.5%
3. **Appearance:** Transparent to slightly opaque, orange-colored, stringy liquid material.
4. **Temperature use range:** 20°F to 140°F (-5°C to 60°C) for Polywater® F, -20°F to 140°F (-30°C to 60°C) for Polywater® WF.
5. **pH:** 8.0 to 9.5
6. **Cable compatibility:** No deleterious effects on physical or electrical properties of cable jackets.
7. **Polyethylene stress cracking:** No stress cracking on LDPE cable jackets when tested by ASTM D1693.
8. **Temperature stability:** No more than a 20% change in Brookfield viscosity from 40°F to 100°F (5°C to 40°C). No phase-out after five freeze/thaw cycles or 5-day exposure at 140°F (60°C).
9. **Toxicity:** Non-toxic and non-sensitizing. Industrial use only.
10. **Flammability:** Lubricant has no flash point and dried residue is not combustible.
11. **Clean-up:** Complete clean-up possible with water.

To view technical information on our website, go to:

General Cable Lubricant information: www.polywater.com/lubeinfo.asp
Installing Communication Cable in Conduit: www.polywater.com/commcabl.html
Duct Factor in F/O Pulling: www.polywater.com/ductdisp.html

LIT-FFLYER/3-07/CURTIS/(3-07)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

Polywater® F Communications Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Polywater® F Lubricant is a high performance, pourable liquid, cable pulling lubricant recommended for pulling underground fiber optic cable. Polywater® F is also suitable for pulling coaxial and copper-pair cable.

Polywater® F wets and clings to cable jacket and evenly coats the jacket surface. It continues to lubricate by leaving a lubricating film after its water base has evaporated. Lubricant F is compatible with a broad range of cable jackets, including polyethylene types.

Polywater® F is a thick liquid, and is applied by pouring or pumping the lubricant into the duct system. F is a popular lubricant and used in the pulling over 50,000 miles (80,000 km) of fiber optic cable into duct.

Friction Testing:

Friction is measured using a standard Telcordia test procedure[1]. HDPE duct is wrapped 420° around a three-foot-diameter (0.91 m) cylinder. A weight is attached to the back of the test cable (variable back tension). Pulling force is measured as the cable is pulled at 65 ft/min (19.8 m/min) through the wrapped duct. A friction coefficient is calculated from the pulling force/back tension ratio. Results below are typical values.

Coefficient of Friction for Communication Cable into HDPE Smoothwall Innerduct

Back Tension	Cable Jacket		
	MDPE	HDPE	PVDF
8 lb_f	.10	.12	.10
14 lb_f	.10	.12	.09
25 lb_f	.10	.11	.09

Polywater® F Lubricant shows good friction reduction for these common cable jackets at both high and low bend shear.

[1] *Telcordia Standard TR-NWT-002811, Section 4.1.3 and 4.1.4; Generic Requirements for Cable Placing Lubricants.*

Product Benefits:

- Field proven performance
- Easy to pour into innerducts and feeder tubes
- Approved and recommended by many cable manufacturers
- Superior friction reduction
- Carries with cable for long distance - wets and clings to cable.
- Compatible with cable jackets
- Clean and non-staining

End Use:

Use for all types of cable installations, including:

- Outside plant cable pulls
- Underground cable installation
- Lightweight cable, long-haul installation

Performance Properties

For fiber pulling, special pulling lubricants are required for the long lengths and significant duration of the pulls. Lightweight fiber cable can rub on both the top and bottom of the duct, so the lubricant must completely coat the cable jacket and stay evenly coated. The lubricant must remain slippery over time, and not dry to a hard or sticky residue.

Wetting – Continuous Coat:
Wetting is a measure of the lubricant's ability to coat the jacket for continued lubricity on longer pulls.

Polywater® F Lubricant will wet and coat evenly on jacket surfaces. A half-inch (13 mm) diameter PE-jacketed cable shall be dipped six inches (152 mm) into Polywater® F Lubricant for 10 seconds and then removed. The lubricant coating shall cover 100% of the cable jacket without dripping off, beading up, or pulling away from the edges as the cable is held horizontally for one minute at 70° F (21° C).

Stringy Rheology:
"String" character is a measure of the lubricant's pituity and its ability to adhere, follow and stay with cable over long distances.

A ¼-inch (6 mm) fiber cable (MDPE jacket) dipped two inches (50 mm) into Polywater® F Lubricant and then pulled out at a 40 inches/minute rate (100 cm/min) will produce a non-supported, lubricant string length greater than 8 inches (20 cm) .

Pourability:
Pourability is a measure of the lubricant's ease of pouring.

Five gallons (18.9 l) of Polywater® F Lubricant will empty from a Reike® spouted 5-gallon pail in less than 90 seconds (no air relief) and in less than 60 seconds with air relief.

Combustibility:
Polywater® F Lubricant has no flash point and its dried residue is not flammable.

Physical Properties:

Property	Result
Appearance:	Orange-colored, stringy liquid
Percent Non-Volatile Solids:	< 5 %
VOC Content:	60 gms/liter 260 gms/liter (wintergrade)
Viscosity:	1,000 – 3,000 cps @10rpm
pH:	8.0 – 9.5

Application Properties:

Temperature Use Range:
Polywater® F:
20° F to 140° F (-5° C to 60° C).
Polywater® WF (wintergrade version):
-20°F to 140°F (-30° C to 60° C).

Temperature Stability:
Polywater® F will not show more than a 20% change in Brookfield viscosity from 40° F to 100° F (5° C to 40° C). Polywater® F will not phase-out after five freeze/thaw cycles or 5-day exposure at 120° F (50° C). Polywater® F will not phase out or separate over the shelf life of the lubricant.

Clean-Up:
Polywater® F is non-staining. Complete clean-up is possible with water.

Storage and Shelf Life:
Store Polywater® F in a tightly sealed container away from direct sunlight. Lubricant shelf life is one year.

Cable Compatibility:

Polyethylene Stress Cracking:
Polywater® F does not cause stress cracking of polyethylene jackets commonly used on communications cables.

Cable jacket polyethylene blends were tested according to ASTM ESCR standard method.[1]

DFDA 0588 Low density polyethylene
DFDA 6049 Linear low density polyethylene
DHDA 6497 Medium density polyethylene
DGDJ 3479 High density polyethylene
MDPE Stripped Cable Jacket

After 500 hours immersion in Polywater® F none of the specimens showed failures.

Polycarbonate Stress Cracking:
Polywater® F does not stress crack polycarbonate. Polycarbonate bars were bent to a defined stress and exposed to Polywater® F lubricant as described in the Telcordia standard[2], Section 8.2, Stress Cracking of Polycarbonate". After 48 hours, none of the test specimens showed crazing or cracking.

[1] ASTM Test Method D1693, Environmental Stress-Cracking of Ethylene Plastics.
[2] Telcordia Standard TR-NWT-002811; Generic Requirements for Cable Placing Lubricants.

Directions for Use:

Polywater® F can be poured or pumped directly into the conduit before and during the pull. Coat the entire cable as it enters the conduit.

Polywater® F can be pumped with the Polywater® LP-D5 specialty lubricant pump. Pumping allows hands-free transfer and consistent application of lubricant. SureGrip™ Nonslip Cable Handling Gloves offer maximum grip for handling slippery, lubricant-covered cable.

Clean up by wiping off any excess lubricant with a rag.

Recommended Lubricant Quantity

Q = k X L X D

Where:

Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
k = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and stiffness
(Increase quantity for stiff, heavy cable)

Conduit condition
(Increase quantity for old, dirty or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Pulling environment
(Increase quantity for high temperatures)

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Polywater® Lubricant F. The lubricant shall contain no waxes, greases, silicones, or waxes.

The lubricant shall be a pourable liquid with good wetting (coating) properties. It shall have a friction coefficient less than 0.15 using MDPE-jacketed cable and HDPE innerduct.

The lubricant shall conform to the physical and performance requirements of Telcordia Standard, TR-NWT-002811, “Generic Requirements for Cable Placing Lubricants”. It shall not stress crack polyethylene when tested by ASTM 1693. .

No substitutions are permitted without certification from an officer of the manufacturer that the substitute product meets all of the requirements of this specification

Order Information:

Cat #	Package Description
	Regular
F-35	1-quart squeeze bottle (0.95 liter)
F-128	1-gallon jug (3.78 liter)
F-320	2 ½- gallon jug (9.5 liter)
F-640	5-gallon pail (18.9 liter)
	Wintergrade
WF-35	1-quart squeeze bottle (0.95 liter)
WF-128	1-gallon jug (3.78 liter)
WF-320	2 ½- gallon jug (9.5 liter)
WF-640	5-gallon pail (18.9 liter)

Lit-FTech 6/09

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

American Polywater® Corporation

5630 Memorial Ave, Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270, 800-328-9384
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com
custserv@polywater.com (e-mail)

Recommended Amount of Polywater® Lubricant F

For Lubricating and Installing Fiber Optic Into Innerduct (In Gallons)

Duct Size (I.D./inches)	Length of Pull (ft)							
	1000	**2000**	**3000**	**4000**	**5000**	**6000**	**7000**	**8000**
1.0	1.5	3.0	4.5	6.0	7.5	9.0	10.5	12.0
1.25	1.8	3.75	5.6	7.5	9.4	11.25	13.0	15.0
1.5	2.25	4.5	6.75	9.0	11.25	13.5	15.75	18.0
2.0	3.0	6.0	9.0	12.0	15.0	18.0	21.0	24.0

When pulling into corrugated innerduct, multiply the above numbers by 1.6

Specification Grade
Polywater® Lubricant LZ

Do you specify or install low-smoke zero-halogen cables?

Ensure the integrity of electrical construction projects by specifying an appropriate cable pulling lubricant. Many commercially available pulling lubricants weaken LSZH/LSHF jackets and should not be used on these cables.

Polywater® LZ is the only pulling lubricant developed for and tested on LSZH/LSHF jackets. It meets the performance needs of power plants, mass transit systems, airports, petrochemicals, high-occupancy buildings, and other construction projects using LSZH power, control, instrumentation, and communication cables.

Polywater® LZ is a specification-grade, clean, slow-drying, gel lubricant that is broadly compatible with low-smoke zero-halogen jackets. Lubricant LZ provides reduced tension on all types of cable jackets. Lubricant LZ dries to a thin lubricating film that retains its lubricity for months and won't cement in the cables.

Research on Cable Pulling Lubricant Fire Parameters

An International Wire & Cable Symposium paper entitled "Fire Parameters and Combustion Properties of Cable Pulling Compound Residues" presents startling data on lubricant residue combustibility. In the research, "wax-type" lubricants were found to melt, ignite easily, burn vigorously, and spread flame through a conduit. This paper with details on energy flux testing is available online at *www.polywater.com/IWCS.html*

Polywater® LZ will not ignite and sustain flame in standard tests. It is less combustible than fire-retardant cable jacket control samples.

Cable Compatibility

Cable pulling lubricant compatibility is evaluated using IEEE 1210 test methods. Tensile strength and elongation tests were performed on over 29 different LSZH cable jackets representing a number of manufacturers and LSZH technologies. Cable jackets were aged in the lubricant at the temperatures specified in the standard. Polywater® LZ lubricant showed the broadest compatibility with LSZH cable jackets. Most cable pulling lubricants available through local supply houses had significant and sometimes devastating effects on LSZH cable jackets. Shown at lower right is a photograph where improper cable lubricant choice contributed to LSZH cable jacket failure.

Wax-based lubricants destroyed some low-smoke zero-halogen cable jackets in aging tests.

Lubricant residue from an adjacent duct system contributed to LSZH jacket failure.

Polywater® Lubricant LZ

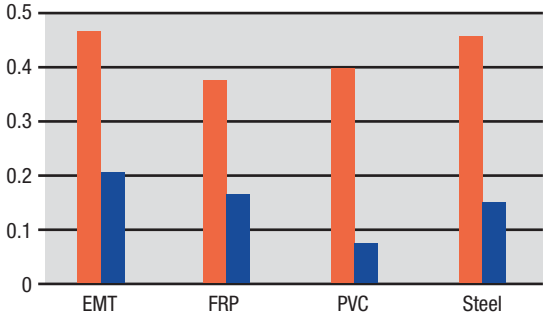
Recommendations

Engineers should specify a cable pulling lubricant that does not negate the fire suppression effectiveness of fire-retardant cables or degrade jacket materials. Performance specifications for lubricants should include physical property effects, jacket compatibility, ignition and flame propagation character of residues, coefficient of friction parameters specific to cable type, and manufacturer approvals. Polywater® LZ offers proven cable compatibility, superior combustion resistance, and an inherently low coefficient of friction. Polywater® LZ should be specified for installations of LSZH/LSHF cable in duct.

Caution

Because of ongoing production and formulation advances in LSZH cable technology, please verify with cable manufacturers the current status of lubricant compatibility, or contact American Polywater directly for specific jacket details.

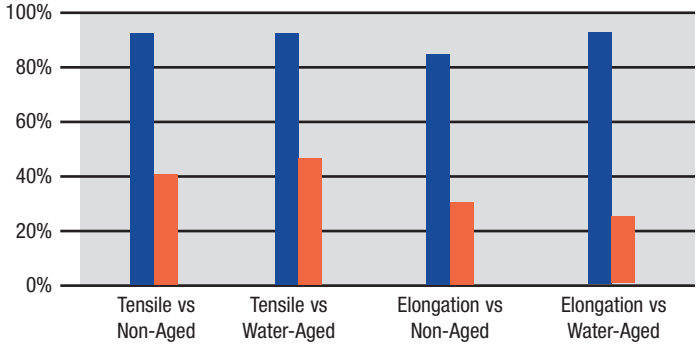
Coefficient of Friction Test Results



Polywater® LZ significantly reduces the friction of LSZH jackets in common conduits.

Bare (unlubricated)
Polywater® LZ

IEEE Test Results



Polywater® LZ is vastly superior to wax-based lubricants in physical property retention testing.

Wax-Based Lubricants
Polywater® LZ

PACKAGE SIZE	SUMMERGRADE POLYWATER® LZ CAT. #	WINTERGRADE POLYWATER® WLZ CAT. #
55-Gallon Drum (208 liters)	LZ-DRUM	WLZ-DRUM
5-Gallon Pail (18.9 liters)	LZ-640	WLZ-640
1-Gallon Pail (3.8 liters)	LZ-128	WLZ-128
1-Quart Bottle (0.95 liter)	LZ-35	WLZ-35

www.polywater.com/polyLZ.asp

IMPORTANT NOTICE: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com (e-mail)
http://www.polywater.com (URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

Lit-LZFlyer/1-08

Polywater® LZ
High Performance Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Polywater® Lubricant LZ is a high-performance, specification-grade, cable pulling lubricant. This newest Polywater® Lubricant was developed for compatibility with the broad variety of modern LSZH/LSHF compounds. Polywater® LZ is also compatible with other high-performance cable jackets. It provides excellent tension reduction and is recommended for all types of cable pulling.

Polywater® LZ is slow drying and leaves a thin, slippery film that retains its lubricity for months after use. Lubricant LZ does not sustain flame when used with fire-retardant cables and systems. Its dried residue is non-conductive and non-combustible.

Polywater® Lubricant LZ is a stringy gel. It can be applied by hand or using Polywater's LP Pumps. It is also available in the unique Front End Pack™ pre-lubrication bags.

Friction Testing:

Lubricity: Polywater® LZ Lubricant shows superior friction reduction on a variety of jacket types. Typical friction coefficients at 200 lbs/ft (2.91 kN/m) normal pressure are shown. Test results are based on the method described in the white paper, "Coefficient of Friction Measurement on Polywater's Friction Table, 2007" (polywater.com/FTable.pdf). Values are averages based on cable jacket and conduit materials from multiple manufacturers.

Cable Jacket	Conduit Type				
	Steel	FRP	HDPE	PVC	EMT
LSZH	.15	.17	.07	.07	.21
CSPE	.21	.24	.12	.16	.24
CPE	.13	.17	.06	.10	.16
XLPE	.10	.12	.04	.05	.11
LLDPE	.10	.11	.04	.05	.13

Coefficient of friction data on additional or specific cable jackets or conduits can be obtained from American Polywater Corporation.

Product Benefits:

- Specification grade
- Compatible with cable jacket materials
- Extensively tested on LSZH compounds
- Excellent friction reduction
- High cling factor
- Non-combustible residue
- Clean and non-staining
- Temperature stable

End Use:

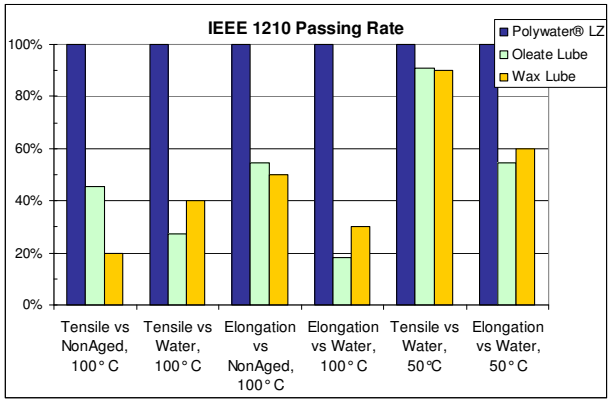
Suitable for all types of cable installations, including:

- Nuclear and other generation plants
- Mass transit systems
- Oil and petrochemical
- Other critical fire areas
- Multi-bend cable pulls

Cable Compatibility:

Tensile and Elongation:
LSZH, CSPE, LLDPE, XLPE, CPE, and PVC cable jacket materials aged in Polywater® Lubricant LZ per IEEE Standard 1210[1] meet the tensile and elongation retention requirements of that standard.

Modern LSZH jackets are numerous and vary significantly in formulation. Polywater® LZ shows broad compatibility with this jacket technology. As shown in the graph below, the common cable pulling lubricants available through local supply houses show significant and sometimes devastating effects on LSZH cable jackets.



Polyethylene Stress Cracking:
Polywater® LZ shows no stress cracking on LDPE, MDPE, or HDPE cable jacket when tested per IEEE Standard 1210[1].

Volume Resistivity:
There are no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when volume resistivity is tested according to IEEE Standard 1210[1].

Building Wire Testing:
THHN and XLPE building wire meet UL tensile, elongation, and voltage withstand requirements after exposure to Polywater® LZ Lubricant as tested by UL requirements[2].

Cable Approvals:
Polywater® Lubricant LZ is approved by many cable manufacturers. Contact American Polywater for details.

[1] *IEEE Std 1210-2004; IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.*

[2] *UL Subject 267, Investigation for Wire-Pulling Compounds.*

Performance Properties

Cling Factor:
Cling factor is a measure of the ability to apply the lubricant and have it stay on the jacket while the cable enters the conduit.

A six-inch length (152 mm) of a one-inch (25 mm) diameter cable will hold at least 35 grams of Polywater® Lubricant LZ for one minute when held vertically at 70° F (21° C).

Coatability:
Coatability is a measure of the lubricant's ability to coat the jacket as a thin film for continued lubricity on longer pulls.

Polywater® LZ will wet out evenly on cable jacket surfaces. It will not bead up or rub off of the jacket sample. A one-inch (25 mm) diameter XLPE cable dipped six inches (152 mm) into Polywater® Lubricant LZ, then withdrawn and held vertically, will retain at least 25 grams of Polywater® Lubricant LZ for one minute at 70° F (21° C).

Combustibility:
Combustibility is a measure of combustion properties of the lubricant residue in a fire situation (with an impinging heat flux).

Polywater® LZ has no flash point and its dried residue will not support combustion and spread flame. A 15-gram sample of the LZ Lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105°C, will not ignite and spread a flame more than three inches beyond the point of ignition when subjected to a continuous heat flux of 85 kW/m^2. The total test time was one-half hour.

Test method described in "Fire Parameters and Combustion Properties of Cable Pulling Compound Residues," presented to the International Wire & Cable Symposium, 1987.

Physical Properties:

Property	Result
Appearance:	White, stringy gel
% Non-Volatile Solids (weight):	4.0
VOC content:	0 gms/L 200 gms/L (wintergrade)
Viscosity (Brookfield):	35,000 – 50,000 cps @10 rpm
pH:	6.5 – 7.5

Application Properties:

Application Systems:
Polywater® LZ has a stringy gel consistency that makes it easy to lift, carry and hand apply.

Polywater® LZ can also be pumped directly into the conduit or onto the cable using the Polywater® LP-3 or LP-D5 specialty lubricant pumps. Pumps allow hands-free transfer and consistent application of lubricant. Polywater's low-shear pumps will not change the gel character of LZ lubricant. The LP-3 and LP-D5 pumps support lubricant application rates of 1 to 3 gallons (4 to 11 liters) per minute.

Polywater® LZ Front End Packs™ are bag packages that "pre-lubricate" the head end of the cable during the pull. The Front End Pack™ attaches to the winch line and pre-lubricates as it goes through the conduit. Two sizes are available to fit 2" and larger conduits.

Pull-Planner™ Tension Calculation Software is available from Polywater. Pulling tension estimations can ensure the use of appropriate pulling equipment and that the cable is installed within safe limits.

Polywater® LZ is also available in a special-order, pourable version (lower viscosity) called Polywater® PLZ. PLZ is primarily for underground work where pouring the lubricant into a cable feeder tube is a convenience.

Temperature Use Range:
Polywater® LZ:
20°F to 120°F (-5°C to 50°C).
Polywater® WLZ (wintergrade version):
-20°F to 120°F (-30°C to 50°C)

Temperature Stability:
Polywater® LZ will not phase-out or separate after five freeze/thaw cycles or 5-day exposure at 120°F (50°C).

Clean-Up:
Polywater® LZ is non-staining. Complete clean-up is possible with water.

Storage and Shelf Life:
Store Polywater® LZ in a tightly sealed container away from direct sunlight. Lubricant shelf life is one year.

Directions for Use:

Polywater® LZ Lubricant can be hand applied or pumped onto the cable as it enters the conduit.

For long pulls, place approximately two-thirds of the recommended quantity of lubricant into the conduit using the Front End Packs™ or by pumping.

For Front End Packs™ use, attach the packs of Polywater® LZ to the winch line or pulling rope in front of the cable by using tape or cable ties. Start the pull and slit open the entire length of the pack(s) with a sharp knife as it enters the conduit.

Supplement with direct jacket lubrication as the cable enters the conduit.

Clean-up by wiping off any excess lubricant with a rag.

Recommended Lubricant Quantity:

$$Q = k \times L \times D$$

Where:
Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
k = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and stiffness
(Increase quantity for stiff, heavy cable)

Conduit condition
(Increase quantity for old, dirty or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Pulling environment
(Increase quantity for high temperatures)

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Polywater® LZ Lubricant. The cable pulling lubricant shall provide excellent friction reduction with good cling and wetting through long pulls and multiple bends. The lubricant shall leave minimal, non-combustible residue. It shall be compatible with most cable jacket materials and be extensively tested on a broad variety of low smoke, halogen-free cable jacket materials.

Cable jacket compatibility shall be tested with the specific LSZH jacket material used on the cable. Test data shall be provided by the cable manufacturer or the lubricant manufacturer. It shall not stress crack polyethylene per ASTM Standard 1693. There shall be no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when the lubricant's effect on volume resistivity is tested according to IEEE Standard 1210.

A 15-gram sample of the lubricant, when placed in a one-foot, split metal conduit and fully dried for 24 hours at 105 degrees C, shall not spread a flame more than three inches beyond a point of ignition at a continued heat flux of 85 kW / meter^2. Total time of test shall be one-half hour.

Order Information:

Cat #	Package Description
	Regular
LZ-27	1-qt bag in a box (0.95 liter)
LZ-99	1-qt bag in a pail (0.95 liters)
LZ-55	½-gal bag in a box (1.9 liters)
LZ-110	½-gal bag in a pail (1.9 liters)
LZ-35	1-qt squeeze bottle (.95 Liter)
LZ-128	1-gallon pail (3.78 Liter)
LZ-640	5-gallon pail (18.9 Liter)
LZ-DRUM	55-gallon drum (208 Liter)
	Wintergrade
WLZ-55	½-gal bag in a box (1.9 liters)
WLZ-110	½-gal bag in a pail (1.9 liters)
WLZ-35	1-qt squeeze bottle (.95 liter)
WLZ-128	1-gallon pail (3.78 liter)
WLZ-640	5-gallon pail (18.9 Liter)
	Pourable
PLZ-128	1-gallon pail (3.78 Liter)
PLZ-640	5-gallon pail (18.9 Liter)

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 3000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
www.polywater.com (URL) custserv@polywater.com (e-mail)

Polywater®

SPY

SPRAY CABLE LUBRICANT

New Concentrated Lubricant Technology for Pulling or Pushing Wire and Cable

Polywater® SPY Spray Lubricant offers an innovative approach to cable lubrication. The concentrated lubricant reduces pulling tension with only a thin coating. Use less with no need to "glop" on pasty wax lubricants. Just spray or wipe to coat the cable jacket. Quick and easy lubrication with no mess.

- **Easy Spray or Wipe Application**
- **Lubricates With a Thin Film**
- **Works Even When Dry**
- **Non-Staining - Easy Clean-Up**
- **Compatible with Cable Jackets***
- **Convenient Application Options**

Usage Recommendations

Polywater® SPY Lubricant works on all types of jobs.
Lubricate cable or conduit using one of the application options.

Pre-Saturated Towels -- Catalog #SPY-D20

This lightweight and handy package fits easily into tool bags. Use the lubricant-saturated towels to coat the wires as they are pulled. The SPY-D20 pop-up package contains 20 tough, non-tearing towels. A neat way to apply lubricant for runs up to several hundred feet.

Refillable Quart Trigger Sprayer -- Catalog #SPY-35LR

For small conduits, the trigger sprayer is a good way to apply the SPY Lubricant. The SPY-35LR quart bottle comes with an industrial-quality, high-volume spray trigger head. For short runs, you can even eliminate fishing by spraying Polywater® SPY and simply pushing the cables. The spray trigger package is reusable and can be refilled from gallon jugs.

Industrial Sprayer -- Catalog #IS-3

For larger installations, liquid Polywater® SPY Lubricant can be applied from a manually pressurized commercial sprayer. Polywater's Industrial Sprayer (IS-3) sprays up to 1/2 gallon per minute. This corrosion-resistant sprayer has a 3-gallon capacity poly container, an 18-inch curved brass extension, a 10-foot flexible heavy-duty hose, and a brass fan-spray nozzle.

Polywater® SPY Spray Lubricant Ordering Information

Part #	Winter Grade Part #	Description	Case Quantity
SPY-D20	WSPY-D20	20-Count Towelette Dispenser	12/Case
SPY-35LR	WSPY-35LR	1-Quart (.95 *liter*) Spray Bottle	12/Case
SPY-128	WSPY-128	1-Gallon (3.8 *liters*) Jug	4/Case
SPY-640	WSPY-640	5-Gallon (18.9 *liters*) Pail	1/Each
IS-3	IS-3	Industrial Sprayer	1/Each
PB-5	PB-5	Pump-in-a-Bucket	1/Each

***** See http://www.polywater.com/lubeinfo.asp for specific compatibility recommendations.

Lit-SPYFLYER/3-2007/C1000/(3-2007)

Makers of Polywater® J and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com (e-mail)
www.polywater.com (URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

Polywater® SPY Cable Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Polywater® SPY Spray Lubricant is a high performance, thin liquid cable pulling lubricant. Lubricant SPY is highly concentrated and works with only a thin coating. Polywater® SPY can be sprayed for easy application, yet has excellent cling and wetting to the cable. Lubricant SPY works even after it has dried. The residue is a thin, slippery film that retains lubricity for months after use.

Polywater® SPY Spray Lubricant is recommended for spray or wipe lubrication with no mess. The lubricant is suitable for all types of cable installations.

Innovation and Function:

Polywater® Lubricant SPY is a thin, concentrated liquid that can be sprayed into the duct or wiped on the cable. Industrial sprayers are available for automatic spraying application. Polywater® SPY is based on unique lubricant chemistry and technology. Much like a paint, the lubricant thins as it is sprayed or wiped. Once on the cable or conduit surface, it thickens to stay coated.

Polywater® SPY reduces friction effectively and compares favorably with the other high-quality Polywater® Lubricants. It has been successfully tested for a variety of uses:

- Lubricating fiberglass rods for easier and longer insertions during fishing.
- Spraying holes in wood studs to reduce tension in hand-pulled Romex wire.
- Eliminating need to fish by allowing shorter runs of wire to be pushed.
- Lowering tension on traditional building wire pulling into EMT or PVC conduits.
- Pressurized spraying for no-mess underground cable installation.

Product Benefits:

- Easy spray or wipe application
- Lubricates with a thin film
- Excellent friction reduction
- Continues to lubricate after drying
- Compatible with cable jackets
- Clean and non-staining
- Convenient

End Use:

Use for all types of cable installations, including:

- General construction
- Hands-free installations
- Automated spray application
- Cables with friction-enhanced jackets

Cable Compatibility:

Polyethylene Stress Cracking:
Polywater® SPY shows no stress cracking on LLDPE cable jacket when tested per IEEE Standard 1210[1].

Tensile and Elongation Effects:
LLDPE, XLPE, and PVC cable jacket materials aged in Polywater® Lubricant SPY per IEEE Standard 1210[1] meet the tensile and elongation retention requirements of that standard.

Volume Resistivity:
There are no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when volume resistivity is tested according to IEEE Standard 1210[1].

Building Wire Testing:
THHN and XLPE building wire meet UL tensile, elongation, and voltage withstand requirements after exposure to Polywater® SPY Lubricant as tested by UL requirements[2].

Corrosivity:
Lubricant is non-corrosive to steel, copper, or aluminum. Passes UL 267[2] corrosion testing on zinc-coated EMT.

[1] *IEEE Std 1210-2004; IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.*

[2] *UL Subject 267, Investigation for Wire-Pulling Compounds.*

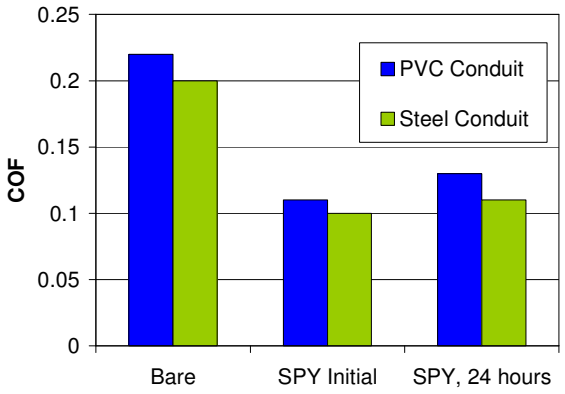
Physical Properties:

Property	Result
Appearance:	Slightly thickened, white liquid
Percent Non-Volatile Solids:	4%
VOC Content:	0 gms/liter
Viscosity:	250-750 cps @10rpm
pH:	7.5 – 9.0

Performance Properties

Dry lubrication
Dry lubrication measurements indicate the capability of thin-film lubricants to continue to lubricate when dry.

Polywater® SPY Lubricant continues to work even after it dries. Coefficient of friction values measured on cable coated and then dried for 24 hours are within 20% of the initial "wet" value. Measurements were done using the Friction Table Method described in the white paper, "Coefficient of Friction Measurement on Polywater's Friction Table, 2007." (polywater.com/FTable.pdf).



Wetting – Continuous Coat:
Wetting is a measure of the lubricant's ability to coat the jacket as a thin film for continued lubricity on longer pulls.

Polywater® SPY Lubricant will wet out evenly on cable surfaces. It will not bead up or rub off of the cable jacket. Lubricant will completely coat a one-inch diameter THHN or PVC-jacketed cable dipped six inches (152 mm) into the lubricant and then withdrawn after 10 seconds. The lubricant coating shall cover 100% of the immersed cable jacket without dripping off, non-wetting, or drawing back from the edges as the cable is held horizontally for one minute at 70° F (21° C).

Combustibility:
Lubricant has no flash point and dried residue is non-flammable.

Spraying Characteristics:
Low viscosity lubricant allows product to flow through airless spray heads. Lubricant will not clog valves or atomizers on the sprayer.

Application Properties:

Application Systems:
Polywater® SPY Lubricant can be applied in several unique and innovative ways. This thin liquid can be sprayed or wiped directly on the cable jacket. Shorter cable runs can be pushed once the cable is coated with Polywater® SPY. The slightly gelled character of Lubricant SPY helps it to coat and wet the cable for more difficult and complex cable pulls as well.

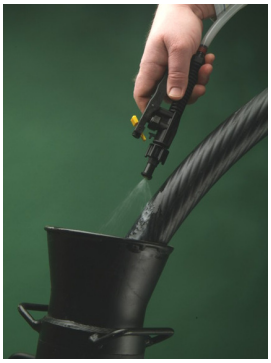
Wipe Application: For small cables, use the SPY-D20 towelette to wipe the lubricant on the cable jacket. This pre-saturated wipe lays down a thin, even coat of lubricant. The towel material is will release the lubricant without a mess.

Trigger Spray Bottle: Use the trigger sprayer on the SPY-35LR bottle to spray Polywater® SPY Lubricant directly on the cable or into the conduit. The bottle can refilled for multiple uses.

Pressurized Sprayer: For larger installations, apply Polywater® SPY Lubricant from a "pump-up" pressurized commercial sprayer (Cat #: IS-3). Spraying allows for the controlled and consistent, hands-free application of lubricant.

The IS-3 Sprayer can feed up to 0.5 gallon (2 liters) of lubricant per minute. This corrosion-resistant sprayer has a 3-gallon capacity poly container, an 18-inch curved brass extension, a 10-foot flexible heavy-duty hose, and a brass fan-spray nozzle.

Hand Wiping



Pressurized Spraying

Temperature Use Range:
Polywater® SPY:
20° F to 120° F (-5° C to 50° C).
Polywater® WSPY (wintergrade version):
-20° F to 120° F (-30° C to 50° C)

Temperature Stability:
No phase-out after five freeze/thaw cycles or 5-day exposure at 120° F (50° C). *Will not phase out or separate during the shelf life of lubricant.*

Clean-Up:
Non-staining. Complete clean-up is possible with water.

Storage and Shelf Life:
Store Polywater® SPY in a tightly sealed container away from direct sunlight. Lubricant shelf life is one year.

Directions for Use:

Polywater® SPY Lubricant can be sprayed or wiped directly onto the cable as it enters the conduit. Coat the entire cable jacket for best friction reduction.

For short runs, spray an appropriate amount of Polywater® SPY into the conduit before the pull, so the cable will pick up the lubricant as it is pulled.

Polywater® SPY leaves a light, clean residue. Any remaining residue will evaporate quickly.

Recommended Lubricant Quantity

$$Q = k \times L \times D$$

Where:
Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
k = 0.0005 (0.0004 if metric units)

The appropriate quantity for use on any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and jacket hardness
(Increase quantity for stiff, heavy cable)
Conduit type and conditions
(Increase quantity for old, dirty or rough conduits)
Conduit fill
(Increase quantity for high percent conduit fill)
Number of bends
(Increase quantity for pulls with several bends)
Pulling environment
(Increase quantity for high temperatures

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Polywater® Lubricant SPY. Lubricant has a sprayable viscosity and will not clog valves or applicators. It shall coat and cling to the cable. It shall be non-staining.

Lubricant shall produce a low coefficient of friction on a wide variety of cable jacket materials and shall lubricate at low coating thickness. Lubricant shall continue to reduce friction after it has dried. It shall conform to the physical and electrical requirements of IEEE 1210. It shall not contain solvents and shall not have a flash point.

No substitutions are permitted without certification from an officer of the manufacturer that the substitute product meets all of the requirements of this specification

Order Information:

Cat #	Package Description
	Regular
SPY-D20	20-count wipe canister
SPY-35LR	1-quart spray bottle (0.95 Liter)
SPY-128	1-gallon pail (3.78 Liter)
SPY-640	5-gallon pail (18.9 Liter)
	Wintergrade
WSPY-35LR	1-quart spray bottle (.95 Liter)
WSPY-128	1-gallon pail (3.78 Liter)
WSPY-640	5-gallon pail (18.9 Liter)

Lit-SPYTech/9-08/Internal/9-08

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 3000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-612-430-3634
www.polywater.com(URL) custserv@polywater.com(e-mail)

Polywater®

Prelube

Cable Blowing Lubricants for Air-Assisted Installation of Fiber Cable

Lower Friction and Increase Blowing Distance

Prelube 2000™

for blowing conventional fiber optic cable

Easy to Apply

Low Overall Cost

Proven, Effective Formula

Prelube 5000™

for blowing fiber optic microcables

Thinner Viscosity

Field Developed & Tested

New, More Concentrated Formula

Polywater®

Prelube

2 0 0 0™

for blowing conventional fiber optic cable

Polywater® Prelube 2000™ reduces frictional drag during the blowing of outside plant cable into duct. It increases the length of cable that can be blown in a single shot. Prelube 2000™ can also be used to blow in the hollow microtubes intended to hold future microcables. Over the last decade, Prelube 2000™ has been proven in the blowing of tens of thousands of kilometers of cable in over 20 countries on a variety of cable blowing machines.

Features

- Polywater® Prelube 2000™ has proven superior to paraffin oils and cable pulling lubricants for cable blowing. The use of this lubricant results in longer installation distances.
- Polywater® Prelube 2000™ is recommended by most blowing equipment manufacturers. It increases installation distance on all types of machines.
- Polywater® Prelube 2000™ is more economical than prelubricated duct.
- Polywater® Prelube 2000™ is compatible with common fiber optic cable jacket.

Application

A properly installed duct system with pressure-tight duct splices is an absolute necessity for efficient cable blowing. Follow the equipment manufacturer's instructions. The duct must be clean, dry, and mandral tested. Clean the duct by blowing a tight-fitting foam sponge through the duct with high pressure. If excess water or dirt comes from the duct, repeat the process. Prelube 2000™ is effective at a coating thickness of 0.5 mg/cm^2.

For smoothwall duct and high air speed machines (no missile), squeeze the recommended amount of Prelube 2000™ Lubricant from the table below into the duct. Spread the lubricant by blowing a foam carrier through the duct. The quart squeeze bottle (Cat. # P-35) is a good package for this type of application.

Duct Size	Lubricant Quantity	
	per 1,000 Feet	per Kilometer
1 inch (2.5 cm)	3 fl. oz.	300 ml
1.25 inch (3 cm)	4 fl. oz.	400 ml
1.5 inch (4 cm)	5 fl. oz.	500 ml
2 inch (5 cm)	6 fl. oz.	600 ml

For smooth wall duct (ID 1 to 1.25 inch) and piston type machines, use 5 to 10 fl oz per thousand feet of duct (0.5 to 1.0 liter per kilometer). Place 75% of the lubricant in front of the missile and the rest behind it. The lubricant is spread by the missile as the cable is blown.

Polywater®

Prelube

5 0 0 0™

for blowing fiber optic microcables

Polywater® Prelube 5000™ is more concentrated than the Prelube 2000™. It is intended for blowing microcable into small diameter microtubes. The improved chemistry allows this product to spread further and lower friction at extremely low coating levels. The lower viscosity allows practical application into the microtubes.

Features

- Polywater® Prelube 5000™ is easy to use. It can be squeezed into the small diameter microducts.
- Polywater® Prelube 5000™ works at extremely low coating levels. It coats further and more effectively than conventional blowing lubricants.
- Polywater® Prelube 5000™ has proven superior in side-by-side testing in blown microcable installations.
- Polywater® Prelube 5000™ is compatible with known microcable plastic jackets. However, it should not be used for resin-coated fiber cables.

Application

The microduct tubing must be pressure tight. Clean and dry the tubing by blowing a tight fitting foam sponge through the microduct with high pressure. If excess water or dirt comes from the microduct, repeat the process. Trapped water can block the air flow.

Prelube 5000™ is effective at quantities as low as 0.05 mg/cm^2. Squeeze recommended amount of lubricant into microduct. Quantity can be measured with a syringe or estimated based on duct fill length (table below). Spread lubricant by blowing a foam carrier or sponge through the microduct as many times as necessary to avoid puddling at the front of the duct.

Tube Size (OD/ID)	Lubricant per 1,000 ft of Microtube	
	Volume Required	Fill Length of Microtube
14/12 mm	0.30 fl. oz. (9 ml)	3 in. (8 cm)
12/10 mm	0.25 fl. oz. (7 ml)	4 in. (10 cm)
10/8 mm	0.20 fl. oz. (6 ml)	5 in. (12 cm)
8/6 mm	0.15 fl. oz. (4 ml)	6 in. (16 cm)
7/5 mm	0.13 fl. oz. (4 ml)	7 in. (19 cm)
5/3.5 mm	0.09 fl. oz. (3 ml)	10 in. (27 cm)
4/3 mm	0.08 fl. oz. (2 ml)	12 in. (31 cm)

The quantities of lubricant appropriate for any job will vary with the size, type, and condition of the duct. Use the recommendations above as a place to start and adjust as necessary.

Cost Effectiveness

Polywater® Prelube 2000™ offers significant cost savings over "factory-lubricated" duct. In high quality HDPE duct, it lubricates efficiently at coating levels of 0.5 mg/cm² of duct surface. At these levels, the lubricant cost for 1.25" (3.2 cm) duct is approximately $1 per 1,000 feet ($3 per kilometer), much lower than the additional cost for factory-lubricated duct.

Polywater® Prelube 5000™ is extremely efficient and cost effective. It lubricates at coating levels as low as 0.05 mg/cm^2 of the tubing's interior surface. At these levels, the lubricant cost is $0.15 to $0.60 per 1,000 feet ($0.50 to $1.95 per kilometer) depending on microtube size.

Packaging and Catalog Numbers

Package Size	Prelube 2000™	Prelube 2000™ - Winter Grade	Prelube 5000™ for Microcables
1-quart squeeze bottle (0.95 l)	P-35	WP-35	
1-gallon pail (3.8 l)	P-128	WP-128	
5-gallon pail (18.9 l)	P-640	WP-640	
8-fl ounce squeeze bottle			PM-8

References

1. Installation of Fiber Optic Cables in Duct, W. Griffioen, Plumettaz S. A., 1993

2. The Use of the High Air-Speed Blown-Cable System for Placing Optical-Fiber Cables in Ducts, P. R. Briggs et al, NFOEC Conference, 1993

3. Analysis and Measurement of Friction in High Speed Air Blowing Installation of Fiber Optic Cable, J. M. Fee et al, NFOEC Conference, 1995

See the web page **www.polywater.com/airblow.html** for additional information on high speed air assisted cable installation.

Lit-PL2000-5000Flyer/2-05/INTERNAL/2-05

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

www.polywater.com(URL) custserv@polywater.com

Network *Loop*™ Lubricant NL
Communications Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Network *Loop*™ Lube NL is a pourable, high-performance pulling lubricant recommended for underground pulling of communication cables (copper, fiber optic, and coaxial).

Lubricant NL is a silicone-enhanced lubricant. This clean, slow-drying pulling compound offers economical friction reduction and universal compatibility with communication cable jackets, including polyethylene types. It coats evenly and clings well to cable. Network *Loop*™ Lube continues to lubricate after its water-base has evaporated.

Lubricant NL is a thick liquid. Apply by pouring or pumping the lubricant into the duct system.

Friction Testing:

Friction is measured using a standard Telcordia test procedure[1]. HDPE duct is wrapped 420° around a three-foot-diameter cylinder. A variable "back tension" weight is attached to the cable and the cable is pulled through the wrapped duct at a speed of 65 ft/min. A load cell measures pulling force, which, combined with the "back tension", is used to calculate a friction coefficient. Results below are typical values.

Coefficient of Friction for MDPE Jacket Cable into HDPE Smoothwall Innerduct

Back Tension	Condition		
	Unlubricated	Initial	Dry
14 lb_f	>0.30	0.10	0.12
25 lb_f	>0.30	0.09	0.11

For the dry test, continuous, warm air was run through the conduit until the lubricant volatiles had evaporated (~1 hour). Network *Loop*™ Lube shows good friction reduction even after drying. Dry coefficient of friction values are within 30% of initial value.

[1] *Telcordia Standard TR-NWT-002811, Section 4.1.3 and 4.1.4; Generic Requirements for Cable Placing Lubricants.*

Product Benefits:

- Silicone enhanced for superior friction reduction
- Effective lubrication when dry
- Pour lubricant for easy underground application
- Carries with cable for long distance - liquid clings to cable.
- Compatible with cable jackets—including polyethylene
- Clean and non-staining

End Use:

Suitable for all types of cable installations, including:

- Network cabling
- Silicone-lined and prelubricated ducts
- Lightweight cable, underground installation

Performance Properties

Specialty pulling lubricants are required for the long installation lengths and significant time duration of the fiber optic pulls. The lubricant must coat the cable jacket and stay evenly coated since lightweight cable can rub on the top as well as the bottom of the conduit. The lubricant must remain slippery over time, and not dry to a higher-friction residue.

Wetting – Continuous Coat:
Wetting is a measure of the lubricant's ability to completely coat the jacket for continued lubricity on longer pulls.

Network *Loop*™ Lube will wet out evenly on cable jacket surfaces. It will not bead up or rub off of the cable jacket. Lubricant will completely coat a one-inch diameter PE-jacketed cable dipped six inches into the lubricant; then withdrawn within 10 seconds. The lubricant coating shall cover 80% of the cable jacket without dripping off, beading up, or pulling away from the edges as it is held horizontally for one minute at 70°F (21°C).

Stringy Rheology:
Network *Loop*™ Lube *shows a strong, cohesive "string" character. Lubricant will follow and stay with cable over long distances.*

A ¼-inch fiber cable (MDPE jacket) dipped two inches into the lubricant and pulled out (40 inches per minute) will produce a continuous, non-supported, lubricant string length greater than 6 inches (150 mm).

Pourability:
A five-gallon pail of Network *Loop*™ Lube will empty from a Reike® spout without an air relief hole in lid in less than 90 seconds and with an air relief hole in lid in less than 60 seconds.

Combustibility:
Lubricant has no flash point and dried residue is non-flammable.

Physical Properties:

Property	Result
Appearance:	Opaque-white, stringy liquid
Percent Non-Volatile Solids:	2.0 %
VOC Content:	0 gms/liter
Viscosity:	1,000 – 3,000 cps @10rpm
pH:	6.5 – 7.5

Application Properties:

Temperature Use Range:
Network *Loop*™ Lube:
20°F to 120°F (-5°C to 50°C).

Temperature Stability:
No more than a 20% change in Brookfield viscosity from 40°F to 100°F (5°C to 40°C). No phase-out after five freeze/thaw cycles or 5-day exposure at 120°F (50°C). *Will not phase out or separate during the shelf life of lubricant.*

Clean-Up:
Non-staining. Complete clean-up with water.

Storage and Shelf Life:
Store tightly sealed, away from direct sunlight. Lubricant shelf life is one year past the date of manufacture.

Cable Compatibility:

Polyethylene Stress Cracking:
Network *Loop*™ Lube does not stress crack polyethylene jackets commonly used on communications cables. Untreated polyethylene (Union Carbide DYNK) and MDPE jacket material were both tested according to ASTM standard method.[1] After 168 hours exposure none of the test specimens showed failures.

Polycarbonate Stress Cracking:
Network *Loop*™ Lube will not stress crack polycarbonate. Polycarbonate bars are bent to a defined strain and exposed to lubricant as described in the Telcordia standard[2], Section 8.2, Stress Cracking of Polycarbonate. After 48 hours, none of the test specimens showed signs of crazing or cracking.

[1] ASTM Test Method D1693, Environmental Stress-Cracking of Ethylene Plastics.

[2] Telcordia Standard TR-NWT-002811; Generic Requirements for Cable Placing Lubricants.

Directions for Use:

Network *Loop*™ Lube can be can be poured directly into the conduit. Directly lubricate the cable or wire during the entire portion of the pull. It is best to coat the entire cable or wire as it enters the conduit.

Network *Loop*™ Lube may be gravity fed or pumped into conduit using the LP-D5 automatic pump, allowing the lubricant to fully coat the outside of the cable. SureGrip™ Nonslip Cable Handling Gloves offer maximum grip for pulling slippery, lubricant-covered wires and cable into or out of conduit.

For clean-up, use a rag to squeegee the end of the cable, tightly gripping the cable with a rag. The remaining residue will evaporate quickly.

Recommended Lubricant Quantity

Q = k X L X D

Where:

Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
k = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and stiffness
(Increase quantity for stiff, heavy cable)

Conduit condition
(Increase quantity for old, dirty or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Pulling environment
(Increase quantity for high temperatures)

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Network *Loop*™ Lube. The lubricant shall be a high performance, silicone-enhanced liquid with excellent tension reduction properties.

When tested according to Bellcore test procedure TR-TSY-00356 Sections 4.1.3. and 4.1.4, it shall produce low friction coefficient. It shall have a friction coefficient less than 0.12 using MDPE-jacketed cable and HDPE innerduct. When lubricant is dried with continuous warm air flow for one hour, it shall have a friction coefficient less than 0.16.

It shall conform to the physical and performance requirements of Telcordia Standard, TR-NWT-002811, Generic Requirements for Cable Placing Lubricants. The lubricant shall not stress crack polyethylene when tested by ASTM 1693. The lubricant shall have a neutral pH and shall be non-toxic, non-sensitizing. It shall be non-staining.

No substitutions are permitted without certification from an officer of the manufacturer that the substitute product meets all of the requirements of this specification

Order Information:

Cat #	Package Description
NL-128	1-gallon pail (3.78 Liter) 4/case
NL-640	5-gallon pail (18.9 Liter)

American Polywater Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

Premise *Loop*™ Lubricant RL Communications Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Premise *Loop*™ Lubricant RL is a silicone-enhanced, gel lubricant that is easy-to-apply. It is formulated for lightweight fiber-optic, coaxial, and other types of premise data cable.

Premise *Loop*™ Lube is a clean, slow-drying pulling compound that offers excellent friction reduction and universal compatibility on communication cables, including all polyethylene types. It coats evenly and clings well to cable. Premise *Loop*™ Lube leaves a lubricating film after its water-base has evaporated. It is an economical gel silicone choice.

Friction Testing:

Friction is determined using a standard Telcordia test procedure[1]. The duct is wrapped 420° around a three-foot-diameter cylinder. A 25-lb incoming weight is attached to the cable as it is pulled at a set rate of 65 feet per minute. A load cell takes pulling tension data which is used to determine a "dynamic" friction coefficient. Below is typical data.

	Cable Jacket Type	
	Fiberoptic	Premises
Conduit Type	MDPE	PVC
Polyethylene	.08	.08
Smoothwall PVC	--	.09
Corrugated PVC	.13	.06

[1] *Telcordia Standard TR-NWT-002811, Section 4.1.3 and 4.1.4; Generic Requirements for Cable Placing Lubricants.*

Further friction testing was done using the method described in the white paper, “Coefficient of Friction Measurement on Polywater’s Friction Table, 2007” (polywater.com/FTable.pdf). Typical value at 200 lbs/ft (2.91 kN/m) normal pressure are shown.

COF based on Friction Table Method	
Premise Cable (PVC Jacket) on Schedule 40 PVC Conduit	.10

Premise *Loop*™ Lube shows excellent friction reduction.

Product Benefits:

- Silicone enhanced for superior friction reduction
- Good gel cling for hand application
- Suitable for premise cable
- Compatible with cable jackets—including polyethylene
- Clean and non-staining
- Slow drying for continuous lubricity

End Use:

Use for all types of cable installations, including:

- Vertical-up runs at beginning of pull
- Silicone-lined and prelubricated ducts
- Lightweight cable, building construction

Performance Properties

Coatability:
Coatability is a measure of the lubricant's ability to coat the cable jacket as a thin film for continued lubricity on longer pulls.

Premise *Loop*™ Lube will wet out evenly on cable jacket surfaces. It will not bead up or rub off of the jacket sample. A ½-inch (13 mm) diameter MDPE fiber cable dipped six inches (152 mm) into the Premise *Loop*™ Lube, when withdrawn and held vertically will retain at least 10 grams of Premise *Loop*™ Lube for one minute at 70° F (21° C).

Cling Factor:
Cling factor is a measure of the ability to apply the lubricant and have it stay on the jacket while the cable enters the conduit.

A six-inch length (152 mm) of a ½-inch (13 mm) diameter fiber cable will hold at least 25 grams of Premise *Loop*™ Lube for one minute when held vertically at 70° F (21° C).

Combustibility:
Lubricant has no flash point and dried residue is non-flammable.

Cable Compatibility:

Polyethylene Stress Cracking:
Premise *Loop*™ Lube does not cause environmental stress cracking of polyethylene jackets commonly found on communications cables. Untreated polyethylene (Union Carbide DYNK) and MDPE jacket material were both tested according to ASTM standard method.[1] After 168 hours exposure none of the test specimens showed failures.

Polycarbonate Stress Cracking:
Premise *Loop*™ Lube will not stress crack polycarbonate. Polycarbonate bars are bent to a defined strain and exposed to lubricant as described in the Telcordia standard[2], Section 8.2, Stress Cracking of Polycarbonate. After 48 hours, none of the test specimens showed signs of crazing or cracking.

[1] *ASTM Test Method D1693, Environmental Stress-Cracking of Ethylene Plastics.*

[2] *Telcordia Standard TR-NWT-002811; Generic Requirements for Cable Placing Lubricants.*

Physical Properties:

Property	Result
Appearance:	Opaque-white, stringy liquid
Percent Non-Volatile Solids:	3 %
VOC Content:	0 gms/liter
Viscosity:	40,000 – 70,000 cps @10rpm
pH:	6.5 – 7.5

Application Properties:

Temperature Use Range:
20°F to 120°F (-5°C to 50°C).

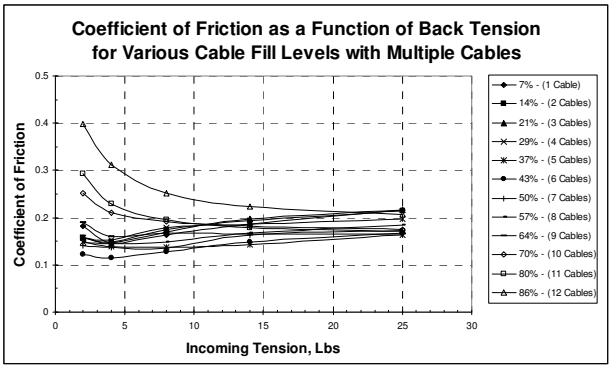
Temperature Stability:
No phase-out after five freeze/thaw cycles or 5-day exposure at 120°F (50°C). *Will not phase out or separate during the shelf life of lubricant.*

Clean-Up:
Non-staining. Complete clean-up with water.

Storage and Shelf Life:
Store tightly sealed, away from direct sunlight. Lubricant shelf life is one year past the date of manufacture.

Cable Fill Study:

Communication cables are often pulled in large bundles. To study this installation method, Premise *Loop*™ Lube was coated onto bundles of premises wire, and the effects of cable fill on tension and friction was measured. Testing was completed using the BellCore Test Procedure. Larger bundles of cable increase friction and, therefore tension as detailed in the graph below.



More information can be found in the paper, "The Effect of Conduit Fill on Premises Cabling". (LINK) At higher fill levels, friction increases. Use of lubricant becomes necessary to lower tension.

Directions for Use:

Premise *Loop*™ Lube can be can be squeezed, pumped or hand applied directly onto the wire or cable. Directly lubricate the cable or wire during the entire portion of the pull. It is best to coat the entire cable or wire as it enters the conduit.

Premise *Loop*™ Lube may be pumped into conduit using the LP-D5 automatic pump, allowing the lubricant to fully coat the outside of the cable. SureGrip™ Nonslip Cable Handling Gloves offer maximum grip for pulling slippery, lubricant-covered wires and cable into or out of conduit.

For clean-up, use a rag to squeegee the end of the cable, tightly gripping the cable with a rag. The remaining residue will evaporate quickly.

Recommended Lubricant Quantity

Q = k X L X D

Where:

Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
k = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and stiffness
(Increase quantity for stiff, heavy cable)

Conduit condition
(Increase quantity for old, dirty or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Premise *Loop*™ Lube. The lubricant shall be a thick gel that is easy to handle and adheres well to the cable. It shall have good wetting (coating) properties and will not bead or rub off of the cable jacket. It shall have <3% solids and shall continue to reduce friction once dry.

It shall conform to the physical and performance requirements of Telcordia Standard, TR-NWT-002811, Generic Requirements for Cable Placing Lubricants. The lubricant shall not stress crack polyethylene when tested by ASTM 1693. The lubricant shall have a neutral pH and shall be non-toxic, non-sensitizing. It shall be non-staining.

No substitutions are permitted without certification from an officer of the manufacturer that the substitute product meets all of the requirements of this specification

Order Information:

Cat #	Package Description
RL-128	1-gallon pail (3.78 Liter) 4/case
RL-640	5-gallon pail (18.9 Liter)

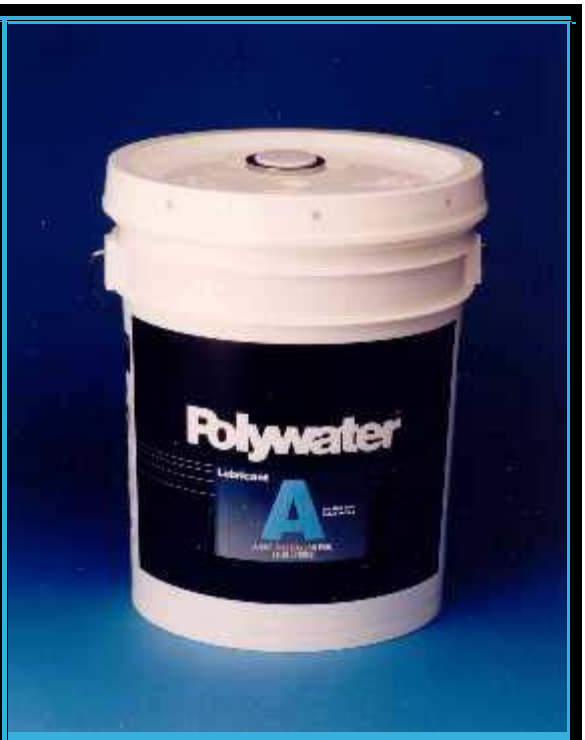
American Polywater® Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

The Clean Lubricant

Polywater® A

CLEAR *LIQUID*

Cable Pulling Lubricant



- Clean drying and non-staining for less mess.
- Water based and water washable.
- Good friction reducing properties. For *maximum* friction reduction, use Polywater® F.
- Applies easily by pouring or pumping.
- Low solids will not cement-in cables.
- Evaporates after use. Nothing to soil hands or pollute environment.
- Temperature stable. No waste due to phase separation.
- Compatible with most cables, including polyethylene jackets.
- Proven effectiveness through decades of worldwide use.

Polywater® A is a general purpose, clean, clear, water-based, liquid lubricant recommended for all types of horizontal cable pulling. Environmentally safe and non-toxic. (NOTE: For especially long, hot, or difficult pulls, liquid Polywater® Lube F or Lube PJ is recommended.

ORDERING OPTIONS			
Catalog Number	**Package Size**	**Units/CS**	**Image**
A-640	**5-gallon pail (18.9 *liters*)**	1	
A-128	**1-gallon jug (3.8 *liters*)**	4	None
A-32	**1-quart squeeze bottle (.95 *liters*)**	12	None

SPECIFICATIONS

1. **Lubricity:** PVC- or LDPE-jacketed cable on PVC conduit at 200 lbs/ft normal pressure; coefficient of dynamic friction <.14.
2. **Temperature stability:** No more than a 10% change in Brookfield viscosity from 5°C to 38°C (40°F to 100°F). No phase-out after five freeze/thaw cycles or 24-hour exposure at 49°C (120°F).
3. **Appearance:** Clear, colorless, stringy liquid material.
4. **pH:** 6.5 to 7.3
5. **Wax, grease, and silicone content:** None
6. **Cable compatibility:** No deleterious effects on physical or electrical properties of cable jackets.
7. **Temperature Use Range:** -5°C to 33°C (20°F to 90°F).
8. **Percent non-volatile solids:** .3 to .7%
9. **Polyethylene stress cracking:** No stress cracking on LDPE cable jacket when tested by ASTM D1693.
10. **Toxicity:** Non-toxic and non-sensitizing. Industrial use only.
11. **Flammability:** Lubricant has no flash point and dried residue is non-flammable.
12. **Cleanup:** Complete cleanup possible with water.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-POLYA/3-07/INTERNAL/(3/07)

The Clean Lubricant

Polywater® G

CLEAR *GEL*

Cable Pulling Lubricant

- Clean drying and non-staining for less mess.
- Water based and water washable.
- Good friction reducing properties. For *maximum* friction reduction, use Polywater® J.
- Applies easily by pumping, or using the Front End Pack™ Bag System.
- Low solids will not cement-in cables.
- Evaporates after use. Nothing to soil hands or pollute environment.
- Temperature stable. No waste due to phase separation.
- Compatible with most cables, including polyethylene jackets.
- Proven effectiveness through decades of worldwide use.

Polywater® G is a general purpose, clean, clear, water-based, thixotropic gel lubricant recommended for all types of cable pulling, including verticals. Environmentally safe and non-toxic. (NOTE: For especially long, hot, or difficult pulls, gel-type Polywater® Lubricant J is recommended.

ORDERING OPTIONS			
Catalog Number	**Package Size**	**Units/CS**	**Image**
G-640	**5-gallon pail (18.9 *liters*)**	1	
G-128	**1-gallon jug (3.8 *liters*)**	4	None
G-55	**½-gal Front End Pack™ bag (1.9 *liters*)**	6	None
G-35	**1-quart squeeze bottle (.95 *liters*)**	12	None

SPECIFICATIONS

1. **Lubricity:** PVC- or LDPE-jacketed cable on PVC conduit at 200 lbs/ft normal pressure; coefficient of dynamic friction <.20.
2. **Temperature stability:** No more than a 10% change in Brookfield viscosity from 5°C to 38°C (40°F to 100°F). No phase-out after five freeze/thaw cycles or 24-hour exposure at 49°C (120°F).
3. **Appearance:** Thick, clear, colorless, gel material.
4. **pH:** 6.4 to 7.2
5. **Wax, grease, and silicone content:** None
6. **Cable compatibility:** Passes IEEE 1210 physical and electrical testing on a wide variety of cable materials.
7. **Temperature Use Range:** -5°C to 33°C (20°F to 90°F).
8. **Percent non-volatile solids:** .5 to 1.5%
9. **Polyethylene stress cracking:** No stress cracking on LDPE cable jacket when tested by ASTM D1693.
10. **Toxicity:** Non-toxic and non-sensitizing. Industrial use only.
11. **Flammability:** Lubricant has no flash point and dried residue is non-flammable.
12. **Cleanup:** Complete cleanup possible with water.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-POLYG/3-07/INTERNAL/(3-07)

Polywater®

CLR

CLEAR CABLE LUBRICANT

All-purpose lubricant for electrical and datacom applications. Compatible with most cable jacket materials.

- Clean, Non-staining
- Reduces Friction
- Safe, Non-toxic
- Clings to Cable
- Easier Installation
- Biodegradable

Product Number	Product Description
CLR-35	1-Quart Squeeze Bottle Polywater® Clear Lubricant (12/cs)
CLR-128	1-Gallon Pail Poywater® Clear Lubricant (4/cs)
CLR-640	5-Gallon Pail Poywater® Clear Lubricant

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.
American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com (e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-CLRFLYER/3-07/MARU/3-07

Polywater® CLR
Clear Cable Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Polywater® CLR Clear Cable Pulling Lubricant is a clear, colorless, clean, slow-drying, easy-to-apply gel lubricant. This thick gel lubricant was developed with "clingability" for easy handling and application. Polywater® CLR Cable Pulling Lubricant is a good lubricant for everyday cable pulling of both electrical and communication cable.

Polywater® CLR Clear Cable Pulling Lubricant is popular for small cable installation in a commercial environment because it is non-staining and easy to clean up.

The dried residue of Polywater® CLR is non-conductive and non-combustible. Polywater® CLR Lubricant is harmless to humans, environmentally safe, compatible with cable jacket materials and easy to use.

Friction Testing:

Lubricity: Polywater® CLR Lubricant effectively reduces friction across a broad variety common of jacket types. Typical friction coefficients at 200 lbs/ft (2.91 kN/m) normal pressure are shown below. Test results are based on the method described in the white paper, "Coefficient of Friction Measurement on Polywater's Friction Table, 2007" (polywater.com/FTable.pdf). Values are compiled from testing on multiple cable jacket and conduit materials from multiple manufacturers.

	Conduit Type		
Cable Jacket	**EMT**	**PVC**	**Steel**
XLPE	.14	.11	.13
PVC	.11	.11	.13

Coefficient of friction data on additional or specific cable jackets or conduits can be obtained from American Polywater Corporation.

Product Benefits:

- Excellent cling for easy hand application
- Clear and Colorless
- Clean and non-staining
- Good friction reduction
- Compatible with cable jacket materials
- Biodegradable
- Environmentally safe
- Non-toxic
- Temperature stable

End Use:

Suitable for all types of cable installations, including:

- General electrical and datacom installation
- Smaller wiring in upgrades
- Indoor construction

Cable Compatibility:

Polyethylene Stress Cracking:
Polywater® CLR shows no stress cracking on LLDPE cable jacket when tested per IEEE Standard 1210[1].

Tensile and Elongation Effects:
PVC, LLDPE and XLPE cable jacket materials aged in Polywater® Lubricant CLR per IEEE Standard 1210[1] meet the tensile and elongation retention requirements of that standard.

Volume Resistivity:
There are no significant changes in the conductive properties of XLPE and EPR semi-conducting compounds when volume resistivity is tested according to IEEE Standard 1210[1].

Building Wire Testing:
THHN and XLPE building wire meet UL tensile, elongation, and voltage withstand requirements after exposure to Polywater® CLR Lubricant as tested by UL requirements[2].

Corrosivity:
Lubricant is non-corrosive to steel, copper, or aluminum. Passes UL 267[2] corrosion testing on zinc-coated EMT.

[1] *IEEE Std 1210-2004; IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable.*

[2] *UL Subject 267, Investigation for Wire-Pulling Compounds.*

Physical Properties:

Property	Result
Appearance:	Clear, colorless gel
Wax, Grease and Silicone Content:	None
Percent Non-Volatile Solids:	5%
VOC Content:	20 gms/liter
Viscosity:	40,000 – 60,000 cps @10rpm
pH:	6.5 – 8.0

Performance Properties

Cling Factor:
Cling factor is a measure of the ability to apply the lubricant and have it stay on the jacket while the cable enters the conduit.

A six inch length (152 mm) of a one-inch (25 mm) diameter cable will hold at least 70 grams of Polywater® Lubricant CLR for one minute when held vertically at 70° F (21° C).

Coatability:
Coatability is a measure of the lubricant's ability to coat the jacket as a thin film for continued lubricity on longer pulls.

Material will wet out evenly on all surfaces. It will not bead up or rub off of the cable jacket. A one-inch (25 mm) diameter XLPE cable dipped six inches (152 mm) into the Polywater® Lubricant CLR, then withdrawn and held vertically, will retain at least 20 grams of Polywater® Lubricant CLR for one minute at 70° F (21° C).

Residue:
Residue is the percent solids remaining when the lubricant dries. A high residue can "cement" cables in place to prevent future removal or adjustment.

Polywater® CLR Lubricant has a low residue, less than 5% solids. The residue dries clear with no powders or discoloration. As Lubricant CLR dries, the product retains its lubricity.

Combustibility:
Lubricant has no flash point and dried residue is non-flammable.

Clarity:
Polywater® CLR Lubricant is completely clear and non-staining. All components are water soluble.

Application Properties:

Application Systems:
Polywater® CLR has a thick gel consistency that makes it easy to hand apply. The product will cling to the cable through vertical and long pulls.

The clear character of the lubricant and the low solids content make Polywater® CLR an ideal lube for installations where cleanliness is a concern.

Pull Planner™ Cable Tension Calculation Software is available from Polywater. Pulling tension estimations can ensure the use of appropriate pulling equipment and that the cable is installed within safe limits.

Temperature Use Range:
20° F to 120° F (-5° C to 50° C).

Temperature Stability:
No phase-out after five freeze/thaw cycles or 5-day exposure at 140° F (60° C).

Clean-Up:
Polywater® CLR is non-staining. Complete clean-up is possible with water.

Storage and Shelf Life:
Store Polywater® CLR in a tightly sealed container away from direct sunlight. Lubricant shelf life is one year.

Directions for Use:

Polywater® CLR Lubricant can be squeezed, pumped or hand applied directly onto the wire or cable. The conduit should be clean and continuous.

To prelubricate for long or difficult pulls, squirt a liberal amount of Polywater® CLR Lubricant into the conduit before the pull begins and use a mandrel or a swab on the winch line to spread the lubricant during the pull.

Clean-up by wiping off excess lubricant with a rag.

Recommended Lubricant Quantity

$$Q = k \times L \times D$$

Where:

Q = quantity in gallons (liters)
L = length of conduit run in feet (meters)
D = ID of the conduit in inches (mm)
k = 0.0015 (0.0008 if metric units)

The quantity that is appropriate for any given pull can vary from this recommendation by 50%, depending on the complexity of the pull. Consider the following factors:

Cable weight and stiffness
(Increase quantity for stiff, heavy cable)

Conduit condition
(Increase quantity for old, dirty or rough conduits)

Conduit fill
(Increase quantity for high percent conduit fill)

Number of bends
(Increase quantity for pulls with several bends)

Pulling environment
(Increase quantity for high temperatures)

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Polywater® CLR Lubricant. The lubricant shall be a clear, colorless thick gel that can be hand applied without dripping. The lubricant shall contain **no** waxes, greases, or silicones.

Cable jacket compatibility shall be tested by the IEEE 1210, Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable. It shall pass physical compatibility tests on PVC, LLDPE and XLPE cable jacket or sheath materials. It shall not stress crack polyethylene per ASTM Standard 1693. There shall be no significant changes in the conductive properties of XLPE semi-conducting compounds when the lubricant's effect on volume resistivity is tested according to IEEE Standard 1210.

Order Information:

Cat #	Package Description
CLR-35	1-quart squeeze bottle (0.95 Liter)
CLR-128	1-gallon pail (3.78 Liter)
CLR-640	5-gallon pail (18.9 Liter)

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 3000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-612-430-3634

www.polywater.com(URL) custserv@polywater.com(e-mail)

Polywater® Lubricant Pump Model LP-D5

Use <u>your</u> ½-inch drill to pump pulling lubricant from a 5-gallon pail or a 55-gallon drum.

New Applicator

Now includes two hands-free applicators for 1½ to 6-inch conduits.

The Polywater® Lubricant **LP-D5 Pump** is a ½-inch drill-operated, self-priming, gear pump. Now includes two hands-free applicators (small for 1½ to 3-inch and large for 3 to 6-inch conduits). All Polywater® lubricants can be pumped directly into the conduit or onto the cable during cable installations at rates exceeding 1.5 gallons per minute.

The LP-D5 pump sets directly onto a 5-gallon pail or 55-gallon drum and comes with a 10-foot discharge hose with lubricant applicator.

Advantages

- **Practical Transfer of all Polywater® Lubricants –** Save time and effort in cable pulling. Eliminate hand scooping, messy pouring, and lengthy clean-ups.
- **Variable Pumping Capability –** Adjustable speed ½-inch drill allows pump to deliver lubricants at a rate of up to 1.5 gallons per minute.
- **Consistent Lubricant Application –** Automates lubricant application with consistent lubrication throughout pull.
- **Convenient –** No hand pumping. Requires battery or ½-inch electric variable speed drill.
- **Easy Maintenance –** Minimum assembly required. Cleans up with water.
- **Corrosion Resistant –** Solid brass body and stainless steel shaft.

Operation

For use on 55-gallon drum

Open drum and drum liner. Replace cover on drum. Screw lower section of **LP-D5** input pipe to upper section. Set **LP-D5** pump into open 2-inch bung hole of lid. Attach your variable speed ½-inch drill securely to **LP-D5** drive shaft. Insert lubricant applicator into conduit opening. Place applicator so that the lubricant coats the cable as it enters the conduit. Start drill to pump lubricant. Use variable speed on drill to adjust to desired flow rate. It may be necessary to prime pump with water for initial use.

For use on 5-gallon pail

Open 5-gallon pail or cut a hole in the lid. Set **LP-D5** in 5 gallon pail (upper section of input pipe only). Attach variable ½-inch speed drill securely to **LP-D5** drive shaft. Insert lubricant applicator into conduit opening. Place applicator so that the lubricant coats the cable as it enters the conduit. Start drill to pump lubricant. Use variable speed on drill to adjust to desired flow rate. It may be necessary to prime pump with water for initial use.

Cleaning

Pump clean tap water through **LP-D5** Pump until water discharge is clear. Let pump sit for 15 minutes. Run pump again with clean tap water to remove any remaining lubricant. Repeat the process as necessary. Wipe off pump and applicator. Protect from dirt with bag or other cover.

General

Keep dirt and debris away from pump to avoid damage. Avoid running pump dry to prevent damage.

Order Information

Catalog No.	Description
LP-D5	Drill Powered pump for 5-Gallon Pail or 55-Gallon Drum. Includes 2 applicators (1/2-inch drill not included)

lit-lp-d5flyer/11-06/MARU (11-06)

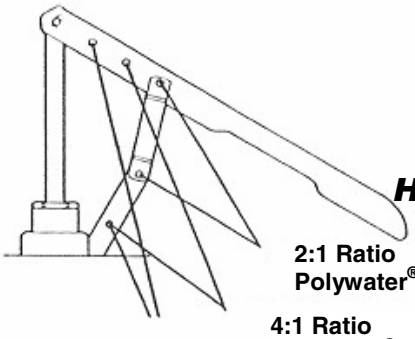
Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

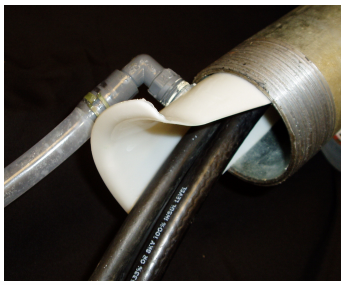
American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
www.polywater.com(URL) 1-651-430-2270
custserv@polywater.com(e-mail) fax 1-651-430-3634

Polywater® Lubricant Pump Model LP-3





New
Hands-free applicator

2:1 Ratio
Polywater® F, WF, PJ, WPJ, PR

4:1 Ratio
Polywater® J, WJ, Polywater® Plus Silicone

7:1 Ratio
DynaBlue® Lube, Polywater® G

The Polywater® Lubricant **LP-3** Pump is a hand operated, self-priming, piston style transfer pump with two conduit applicators. Three different ratio settings allow the user to pump liquid to gel viscosity lubricant. All Polywater® lubricants can be pumped directly to the conduit or onto the cable in cable installations. The LP-3 now includes two hands-free applicators (small for 1½ to 3-inch and large for 3 to 6-inch conduit). Both applicators will slip directly into the conduit making it easy to apply the lubricant during the cable installation.

The **LP-3** Hand Pump mounts directly onto a 5 gallon pail and comes with a 10 foot discharge hose.

Advantages

- **Practical Transfer of all Polywater® Lubricants –** Save time and effort in cable pulling. Eliminate hand scooping, messy pouring, and lengthy clean-ups.
- **Variable Pumping Capability –** Adjustable settings allow pump to deliver various viscosity lubricants with least effort.
- **Pail Attachment –** No lubricant transfer required.
- **Consistent Lubricant Application –** Automates lubricant application with constant lubrication throughout installation
- **No Power Equipment Required –** Electricity, batteries, and compressed air are not needed.
- **Easy Maintenance –** No assembly required. Cleans up with water.

Operation

Set pump handle to the proper ratio for your lubricant. Place pump onto pail. Insert applicator into conduit so that the cable will be lubricated as the cable enters the conduit. Pump lubricant until it starts coming out. Start pulling cable and pump lubricant at the desired rate.

Note: Keep dirt and debris away from pump to avoid damage.

Cleaning

Pump clean tap water through LP-3 Pump until water discharge is clear and no lubricant is apparent. Let pump containing tap water soak for 15 minutes. Run pump again with clean tap water to remove any remaining lubricant. Repeat the process as necessary. Wipe pump and lightly spray inside with protection oil. (American Polywater P7™ Penetrating Oil) This will help prevent the pump from rusting. Protect from dirt with plastic bag or other cover.

Lubricant	Ratio at 7:1		Ratio at 4:1		Ratio at 2:1	
	gal/stroke	gal/minute	gal/stroke	gal/minute	gal/stroke	gal/minute
Polywater® J, WJ	Not Recommended		0.04	2.0	0.07	2.6
DynaBlue®	0.01	0.9	0.03	1.1	Not Recommended	
Polywater® PJ, WPJ	Not Recommended		Not Recommended		0.07	3.2
Polywater® F	Not Recommended		Not Recommended		0.07	3.2
Polywater® G	0.02	0.6	0.04	1.6	Not Recommended	
Polywater® PR	Not Recommended		Not Recommended		0.07	3.2
Polywater® Plus Silicone NN	Not Recommended		Not Recommended		0.07	3.2

Note1: Pumping rates are approximate and vary with pumping rate and hose length.
Note2: Type NB does not work in this pump. The solid microspheres interfere with operation.

Order Information

Catalog No.	Description
LP-3	Hand pump with 2 applicators

Lit-lp-3flyer/8-06/internal(8/06)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

www.polywater.com(URL)
custserv@polywater.com(e-mail)

American Polywater's Pull-Planner™ 3000 Software

The Pull-Planner™ 3000 For Windows™ calculates cable pulling tension and sidewall pressure using the pulling equations. Tension estimates are useful in designing conduit systems and planning cable pulls. Such planning can save time and money by minimizing splices, vaults, pulling setups, etc., while ensuring installation tensions that won't damage cable.

New Features

- Calculate and recalculate tensions and sidewall pressures automatically during easy changes of friction coefficient, cable data, incoming tension, or pull direction. Cable, conduit, and friction data have been updated to include new LSZH jackets and HDPE conduit.

- Establish a custom cable data file (up to 100 cables) with your common cables by name, type, weight, and OD. These standard cables are available for quick data entry. Longer cable descriptions are now accepted.

- Print pull details and calculation results to a Windows™ printer or paste the data into other Windows™ programs. New links to application, product and other reference literature.

- Determine "maximum" allowable cable tension and/or sidewall pressure and "flag" calculations when maximum tension is surpassed. Separate straight sections from bends and vary the coefficient of friction by segment for different conduits, cable tray, and bends. Add a pushing force for push/pull calculations.

- Add, subtract, change, or insert conduit segments in a pull for analysis. Direct click on the data cell to change segment data. New graphics have been added to assist in bend selection.

- Back calculate an effective friction coefficient from field measured tensions – useful for additional calculations in similar environments. New large radius bend calculations are used for HDD conduit installations or other large radius sweeps.

Ordering information

Call 1-800-328-9384 or visit www.polywater.com/order.asp to place your order. The Pull-Planner™ 3000 For Windows™ runs on numerous Windows™ operating systems. $129.00 Retail. $59.00 Upgrade.

Pull Planner™ Preview Page: www.polywater.com/preview.html
Technical Article: www.polywater.com/3000tech.html
Special offer: www.polywater.com/pp3koffr.html

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Bonduit® Conduit Adhesive

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
www.polywater.com (URL) 1-651-430-2270
custserv@polywater.com fax 1-651-430-3634

LIT-PP3000FLYER/12-08

American Polywater® Corporation

5630 Memorial Ave. Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

ORANGE & ROCKLAND

The attached IEEE paper describes a transmission cable installation by Orange & Rockland Utilities in New York (Jim Tarpey – 914-577-2601). The paper compares predicted tension with actual tension on page 6.

POLYWATER® J was the lubricant used in the pulls. Table 1 presents a comparison of pulling calculations done using coefficients of friction based on EPRI and AEIC data, and those from American Polywater's research. Clearly, the POLYWATER® data correlates much better with the actual tensions.

This is no reflection on the quality of the research that went into the development of the EPRI/AEIC data. They were required to use "generic" lubricants, and their data does not reflect the superior performance of POLYWATER ® J

For tension calculation software to be useful, valid friction coefficients must be input. The Pull-Planner™ II Software Manual includes extensive friction data for a variety of conduit and cable jacket types.

INSTALLATION OF A SOLID DIELECTRIC 138KV UNDERGROUND TRANSMISSION SYSTEM – FROM CONCEPT TO COMPLETION

J.W. Tarpey, Senior Member
A.M. Regan, Member
P.R. Nannery, Fellow
Orange and Rockland Utilities, Inc.
Pearl River, New York

E. Favrie, Member
Societe Industrielle De Liaisons Electriques
Montereau, France

Abstract

This paper discusses the planning, design and installation of a 138KV extruded dielectric transmission system. Construction alternatives and project considerations are reviewed as well as cable selection, design, testing and installation. Improved cross linked polyethylene transmission cables are increasingly being considered as an alternative to conventional cable systems at higher voltages. This paper shows the steps required for the successful completion of such a transmission system.

Keywords

Cross linked polyethylene, extruded dielectric cable, underground transmission design, underground transmission construction, cable pulling.

INTRODUCTION

The need for a distribution substation in Oakland, New Jersey was identified in long range planning studies conducted in the early 1970's. At that time, a substation site was acquired that was approximately 1 ½ miles away from an existing Franklin Lakes distribution substation and was close to major load centers. Since Franklin Lakes and Oakland are at an extremity of the Orange & Rockland Utilities (O&RU) franchise area, the transmission supply planned at that time was an overhead 69KV double circuit that would extend the existing transmission loop feeding the Franklin Lakes Substation to the new Oakland Substation. A preferred routing was selected from a number of alternatives.

As the load growth in the area increased, the projected service date for the new substation was identified as the summer of 1990. In 1987, the preparations began for implementing the plans prepared more than 15 years earlier. The State of New Jersey had since that time approved plans for a major interstate highway whose final route transversed the right-of-way between two substations. This road had been delayed by community opposition for nearly a decade and at that time, Orange & Rockland had planned that the new transmission line would be installed and in service before highway construction started. Overhead construction plans were coordinated with the highway layout resulting in some minor re-routing. Community leaders were then presented with the proposed transmission line plans. Although they recognized the need for the new substation and the service improvement it would provide, both towns formally opposed the construction of an overhead transmission line. To pursue an overhead alternative would have delayed the service date well beyond our requirements. Therefore, underground transmission alternatives had to be considered.

UNDERGROUND SYSTEM SELECTION

In selecting the most economic underground transmission system, a number of cable alternatives and routes were considered. Plans also called for the existing 69KV to be upgraded within 10 years. The system was therefore designed for 120 MVA capacity per line at 138KV.

The cable types considered were pipe-type (HPOF), self-contained oil-filled (SCOF), and extruded dielectric. The HPOF system was the most expensive alternative. Three major problems with the construction of a HPOF system were the requirements for a completely encased 1200' diagonal crossing of the new highway, the substation expansion necessary for the pumping plant, and anticipated environmental concerns due to the proximity of the line to an active stream which it paralleled for almost half of the route. The SCOF cable was more economical but severe elevation changes were a concern. The extruded dielectric cable installation was the most economical and attractive for this particular application. The expected reliability of the cable with improved materials and manufacturing techniques and lack of maintenance after installation influenced this choice.

Once extruded dielectric cable was chosen, consideration was given to installation alternatives and how these would affect the operation, maintenance, reliability, and cost of the system. The route chosen can be

0-7803-0219-2/91/0009/S01.00©1991IEEE

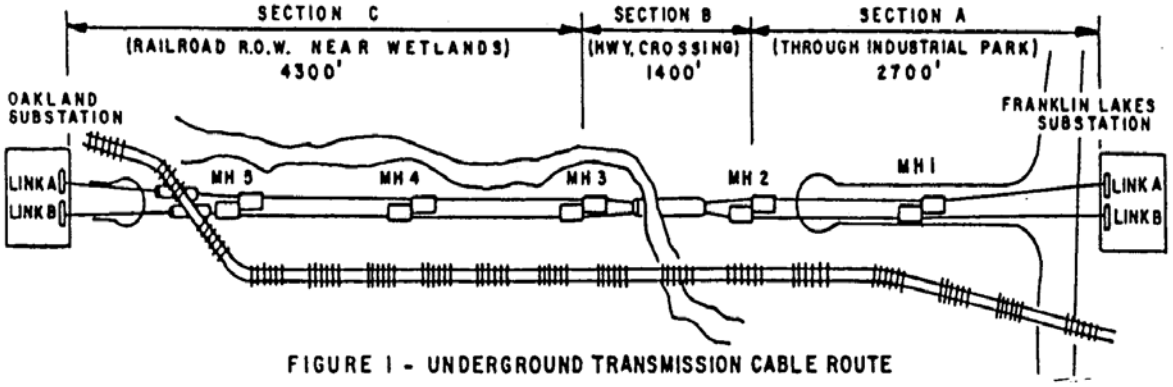


FIGURE 1 - UNDERGROUND TRANSMISSION CABLE ROUTE

segmented into three distinct areas as shown in Figure 1. The first 2,700 feet from the existing substation through the industrial park to the new interstate (Section A) crossed a county highway and is along a town road with little room between curbs and buildings. After locating other underground utilities, it became apparent that the system had to be installed in the road. Both preformed concrete trenches and concrete-encased conduit were considered as acceptable alternatives.

At the end of Section A, a splicing chamber would be required as a transition point to Section B, which encompassed approximately 1,400 feet and included the 1,200 foot diagonal crossing of the new highway. The Sate Department of Transportation required the installation of a system that could be maintained and serviced outside of the highway right-of-way. It also had to conform with the new grades and obstructions without interfering areas, almost 30 feet of fill was being added, the 30 foot wide stream was being relocated and pilings and piers for ramps were being installed. While examining the requirements, the State announced that the construction of the highway in the area would begin in 1989 and that all planned facilities must be in place by the summer of 1989. To comply with all of these requirements, a 42" diameter ½" steel casing with a PVC conduit system was installed by that date. Specifications for the transmission line would include use of this casing.

Section C started with a splicing chamber at the end of Section B and traveled a 4,300 foot path parallel to a 60" diameter water main and communication cables. The route was bordered by a stream and a railroad line. At some points, the distance between the stream and railroad narrowed to almost 20 feet, presenting excavation and construction challenges. Neither direct buried or precast concrete trench alternatives could be considered. The railroad would not allow open trench for cable installation, and the water company was concerned about disruption of the pipe support provided by the surrounding earth. A concrete encased conduit system was therefore required for the final section of the transmission line to the new station.

The project specifications required the cable manufacturer to be the prime contractor and provide a total turnkey package. The use of local subcontractors to perform the civil work was also encouraged. Total responsibility for the construction and warrantee of the system, however, rested with the cable manufacturer.

The cable required by the specification was 1,000 Kcmil compact aluminum conductor with 138KV XLPE insulation, an extruded lead sheath, and an overall polyethylene jacket. Quotations were requested for cable built to AEIC Specification CS-7-87, and as an alternate, cable built to the IEC-840 Specification. Both specifications were supplemented with additional Q&RU requirements. The alternate quotation was requested to assess the economic impact that the thinner-walled IEC alternative may have offered due to its lighter weight, smaller diameter, and longer pulling lengths. Because of the inability to physically eliminate or relocate the manholes, the savings of using an IEC wall cable were minimal.

In early October, 1989, the bid was awarded to Societe Industrielle De Liasions Electriques (SILEC) of France and construction began later that month. The final contract required the installation of a double circuit

138KV cable manufactured to AEIC specifications in a double manhole and concrete encased duct system along the entire 8,400 foot length. The responsibility for all permits and required approvals rested with the utility. The anticipated service date was July, 1990.

CABLE CONSTRUCTION

The cable manufactured for this project is shown in Figure 2. The conductor is a round compact 61 strand Class B 1,000 Kcmil aluminum. The strand shield is a super smooth semi-conducting cross linked polyethylene of approximately 45 mils. The insulation wall is an extra clean cross linked polyethylene with a thickness of 850 mils. The insulation shield is also a super smooth semi-conducting cross linked polyethylene compound with a minimum thickness of 55 mils. The cable core was covered with an extruded lead alloy sheath of 118 mils with the short circuit capability of 27,500 amperes for 0.5 seconds. A final high density polyethylene layer of 126 mils was then extruded to provide mechanical protection for the lead sheath. The cable had an overall diameter of 3.54 inches and weighed 10.1 pounds per foot.

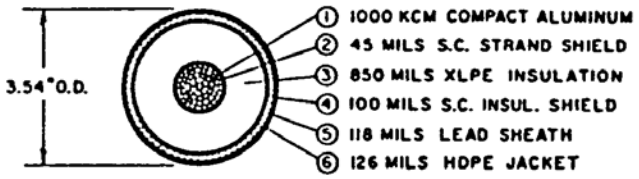


FIGURE 2 1000 KCM ALUMINUM 138 KV. XLPE CABLE

The cable was manufactured on a dry cure water-cooled catenary system in late 1989. After manufacture the reels were placed in a degassing chamber to allow gases to escape before the lead sheath was extruded. Production testing began in January of 1990. All AEIC tests were performed on each of the 36 shipping lengths with no failures. In addition to the required AEIC production testing, a sample of the cable with the proposed field splice was required to pass the Hot Impulse Test at a conductor temperature of 130°C (Qualification Test #1 – L.1.3). The sample passed the Minimum Impulse Withstand Voltage of 815KV and failed on the first 975KV impulse due to a termination flashover. A second sample without a splice was then subjected to load cycling for 35 days as per L.1.4 and then impulsed with a conductor temperature of 130°C (Qualification Test #3 – L.1.3). This sample passed the required 815KV level and failed on the first impulse at 1138KV. The test failure occurred in the cable within the PVC pipe. All test results showed conformance to the specification and cable was prepared for shipment in February.

The termination and splices approved for this project were also manufactured by SILEC. The 12 terminations used a premolded silicone rubber stress cone inside a mineral oil filled porcelain housing. The 30 splices used on this project utilized a premolded EPDM stress tube with layers of the appropriate tapes and a field injected hard setting resin exterior for mechanical protection. All splices were fixed on the manhole wall with steel racks.

FIELD CONSTRUCTION

Construction began on the manhole and duct system in October 1989. Several permits were required to start the project. They were county and town road opening permits, building permits for each substation end, railroad crossing and access permits. At that time, the State of New Jersey expanded the limits of their wetlands waiver permit and thus added this requirement to the project as well. This unanticipated permit delayed any construction in Section C until May 1990, when it was finally received. All cable pulling, splicing and terminating was delayed as well and the project completion date was extended.

The final design of the manhole and duct system was based upon the maximum conductor length per pulling reel and the actual physical field conditions. With a maximum conductor length of 1,600 feet, it was decided that manholes would be spaced between 1,300 feet and 1,500 feet, apart – thus requiring five manhole locations along the total run (see Figure 1.) Final manhole locations were chosen after a thorough review of the existing field conditions along the proposed route. In most cases, the manhole locations were selected where there was extra R.O.W. width, distance from the other utility congestion, and ease of access for construction. To avoid the possibility of a double contingency failure, each of the lines was installed in a separate set of manholes. Therefore, at each manhole site, there are a pair of staggered manholes with Line A entering one set of manholes, and Line B entering the other set.

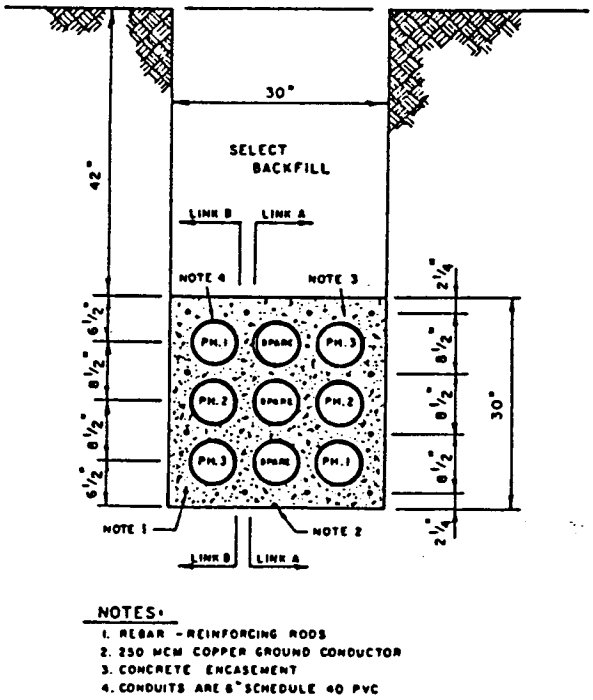


FIGURE 3 CONCRETE ENCASED DUCT ARRANGEMENT

The manholes were precast in two separate pieces – a top and a base of almost equal size. The overall exterior dimensions for each manhole were 21 feel long, 7 feet wide, and 7 ½ feet high, with a minimum wall thickness of 6 inches.

The manhole roof opening was fitted with a steel frame and a two piece cover assembly which measures 4 feet wide by 6 ½ feet long. In their staggered arrangement, manhole A and manhole B's width overlap each other (see Figure 1), allowing the ducts to easily enter and exit the manholes.

Due to this arrangement, an area of approximately 40 feet long by 10 feet wide was required at each manhole site. Once the final manhole locations were selected, they were field surveyed along with the line route and plan and profile maps were completed. Based on this information, the final cable cutting lengths were determined. The duct system, as shown in Figure 3, was comprised of 9 – 6" Schedule 40 PVC concrete encased-conduits arranged in a 3 x 3 square. The ducts were spaced with a 2.5 inch separation using plastic interlocking spacers with rebar securing provisions.

The depth of the conduit system was controlled so that the top portion of the conduit encasement was 42 inches below final grade. At each manhole location, the ducts split into a 1 x 3 and a 2 x 3 configuration as 3 ducts entered the Line B manholes and 6 ducts entered the Line A manholes. A 250MCM bare copper ground wire was installed in the trench underneath the duct system for the entire length of the line in order to provide a consistent and redundant ground path. At each manhole location a ground grid was also established.

Cross bonding was not required for this project because of the anticipated operation of the line. To minimize sheath voltages, the cable lead sheath and the exterior grounding system were bonded at three locations. At each substation, the termination exit grounds were mechanically connected to the substation ground grids. At manhole location number 3, the splices were fabricated with exit grounds and tied to the exterior grounding system through manual ground disconnect switches installed inside the manholes.

The actual construction time for the manhole and duct system was approximately four months. Coordination with the municipalities involved, the highway contractor, and the other utilities affected along the line route was time consuming and very involved. The new highway construction had closed access to almost all of Section C and a new railroad crossing had to be built for temporary access for the duration of the project. Coordination with the railroad was continuous as manhole and cable deliveries and installations were scheduled around train schedules. This work had to be suspended for approximately one month until the wetlands transition area permit was received for Section C. The station entrances were the final portion of the duct system to be completed and were coordinated with the station construction. The ducts were flared out from the square encased arrangement to approach the termination structures. In the duct system (see Figure 3), the phasing for the two circuits opposed each other so that EMF effects at ground level would be minimized. This phasing arrangement was rolled into the termination structures to be consistent with station design. The entire manhole and duct system was completed in June.

The cable pulling lengths were shipped on wooden reels. The average shipping reel weighed 16,000 pounds. With the cable footage per reel ranging from 1,335 feet to 1,590 feet, the reels were 10 feet in diameter and 5 ½ feet wide. After arrival at Port Newark by boat and approximately 10 days to unload and clear customs, the reels were trucked to the project site. All of the reels and the cable arrived at the project site without damage.

Each pulling length terminated in a lead pulling eye with a design strength greater than the maximum permissible cable pulling tension. Besides providing a moisture seal, the eyes were smooth and flat with a diameter slightly larger than that of the cable and shaped for ease in pulling in the PVC duct system. The reel ends were also sealed with a lead end cap.

After the manhole and duct system was constructed and as-built surveys completed, the pulling tensions were recalculated. The tension to be experienced and the preferred pulling direction for each line section were confirmed. The pulling tensions were calculated using the EPR1 computer program CABLPUL resulting from RP1519-1. The calculated pulling tensions ranged from 3,500 pounds to 9,000 pounds and varied greatly from line section to line section, depending on section characteristics (such as length, number of sweeps, etc…) and pulling direction. These are shown in Column 1 of Table 1.

Cable pulling was accomplished using an 18,000 pound winch and a ½" steel rope rated for 20,000 pounds. All but one set of cable pulls were started at the manhole. At the feed end the cable reel was mounted on a large single reel pulling trailer with braking and levelizing adjustments. The cable was fed into the duct system from the manhole entrance using a long, flexible feed tube. The pulling lubricant was applied at the top of this tube. At the winch end, a series of cable riding wheels smoothly trained the steel pulling rope out from the duct exit and over the manhole entrance lip to the truck winch. A dynamometer was also installed to monitor the pulling tensions.

The pulling program results in Column 1 of Table 1 proved to be useful in making cable pulling decisions, but yielded conservatively higher tensions than experienced. The actual cable pulling tensions ranged from 700 pounds to 3,200 pounds. At no time did the actual pulling tensions come close to the maximum cable limitation of 7,000 pounds. The program was then rerun using a lower coefficient of friction, as suggested by the pulling lubricant manufacturer. These results more accurately reflected the actual tensions measured in the field and are shown in Column 2 of Table 1.

The footings and foundations for the pothead support structure were constructed at each end by the substation contractor. The steel termination support structures were supplied and installed by SILEC. The structures

Direction of Actual Cable Pull	Calculated Pulling Tension		Actual Pulling Tensions
F.L. Sub. To MH1	4908	927	700
MH2 to MH1	7782	1889	1500
MH3 to MH2	5119	1743	1900
MH3 to MH4	3678	1426	1500
MH4 to MH5	5706	2131	1750
MH5 to Oakland Sub.	7831	2870	3200
Coefficients of Friction:	AEIC	Lubricant Mfgr.	
Straight Pull/Low SWBP	0.40	0.15	
High SWBP	0.15	0.12	

TABLE 1 - CALCULATED VS. ACTUAL PULLING TENSIONS

were 19 feet wide and 7 feet high for each line with the phases rising 8 feet apart.

Each cable termination took approximately 1 ½ to 2 days to complete. The majority of time spent during cable preparation involved hand shaving of the semiconducting layer and insulation. The termination voltage stress relief was provided by a premolded silicone rubber stress cone. Termination exit grounds were connected from the lead sheath to the substation ground grid. Once prepared, the pothead base was mounted and the porcelain housing lowered over the cable end. Once gaskets were in place, the insulating oil was degassed and the porcelain housing was filled under vacuum and sealed. The terminations are approximately 20 inches in diameter at the base and 6 feet 3 inches high. When complete on the support structure, the connector lug of the termination was approximately 15 feet above ground level.

The installation of the 30 line splices took approximately two and a half months, with each individual splice requiring three normal work days to complete. The manholes provided a clean and workable splicing environment. The conductor was joined with a welded connection. Once the assembly was prepared, the EPDM stress tube was slid and centered over the connection. The remainder of the splice was completed with hand taping. Mechanical protection of the splice was achieved by injection of a polyester resin, which set up and hardened into a continuous and impenetrable layer along the entire length of the splice. The entire splice was approximately ten inches in diameter and an 8 ½ feet long. The splices were mounted horizontally on galvanized steel racks attached to the manhole wall. All of the racks were installed and leveled prior to the commencement of the splicing. The splice racks are 5 feet high and 19 feet long and provide 5 different attachment points for each phase.

The entire project was completed in December 1990, and was energized in the spring 1991. It is expected to satisfy system requirements in that area for many years.

CONCLUSIONS

The installation of a 138KV extruded dielectric transmission cable system can be considered as an economical and reliable alternative for underground transmission. The quality of cable materials and manufacturing capabilities available today increase the confidence that XLPE with a moisture barrier can perform reliably at higher voltages. The construction of this system is simpler and requires less skilled labor than the other alternatives. The critical areas where care must be taken is in assuring that the cable is not damaged when installed and that splices and terminations are properly prepared.

As with all major projects, the increasing regulatory and environmental requirements must be clearly defined and anticipated. Their affect on project scheduling can be significant. The permits required for an underground line can be more involved than those for an overhead line. The environmental concerns with overhead transmission will require more and more underground systems to be built, many with limited time to thoroughly plan construction. It is recommended that an underground option be thoroughly considered in transmission planning stages. In doing so, design and anticipated construction scheduling requirements can be available to satisfy required service dates.

REFERENCES

(1) "Underground Extruded Power Cable Pulling Guide," AEIC G5-90, 1st Edition, May 1990.

(2) "Maximum Safe Pulling Lengths for Solid Dielectric Insulated Cables, Volume 1: Research Data and Cable Pulling Parameters," EPRI EL-3333, RP 1519-1, February 1984.

(3) "Maximum Safe Pulling Lengths for Solid Dielectric Insulated Cables, Volume 2: Cable User's Guide," EPRI EL-3333-CMM, RP 1519-1, February 1984.

(4) "Specifications for Crosslinked Polyethylene Insulated Shielded Power Cables Rated 46 through 138KV," AEIC CS7-87, 2nd Edition, October 1987.

(5) "Tests for Power Cables with Extruded Insulation for Rated Voltages above 30KV (Um = 36KV) up to 150KV (Um = 170KV)," IEC 840, 1st Edition, 1988.

Philip R. Nannery (M'70-SM'78-F'90) was born in the Bronx, NY. He received his B.S.E.E. in Electrical Engineering from Newark College of Engineering. He has attended several courses for his MBA at New York University.

Currently, he is the Director of Electrical Engineering at Orange and Rockland Utilities, Inc., Pearl River, NY; responsible for all Electrical Engineering, System Planning, System Communications and Design of Substations. He was with American Electric Power Service Corporation, New York, from 1960 to 1980.

Mr. Nannery is a Fellow of the IEEE and is currently Chairman of IEEE Substations Committee and chairs several Working Groups and Subcommittees of PES. He is the U.S. Representative for CIGRE Study Committee 23 – Substations. He is Vice Chairman of the EEI Electrical System and Equipment Committee and is presently Chairman of the AEIC Committee of Power Apparatus.

James W. Tarpey (M'72-SM'88) received his B.S.E.E. from Worcester Polytechnic Institute in 1972 and his M.S.E.E. from New Jersey Institute of Technology in 1976.

Mr. Tarpey has been employed by Orange and Rockland Utilities, Inc., since 1972. As Manager, Distribution Engineering, his responsibilities include materials, standards, planning, engineering, protection, and reliability of both overhead and underground distribution and design and construction of underground transmission. Mr. Tarpey is a senior member of the IEEE, a member of the Insulated Conductor Committee, a member of the AEIC Cable Engineering Section, and a Registered Professional Engineer in the States of New York and New Jersey.

Angelo M Regan (M'85) received his B.S. in Electrical Engineering from Fairleigh Dickinson University in 1985 and his M.S. in Management Science from Fairleigh Dickinson University in 1987.

Mr. Regan has been employed by Orange and Rockland Utilities, Inc., since 1987. As an Electrical Engineer in the Distribution Engineering Department, his responsibilities have been concentrated on the design, installation and reliability of both underground transmission and distribution systems. Mr. Regan is a member of the IEEE, and is an Engineer In Training in the State of New York.

Eugene Favrie (M'89) was born in France, on November 1, 1936. He received the Degree of Electrical Engineering from the Ecole Superieure D'Electricite, Paris, France.

Since 1962 he has been with Societe Industrielle De Liaisons Electriques (SILEC), Montereau, France, where he is Director, Technical Advisor of the Power Cable Department. Mr. Favrie is a member of the IEEE.

American Polywater's

SpliceMaster®

Cleaners and Accessories for Safer Electrical Cleaning

A Family of Cleaners
for Safer Electrical Cleaning

Cleaners and Accessories for Safer Electrical Cleaning

There are a number of SpliceMaster® Cleaner/Degreaser types available to meet different needs in cable and general electrical cleaning. They share the following features:

- **No Residue** – SpliceMaster® Cleaners evaporate completely and leave no residue. They meet IEEE 1493 (draft) requirement for less than 100 PPM residue.
- **High Solvency Power** – All are excellent cleaners for electrical grime like shield picks, corrosion inhibitor, silicone grease, and oils.
- **Accessories Compatible** – Tested to IEEE 1493. When used as directed, SpliceMaster® Cleaners do not harm insulating or semi-conducting polymers. Polymer materials should never be soaked in cleaning solvent.
- **Environmental Status** – All cleaners are SNAP approved for intended use. They do not contain Class 1 ozone depleters or HAP's (Hazardous Air Pollutants).
- **Plastics Compatiblity** – Some of the cleaners are suitable for use on solvent-sensitive plastics such as polycarbonate. Consult cleaner technical data sheet for specifics.
- **Safer, Controlled Use** – SpliceMaster® Pel-PAC® package controls release of, and exposure to, solvent vapors.

The Separate Types:

SpliceMaster® Cleaner Characteristics

Cleaner Type	Cleaning Power	Drying Rate	Flash Point	Meets IEEE 1493 Voltage Withstand	Features and Uses
FD™	Good	Fast	>20°F (>-5°C)	Yes	Available in aerosol cans or bulk containers. Fast evaporating cleaner for splicing cables, degreasing transformers or cleaning contacts. Economical and versatile. Crews that prefer aerosols will love Type FD™.
GP™	Excellent	Medium/Fast	123°F (50°C)	Yes	Faster evaporating than citrus cleaners. A versatile cleaner for all operations. Available in bulk, towelette or kit packages. **Great for silicone grease residue**.
HP™	Good	Medium	>141°F (>61°C)	Yes	Broadly effective, economical, general-purpose cleaner. Use for electrical maintenance and general electrical cleaning. Can be dried from surface for fastest use. Comes in broad variety of packages for different use methods.
KC™	Good	Very Fast	None	Yes	A non-flammable, specialty, electrical cable and contact cleaner. Does not dissolve or stress crack most plastics. Very fast evaporating cleaner. Only available in aerosol cans. Excellent for cleaning cables, relays, electronic equipment, and contacts.
NF™	Good	Very Fast	None	No*	Very fast evaporating splice preparation cleaner with no flash point. Only available in the tin style splice preparation kits. No flash point or residue.
TR™	Excellent	Fast	None	Yes	Excellent replacement for chlorinated solvents in high voltage cable splice preparation. Non-flammable. Leaves no residue. Only available in pre-saturated towelettes. Best replacement for Trichlor.

*Type NF™ Cleaner is very fast evaporating and does not remain in liquid form long enough to pose a conduction hazard.

Packaging

Cable Prep Kits

Kits provide everything needed for splice and termination cleaning. The cleaner is saturated on non-linting wipes. Sanding cloth and dry towels are optional.

- Convenient. Everything needed for the job.
- Safer. Minimizes Solvent Exposure
- No Spills or Mess

Aerosols and Sprays

Aerosols and directional sprayers provide a way to get solvent to hard-to-reach places.

- Convenient for Maintenance Use
- Adjustable Flow Spray Heads
- Cleans Hard-to-Reach Places

Bulk Packages

SpliceMaster® Cleaners are available in 55-gallon, 5-gallon, gallon, quart, pint, and spray aerosol containers. Special packages can be filled on customer request.

- Economical for large jobs
- Refill Spray Bottles Economically
- Convenient for dipping or pumping

The System

Cleaners and Packages for Convenience, Control and Safety

Small PEL-PAC® Kit contains just enough for the job.

Low volume of solvent in packs controls vapor exposure.

Packs eliminate solvent spills and potential environmental liability.

Packs fit in tool bag or pocket for convenient use.

Choose the right cleaner for your job from multiple cleaner options.

Package options designed for a variety of cleaning needs.

Field-friendly, cable preparation kits with optional abrasive and drying cloth.

Aerosol sprays for diverse electrical maintenance use.

American Polywater's support includes video or CD on termination cleaning procedures.

PelPac® calculations can estimate vapor levels for safer working environment.

American Polywater expertise. Whether VOC's, evaporation rates, or dielectric properties. Just ask.

Empty refillable solvent-resistant bottles. Save money by purchasing bulk product and refilling bottles. Labeling with SpliceMaster® Cleaner available upon request.

Other Accessories

Wet Dry System

Surface drying of slower evaporating solvents speeds up their use. HP™ Tandem Pack™ (HP-P158ID) includes both a wet and dry wipe.

- Speeds up cleaner evaporation and use.
- Minimize solvent contact time with rubber/plastic.
- Lint-free, disposable wiping towels also available separately.

Empty Solvent-Resistant Bottles

- Available in 2 sizes:
  ST-1 Pint with spray head
  ST-2 Quart with spray head

Dry Towels

Durable, non-linting for applying bulk SpliceMaster® Cleaners or for wiping them dry.

- Two convenient sizes:
  DT-69 (6" x 9")
  DT-1212 (12" x 12")

SpliceMaster®

Bulk Components and Accessories

Package Description	Product Number	Units per case
Dry Towels: (200) Dry 6” x 9” towelettes, non-linting, durable. Self-dispensing box	DT-69	1
Dry Towels:(100) Dry 12” x 12” towelettes, non-linting, durable. Self-dispensing box	DT-1212	1
Sanding Cloth: 1” x 50-yard roll of 120 grit, non-conductive aluminum oxide.	SP-ROLL	1
EMPTY Solvent Resistant Bottles: 16-oz bottle with spray trigger head. **Special Order**	ST-1	12
EMPTY Solvent Resistant Bottles: 32-oz bottle with spray trigger head. **Special Order**	ST-2	12
Spray trigger head which fits pint or quart bottles	ST-R	12

SpliceMaster® Product Numbers

CLEANER TYPES

Package Description	Units per Case	FD™ Cleaner	GP™ Cleaner	HP™ Cleaner	KC™ Cleaner	NF™ Cleaner	TR™ Cleaner
55-gallon drum	1	FD-DRUM	GP-DRUM	HP-DRUM	---	---	---
5-gallon pail	1	FD-640	GP-640	HP-640	---	---	---
1-gallon container	4	FD-128	GP-128	HP-128	---	---	---
Quart bottle w/flip top	12	FD-35LF	GP-35LF	HP-35LF	---	---	---
Pint bottle w/flip top	12	FD-16LF	GP-16LF	HP-16LF	---	---	---
Aerosol (16 oz can)	12	FD-9	---	HPY-12	KC-16	---	TR-16
Aerosol (6 oz can)	12	---	---	---	KC-4	---	---
8”x 12” saturated wipe in pouch	144	---	GP-1	HP-1	---	---	TR-1L
5” x 8” saturated wipe in pouch	96	---	---	---	---	---	TR-1
Tandem Pack™- wet/dry 5” x 8” wipes	144	---	---	HP-P158ID	---	---	---
Canister with 72 10”x12” saturated wipes	6	---	GP-D72	HP-D72	---	---	---
PEL-PAC® Prep Kit for cable cleaning, in tin	24	---	GP-T369	HP-T369	---	NF-T369	---
PEL-PAC® Prep Kit for cable cleaning, in tin, with sanding strip	24	---	GP-T369/S	HP-T369/S	---	NF-T369/S	---
PEL-PAC® Prep Kit for cable cleaning, in tin, with sanding strip & drying towel	24	---	---	HP-T369/S-D	---	---	---
Prep Kit Pouch, 6 cleaning wipes/drying towels, 3 sanding cloth, instructions	12	---	---	HP-P63	---	---	TR-P63

NOTE: Product codes for the PEL-PAC® Prep Kit for cable cleaning shown, are for **tins**.
Kits are also available in **pouches** or with **customized** towel counts and sizes.

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

American Polywater Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

LIT-SMFlyer/3-07/C1000/(3/07)

Type TR™
Multi-Purpose Cleaner

American Polywater® Corporation

TECHNICAL DATA SHEET

Description:

Type TR™ Cleaner is fast evaporating and non-flammable. It effectively cleans semi-conducting cable shield, corrosion inhibiting compound, silicone greases, filling gels, transformer oils and many other contaminants found in electrical construction and maintenance. Type TR™ Cleaner leaves no residue and is essentially non-conductive.

Type TR™ Cleaner replaces ozone-depleting CFC's, trichloroethane and other carcinogenic chlorinated solvents. Type TR™ Cleaner is compatible with most materials.

Type TR™ Cleaner is available in convenient pre-saturated towelettes. Pre-saturated wipes are a great option for field use. They limit solvent exposure and eliminate spill hazard.

Performance Properties:

Type TR™ Cleaner meets IEEE 1493 performance criteria[1]. It effectively cleans semi-conducting cable shield. A towel saturated with cleaner quickly removes the compound and becomes visibly black.

Property	Result
Cleaning Effectiveness	Excellent
KB Value	125
Hildebrand Solubility Parameter	18.2
Dielectric Strength, 100 mil gap (ASTM D877):	16 KV
Evaporation Rate	Fast
Residue (ASTM D2369)	< 100 ppm

[1] Tested using methods from IEEE 1493, "Guide for the Evaluation of Solvents Used for Cleaning Electrical Cables and Accessories."

Product Benefits:

- Fast Evaporating
- Excellent Solvency
- No Flashpoint
- Contains No Chlorinated Solvents
- No Residue
- Non-Conductive

End Use:

- Cable Splice Preparation
- Elbow connectors
- Transformers
- Switch Gear
- Motor Control Devices
- Fusible Disconnecting Devices
- Relays
- Generators

Physical Properties:

Type TR™ Cleaner is a high purity solvent with low aromatic content.

Property	Result
Flashpoint (ASTM D93)	None
Initial Boiling Point	158°F (70°C)
Specific Gravity	1.31

Cleaning Properties:

Type TR™ Cleaner is an excellent cleaner with great solvency on a variety of contaminants. It quickly removes XLPE insulation shield (Union Carbide Type 0691). A clean towel wetted with Type TR™ Cleaner becomes visibly black in just two wipes over 2-inches of cable length with light pressure.

Usage Directions:

To prepare cable for splice, buff the insulation with the abrasive strip to remove any conductive material remaining on the insulation. The surface should be smooth with no particle contaminants.

Clean the cable insulation with the Type TR™ Cleaning Wipe. Wipe away from the conductor towards the insulation shield. Turn the solvent towelette after each wipe, using a fresh portion of the towel each time. It is important not to wipe material from the insulation onto the insulation shield. Do not wipe the insulation shield. TR™ Cleaning Wipes can also be used to clean the cable jacket for improved adhesion of mastics and tapes used in splicing and termination.

For general electrical cleaning, follow manufacturers' instruction. TR™ Cleaning Wipes are fast evaporating. Do not open until ready to use.

Safety:

Type TR™ Cleaner does not contain any listed carcinogens. Keep away from fire and flame. Good industrial hygiene practice and appropriate precautions should be employed during use. Use with adequate ventilation and avoid contact with skin. Use of protective gloves is recommended (Silver Shield or viton for extended use and nitrile, neoprene or butyl gloves for short-term exposure). See MSDS for specific details.

Pel Pac System

Type TR™ Cleaner presaturated towelettes are a convenient package with multiple safety benefits.

Control

Presaturated wipes minimize solvent exposure on sensitive electrical parts. Directly spraying or immersing the part allows the solvent to puddle into small openings. Wipe cleaning will also ensure that the solvent evaporates more quickly.

Safety

The presaturated towelette package eliminates spill hazard and limits solvent vapor exposure. Wipes contain a carefully measured quantity of solvent and are an excellent way to control vapor.

Convenience

Each Pel-Pac package utilizes non-linting, non-tearing towels. Clean wipes are always available, eliminating recontamination of parts with dirty rags. Custom kits may include abrasive cloth or gloves as needed.

Convenient pre-saturated wipe (TR-1L or TR-1) controls solvent exposure.

Environmental Impact:

Type TR™ Cleaner is a safer alternative to chlorinated solvents.

Property	Result
VOC Content	1330 grams/liter
Global Warming Potential	Does not contain global warming compounds
Ozone Depletion Potential	Negligible
CFC, HCFC, HFC Content:	None
RCRA	Not regulated as hazardous waste
CERCLA/SARA Status	Not regulated as a hazardous substance
SNAP Status	Approved

Compatibility:

Type TR™ Cleaner is compatible with many common plastics and rubbers. It meets standard electrical utility test requirements based on IEEE 1493.

Plastic Materials - XLPE
XLPE jacket material immersed in Type TR™ Cleaner retains tensile and elongation characteristics and shows minimal weight change[1].

Rubber Materials – EPDM and Silicone Rubber
Platen samples of EPDM and Silicone Rubber immersed in Type TR™ Cleaner retain tensile and elongation characteristics and show minimal weight change[1].

Volume Resistivity of Cable Insulation Shield
Type 0691 XLPE immersed in Type TR™ Cleaner shows acceptable volume resistivity values[1]. After exposure to the cleaner, volume resistivity measurements return to control levels.

[1] Tested using methods from IEEE 1493, "Guide for the Evaluation of Solvents Used for Cleaning Electrical Cables and Accessories."

Soak Testing:

Type TR™ Cleaner is compatible with many materials. It is an aggressive cleaner that will dissolve or swell certain materials. The fast evaporation profile limits exposure.

Metals	Corrosion Test
Carbon Steel	Pass
Copper	Pass
Stainless Steel	Pass
Aluminum	Pass

Metals are degreased and scrubbed to remove surface oxides. Metals are then immersed in Type TR™ Cleaner for 2 months at 48.9°C (120°F). Metals are examined for any signs of corrosion, pitting, or discoloration for failure.

Plastics	Exposure Result
ABS	Incompatible
Acrylic	Incompatible
Delrin®	Acceptable
Epoxy	Acceptable
Nylon	Acceptable
Polycarbonate	Incompatible
Polyethylene	Acceptable
Polystyrene	Incompatible
PVC	Acceptable
Teflon®	Acceptable
Ultem® 1000	Acceptable

Plastics are immersed in Type TR™ Cleaner for 24 hours at 48.9°C (120°F). Plastics are examined for any sign of dissolving, swelling, or fraying for incompatibility.

Elastomers	% Weight Change
Neoprene®	(11 – 15%) Incompatible
Viton®	(< 5%) Acceptable

Elastomers are immersed in Type TR™ Cleaner and heated to boiling (70°C) for exposure to vapor for 60 minutes. Some rubbers will swell, but should return to their original state once the cleaner evaporates. Wipe cleaning minimizes solvent exposure.

Model Specification:

The statement below may be inserted into a customer specification to help maintain engineering standards and ensure work integrity.

The cleaner shall not leave a residue. The cleaner shall be fast evaporating. It shall evaporate at a rate >2 (n-butyl acetate = 1). When wiped over an XLPE (Union Carbide Type 0691) insulation shield, a clean towel wetted with the cleaner shall become visibly "black" with two wipes over 2-inches of cable length with light hand pressure.

The cleaner shall not have a flashpoint. When tested by ASTM D877 (100 mil gap), the cleaner shall show a voltage withstand of at least 15 kV before breakdown.

The cleaner shall not significantly affect the tensile and elongation properties of XLPE, silicone rubber, and EPDM rubber when tested to guidelines proposed in IEEE P1493. The cleaner shall not significantly affect the volume resistivity of Union Carbide 0691 XLPE cable insulation shield.

The cleaner shall not be a carcinogen or listed by CERCLA as a hazardous waste. It shall not be on the EPA Phase I or Phase II list of banned or phased-out chlorofluorocarbons.

Order Information:

Cat #	Package Description
TR-1	Single, saturated towelette (5"X8") 96/case
TR-1L	Single, saturated towelette (8"X12") 144/case
TR-16	16-oz aerosol can 12/case
TR-3PS	Pel-Pac™ Cable Splicing Prep Kit with Sanding Strip 24/case
TR-P63	Cable Preparation Kit includes: 6 TR-1 wipes 3 Strips 120-grit, non-conductive aluminum oxide sanding cloth 1 Instruction card 12/case

Not available in bulk packaging

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

American Polywater® Corporation

Stillwater, MN 55082 USA

Product Announcement
Replacement for Raychem/Tyco P-63

American Polywater, the original manufacturer of the cable prep kit bag, is pleased to make both the original and an enhanced version available directly to our distributors at an economical price. This is one of those rare opportunities **to make more money!!**

The first kit contains Polywater's well-known HP solvent.

Cat # HP-P63

Contains:

6 HP-P158ID wet/dry wipe cleaning pads

3 strips of 120 grit non-conductive aluminum oxide sanding cloth

Use instruction card

For those who want a faster drying cleaner, the new TR-P63 kit contains Polywater's popular fast-drying but non-combustible TR solvent wipes.

Cat # TR-P63

Contains:

6 TR-1 cleaning pads

3 strips of 120 grit non-conductive aluminum oxide sanding cloth

Use instruction card

Contact Sharon Hindahl toll-free at **800-328-9384** with questions or for pricing.

American Polywater® Corporation

5630 Memorial Ave. Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

SpliceMaster® Cable Cleaners

Electrical Cable / Splice Manufacturer Testing

The following cable/splice manufacturers evaluated or tested American Polywater's SpliceMaster® Cable Cleaners. Technical contacts at the cable/splice manufacturers are provided for additional details, when necessary.

Manufacturer	Name	Phone Number
American Insulated Wire	Lowell Lisker	1-401-726-0700
Brugg Cable	Leonardo Dilulio	41-21-803-4142
BICC® Brand Utility Cables	Ed Walcot	1-845-369-6000 X452
Hubell® Cable Accessories Products	Ray Jazewski	1-573-682-5521
Elastimold	Paul Bolcar	1-800-888-0211
Hendrix	Ray O. Bristol	1-603-673-2040
Kerite	Bob Fleming	1-203-881-5380
Okonite	Jim Fitzgerald	1-201-825-0300
Pirelli	Frank Kuchta	1-803-951-4800
Southwire	Dave Mercier	1-770-832-4522
Alcan	Larry Watkins/Bruce Vaughn	1-770-394-9886

The list above does not include all electrical cable/splice manufacturers. Ask your cable/splice manufacturer if they maintain a list of electrical cable cleaners approved with their cable.

American Polywater has extensive cleaner test data. Please call our Technical Service department toll-free at 1-800-328-9384 for details. Visit the SpliceMaster® product flyer online at http://www.polywater.com/splicemaster.asp.

95% Pure Zinc!

CG™

Cold Galvanizing Spray for Weld Coating, Metal Protection and Repair

Type CG™ Cold Galvanize is an industrial aerosol coating for metal protection and repair. Powerful CG™ contains 95% pure zinc; when sprayed on metal it forms a zinc-rich coating that prevents rust and inhibits corrosion through sacrificial galvanic action. Type CG™ aerosol offers easy on-the-job application, and is ideal as a primer or for touch-up. Quick drying CG™ contains no chlorinated solvents, and is excellent for weld coating.

ADVANTAGES

- Protects metal
- Prevents rust and inhibits corrosion
- Excellent for weld coating
- Contains no listed carcinogens
- Contains no CFC's or HCFC's
- Contains no chlorinated solvents
- Ideal as a primer or touch-up paint
- Similar to hot-dip galvanizing
- Efficient nozzle minimizes drips/runs
- Dries quickly
- Easy on-the-job application

APPLICATIONS

- Damaged galvanized steel
- Metal equipment and boxes
- Welded parts and welds
- Springs and coils
- HVAC equipment
- Pipes and water tanks
- Flood restoration and repair
- Paint primer and touch-up
- Much, much more

USE DIRECTIONS

Apply to clean, dry metal surfaces. Brush off loose rust or scale. Clean surface with Type HP™ or Type FD™ Cleaner/Degreaser as necessary. Shake the can vigorously until internal agitator rolls freely. Spray using light, even strokes about 18" (1/2 m) from the surface. Several thin coats are recommended. Allow 15 minutes drying time between coats. Final coat should dry thoroughly (up to 24 hours). To avoid clogging, invert can and spray until only air escapes.

CATALOG NUMBERS

Type CG™	Package Size	Units/CS	Image
CG-13	16 fluid oz (475 ml) aerosol can with spray nozzle. Net wt 13 oz.	12	

American Polywater's

Technical Bulletin

FD™

Electrical Contact Cleaner

A Fast-Drying Cleaner for General Industrial and Maintenance Use

Description

FD™ Electrical Contact Cleaner is a fast drying, multi-purpose industrial and maintenance cleaner. It replaces ozone-depleting CFC's, trichloroethane, HCFC's, perchloroethylene and other carcinogenic chlorinated solvents. FD™ Electrical Contact Cleaner effectively dissolves industrial grimes, greases, lubrication fluids, silicone, tars, adhesives, and fluxes.

FD™ Electrical Contact Cleaner evaporates quickly without a residue. It is suitable for use in electrical maintenance as a replacement for 1,1,1-trichloroethane. Transformer oils, corrosion inhibitor compounds, silicone grease, semi-conducting paints, and many other kinds of electrical grime clean up quickly with Type FD™ Cleaner.

Typical Physical Properties

Dielectric Strength (ASTM D877)	36 KV
Relative Evaporation Rate	Fast
Residue (ASTM D 2369)	< 100 ppm
Flashpoint (ASTM D 56)	~ 20°F/-5°C
Initial Boiling Point	141°F/60°C
Specific Gravity	0.69
Percent Aromatics	< 0.1%
Propellant (aerosol only)	CO_2
Cleaning Strength	Excellent

Advantages

- Multiple packages to fit different end uses
- Fast evaporating
- Good general solvency power
- One cleaner for many needs
- Contains no CFC's or HCFC's
- Contains no chlorinated solvents
- Harmless to most plastics
- Non-conductive, non-corrosive, non-staining

FD™ Electrical Contact Cleaner aerosol (cat. # FD-9) has a variable spray head (low, medium, high) for better spray control.

Usage Directions/Performance

FD™ Electrical Contact Cleaner is suitable for many types of cleaning and degreasing, including contact cleaning and electrical maintenance cleaning. It can be used as a spray, wipe, or solvent rinse. FD™ Cleaner is effective at room temperature. It does not freeze and can be used in cold weather applications. FD™ Electrical Contact Cleaner is authorized by the USDA for use in federally inspected meat and poultry plants.

FD™ Cleaner has good solvency power. Cleaning time and effectiveness will vary based on the contaminant and cleaning method. Wiping or agitation speeds the cleaning. Experiment with your particular contaminant and conditions.

A comparison of FD™ Cleaner to other solvent types is charted below. A stainless steel surface is coated with 50 mils of contaminating compound. The surface is immersed and lightly agitated in FD™ Cleaner. The time at which the contaminant has dissolved is noted.

Silicone Electrical Insulating Compound	
Cleaner	**Cleaning Time**
FD™ Electrical Contact Cleaner	<2 Minutes
Odorless Mineral Spirits	5 Minutes
Isopropyl Alcohol	>5 Minutes

Hydrocarbon Lubricating Grease	
Cleaner	**Cleaning Time**
FD™ Electrical Contact Cleaner	<3 Minutes
Odorless Mineral Spirits	>5 Minutes
Isopropyl Alcohol	>>5 Minutes

Cable Filling Grease (PE/PJ)	
Cleaner	**Cleaning Time**
FD™ Electrical Contact Cleaner	5 Minutes
Odorless Mineral Spirits	>5 Minutes
Isopropyl Alcohol	>>5 Minutes

Oxide Inhibiting Compound	
Cleaner	**Cleaning Time**
Type FD™ Cleaner	<1 Minutes
Odorless Mineral Spirits	<2 Minutes
Isopropyl Alcohol	>>5 Minutes

FD™ Electrical Contact Cleaner contains no surfactants and leaves no residue once dried. For precision cleaning (residue free use), prevent recontamination with existing grime by finishing with a fresh wipe, spraying until the solvent runs clear, or rinsing in a fresh bath of FD™ Cleaner.

FD™ Electrical Contact Cleaner is fast evaporating and does not require forced air to dry. In areas where solvent has pooled, the part may be wiped with an absorbent, lint-free towel.

Evaporation Rate

FD™ Electrical Contact Cleaner:	40 mg/min.
111 Trichloroethane:	50 mg/min.
Perchloroethylene:	20 mg/min.
Isopropyl Alcohol:	10 mg/min.
Odorless Mineral Spirits:	.3 mg/min.

Compatibility

FD™ Electrical Contact Cleaner will not corrode or stain metal parts. It does not tarnish or corrode copper per ASTM D130 and D1729.

FD™ Electrical Contact Cleaner is compatible with most plastics and elastomers. Tables I and II show the effect of FD™ Cleaner on various plastics and rubbers.

Testing, shown in charts I and II, is based on a soak test described in ASTM D543. FD™ Cleaner may temporarily swell some rubber compounds. These rubbers should return to their original state after the cleaner has evaporated. Immersion will affect sensitive materials more than incidental contact of a spray or wipe. It is recommended that all plastic parts, gaskets, seals and O-rings be tested for specific use and exposure method.

FD™ Solvent Compatibility with Plastics and Elastomers

TABLE I

PLASTICS	AGING 72 HOURS AT 50°C		
	% WEIGHT CHANGE	% THICKNESS CHANGE	APPEARANCE
ABS	+0.81	0	NC
Acrylic	+0.06	+0.15	NC
CPE Thermoplastic	+6.49	0	NC
CPE Thermoset	-6.51	0	NC
Delrin®	+0.24	0	NC
Epoxy	+0.08	0	NC
Nylon 101	+0.70	+0.27	NC
Polycarbonate	+0.18	0	NC
Phenolic	+6.99	+9.00	NC
Polyethylene	+12.46	+3.78	NC
Polystyrene	+31.49	+33.12	SF
PVC	-0.03	0	NC
Teflon®	+0.07	0	NC
Tygon®	-0.17	+6.62	NC
Ultem® 1000	-0.08	+0.27	NC
Valox® 420	+0.10	+1.12	NC

TABLE II

ELASTOMERS	AGING 72 HOURS AT 50°C		
	% WEIGHT CHANGE	% THICKNESS CHANGE	APPEARANCE
EPDM	+100.88	+37.15	S
Neoprene	+2.36	+2.72	NC
Nitrile	+2.00	+5.26	NC
SBR	+16.96	+31.53	SS
Silicone	+65.97	+47.50	S
Viton®	+1.98	+4.43	NC

KEY:
NC = NO CHANGE
S = SWELLING
SS = SLIGHT SWELLING
SF = SOFTENING

FD™ Cleaner is a trademark of American Polywater Corporation
Delrin®, Teflon®, and Viton® are trademarks of Du Pont
Ultem® 1000 and Valox® 420 are trademarks of G.E. Plastics
Tygon® is a trademark of Norton Performance Plastics

Safety

FD™ Electrical Contact Cleaner has a low level of toxicity. As with any solvent, ventilation should be sufficient to keep vapors at safe levels. Avoid eye contact and excessive skin contact. Wash hands with soap and water after using.

FD™ Electrical Contact Cleaner is an extremely flammable liquid. It should not be used on energized equipment. FD™ Electrical Contact Cleaner should not be used for high temperature cleaning or exposed to pilot lights, flames or heated surfaces. Good industrial hygiene practice and appropriate precautions should be employed during use. See MSDS for specific details.

Storage

FD™ Electrical Contact Cleaner is classified as flammable. Keep containers cool, dry and away from sources of ignition and oxidizing materials. Do not expose aerosol cans to direct sunlight or temperatures above 120°F. Do not puncture or incinerate aerosol cans.

Package Options

Catalog No.	Description
FD-9	9-wt. oz. aerosol with adjustable nozzle (16 oz can) (12/cs)
FD-16LF	16-fl. oz. bottle with flip top (12/ cs)
FD-35LF	1-quart bottle with flip top (12/cs)
ST-R	Trigger sprayer fits pt. & qt. Bottles (12/cs)
FD-128	1-gallon can (4/cs)
FD-640	5-gallon pail (1 ea).
FD-Drum	55-gallon drum (1 ea)

LIT-FDTECHB/4-03/C1000(8/04)

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
www.polywater.com(URL) custserv@polywater.com(e-mail)

Type HP™
Multi-Purpose Cleaner

American Polywater® Corporation

TECHNICAL DATA SHEET

Description:

Type HP™ Cleaner effectively cleans semi-conducting cable shield, corrosion inhibiting compound, silicone greases, filling gels, transformer oils and many other contaminants found in electrical construction and maintenance. It evaporates with no residue. Type HP™ is non-conductive.

Type HP™ Cleaner replaces ozone-depleting CFC's, trichloroethane and other carcinogenic chlorinated solvents. Type HP™ Cleaner lasts longer than fast evaporating solvents and is compatible with most materials and plastics, including polycarbonate.

Type HP™ Cleaner is available in multiple package options. Bulk Type HP™ Cleaner is an excellent choice for soaking or rinsing parts. Pre-saturated towels limit solvent exposure and eliminate spill hazard. Depending on end use, Type HP™ Cleaner has the optimal package available.

Performance Properties:

Type HP™ Cleaner meets IEEE 1493 performance criteria[1]. It effectively cleans semi-conducting cable shield. A towel saturated with cleaner quickly removes the compound and becomes visibly black.

Property	Result
Cleaning Effectiveness	Excellent
KB Value	33
Hildebrand Solubility Parameter	7.5
Dielectric Strength 100 mil gap (ASTM D877):	>40 KV
Water Content (ASTM D1533B)	< 50 ppm
Evaporation Rate	Medium
Residue (ASTM D2369)	<100 ppm

[1] Tested using methods from IEEE 1493, "Guide for the Evaluation of Solvents Used for Cleaning Electrical Cables and Accessories."

Product Benefits:

- Excellent Solvency
- No Residue
- Non-Conductive
- Contains No Chlorinated Solvents
- Compatible with Most Plastics and Rubbers
- Multiple Package Options

End Use:

- Transformers
- Switch Gear
- Motor Control Devices
- Fusible Disconnecting Devices
- Wind Turbine Nacelles
- Relays
- Generators
- Motors
- Circuit Boards
- Rheostats
- Tools

Physical Properties:

Type HP™ Cleaner is a high purity solvent with low aromatic content.

Property	Result
Flashpoint (ASTM D93)	>140°F (60°C)
Initial Boiling Point	365°F (185°C)
Specific Gravity	0.79
Percent Aromatics	< 1%

Cleaning Properties:

Type HP™ Cleaner dissolves a broad range of contaminants. Contaminant is added to 20 grams cleaner at ambient temperature. The quantity dissolved is recorded.

Contaminant	Amount Dissolved
PCB (Aroclor® 1260)	10 grams
Cutting oil (Rigid Nu-Clear, sulphurized oil)	10 grams
Silicone grease (Dow Corning 4 Compound)	2 grams
Animal oil (Lanolin-Tech Grade)	2 grams

Usage Directions:

Type HP™ Cleaner is suitable for many types of cleaning and degreasing and is effective at room temperature. It does not freeze and can be used in cold weather applications.

Cleaning time and effectiveness will vary based on the contaminant and cleaning method. Wiping or agitation cleans faster than just soaking. Experiment with your particular contaminant and conditions.

Type HP™ Cleaner is residue-free. For precision cleaning, a final rinse of fresh cleaner should be used. Finish with a fresh wipe, spray until the solvent runs clear, or rinse in a fresh bath of Type HP™ cleaner.

For faster drying, air or centrifugal dryers can be used to accelerate evaporation. Wiping the part with an absorbent, lint-free towel (Cat.# DT-69) will reduce drying time considerably.

Drying Time Comparisons:

No Drying:	60-90 Mins.	Cool Air:	3-5 Mins.
Drying Wipe:	1-2 Mins.	Hot Air:	2-3 Mins.

Safety:

Type HP™ Cleaner has a low level of toxicity and does not contain any listed carcinogens. It is combustible and should not be exposed to fire or flame. Good industrial hygiene practice and appropriate precautions should be employed during use. See MSDS for specific details.

Pel Pac System

Type HP™ Cleaner presaturated towelettes are a convenient package with multiple safety benefits.

Control
Presaturated wipes minimize solvent exposure on sensitive electrical parts. Directly spraying or immersing the part allows the solvent to puddle into small openings. Wipe cleaning will also ensure that the solvent evaporates more quickly.

Safety
The presaturated towelette package eliminates spill hazard and limits solvent vapor exposure. Wipes contain a carefully measured quantity of solvent and are an excellent way to control vapor. Type HP™ Cleaner presaturated towelettes are a great choice for underground or confined space applications.

Convenience
Each Pel-Pac package utilizes non-linting, non-tearing towels. Clean wipes are always available, eliminating recontamination of parts with dirty rags. Custom kits may include extra dry towels or abrasive cloth as needed.

Convenient Wet/Dry Tandem Pack (HP-P158ID) controls solvent exposure.

Environmental Impact:

Type HP™ Cleaner is a safer alternative to chlorinated solvents.

Property	Result
VOC Content	790 grams/liter
Global Warming Potential	Does not contain global warming compounds
Ozone Depletion Potential	None
CFC, HCFC, HFC Content:	None
RCRA	Not regulated as hazardous waste
CERCLA/SARA Status	Not regulated as a hazardous substance

Compatibility:

Type HP™ Cleaner is compatible with most common plastics and rubbers. It meets standard electrical utility test requirements based on IEEE 1493.

Plastic Materials - XLPE
XLPE jacket material immersed in Type HP™ Cleaner retains tensile and elongation characteristics and shows minimal weight change[1].

Rubber Materials – EPDM and Silicone Rubber
Platen samples of EPDM and Silicone Rubber immersed in Type HP™ Cleaner retain tensile and elongation characteristics and show minimal weight change[1].

Volume Resistivity of Cable Insulation Shield
Type 0691 XLPE immersed in Type HP™ Cleaner shows acceptable volume resistivity values[1]. After exposure to the cleaner, volume resistivity measurements return to control levels.

Corrosivity:
Type HP™ Cleaner will not corrode or stain metal parts. It does not tarnish or corrode copper[2].

[1] Tested using methods from IEEE 1493, "Guide for the Evaluation of Solvents Used for Cleaning Electrical Cables and Accessories."

[2] Testing based on ASTM D130, "Standard Test Method for Detection of Copper Corrosion from Petroleum Products by the Copper Strip Tarnish Test."

Soak Testing:

Materials are immersed in Type HP™ Cleaner for 72 hours at 50°C (122°F). Some rubbers will swell, but should return to their original state once the cleaner evaporates. Wipe cleaning minimizes solvent exposure.

Plastics	% Weight Change	Appearance
ABS	+0.04	NC
Acrylic	-0.01	NC
Delrin®	+0.03	NC
Epoxy	0.00	NC
Nylon 66	-0.02	NC
Nylon 101	+0.07	NC
Polycarbonate	+0.04	NC
Phenolic	-0.05	NC
PPO	+0.02	NC
PVC	+0.01	NC
Teflon®	+0.03	NC
Tygon®	-0.25	NC
Ultem® 1000	-0.01	NC
Valox® 420	0.00	NC

Elastomers	% Weight Change	Appearance
Neoprene®	+9.31	SS
Nitrile	-2.01	NC
SBR	+47.34	S
Viton®	+0.07	NC

KEY:

NC = No Change
S = Swelling
ES = Extreme Softening
C = Crazing
SS = Slight Swelling
D = Disssolved

Testing based on ASTM D543, "Standard Test Method for Resistance of Plastics to Chemical Reagents."

Model Specification:

The statement below may be inserted into a customer specification to help maintain engineering standards and ensure work integrity.

The cleaning solvent shall be at least 80% high purity, dearomatized, aliphatic hydrocarbon enhanced with a cyclic terpene. Aromatic content shall be less than 1%. Water content shall be less than 75 ppm.

The cleaner shall not leave a residue. The cleaner shall not significantly affect the volume resistivity of Union Carbide 0691 XLPE cable insulation shield. The cleaner shall show a voltage withstand of at least 40 kV before breakdown.

The cleaner shall not significantly affect the tensile and elongation properties of XLPE, silicone rubber, and EPDM rubber when tested to guidelines proposed in IEEE P1493. When wiped over an XLPE (Union Carbide Type 0691) insulation shield, a clean towel wetted with the cleaner shall become visibly "black" with two wipes over 2-inches of cable length with light hand pressure.

The cleaner shall not be a carcinogen or listed by CERCLA as a hazardous waste. It shall not be on the EPA Phase I or Phase II list of banned or phased-out chlorofluorocarbons.

Order Information:

Cat #	Package Description
HP-1	Single, saturated towelette 144/case
HP-P158ID	Wet/dry wipe Tandem Pack™ 144/case
HP-D72	72-Count Wipe Canister 6/case
HPY-12*	16-oz aerosol can 12/case
HP-16LF	1-pint bottle with flip top (475 ml) 12/case
HP-35LF	1-quart bottle with flip top (.95 Liter) 12/case
ST-R	Trigger sprayer, fits pint and quart bottles 12/case
HP-128	1-gallon bottle (3.8 Liter) 4/case
HP-640	5-gallon can (18.0 Liter)
HP-DRUM	55-gallon drum
HP-P63	Tandem Pack™ Cable Prep Kit contains 6 HP-P158ID wet/dry wipes 3 strips 120-grit non-conductive aluminum oxide sanding cloth 1 instruction card 12/case
HP-T369	Pel-Pac® Kit, 3 saturated towels in sturdy tin 24/case
HP-T369/S	Pel-Pac® Kit with sandpaper 24/case
HP-T369/S-D	Pel-Pac® Kit with sandpaper and dry towel 24/case
DT-1212	Non-linting, 12" X 12" dry towels 100/box
DT-69	Non-linting, 6" X 9" dry towels 200/box
DT-D65	Dispensing canister, 65 8" X 12" dry towels 6 canisters/case

**Government NSN # 6850-01-387-4567 for HPY-12*

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

Technical Bulletin

American Polywater's

KC™

Electrical Cable & Equipment Cleaner

A Fast Acting Cleaner for Electrical and Electronic Use

Description

KC™ Electrical Cable & Equipment cleaner replaces CFC, HCFC, and chlorinated solvent contact cleaners. It is fast evaporating, non-flammable, and non-carcinogenic. KC™ Electrical Cable & Equipment Cleaner will not attack or degrade sensitive plastics and will not corrode metals. It is essentially non-conductive.

KC™ Electrical Cable & Equipment Cleaner effectively cleans oxidation, dust and light oils from electrical equipment. Use KC™ Cleaner to clean circuit boards, controls, switches, relays, etc. It will evaporate from the cleaned surface quickly, leaving no residue.

Physical Properties

Flashpoint (ASTM D93)	None
Initial Boiling Point	90° F (32°C)
Specific Gravity	1.4
Dielectric Strength (ASTM D877)	21 KV
Relative Evaporation Rate	Fast
Residue (ASTM D2369)	<100 ppm
Water Content (ASTM D1533B)	< 50 ppm
Propellant	HFE
Cleaning Strength	Good

Advantages

- No Flash Point
- Fast Evaporating
- Harmless to Most Plastics
- Residue-Free
- Non-Conductive, Non- Corrosive, Non-Staining
- Not an RCRA-Regulated Hazardous Waste
- No Chlorinated Solvents

KC™Electrical Cable & Equipment Cleaner aerosol (cat. #KC-4 & KC-16) has a variable spray head (low, medium, and high) for better spray control.

Usage Directions/Performance

Use KC™ Electrical Cable & Equipment Cleaner to clean contacts and relays on electrical or electronic equipment. Position nozzle 6 to 8 inches (15 - 20 cms) from the surface. Spray liberally and allow solvent to flush oil and dirt. Use the extension tube for hard to reach areas.

KC™ Cleaner is a slightly stronger solvent than the CFC azeotropes that have been used for many years. It will clean light oils, silicone compounds, and fluorinated greases.

KC™ Cleaner evaporates instantly. Forced air, drying towels and heat are unnecessary. There is no time lost, waiting for it to dry.

Evaporation Rate

KC™ Cleaner:	250 mg/min.
Perchloroethylene:	20 mg/min.
CFC 113:	200 mg/min.
Odorless Mineral Spirits:	0.3 mg/min.

Compatibility

KC™ Cleaner will not corrode or stain metal parts. It does not tarnish or corrode copper per ASTM D 130 and D 1729.

KC™ Cleaner is compatible with most plastics and elastomers. Tables I and II show the effect of KC™ Cleaner on various plastics and rubbers. KC™ Cleaner has less effect on these materials than chlorinated solvents and pure HCFC 141b.

Testing is based on a soak test described in ASTM D 543. KC™ Cleaner will temporarily affect some rubber compounds. These rubbers may swell, but should return to their original state after the solvent cleaner has dried. Immersion will affect sensitive materials more than incidental contact of a spray and wipe. It is recommended that all plastic parts, gaskets, seals and O-rings be tested for specific use and exposure method.

Regulations

- USDA and MSHA approved.
- TSCA listed (U.S.A.) and DSL listed (Canada).
- Ozone Depletion Potential = 0.10
- Not listed as a hazardous air pollutant (HAP).
- Not regulated for ground transportation.

Safety

KC™ Electrical Cable & Equipment Cleaner has a low level of toxicity. It is not considered a carcinogen and is quite safe to use. Use with adequate ventilation. Wash hands after use. See MSDS for specific details.

Storage

Keep containers cool, dry and away from sources of ignition and oxidizing materials. Do not expose aerosol cans to direct sunlight or temperatures above 120°F. Do not puncture or incinerate aerosol cans.

Packaging

Catalog No.	Description
KC-4	4-wt. oz. aerosol can with adjustable nozzle
KC-16	16-wt. oz. aerosol can with adjustable nozzle in a 16 oz can

KC™ Compatibility with Plastics and Elastomers

TABLE I

PLASTICS	AGING 5 DAYS AT ROOM TEMPERATURE		
	% WEIGHT CHANGE	% THICKNESS CHANGE	APPEARANCE
ABS	+4.28	+3.10	NC
Acrylic	+0.27	0	NC
CPE Thermoplastic	+18.23	+3.30	NC
CPE Thermoset	+14.87	+0.45	NC
Delrin®	+0.20	-1.45	NC
Epoxy	+0.32	0	NC
Nylon 101	+0.06	-0.27	NC
Polycarbonate	+1.26	0	C
Phenolic	+4.70	+2.93	NC
Polyethylene	+7.53	+1.17	NC
Polystyrene	+49.54	+16.86	ES
PVC	+0.05	0	NC
Teflon®	+1.43	+0.22	NC
Tygon®	+20.94	0	NC
Ultem® 1000	-0.01	+1.09	NC
Valox® 420	+0.09	+1.21	NC

TABLE II

ELASTOMERS	AGING 5 DAYS AT ROOM TEMPERATURE		
	% WEIGHT CHANGE	% THICKNESS CHANGE	APPEARANCE
EPDM	+34.69	+8.43	SS
Neoprene	+23.33	+20.07	SS
Nitrile	+26.37	+20.22	SS
SBR	+20.62	+9.65	NC
Silicone	+112.38	+31.32	S
Viton®	+48.12	+22.30	SS

KEY:
NC = NO CHANGES
C = CRAZING
SS = SLIGHT SWELLING
ES = EXTREME SOFTENING
S = SWELLING
D = DISSOLVED

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

LIT-KCTECHB/2-07/INTERNAL(1-05)

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384

custserv@polywater.com(e-mail)
www.polywater.com(URL)

1-651-430-2270
fax 1-651-430-3634

Great for Silicone Greases!

Type GP™

Specialty Cleaner

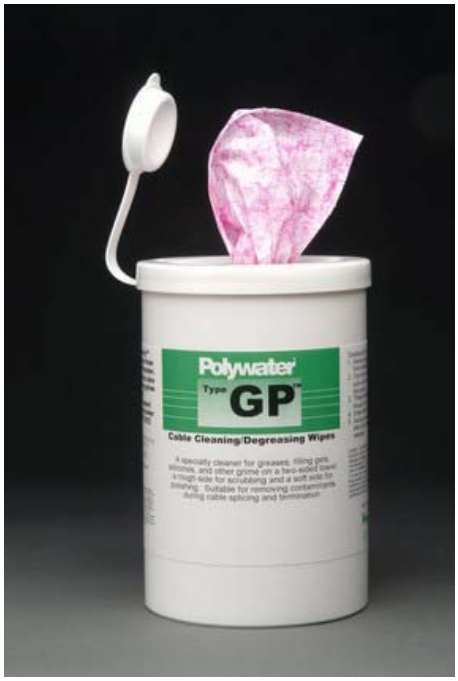
A Unique and Effective Replacement for 1,1,1, Trichloroethane and Other Chlorinated Solvents

American Polywater introduces Specialty Cleaner Type GP™ to its SpliceMaster® family of electrical and communications cleaning products. SpliceMaster® Type GP™ is a less hazardous alternative to 1,1,1 trichloroethane. Type GP™ is an enhanced terpene-based cleaner engineered specifically for electrical and telcom cable cleaning. It evaporates rapidly and leaves no residue, while exhibiting excellent solvency power on silicone and hydrocarbon greases, fluxes, varnishes, shield picks, adhesives, hand grime, and other organic soils. GP™ is non-ozone depleting and non-carcinogenic.

Type GP™ Specialty Cleaner is ideal for electrical and telcom cleaning and degreasing situations where fast evaporation and high solvency power are crucial, yet a low flashpoint is acceptable.

ADVANTAGES

- Powerful cleaner for all electrical and communications cleaning needs.
- No CFC's, HCFC'S, chlorinated solvents or other ozone-depleters.
- No perchloroethylene or other carcinogens.
- No residue, non-conductive, non-corrosive, non-freezing, non-staining.
- Removes residues that can cause poor operation of electrical equipment.
- Suitable replacement for chlorinated electrical and telcom cleaners.
- Available in multiple packages.



CLEANS

- Silicone Greases
- Cables
- Cable Gels
- Transformers Oils
- Varnishes
- Shield Picks
- Hydrocarbon Greases
- Tars
- Saps
- Adhesives
- General Degreasing and Cleaning

(Not Recommended for Use on Energized Equipment)

PACKAGES

Type GP™ Specialty Cleaner comes in a variety of packages for convenient use. For cleaning large areas, bulk packages are available. For smaller jobs there are trigger sprayers, small containers and individually-sealed presaturated towelettes. Separate dry towelettes are available for applying bulk solvent or to further speed evaporation.

ORDERING OPTIONS

Catalog No.	Description	Units/CS	Image
GP-1	Saturated, lint-free wipe	144	
GP-D72	72-Count self-dispensing and resealable canister with saturated, dual-sided wipes (soft/textured)	6	
GP-16LF	16-fluid oz. (475 ml) bottle with flip top	12	None
GP-35LF	1-quart (.95 liters) bottle with flip top	12	None
ST-R	Trigger sprayer fits pint & quart bottles	12	None
GP-128	1-gallon (3.8 liters) can	4	None
GP-640	5-gallon (18.9 liters) pail	1	None
GP-DRUM	55-gallon (208 liters) drum	1	None

SAFETY

Type GP™ Specialty Cleaner has a low level of toxicity. Unlike 1,1,1, trichloroethane, it does not form vapors quickly. As with any solvent, ventilation should be sufficient to keep vapors at safe levels. Type GP™ Degreaser is a combustible liquid with a flash point of 123°F. It should not be used for high temperature cleaning or exposed to fire or flame. Good industrial hygiene practice and appropriate precautions should be employed during use. See MSDS for specific details.

LIT-TYPEGP/1-05/INTERNAL(1/05)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

Electrical Maintenance Aerosols from American Polywater

NEW

TR™ Cable Cleaner

- **Powerful All Purpose Cleaner**
- **Closely Matches Trichlor's Characteristics**
- **No Flash Point, Non-Flammable**
- **Non Chlorinated, No Carcinogens**

KC™ Electrical Cable & Equipment Cleaner

- **No Flash Point, Non-Flammable**
- **Safe On Plastics**
- **Fast Evaporating**
- **No Carcinogens**

HP™ Multipurpose Cleaner/Degreaser

- **Excellent Cable Cleaner**
- **High Flash Point**
- **Non-Chlorinated, Ozone Safe**
- **Plastics Safe**

FD™ Electrical Contact Cleaner

- **Fast Drying, Leaves No Residue**
- **Removes Contamination, Safe on Cables, Circuit Boards & Contacts**
- **Superior Solvency Power**
- **Non-Chlorinated, No Carcinogens**

P7™ Multipurpose Oil

- **Lubricates, Penetrates, Cleans**
- **Displaces Water, Seals out Moisture**
- **Extends Equipment Life**
- **Safe On Plastics**

CG™ Cold Galvanize

- **Prevents Rust & Corrosion**
- **Protects Steel Elect'l Apparatus**
- **Excellent for Weld Coating**

Aerosol Ordering Matrix

Description	Catalog Number	Unit Package Description	Units Per Case
TR™ Cable Cleaner Also available in individually wrapped saturated wipes (2 sizes)	TR-16	16-oz aerosol can	12
	TR-1	Saturated 5”x8” wipe in sealed foil pouch	96
	TR-1L	Saturated 8”x12” wipe in sealed foil pouch	144
KC™ Electrical Cable & Equipment Cleaner	KC-4	6-oz aerosol can	12
	KC-16	16-oz aerosol can	12
FD™ Electrical Contact Cleaner Also available in Pint, Quart, Gallon, 5-gal pail and 55-gal drum	FD-9	16-oz aerosol can	12
	FD-16LF	16-oz bottle with flip top	12
	FD-35LF	32-oz bottle with flip top	12
	FD-128	1-gallon jug	4
	FD-640	5-gallon pail	1
	FD-DRUM	55-gallon drum	1
HP™ Multipurpose Cleaner/Degreaser Also available in Pint, Quart, Gallon, 5-gal pail, 55-gallon drum and convenient saturated wipe in foil pack	HPY-12	16-oz aerosol can	12
	HP-16LF	16-oz bottle with flip top	12
	HP-35LF	32-oz bottle with flip top	12
	HP-128	1-gallon jug	4
	HP-640	5-gallon pail	1
	HP-DRUM	55-gallon drum	1
	HP-1	Saturated wipe in foil pack	144
	HP-P158ID	Wet/dry wipe Tandem pack™	144
CG™ Cold Galvanize	CG-13	16-oz aerosol can	12
P7™ Multipurpose Oil	P7-12	16-oz aerosol can	12

To view additional information on each aerosol cleaner, go to:
www.polywater.com/aerosols.html

American Polywater® Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-MROFLYER/11-06/C1000/11-06

SpliceMaster®

CableWash™

Washing Solution

For Cable Exterior Cleansing

FEATURES

- MILD - No harsh solvents to swell or damage cable jackets.
- BIODEGRADABLE - Water-based cleaner is environmentally friendly.
- CONVENIENT - Eliminates need to source water, soap, or other cleaners.
- ECONOMICAL - A clean and proper splice is always the least expensive.
- SYSTEM APPROACH - Part of the SpliceMaster™ Cable Cleaners system.

Cable Cleansing

Dirt, mud, and clay must be removed from the exterior jackets of direct-buried cables prior to splicing. Solvents are not appropriate for this use as they tend to swell and damage cable jacket materials.

CableWash™ is a mild, water-based cable washing solution for cleansing cable jackets prior to splicing. Its biodegradable formula contains no harsh solvents, and is compatible with jacket materials. It is non-freezing for cold weather application.

Catalog No.	Description	Units/CS	Image
CWS-128	1-gallon CableWash™ Solution.	4	
CWS-22	22-ounce CableWash™ Solution bottle with trigger sprayer and bristle head.	12	

LIT-CABLEWASH/10-06/INHOUSE(10/06)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

Lint Free!

SpliceMaster®

Dry Towelettes

For Cable Cleaning

FEATURES

- NON-LINTING - Leaves no residue that could lead to tracking. Ideal for electrical cable splicing.
- VERSATILE - Use to apply bulk SpliceMaster® Cleaners, or wipe them dry.
- THREE SIZES - Choose 6" x 9", 8" x 12", or larger 12" x 12" size for big jobs.
- TWO TYPES - Regular wipes (boxed) or apertured wipes (dispensing canister).
- DURABLE - Won't shred under heavy wiping load.
- CONVENIENT - Eliminates the need to search for rags.
- HANDY PACKAGING - Perforation-cut for easy dispensing from box or canister.

SpliceMaster® Dry Towels are ideal for wiping excess solvent from electrical cables during splicing. This accelerates the evaporation rate of today's effective but slow-drying cleaners. Towelettes can also replace rags as a means of applying bulk solvent. Rags and other wipes are a poor choice for cable cleaning since they can deposit lint or other residues that can lead to tracking.

SpliceMaster® Dry Towels in the DT-D65 canister package are a slightly different style from the boxed wipes (DT-69 and DT-1212). The material is an apertured, spunlace polyester/woodpulp blend. DT-D65 wipes contain no binders or other chemical residues. They are durable with a high tensile strength in both directions. They have high absorbancy. The apertures (small holes or textured spaces) help grab and hold contaminants during the cleaning process. Non-linting, non-tearing, and non-snagging DT-D65 towelettes have an infinite number of uses beyond cable cleaning. The field-friendly self-dispensing plastic canister is durable, resealable, highly portable, and helps protect wipes from moisture, dust, bugs, and other grime--perfect for the service truck.

Catalog No.	Description	Units/CS	Image
DT-69	Box of 200 6" x 9" dry wipes.	1 200-count box	
DT-1212	Box of 100 12" x 12" dry wipes.	1 100-count box	None
DT-D65	Dispensing canister of 65 8" x 12" dry wipes.	6 canisters per box	

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-DRYTOWEL/-10/INTERNAL(4/10)

Non-Conductive!

SpliceMaster®

Sanding Cloth

For Cable Cleaning

FEATURES

- NON-CONDUCTIVE - Leaves no conductive grit that could lead to tracking or arcing.
- DURABLE - Cloth backing resists shredding. Outlasts sandpapers.
- CONVENIENT - Compact roll dispenses and stores easily.
- ECONOMICAL - Unravel and snip only the needed amount. Eliminates waste.
- EASY TO USE - Inch-wide cloths perfectly sized for "shoe-polishing" hand motions.
- SYSTEM APPROACH - Part of the SpliceMaster® Cable Cleaners system.

SpliceMaster® Sandpaper Rolls contain 50 yards of 1-inch-wide non-conductive aluminum oxide sanding cloth for removing semi-con shield residue, jacket polymers, and other contaminating materials from electrical cable insulation during splicing. Such deposits must be removed prior to splicing electrical cable since they can lead to tracking or arcing. Standard, store-bought sandpapers and abrasives can leave conductive grit residues that could lead to cable failure and hazardous conditions. Only non-conductive sanding materials should be used. NEVER ABRADE AN ENERGIZED CABLE.

Catalog No.	Description	Units/CS	Image
SP-ROLL	1-inch x 50-yard roll of 120-grit non-conductive aluminum oxide sanding cloth.	1	

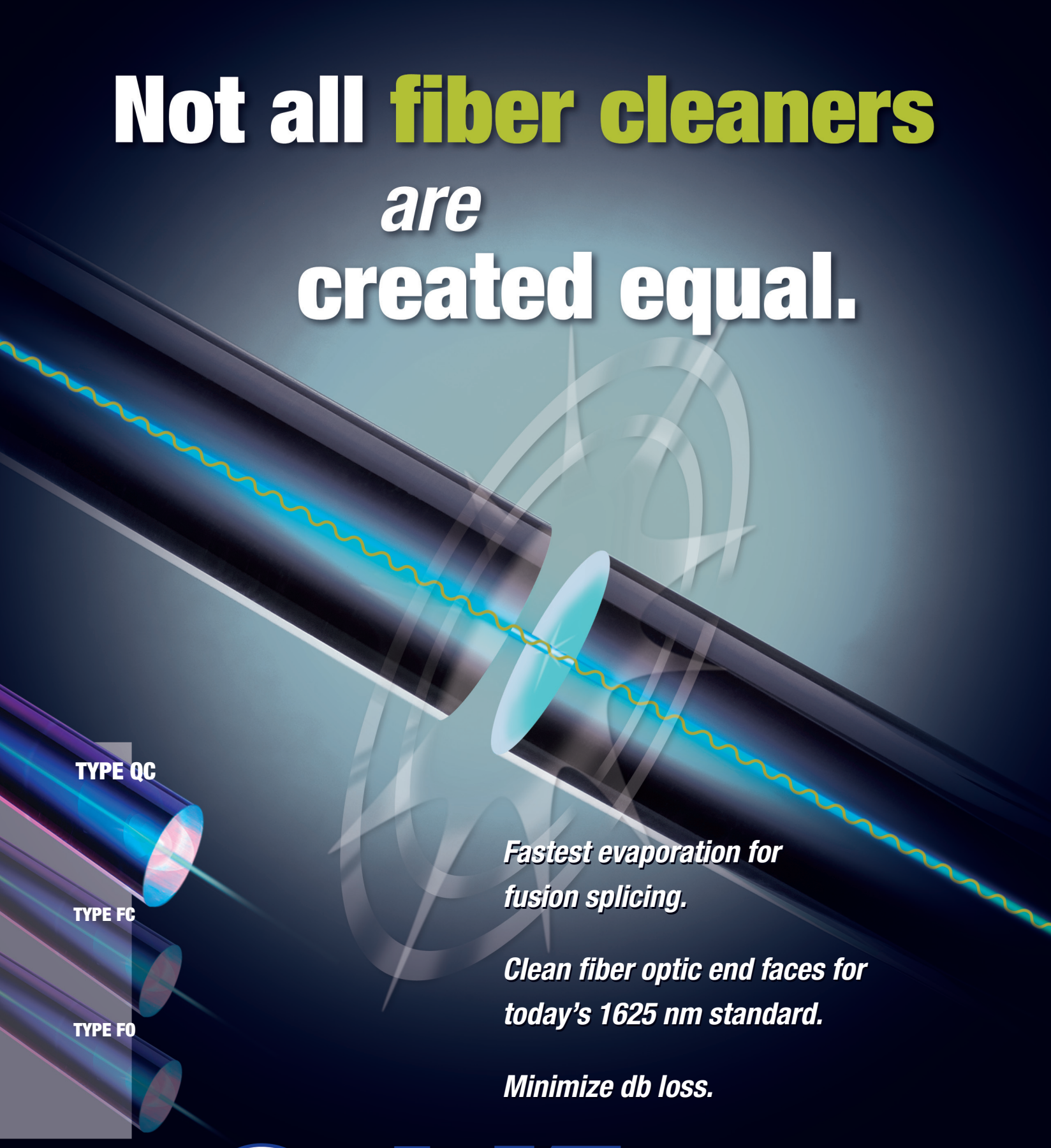
LIT-SANDCLOTH/1-05/INTERNAL(1/05)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

Not all fiber cleaners *are* created equal.



Fastest evaporation for fusion splicing.

Clean fiber optic end faces for today's 1625 nm standard.

Minimize db loss.

QuickKleen™

polywater.com/quickleen.asp

Fastest Evaporation Rate! Great for fusion splicing! Unique solvent blend cleans completely, leaves no residue, and evaporates quickly. No water content means no streaking or residue. Cleaner available in two convenient packages, and as part of an all-inclusive kit:

CATALOG #	DESCRIPTION	CASE QUANTITY
QC-2LP	2-Oz QuicKleen™ Type QC™ Finger Sprayer	12
QC-KIT2	QuicKleen™ Type QC™ Kit w/ 2 oz Finger Sprayer	1

CATALOG #	DESCRIPTION	CASE QUANTITY
DT-D50	50-Count FiberKleen™ Dry Towel Canister	8
SWB-250F100	2.5 mm FiberKleen™ Foam Swab 100-Pack	5
SWB-125F10	1.25 mm FiberKleen™ Foam Swab 10-Pack	5
SWB-C100	FiberKleen™ Cotton Swab 100-Pack	5
SWB-V100	V Groove FiberKleen™ Foam Swab 100-Pack	5
SWB-M100	Mirror FiberKleen™ Foam Swab 100-Pack	5

FiberKleen™ towelette dispenser contains 50 lint-free, high-quality towels that are used to clean ferrules, bulkheads and fiber end faces. Keeps towels safe from contamination and easily fits into tool kits and bags—even your shirt pocket!

The engineered design of the specially non-woven, highly absorbent towel traps the dirt and debris removed from ferrules, making cleaning easier and more effective. Variety of swabs also available.

All products non-hazardous for air shipment.

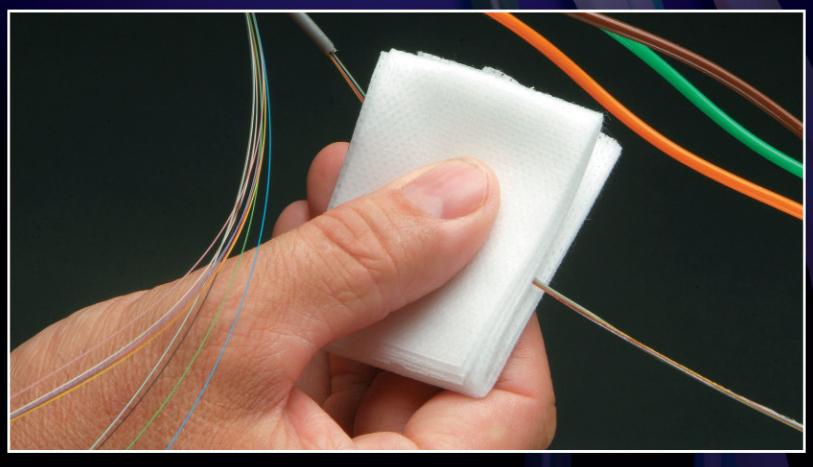
American Polywater® Corporation

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
custserv@polywater.com (e-mail)

Polywater SqueekyKleen™

CABLE CLEANER

- Removes pik without alcohol
- Minimal wiping (2 wipes only)
- No residue
- Safe to use on ribbon fiber
- Fans fiber quickly
- Fibers so clean they ***squeak!***



polywater.com/squeekykleen.asp

Polywater® SqueekyKleen™ Cable Cleaner

New **SqueekyKleen™** cleans and fans fiber in two wipes without alcohol, saving time and money. Hear the difference! No follow-up with alcohol required to get fibers squeaky clean and separated for fast and easy splicing. **SqueekyKleen™** reduces chemical odors and harmful vapor concentrations in splice trailers and vaults while being less harsh on hands.

SqueekyKleen's unique formulation and specially designed high-performance towelette work to remove pik from the entire surface of loose tube or ribbon fibers, leaving no residue.

SqueekyKleen™ helps keep splice equipment clean for better fiber alignment and splice quality. Will not harm acrylate on loose tube cable or Mylar® on ribbon fiber.

SPECIFICATIONS

Cleaning: When wiping a 3-foot section of 12-count fiber from a buffer tube, the pre-saturated towel will squeak and fan fibers with 2 wipes.

Solvency Power: At 68° F (20° C), will dissolve .020" (.5mm) film of ETPR grease completely from cable jacket with less than two minutes of vigorous agitation (no wiping).

Residue: When placed on a clean glass panel and dried, the solvent shall leave less than 100 parts per million of residue (<100 ppm).

Water Content: When tested by the ASTM 1533B method, water content shall be less than 75 ppm.

Flash Point: When tested via a Pensky-Martin Closed Cup Test (ASTM D93), the cleaner shall have a flash point above 140° F (60° C).

CATALOG NUMBER	DESCRIPTION	STANDARD SHIPPING PACKAGE
TC-1	**SqueekyKleen™** Telcom Cleaner–Saturated Wipe	144
TC-16LF	16-Oz **SqueekyKleen™** Telcom Cleaner w/Flip Top cap	12
TC-16LR	16-Oz **SqueekyKleen™** Telcom Cleaner w/Sprayer	12
TC-35LF	Qt **SqueekyKleen™** Telcom Cleaner w/Flip Top cap	12
TC-35LR	Qt **SqueekyKleen™** Telcom Cleaner w/Sprayer	12
TC-128	1-Gal **SqueekyKleen™** Telcom Cleaner	4
TC-384	3-Gal **SqueekyKleen™** Telcom Cleaner (5-gal pail)	1
TC-640	5-Gal **SqueekyKleen™** Telcom Cleaner	1
TC-96	3-Qt **SqueekyKleen™** Telcom Cleaner (1-gal pail)	4
TC-D65	65-Count **SqueekyKleen™** Wipe Canister	6
TC-D65DRY	65-Count **SqueekyKleen™** Dry Wipe Canister	6
TC-DRUM	55-Gal Drum **SqueekyKleen™** Telcom Cleaner	1
TC-1D42	42 TC-1 in a Dispenser Pack	1

American Polywater® Corporation
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
custserv@polywater.com (e-mail)

LIT-TCFLYER/01-10/GH/(01-10)

polywater.com/squeekykleen.asp

Unique

HYDRASOL®

Cable Gel Remover

Safe, Effective, Water-based Cleaner For the Removal of Cable Filling Greases

- **Maximum Solvency Power on PE/PJ or ETPR Greases**
- **No Chlorinated Solvent, CFC, or Glycol Ether Content**
- **Rinses Off With Water--Water Base**
- **Good For Multiple Cleanings**
- **Available in a Variety of Convenient Packages**

HydraSol® Cable Gel Remover

HydraSol® Gel Remover is a new approach in cable cleaning materials. It is a water-based solvent cleaner that offers unique safety and handling. HydraSol® Gel Remover is amazingly effective at dissolving and removing cable filling greases (ickypic).

HydraSol® Remover's components are on the FDA's and FEMA's "generally recognized as safe," lists. They have low toxicity whether by oral, inhalation or dermal exposure. The product is water-based (over 50% water).

HydraSol® Remover softens, removes and suspends cable filling greases. The solvent remains active and is only slowly "used up." HydraSol® Remover is good for multiple cleaning for economy and efficiency.

HydraSol® Remover is easy to rinse off hands and tools. Dissolved grease isn't "redeposited" as the cleaner residue dries.

★ Unique Flip-top and Spray Bottles - HydraSol® Gel Remover is available in environmentally safe, refillable, flip-top cap and trigger spray bottles (adjustable for stream or spray).

Package Size	Product Number
55 gallon drum (208 l)	HS-Drum
5 gallon pail (18.9 l)	HS-640
3 gallons (11.3 l) in a 5-gal. pail	HS-384
1 gallon (3.8 l) jug (4/cs)	HS-128
3 quarts (2.8 l) in a 1-gal pail (4/cs)	HS-96
1 quart (.95l) bottle (12/cs)	HS-32
★ 32 oz. (.95 l) spray bottle (12/cs)	HS-32LR
★ 16 oz. (475 ml) trigger spray btl (12cs)	HS-16LR
★★Saturated towelette/foil pack (144/cs)	HS-1
72-Ct Saturated Wipe Dispenser (6/cs)	HS-D72

★★ Durable Saturated Wipe – HydraSol® Remover is available in a presoaked towelette. The large, tear-resistant towelette comes in an easy-open foil pack. The towelette is especially effective for smaller cleaning jobs and fiber optic splicing. Saves money over bulk use with rags.

SPECIFICATIONS

1. **Solvency Power:** At 68°F (20°C), will dissolve .020" (.5 mm) film of PE/PJ or ETPR grease completely from cable jacket with less than two minutes of vigorous agitation (no wiping).
2. **Water Base:** Greater than 50% water content.
3. **Appearance:** Milky-white liquid. Requires shaking before use.
4. **Percent Non-volatile:** Less than 2%
5. **Chlorinated Solvent, CFC, or Glycol Ether Content:** None
6. **Clean-up:** Can be rinsed off with water.
7. **Combustibility:** Will self-extinguish in under five seconds when wicked onto 00 steel wool and ignited.

View the HydraSol® flyer online at
http://www.polywater.com/hydrasol.html

Lit-HSFlyer/02-04/C1000(02/04)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

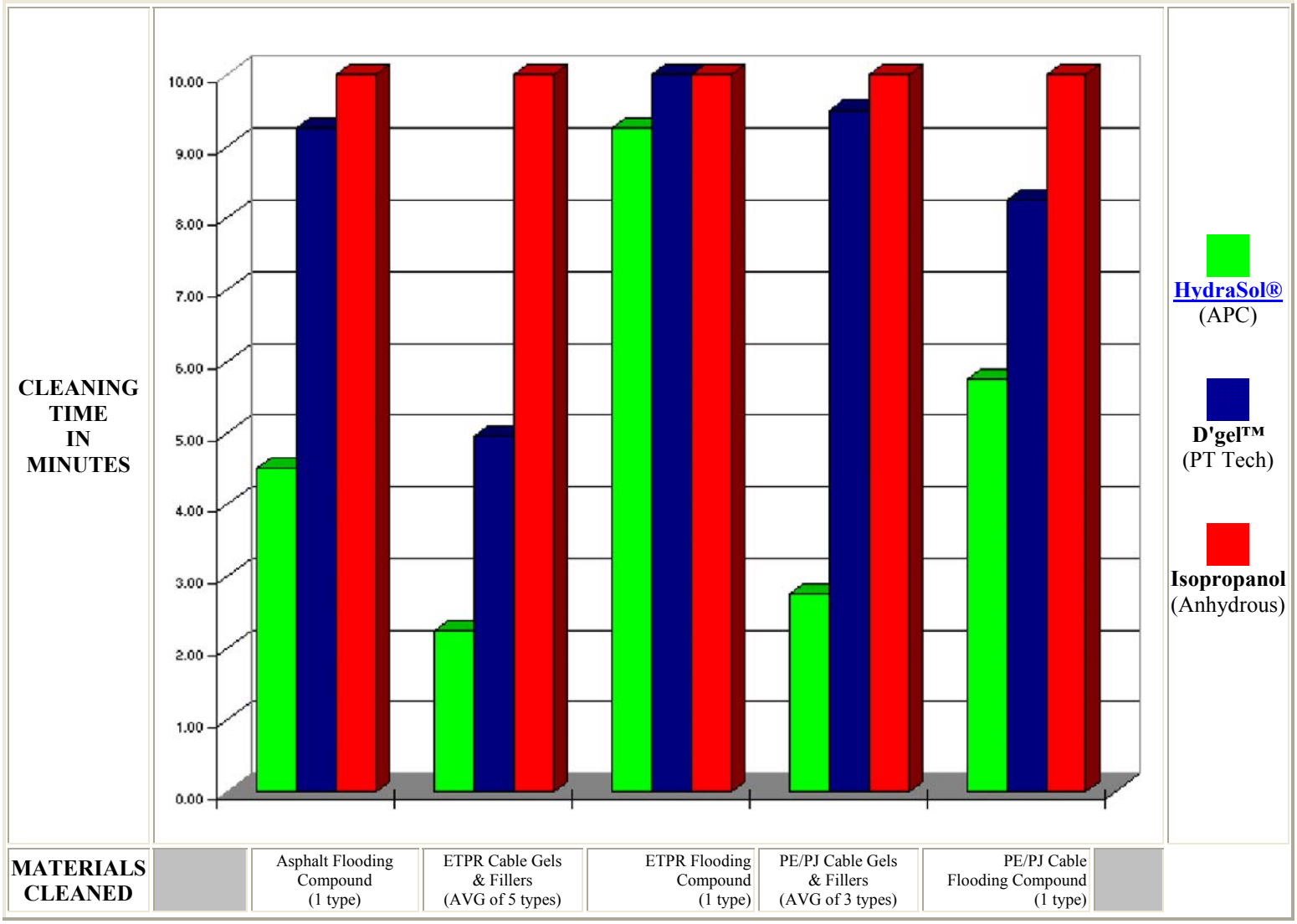
custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

HydraSol® Cable Gel Remover

Solvency Power Comparison Chart #1

Cleaning Time for Various Communication Cleaners



Solvency Power Test Method: Testing performed at 68°F (20°C). Each cable gel/filler is mixed with 0.2% fluorescent brightening agent (CIBA-GEIGY Tinopal® SFP) by weight. A coating of material 1.0" (25.4mm) x 1.0" (25.4mm) x 1 mils (0.03mm) is placed on a clean aluminum platen. A die is used to cut .125" (3.18mm) x .125" (3.18mm) hash marks into the coated platen creating a 64-section grid system. The platen is submerged in solvent and agitated for 5 minutes. Every 15 seconds during this time the platen is quickly visually checked for cleaning ability with the naked eye. After 5 minutes the platen is evaluated under a black light to determine the amount of fluorescent cable gel/filler that was removed. A solvency percent value is obtained by dividing the cleaned surface by the whole surface tested. The time at which 100% of the fluorescent cable gel/filler is 100% removed is also recorded.

Solvency Power Test Method (*for asphaltic coatings*): Testing performed at 68°F (20°C). A 1" (2.54cm) section of 0.5" (12.7mm) diameter cable is submerged in solvent and agitated. The time at which 100% of the asphaltic coating is 100% removed is recorded.

Type FO™

Anhydrous Alcohol Prep Wipe

Now Available in Bulk

- **Fast Evaporating**
- **Non-Abrasive**
- **No Residue**
- **Convenient Packages**
- **99.8% Anhydrous Alcohol**
- **Excellent Solvency**

Type FO™ is great for cleaning glass fiber or connector end faces for better light transmission performance. Type FO™ quickly removes dust, oils, and contaminants, while leaving no residue. The **anhydrous alcohol** in FO™ has essentially no water content. Avoiding water is important with optical fiber cleaning.

FO™ is available in a convenient pre-saturated towelette. The towels are durable and non-linting. Pre-saturated wipes are a convenient option for field use. The package limits vapor exposure and eliminates spill hazards.

We now have bulk packages available for those who prefer pints and quarts.

Catalog #	Description	Units per case
FO-1	5” x 8” Towelette (50/box)	8 boxes per case
FO-16	16 oz Bottle	12
FO-32	32 oz Bottle	12

LIT-FOFlyer/7-03/maru(5/05)

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

www.polywater.com (URL)
custserv@polywater.com

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

American Polywater's

Multi-Purpose Cleaning Wipes

Heavy duty towelettes are pre-moistened with a multi-purpose cleaning solution.

Towels feature a textured side to quickly remove greases and a soft side to be gentler on skin.

Moisturizes and softens hands while cleaning tools and surfaces.

Quickly Removes:

- Transformer oils
- Cable gels
- Silicone greases
- Dirt/Soil
- Tar/Asphalt
- Gray and black oxide inhibitors
- HDD pipe thread grease
- Adhesive
- Caulk
- C Cement

Use On:

- Tools
- Work Surfaces
- Machinery
- Skin
- Equipment
- Service Vehicle

Description	Catalog Number	Standard Shipping Case
Dispenser with 72 10”x12” pre-moistened wipes	HTC-D72	6 per case
GrimeAway™ Saturated Wipes	HTC-1	144 per case

To view technical information on our website, go to:
Competitive Cleaning Wipe Chart: www.polywater.com/grimeawaychart.asp

LIT-Grimeawayflyer/1-06/C1000(1-06)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

Technical Bulletin

American Polywater's

P7™

Multipurpose Oil

A Multipurpose Penetrating Oil for Industrial and Electrical Use

---

Description

P7™ Multipurpose Oil is suitable for all kinds of electrical and industrial uses. P7™ Oil cleans dirt and grime, loosens rust and scale, and penetrates frozen parts. Use it to maintain and lubricate equipment.

P7™ Multipurpose Oil is multi-functional. It cleans, penetrates, and lubricates to extend equipment life. P7™ Oil also acts as a moisture displacer and corrosion inhibitor. It drives out moisture and dries wet connections, leaving a protective film which is non-conductive.

Advantages

- Lubricates Moving Parts
- Frees Stuck Parts
- Protects Against Rust and Corrosion
- Displaces Moisture
- Removes Grime and Rust
- Film is Non-Conductive
- Harmless to Most Plastics
- Safe on Metal, Paint, & Rubber
- Contains No CFC's or Chlorinated Solvents
- Silicone-Free
- Cleans Tar, Grease, Rust, and Adhesives

Properties

Flashpoint (ASTM D93)	100°F/38°C
Initial Boiling Point	245°F/118°C
Specific Gravity	0.69
Dielectric Strength (ASTM D877)	13 KV
Relative Evaporation Rate	Fast
Propellant	Hydrocarbon
USDA	Approved

P7™ Multipurpose Oil Aerosol (cat. # P7-12) penetrates into tight spots and frees stuck parts.

Penetration and Cleaning

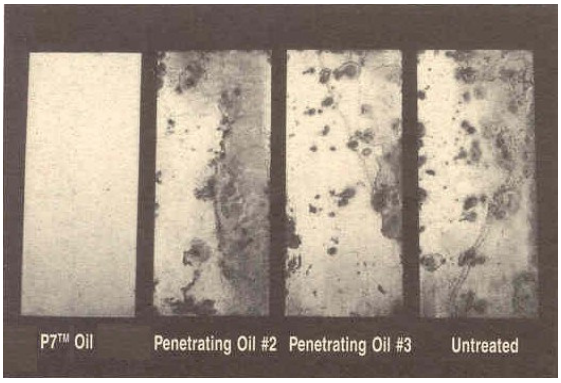
P7™ Multipurpose Oil cleans grease and tars and removes adhesives and rust. Other solvent cleaners are not necessary. P7™ Oil dissolves grit and grime contaminants, leaving behind a fine protective film.

P7™ Multipurpose Oil has a low surface tension, which allows it to spread into a very fine film. One 12-ounce can of P7™ Oil will cover approximately 300 square feet of surface. This low surface tension allows P7™ Oil to "creep" up surfaces against gravity. It will penetrate and coat 16mm of a threaded bolt in 15 minutes. P7™ Multipurpose Oil will lubricate tight crevices and loosen frozen parts.

Protection and Corrosion Prevention

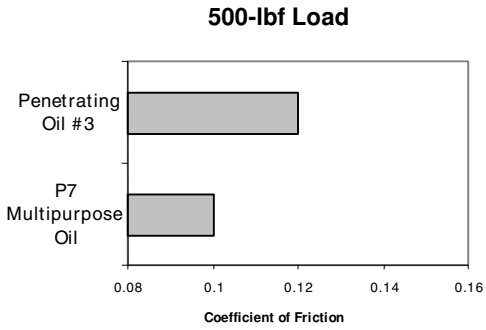
P7™ Multipurpose Oil offers superior corrosion protection by leaving a non-conductive film. This long-lasting film increases service life.

The photo below shows the results of a three-week outdoor weathering test run on low carbon steel. The plates were sanded, cleaned, and saturated with various penetrating oils. The steel plates were left in the elements, untouched for three weeks. P7™ acts as a tough, protective barrier; the steel plate has no rusting or mottling at the conclusion of the test.



Lubrication

P7™ Multipurpose Oil is an exceptional lubricant. The coefficient of friction can be determined using the Falex Pin and Vee Block Test Machine (ASTM D3233A). Load is applied to two V-blocks which press against a rotating steel journal immersed in the oil. The coefficient of friction value is derived from the torque measurement on the pin. The more the penetrating oil lubricates and lowers the torque, the lower the resulting coefficient of friction. Results documented in the following chart show that P7™ has a significantly lower coefficient of friction than another commonly used multipurpose oil.



Extreme pressure testing using the Pin and Vee Block Test Machine confirms P7™ Oil's excellent performance under high loads. The test will run to a load force of over 1,000 pounds before failure.

Water Displacement

P7™ Multipurpose Oil displaces moisture and dries out ignitions. It creeps under water and ice, dissolving and carrying away these contaminants. A non-conductive, protective film is left behind. P7™ Oil displaces water according to the procedure described in Mil-Spec C-16173E. No rusting or mottling was observed on the treated surface.

Compatibility

P7™ Multipurpose Oil is compatible with most plastics and elastomers. Tables I and II show the effect of P7™ Oil on various plastics and rubbers.

Testing is based on a soak test described in ASTM D 543. P7™ Oil will temporarily affect some rubber compounds. These rubbers may swell, but should return to their original state after the solvent carrier has dried. Immersion will affect sensitive materials more than incidental contact of a spray and wipe. It is recommended that all plastic parts, gaskets, seals and O-rings be tested for specific use and exposure method.

P7™ Compatibility with Plastics and Elastomers

TABLE I

PLASTICS	AGING 72 HOURS AT 50°C		
	% WEIGHT CHANGE	% THICKNESS CHANGE	APPEARANCE
ABS	+0.04	+0.79	NC
Acrylic	-0.02	-0.04	NC
CPE Thermoplastic	+16.10	+4.27	NC
CPE Thermoset	+22.12	+20.99	SS
Delrin®	+0.17	+0.25	NC
Epoxy	-0.05	0	NC
Nylon 101	-0.08	-1.57	NC
Polycarbonate	-0.03	-0.59	NC
Phenolic	+1.24	0	NC
Polyethylene	+14.19	+5.44	NC
Polystyrene	+13.85	-3.64	SF
PVC	+0.06	0	NC
Teflon®	+0.07	-0.25	NC
Tygon®	+4.95	0	NC
Ultem® 1000	-0.08	-0.27	NC
Valox® 420	+0.03	-1.11	NC

TABLE II

ELASTOMERS	AGING 72 HOURS AT 50°C		
	% WEIGHT CHANGE	% THICKNESS CHANGE	APPEARANCE
EPDM	+149.56	+43.77	S
Neoprene	+26.64	+9.79	SS
Nitrile	+1.06	0	NC
SBR	+52.48	14.36	S
Silicone	+48.04	+17.87	S
Viton®	+0.56	+0.26	NC

KEY:

NC=NO CHANGE
SS=SLIGHT SWELLING
SF=SOFTENING
S=SWELLING

Usage Directions

Position nozzle 6 to 8 inches (15-20 cms) from surface and spray with light even strokes. Use extension tube for difficult to reach areas. Let P7™ Oil soak for several minutes to loosen rusted parts. Allow 4 to 6 hours to fully dry. P7™ Multipurpose Oil leaves a non-conductive, protective film.

Safety

P7™ Multipurpose Oil has a low level of toxicity. Avoid breathing spray, mist, or vapor. As with any solvent, ventilation should be sufficient to keep vapors at safe levels.

P7™ Multipurpose Oil is combustible. Do not expose to fire or flame. Good industrial hygiene practice and appropriate precautions should be employed during use.

Storage

P7™ Multipurpose Oil is classified as combustible. Keep containers cool, dry and away from sources of ignition and oxidizing materials. Do not expose aerosol cans to direct sunlight or temperatures above 120°F (50°C). Do not puncture or incinerate aerosol cans. Aerosol cans are freeze/thaw stable. This product has a shelf life of three years.

Package Options

Catalog No.	Description
P7-12	12-wt. oz. aerosol can in 16 oz can

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

LIT-P7TECHB/1-03/internal(1/03)

Live Line Maintenance Products

Meet OSHA Live-Line Tool Standards

Boom Pre-wash Wipe or Canister

The pre-wash wipe is a cleaner-saturated towel that cleans grease, tar, creosote, salt spray, pine pitch, hydraulic fluid and road debris off fiberglass boom arms. The cleaner is water soluble, and washes off during subsequent water rinsing. Boom pre-wash does not adversely affect the gel coat on the boom. Available in 2 towel sizes and two packages.

Boom Wash Concentrate

Boom Wash Concentrate is a liquid that is mixed with water (1 part concentrate to 3-5 parts water) to make a mild water-based boom cleaner. Once rinsed and dried, the boom should be waxed with American Polywater Fiberglass Wax. The wax helps protect the boom's outer layer and ensures that water will bead up.

Fiberglass Wax & Buff Kit & 16-oz Can

The Fiberglass Wax and Buff Kit contains a lint-free wipe saturated with a fast hazing fiberglass wax and a soft lint free towel for buffing the wax to a shine. This kit is suitable for use on non-conductive fiberglass booms and hot sticks.

The Fiberglass Wax is also available in a 16-oz can, formulated specifically for fiberglass. This wax hazes quickly and buffs easily to a shine. The wax leaves a long-lasting surface barrier that protects the fiberglass booms.

Product #	Description	Units per Case
B-1	Individual saturated 24"x24" wipe in sealed foil pouch	24 wipes/cs
B-D72	72-count canister of 10"x12" saturated wipe	6 canisters/cs
BWC-128	Boom wash liquid concentrate to be mixed with water (gallon)	4 gallons/cs
W-1	Fiberglass wax & buff kit	72 wipes/cs
W-16	16 oz. fast-hazing fiberglass wax	12 can/cs

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

LIT-BOOMFLYER/5-05/MARU(5/05)

Who takes care of your insulated boom after the testing is done?

If you test your aerial truck's dielectric integrity annually, but don't address maintenance between tests, read this article.

Utilities have a variety of programs to maintain the integrity of their boom trucks. Sometimes overlooked is the regular maintenance and cleaning of the fiberglass boom between annual or semi-annual dielectric testing and service. **Who removes the hydraulic fluid, pine pitch, road tar, and other contaminants that build up during the normal exposure of the boom, and how do they do it?**

Dirt accumulated during normal use can affect the dielectric properties of your boom. These include road debris, salt spray, hydraulic fluid, grease, pine pitch, creosote, and more. When residue builds on the boom, water sheets out rather than beading up and running off. This pooling or sheeting of water on dirty booms can keep the booms from meeting dielectric standards and potentially pose a hazard in the field.

What does your company use to clean fiberglass booms? Common degreasers or solvents can actually harm and strip the gel coat on the boom causing weak or soft spots. Many crews have access to solvents and they know how well these solvents remove grease. They may not know the harmful effects solvents can have on the fiberglass portion of the boom arm or bucket. Some cleaners contain abrasives and leave a considerable residue. Others, like acetone, xylene, and toluene, can cause permanent damage if left in contact with the surface for too long a period. These solvents are also flammable and have other hazards. Personnel should be trained on the proper products for use on the boom and bucket areas to keep the truck in proper working order.

Mild, non-abrasive, low-residue soap in warm water is the safest way to clean your boom arms. For the hard-to-remove dirt you need to get off before the washing, try the B-1 Boom Wipe from American Polywater Corporation. The B-1 Wipe is a large towel saturated with a cleaner that will not harm the gel coat or leave a residue, but it does a great job on the contaminants mentioned above. The ready-to-go wipe package is easy for line personnel to keep on the truck for immediate usage. Never use abrasive pads for cleaning tough dirt areas. These pads scratch the boom and remove the protective gel coat layer.

Once your boom is properly cleaned, a good wax is in order to protect the surface and force water beading during misty or wet weather. American Polywater manufactures a specialty fiberglass wax available in pint cans or individual towelettes. All products that are used on your boom truck should be approved by the aerial lift manufacturer. Cleaners and protectants designed specifically for fiberglass booms are recommended.

Companies should follow boom truck manufacturer guidelines on the frequency of dielectric testing, proper cleaning practice, and other maintenance procedures. The ANSI A92.2-1990 Standard (Section 5.4.3) also addresses proper dielectric testing intervals and field inspections for aerial truck testing.

By following manufacturer and industry guidelines on the maintenance of boom trucks, **your aerial fleet will be safer and last longer.**

BOOM™ Wipes

for **Electrical Safety**

Meet OSHA Live-Line Tool Standard for Boom Maintenance

BOOM™ Prewash Wipes are cleaner-saturated towels that clean grease, tar, creosote, salt spray*, hydraulic fluid, pine pitch, and road debris off fiberglass boom arms. The cleaner is water soluble, and washes off during subsequent water rinsing. Boom™ Wipes don't adversely affect the gel coat on booms. Available in 2 different packages. Boom™ Wipes in the catalog #B-D72 self-dispensing canister won the 2004 Utility Products Magazine **"Readers Choice Award!"**

OSHA states that: Booms and other live-line tools "... can become electrically unsafe because of ... a combination of wetting, surface contamination, and a loss of surface gloss ..."

OSHA demands that: "Each live-line tool shall be wiped clean and visually inspected for defects before use each day."

BOOM™ Prewash Wipes satisfy this requirement and offer these features:

- Convenient, Pre-Saturated, Lint-Free Wipes in Two Sizes and Packages
- Large and Durable for Maximum Surface Coverage
- Won't Remove or Adversely Affect Gel Coat
- Prevents "Build-Up" over Time
- Powerful Cleaner Removes Grease, Dirt, Tar, and Grime
- Removes Road and Sea Spray Salts*
- Water Soluble for Easy Water Rinsing
- Designed for One Time Use and Easy Disposal
- Meets OSHA Maintenance Reg CFR 29 Part 1910

* Salt water is more conductive than fresh water. Rain or foggy mist on a boom covered with salt residue can create a conductive saline coating, adding to the electrical hazard.

Catalog No.	Description	Units/ Case	Image
B-1	Individual Saturated 24" x 24" Wipe in Sealed Foil Pouch	24	
B-D72	72-Count Canister of 10" x 12" Saturated Wipes	6	
BWC-128	1 Gallon of Boom Wash Concentrate. Mix with water for a mild boom cleaner to spray, wipe, or pour on booms. Note: This detergent-based liquid is NOT the same solvent cleaner on the pre-saturated B-1 and B-D72 wipes.	4	

LIT-BOOMFLYER/2-07/Internal(2/07)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

Who takes care of your insulated boom after the testing is done?

If you test your aerial truck's dielectric integrity annually, but don't address maintenance between tests, read this article.

Utilities have a variety of programs to maintain the integrity of their boom trucks. Sometimes overlooked is the regular maintenance and cleaning of the fiberglass boom between annual or semi-annual dielectric testing and service. **Who removes the hydraulic fluid, pine pitch, road tar, and other contaminants that build up during the normal exposure of the boom, and how do they do it?**

Dirt accumulated during normal use can affect the dielectric properties of your boom. These include road debris, salt spray, hydraulic fluid, grease, pine pitch, creosote, and more. When residue builds on the boom, water sheets out rather than beading up and running off. This pooling or sheeting of water on dirty booms can keep the booms from meeting dielectric standards and potentially pose a hazard in the field.

What does your company use to clean fiberglass booms? Common degreasers or solvents can actually harm and strip the gel coat on the boom causing weak or soft spots. Many crews have access to solvents and they know how well these solvents remove grease. They may not know the harmful effects solvents can have on the fiberglass portion of the boom arm or bucket. Some cleaners contain abrasives and leave a considerable residue. Others, like acetone, xylene, and toluene, can cause permanent damage if left in contact with the surface for too long a period. These solvents are also flammable and have other hazards. Personnel should be trained on the proper products for use on the boom and bucket areas to keep the truck in proper working order.

Mild, non-abrasive, low-residue soap in warm water is the safest way to clean your boom arms. For the hard-to-remove dirt you need to get off before the washing, try the B-1 Boom Wipe from American Polywater Corporation. The B-1 Wipe is a large towel saturated with a cleaner that will not harm the gel coat or leave a residue, but it does a great job on the contaminants mentioned above. The ready-to-go wipe package is easy for line personnel to keep on the truck for immediate usage. Never use abrasive pads for cleaning tough dirt areas. These pads scratch the boom and remove the protective gel coat layer.

Once your boom is properly cleaned, a good wax is in order to protect the surface and force water beading during misty or wet weather. American Polywater manufactures a specialty fiberglass wax available in pint cans or individual towelettes. All products that are used on your boom truck should be approved by the aerial lift manufacturer. Cleaners and protectants designed specifically for fiberglass booms are recommended.

Companies should follow boom truck manufacturer guidelines on the frequency of dielectric testing, proper cleaning practice, and other maintenance procedures. The ANSI A92.2-1990 Standard (Section 5.4.3) also addresses proper dielectric testing intervals and field inspections for aerial truck testing.

By following manufacturer and industry guidelines on the maintenance of boom trucks, **your aerial fleet will be safer and last longer.**

Technical Bulletin

Polywater®

Rubber Goods Cleaner

A specially formulated water-based cleaner for removing dirt, grease, and grime from lineman's gloves, sleeves, jumper cables, and other rubber goods.

Description

Polywater® Rubber Goods Cleaner is a specially formulated water-based cleaner for removing grease, dirt, carbon, creosote, and other grimes from insulating blankets, lineman's gloves, rubber sleeves, jumper cables, hot jumpers, and line-hose. Polywater® Rubber Goods Cleaner is safe for use on all natural and synthetic rubbers. Unlike other water-based rubber cleaners Polywater® Rubber Goods Cleaner contains no hazardous ingredients and is pH neutral, making it safe for use on skin. Polywater® Rubber Goods Cleaner is also completely biodegradable and safe for the environment.

Advantages

- No mixing required
- Excellent cleaning power
- Harmless to all elastomers (rubbers)
- Multiple package options
- Environmentally friendly
- Non-toxic and non-corrosive
- Not an RCRA-regulated hazardous waste
- Not listed as a toxic chemical by SARA 313.

  Does not require reporting

Physical Properties

• Rubber Property-Effect of Liquids (ASTM D471)	Passes all tests
• Specification for In-Service Care of Insulating Gloves and Sleeves (ASTM F496)	Passes all tests
• Flashpoint (ASTM D 93)	No flash via TCC
• Initial Boiling Point	~212°F/100°C
• pH	Neutral
• Cleaning Strength	Excellent

Polywater® Rubber Goods Cleaner comes in multiple packaging options like the RBG-D72 towelette canister shown above.

Usage Directions

Polywater® Rubber Goods Cleaner Liquid:
Apply Polywater® Rubber Goods Cleaner by spraying, dipping, brushing, or wiping. Evenly coat rubber surface with cleaner. **Leave Polywater® Rubber Goods Cleaner on the surface of the material to be cleaned for 5 minutes or more to loosen and dissolve deposits.** Allow cleaner to soak material longer for more difficult grimes. The longer Polywater® Rubber Goods Cleaner is on the surface the more it penetrates and breaks loose the creosote, dirt, grease, oils and other grimes without harming the rubber surface. Once material has soaked, wipe surface clean with a rag or towel. A minimal amount of scrubbing may be required. Rinse material with water and either dry with a clean cloth or air dry before use. Use Polywater® Rubber Goods Cleaner daily to clean the rubber's surface for visual inspections to uncover burns, cuts, nicks, crush points, and abrasions on equipment and gloves.

For best results leave RBG cleaner on rubber goods for at least 5 minutes before wiping or scrubbing down surface. To see a demonstration video of Rubber goods cleaner go to www.polywater.com/videos.asp

Polywater® Rubber Goods Cleaner Wipe:
Pull Polywater® Rubber Goods Cleaning Wipe from canister, open the towel and use soft side to wipe down and fully wet surface of material. **Leave Polywater® Rubber Goods Cleaner on the surface of the material to be cleaned for 5 minutes or more to loosen and dissolve deposits.** Allow cleaner to soak material longer for more difficult grimes. The longer Polywater® Rubber Goods Cleaner is on the surface the more it penetrates and breaks loose the creosote, dirt, grease, oils and other grimes without harming the rubber surface. Use the rough side of the wipe to scrub surface. Wipe surface clean with another Polywater® Rubber Goods Cleaner towelette. Rinse material with water and either dry with a clean cloth or air dry before use. Use Polywater® Rubber Goods Cleaner daily to clean the rubber's surface for visual inspections to uncover burns, cuts, nicks, crush points, and abrasions on equipment and gloves.

Safe LIVE-LINE Equipment Practices and Cleaning

Proper protection and performance of rubber protective equipment requires a detailed visual inspection before each use, careful handling of equipment during use, thorough cleaning, periodic electrical testing, and proper storage of equipment after use.

Visual inspection of rubber covers, line-hose, rubber gloves, rubber sleeves, insulating blankets, and jumper cables should be performed before each use in accordance with ASTM F1236 "Standard Guide for Visual Inspection of Electrical Protective Rubber Products". Rubber protective equipment should be checked for:

- Abrasions, cuts, crush points, gouges, holes, punctures, and tears
- Embedded foreign objects
- Ozone cutting or ozone checking
- Swelling, softening, hardening, stickiness, and inelasticity
- Any other defect that damages the rubber insulating properties of the protective equipment

Cleaning of rubber protective equipment is necessary not only for visual inspections but to preserve the protective equipment's electrical integrity, protection, and to add to the life of the equipment. Creosote, dirt, grease, and other contaminants can be conductive, especially when combined with moisture from rain, snow, and fog. Protective equipment should be cleaned daily and whenever it appears dirty with contaminants. **Strong industrial cleaners and solvents such as petroleum distillates and d-Limonene may cause permanent damage to the rubber protective equipment.** These products may cause rubbers to swell, soften, and lose electrical insulating properties. EPDM rubber is used for protective equipment because it has excellent resistance to ultraviolet light, ozone, and oxidants, but it has poor solvent resistance, making it susceptible to chemical damage. Polywater® Rubber Goods Cleaner contains no solvents and is an ideal product to use because it is safe to use on all rubber products, including: covers, line-hose, gloves, sleeves, and insulating blankets. Daily use of Polywater® Rubber Goods Cleaner makes inspection of protective equipment easier and helps to maintain the electrical insulating properties of the equipment.

Safety

Polywater® Rubber Goods Cleaner has a low level of toxicity and is environmentally friendly. Good industrial hygiene practice and appropriate precautions should be employed during use. See MSDS for specific details.

Compatibility

Polywater® Rubber Goods Cleaner is compatible with plastics and elastomers. Testing is based on soak test described in ASTM D471, Standard Test Method for Rubber Property-Effect of Liquids. Immersion will affect sensitive materials more than incidental contact of a spray and wipe would.

ELASTOMERS (Rubbers)	IMMERSED 72 HOURS AT 122°F (50°C)	
	Polywater® RBG	
	% WEIGHT CHANGE	APPEARANCE
EPDM	NC	NC
EPDM (Type II) blanket	NC	NC
EPDM gloves	NC	NC
EPDM (Type II) line hose	NC	NC
Natural Rubber	NC	NC
Natural Rubber (Type I) blanket	NC	NC
Natural Rubber (Type I) gloves	NC	NC
SALCOR® (Type II) blanket	NC	NC
Silicone	NC	NC

ELASTOMERS (Rubbers)	IMMERSED 28 DAYS AT 70°F (21°C)	
	Polywater® RBG	
	% WEIGHT CHANGE	APPEARANCE
EPDM	NC	NC
EPDM (Type II) blanket	NC	NC
EPDM gloves	NC	NC
EPDM (Type II) line hose	NC	NC
Natural Rubber	NC	NC
Natural Rubber (Type I) blanket	NC	NC
Natural Rubber (Type I) gloves	NC	NC
SALCOR® (Type II) blanket	NC	NC
Silicone	NC	NC

KEY:

NC = NO CHANGE
ES = EXTREME SOFTENING
C = CRAZING
S = SWELLING
SS = SLIGHT SWELLING
D = DISSOLVED

SALCOR® is a trademark of W.H. Salisbury & Co.

Protective Equipment Testing

Polywater® Rubber Goods Cleaner was sent to an independent NAIL® for PET (North American Independent Laboratories for Protective Equipment Testing) accredited laboratory for testing in accordance with ASTM F496 Standard Specification for In-Service Care of Insulating Gloves and Sleeves. Gloves and sleeves are first washed and dried at the testing laboratory. The items are then inflated and carefully inspected for cuts, tears, punctures, scratches, abrasions, or any other conditions that could adversely affect the dielectric integrity of the item. If any of these conditions are present, the item fails the visual inspection and is rejected and immediately rendered unusable. Gloves, sleeves, and blankets then undergo an electrical test as specified by the "class rating" of the item and the ASTM and OSHA Standards (maximum 40kv A.C.). Again, any item that fails the electrical test is rejected.

ASTM F496-99 Test results for lineman's gloves

Class	Type	Exposure	Solvent	Visual Check	Electrical Test (max 40kv A.C.)
00	1	Wipe - no rinse	RBG	PASS	PASS
00	1	24 hour soak - no rinse	RBG	PASS	PASS
00	2	Wipe - no rinse	RBG	PASS	PASS
00	2	24 hour soak - no rinse	RBG	PASS	PASS
0	2	Wipe - no rinse	RBG	PASS	PASS
0	2	5 minute soak - no rinse	RBG	PASS	PASS
0	2	24 hour soak - no rinse	RBG	PASS	PASS
1	1	Wipe - no rinse	RBG	PASS	PASS
1	1	5 minute soak - no rinse	RBG	PASS	PASS
1	1	24 hour soak - no rinse	RBG	PASS	PASS
2	1	Wipe - no rinse	RBG	PASS	PASS
2	1	24 hour soak - no rinse	RBG	PASS	PASS

Packaging Options

Catalog No.	Description
RBG-D72	72-ct saturated wipe dispenser (6/cs)
RBG-35LR	1-quart bottle with sprayer (12/cs)
RBG-128	1-gallon bottle (4/cs)
RBG-640	5-gallon pail (1 ea)

View additional technical information online: www.polywater.com/rubber.asp

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

Lit-RBGTechB/1-06//C1000/1-06

Makers of Boom™ Cleaner, Live-Line Tool Cleaning and Wax Wipes (W-1), and Hot Stick Cleaner and Wax Repellent Wipes (S-1).

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

www.polywater.com(URL)
custserv@polywater.com(e-mail)

Cleaning Rubber Goods for Safety

Dirty grounding jumper for underground.

Cleaned grounding jumper for underground.

How the right cleaner can extend the life of tools and workers by uncovering hidden damage and restoring high visibility.

By Sheri H. Dahlke

A power utility got a big surprise recently when they tested a new, specially formulated rubber goods cleaner on a hot-line jumper. The cleaner revealed potentially hazardous burn and cut damage lurking beneath the grimy, blackened surface. The failed tool was removed from service, averting possible injury.

REMOVE GRIME, REVEAL DAMAGE

Rubber goods take a beating in the field. Dirt and grime build-up turns tools black. Any change in appearance is a warning that the rubber may not retain its electrical insulating property. Protective rubber equipment should be inspected for anything that might compromise its integrity, but grimy discoloration can mask damage. Abrasions, burns, and minor nicks are particularly difficult to detect on dirty rubber goods. Regular cleaning before each inspection is the best way to stay safe.

VARIETY OF DAMAGE POSSIBLE

Protective rubber goods are not used in a pristine environment. Rubber is soft and particularly susceptible to physical and chemical damage. Damage can be caused by cuts from

sharp tools, punctures from wood splinters and barbed wires, degradation from chemicals such as hydraulic fluid, and much more.

Scratches and scuff-like damage are normally caused when rubber comes in contact with a rough, abrasive surface. This may appear like graining on leather. Nicks, snags, scratches or cuts are typically caused by objects such as knives, pointed tools, sharp edges on electrical equipment, barbed wire, staples, or splinters. This damage is particularly evident—and exacerbated—when rubber is placed under strain, such as stretching. Punctures occur when sharp objects penetrate the entire thickness of the rubber. Embedded foreign matter may appear as a small bump in the rubber. Tears describe the separation of the rubber, usually at the edge, created when the rubber is pulled apart forcefully.

Other kinds of damage are the result of electrical leakage and tracking, as well as chemical degradation. Tracking and breakdown result from excessive electrical leakage over the surface of the rubber. Ozone cracks, a series of interlacing fractures that start at stress points, are caused by continuous exposure to the elements. Age cracks look like glazed ceramic crazing, and worsen with time. These are usually caused by exposure to sunlight and atmospheric ozone, and originate in stressed areas of the rubber. Hard and soft spots are usually created by contact with heat, oils or chemicals.

ROLL THE RUBBER

ASTM F1236 Guide for Visual Inspection of Electrical Protective Rubber Products presents techniques for the visual inspection of electrical protective rubber goods. The preferred method of inspection before each use is to gently roll the entire surface. Lightly squeezing the outside and inside surface of the rubber highlights irregularities that can occur from the damages described above. For gloves and sleeves, carefully pinch and roll the rubber. Once the outside surface is thoroughly checked, continue the inspection by turning the glove inside-out and rolling the inside surface. Never leave a glove or sleeve in an inside-out condition. For blankets, lay on a clean, flat surface and roll tightly, starting at a corner. Line hose can be inspected by slowly bending two ends of the hose downward, forcing the slot open for better inspection. Work through the entire length of hose for a thorough check. Gloves can be manually inflated to test for punctures and small tears. It is important not to over inflate.

WHY CLEAN?

ASTM F1236 further recommends good lighting and a thorough cleaning before each inspection and use. Protective rubber goods are often contaminated with a variety of grimes such as creosote, pine pitch, corrosion inhibitor, carbon, dirt, grease and oils. Contamination darkens the surface, masking its true color. In the worst cases, contaminating materials cover cuts, burns, small nicks and holes. Cleaning the rubber surface can uncover damage that would otherwise stay hidden.

Regular cleaning is simply good practice. It preserves electrical integrity and adds to the life of the equipment. Some contaminants are less obvious and can't be seen on rubber goods. Dry fertilizer, herbicide and pesticide residues are invisible, but will degrade rubber's integrity. Most protective rubbers are designed to resist ultraviolet light, ozone and oxidants, but tend to be susceptible to chemical damage. Degradation by various contaminants such as oil and grease can cause hard or soft spots and accelerated aging. Other contaminants are conductive, especially when combined with moisture from rain, snow or high humidity.

Cleaning also restores original color—usually brilliant yellow or orange—to tools. It is crucial that grounding jumpers be clean and highly visible for electrical and vegetation trimming crews. It is especially critical during storm restoration to differentiate tools from dangling branches.

FIND THE PROPER CLEANER

Though they may effectively remove grime, strong industrial cleaners and solvents can also damage protective rubber. Petroleum distillates or hydrocarbons, kerosene, and terpenes such as d-limonene should be avoided. Other solvents commonly added to water-based degreasers, such as glycol ethers, can also degrade the protective rubber properties. Cleaner residue must not change the physical integrity and insulating properties of the rubber. Cleaners should be tested for compatibility with various types of rubber compounds per ASTM D471 and ASTM F496-99 to ensure compatibility and dielectric integrity.

An effective rubber goods cleaner is easy to use. It removes the heavy grimes and contamination typical of utility work without too much "elbow grease." A mild, pH-neutral cleaner is more likely to be used regularly. Convenient package options such as spray bottles and pre-saturated wipes also encourage regular use.

CLEAN IS SAFE

Clean and inspect your protective rubber goods before each job. Clean rubber is easier to inspect and provides increased tool visibility in the field. Regular cleaning prolongs the life and effectiveness of rubber protective goods and is fundamental to electrical safety. ***ip***

Sheri Dahlke joined American Polywater in 1990 as the laboratory manager. She has been involved in the product development of chemical products for the electric utility and communication industries. Contact her at dahlke@polywater.com or www.polywater.com

Meet OSHA Live-Line Tool Standard for Hot Stick Maintenance with Polywater's

S-1 Hot Stick Cleaner & Water Repellant Wipe

- **Convenient, Pre-Saturated, Lint-Free Wipe**
- **Dual Action - Cleans and Applies Water Repellent**
- **Does Not Remove or Adversely Affect Gloss Coat**
- **Evaporates Quickly**
- **No "Build-Up" over time**
- **Prevents Continuous Water Film on Stick in Wet Weather**
- **Removes Grease, Dirt, and Grime**
- **Designed for One Time Use and Easy Disposal**
- **Meets IEEE Maintenance Recommendations (Std #978)**

Order Catalog # S-1. Comes 144 individual wipes to a case.

View the S-1flyer online at http://www.polywater.com/hotstick.html

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

LIT-SFLYER/9-02/C1000(9-02)

W-1™ Wax & Buff Wipes

for Live-Line Tool Maintenance

Meet OSHA Live-Line Tool Standard for Hot Stick and Boom Maintenance

OSHA states that: Hot Sticks, booms, and other live-line tools "... can become electrically unsafe because of ... a combination of wetting, surface contamination, and a loss of surface gloss ..." *and* " ... the best defense against accidents is a clean, glossy stick that causes water to bead up ..."

OSHA demands that: "Live-line tools ... shall be removed from service every two years ... for examination ... and shall be cleaned *and waxed* ..."

W-1™ Fiberglass Wax & Buff Wipe satisfies the waxing portion of this requirement and offers these features:

- Convenient, Wax-Saturated, Lint-Free Wipe
- Dual Action Tandem Pack Includes Dry Buffing Towel
- Superior Quality, Fast-Hazing Fiberglass Wax
- Suitable for Rubber and Porcelain Materials Too
- Easy to Apply
- Does Not Remove or Adversely Affect Gel Coat
- Leaves Non-Conductive Water Repellent Coating
- Prevents Continuous Water Film on Stick in Wet Weather
- Designed for One Time Use and Easy Disposal
- Meets IEEE Maintenance Recommendations (Std #978)

CATALOG NUMBERS			
Catalog No.	**Package Size**	**Units/CS**	**Image**
W-1	Wax-Saturated Wipe with Dry Buffing Towel	72	
W-16	16 ounces of Fast-Hazing Fiberglass Wax	12	

LIT-W1FLYER/2-07/Internal(2/07)

American Polywater® Corporation
P.O. Box 53
water, MN 55082
U.S.A
1-800-328-9384
custserv@polywater.com(e-mail) 1-651-430-2270
http://www.polywater.com(URL) fax 1-651-430-3634

American Polywater® Corporation

5630 Memorial Ave. Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

IEEE Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools

Sponsor

Transmission and Distribution Committee of the IEEE Power Engineering Society

IEEE Std 978-1984

4.2 Periodic Inspection and Checking

Insulating tools should be visually inspected before use for indications that they may have been mechanically or electrically overstressed (see 5.1.1). Tools that show evidence of overstress (such as damaged, bent, worn, or cracked components) should be removed from service and evaluated for repair. Elongated or deformed rivet ends, for instance, indicate that excessive mechanical loading has occurred and has weakened or sheared the bond between the ferrules and the insulating pole.

The surface of each tool must be inspected before and after each use for contamination such as dirt, creosote, grease, or any other foreign material. If any of the above contaminants exist, the tool surface should be cleaned.

When the insulating member of a tool shows signs of accumulated contamination, surface blisters, excessive abrasion, nicks, or deep scratches the tool should be removed from service and cleaned or refinished as recommended by the manufacturer, and re-tested. Any moisture penetration will reduce the insulating properties of these tools.

When the tools have been exposed to excess moisture, their moisture content can be measured with a moisture meter, which is commercially available (see 4.5), or their general condition determined on the basis of ac dielectric-loss measurements (see 5.9)

4.3 Cleaning and waxing

Before each use, insulating tools should be wiped with a clean, absorbent paper towel or a clean, absorbent cloth and followed by wiping with a silicone-treated cloth.

Caution: Do not use cloths that have been washed in harsh solvents, since some residues on the cloth can be deposited on the pole surface

If simple wiping does not remove the contaminant then apply denatured alcohol with a paper towel or clean, absorbent cloth and follow by wiping with a silicone-treated cloth. Other solvents or cleaners may be used as recommended by the manufacturers of the insulating tools.

Caution: Do not use soap detergents, liquid or powdered form, such as 409, Fantastic, Comet, ND-150, Bon Ami, Ajax, etc, to clean fiberglass tools under field conditions because of the following problems:

(1) The above described cleaning agents will leave a conductive residue unless rinsed with generous amounts of water (usually not available in the field).

(2) Abrasive cleaners will destroy the surface gloss on the stick.

Note: All fiberglass tools that are subjected to such cleaning agents should be electrically tested under wetting conditions to ensure complete removal of residue from soap-type cleaners (see 5.3).

Waxing is not necessary after every use of the tools but rather as needed to maintain a glossy surface that will cause any moisture or water to bead on the surface (see 5.5). Before the tool is rewaxed, to avoid a wax buildup, the pole should always be cleaned with a solvent or cleanser recommended by the manufacturer of the tools.

Waxing imparts not only a glossy finish to the surface of the fiberglass but also adds to the electrical integrity of the tool by providing a protective barrier against dirt, creosote, and other contaminants, and moisture.

American Polywater® Corporation

5630 Memorial Ave. Ste 2 (Office)
11222 60th Street North (Plant)
P.O. Box 53 (Mailing)
Stillwater, Minnesota 55082 U.S.A.

Telephone: 1-651-430-2270
FAX: 1-651-430-3634

www.polywater.com
custserv@polywater.com

Copy of OSHA Regulation 1910.269 Part J – Live Line Tools

(j)
"Live-line tools."

(j)(1)
"Design of tools." Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:

..1910.269(j)(1)(i)

(j)(1)(i)
100,000 volts per foot (3281 volts per centimeter) of length for 5 minutes if the tool is made of fiberglass-reinforced plastic (FRP), or

(j)(1)(ii)
75,000 volts per foot (2461 volts per centimeter) of length for 3 minutes if the tool is made of wood, or

(j)(1)(iii)
Other tests that the employer can demonstrate are equivalent. Note: Live-line tools using rod and tube that meet ASTM F711-89, Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools, conform to paragraph (j)(1)(i) of this section.

(j)(2)
"Condition of tools."

(j)(2)(i)
Each live-line tool shall be wiped clean and visually inspected for defects before use each day.

(j)(2)(ii)
If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service and examined and tested according to paragraph (j)(2)(iii) of this section before being returned to service.

(j)(2)(iii)
Live-line tools used for primary employee protection shall be removed from service every 2 years and whenever required under paragraph (j)(2)(ii) of this section for examination, cleaning, repair, and testing as follows:

(j)(2)(iii)(A)
Each tool shall be thoroughly examined for defects.

..1910.269(j)(2)(iii)(B)

(j)(2)(iii)(B)
If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service. If no such defect or contamination is found, the tool shall be cleaned and waxed.

(j)(2)(iii)(C)
The tool shall be tested in accordance with paragraphs (j)(2)(iii)(D) and (j)(2)(iii)(E) of this section under the following conditions:

(j)(2)(iii)(C)(1)
After the tool has been repaired or refinished; and

(j)(2)(iii)(C)(2)
After the examination if repair or refinishing is not performed, unless the tool is made of FRP rod or foam-filled FRP tube and the employer can demonstrate that the tool has no defects that could cause it to fail in use.

(j)(2)(iii)(D)
The test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of fiberglass-reinforced plastic, its integrity under wet conditions.

(j)(2)(iii)(E)
The voltage applied during the tests shall be as follows:

(j)(2)(iii)(E)(1)
75,000 volts per foot (2461 volts per centimeter) of length for 1 minute if the tool is made of fiberglass, or

(j)(2)(iii)(E)(2)
50,000 volts per foot (1640 volts per centimeter) of length for 1 minute if the tool is made of wood, or

(j)(3)
Other tests that the employer can demonstrate are equivalent. Note: Guidelines for the examination, cleaning, repairing, and in-service testing of live-line tools are contained in the Institute of Electrical and Electronics Engineers Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools, IEEE Std. 978-1984.

American Polywater's

powerpatch®

Leak Repair System for:

- Transformers
- Potheads
- SF_6 Gas
- Oil-Filled Equipment
- Lead-Sheathed Cables
- Pipe Type Cables

Substation

Repair

Features

Quick plugging action - A fast-cure putty that stops oil seepage.

Permanent seal - A 2-part paste overcoat forms a permanent seal.

Durable - Finished seal is impervious to water, oil and weather.

Fast - System can plug and seal active leaks in minutes.

Saves money - Faster than welding. Transformer may stay in service.

Simple - Eliminates "bagging" or removal from field and unexpected outages.

Convenient - Kit contains all materials needed to fix leak while in the field.

PowerPatch® System

Use the PowerPatch® System's 2-part putty stick to block oil leaks. Then make a permanent patch with the fast-cure, 2-part paste overcoat. Optimal mix and performance is ensured with pre-measured packaging.

Seals cracks or punctures in hard to reach areas. Fixes leaks fast. At 70°F, the putty and sealant harden in 10 minutes. Repairs made at temperatures as low as 40° F have a slower cure. The finished patch is resistant to transformer oil and has held oil pressures in excess of 100+ psi (20 psi on lead).

Surface preparation is very important. The kit approach provides everything needed to successfully perform job while in the field. Read detailed application instructions before using.

PowerPatch® Sealant Physical Properties

Color: Dark Grey
Viscosity: No-Sag, Thick Paste
Pot Life: 5 minutes @ 70°F/ 21°C
Dielectric Strength: 43 KV (ASTM D 149)
Cured Hardness: 75 (Shore D)
Durability: Resistant to UV, water, and oil
Adhesion to Metals: Good
Adhesion to Ceramic: Excellent

PRIMER AVAILABLE FOR POLYETHYLENE

PowerPatch® Kit

The PowerPatch® Sealant is provided in a kit containing the surface preparation and patching materials necessary to repair oil leaks in transformers, lead-sheathed cables, potheads and other oil-filled electrical equipment. **Kits can be customized to end-user requirements.**

Product Code	Description
EP-KIT11	**Contains**: 2-part sealant (part A & B), putty stick (~2"), 2 TR™ cleaning and preparation wipes, 12" sandpaper strip, 2 mixing sticks, 1 pair of gloves, and instructions. Single use.
EP-KITB6	**Contains:** Six sealed plastic bags, each with 2-part sealant (part A & B), putty stick (~2"), 2 Type TR™ cleaning and preparation wipes, 12" sandpaper strip, 2 mixing sticks, 1 pair gloves, and instructions. **Box of 6 single-use kits**
EP-KITB12	**Contains:** Twelve sealed plastic bags, each with 2-part sealant (part A & B), putty stick (~2"), 2 Type TR™ cleaning and preparation wipes, 12" sandpaper strip, 2 mixing sticks, 1 pair gloves, and instructions. **Box of 12 single-use kits**
EP-KIT51	**Contains:** 6 sets 2-part sealant (part A & B), putty stick (~7"), 12 TR™ cleaning and preparation wipes, 6 strips sandpaper (24"), 12 mixing sticks, 6 pairs of gloves, and instructions. Seals multiple leaks.

Related website (**www.polywater.com**) links:

Application slide show - **www.polywater.com/EPApplication.asp**
Product benefits slide show - **www.polywater.com/EPPresentation.asp**
Temperature & Cure Time - **www.polywater.com/curechart.asp**

LIT-POWERPATTRAN/12-06/MARUDAS/4-06

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

powerpatch®

Leak Repair

American Polywater® Corporation

TECHNICAL DATA SHEET

Description:

The PowerPatch® Leak Repair System provides fast and effective “in-field” leak repair for transformers, PILC cables, and other oil and gas insulated electrical equipment.

Once a leak has been temporarily stopped using the two-part Putty, the Sealant is applied and cures to form a strong, durable patch. The PowerPatch® Sealant is the functioning patching material.

PowerPatch® System is supplied with all the materials required to seal electrical insulating oil and gas leaks. The sealant bonds to polyethylene, lead, aluminum, ceramic and steel.

The PowerPatch® Leak Repair System provides a fast and easy in-field leak repair system.

Leak Sealing Performance:

To test gas pressure sealing, a 1/16-inch hole was patched. The surface was prepared and sealant applied and cured according to the instructions. The repair was then subjected to continuous air pressure for 24 hours.

Surface	Pressure	Result
Steel	200 psi	No Leaking
HDPE (cable jacket)	80 psi	No Leaking
Lead	50 psi	No Leaking

To evaluate oil leak sealing, a seeping oil leak from a 1/8-inch hole in a galvanized pipe was repaired using standard procedures. The oil pressure in the pipe was then increased and held at 100 psi.

Continuous Pressure	One Month Aging With Polybutene Oil
100 psi	No Leaking

PowerPatch® Sealant shows good adhesion and no leakage under high pressure with both air and polybutene oil.

Product Benefits:

- Quick plugging action
- Easy to use, fast repair time
- Long-lasting seal
- Durable- withstands environmental extremes
- Resistant to oils, water, and uv
- Prevents water entry into oil-filled equipment
- No bagging necessary to catch oil
- Convenient, field-ready kit

Typical Applications:

PowerPatch® Sealant repairs oil and SF_6 filled systems and restores electrical integrity to:

- Transformers
- Switchgear
- Terminations
- PILC Cables

Component Physical Properties:

PowerPatch® Sealant is a 2-part, thick paste sold ready to mix and use.

Property	Part A (Resin)	Part B (Curing Agent)
Color	Black	White
Form	Thick Paste	Thick Paste
VOC Content	0 g/L	0 g/L
Specific Gravity	1.7	1.4

Cured Properties:

PowerPatch® Sealant cures to form a solid patch. Pre-measured packaging contains enough material to seal one typical leak, ~ 6 in^2 at ¼-inch thickness.

Property	Typical Result
Color	Dark Grey
Peak Exotherm @ 70° F	< 200°F
Hardness 7 Days @ 70° F (Shore D Durometer)	75
Flexural Stress (ASTM D790)	6,925 lb_f/in^2
Flexural Strain (ASTM D790)	1.43 X 10^{-2} in/in

Typical Peel Strength:

Substrate	Result
Galvanized Steel (180°)	>100 pli
Aluminum (180°)	>100 pli
Lead (180°)	16.5 pli
Copper (180°)	>100 pli
Stainless Steel (180°)	>100 pli
HDPE (90°)	49 pli
PVC (90°)	46 pli
Ceramic (90°)	> 100 pli

Tested using ASTM C794. Samples are sanded, cleaned and allowed to cure for 24 hours.

Typical Shear Strength:

Substrate	Result
Steel	> 1,000 lbs/in^2
Aluminum	> 1,000 lbs/in^2
Polyethylene	114 lbs/in^2
PVC	148 lbs/in^2

Tested using ASTM D1002. Samples are sanded, cleaned and allowed to cure for 24 hours.

Typical Impact Resistance:

Substrate	Result
HDPE	55 in-lbs
Lead	65 in-lbs
Steel	95 in-lbs

Tested using ASTM G14. Samples are sanded, cleaned and allowed to cure for 24 hours.

Electrical Testing:

PowerPatch® Sealant is non-conductive. Dielectric strength was tested using a 2,000 volts/second rate of rise and type 3 circular electrodes with a 0.25-inch diameter. All tests were performed in insulating oil to prevent discharges and flashovers. Results are the average of 10 trials.

Sample Thickness	Breakdown Voltage	Dielectric Strength
0.0916 Inch	43 kV	469 Volts/Mil

Tested using ASTM D149, Method A. Platen samples are cast and fully cured.

Chemical Resistance:

PowerPatch® Sealant chemically resists dielectric fluids, SF_6 gas, ultraviolet light, water, and oil.

ASTM D1002 was used to test the shear adhesive strength of the PowerPatch® Sealant on steel after exposure to the reagent. The sample was allowed to cure 7 days, then was immersed in the reagent and aged at 50°C for 6 months. Shear adhesion was compared to a control that was air aged.

Fluid*	Appearance (6 months)	Comparison to Control
Mineral Oil	No Change	100% (Pass)
Polybutene Fluid	No Change	100% (Pass)
Hydrocarbon Fluid	No Change	100% (Pass)
Silicone Oil	No Change	100% (Pass)

**Mineral Oil (Holland 70), Polybutene (Duddek PLIC), Hydrocarbon Fluid (Bio Temp), Silicone Oil (GE Silicone SF 96-100)*

Application:

PowerPatch® Sealant is easy to use. For full installation information, please see PowerPatch® Use Instructions. *(www.polywater.com/EPinstructions.pdf)*

In cold weather, materials should be kept as warm as possible. Store materials in a warm vehicle and use chemical warming pad to increase the temperature of the repair area.

Cure Rate:

Recommended application temperature is 40° F to 120° F. Cure rate depends on temperature.

Temperature	Working Time	Functional Cure
35° F	40 Minutes	7 Hours
52° F	20 Minutes	3½ Hours
60° F	10 Minutes	1½ Hours
70° F	6 Minutes	60 Minutes
88° F	4 Minutes	40 Minutes

PowerPatch® Sealant is available in a slower-cure rate for larger applications that require more work time. (Product Code EPSC)

An oil pressure test was used to determine effective seal time under ambient conditions.

Aging Condition	Result
Ambient (70° F)	Holds 20 psi oil pressure after 15 minutes

The seal sets in less than 10 minutes at this temperature.

Vertical Sag:

PowerPatch® Sealant clings to vertical surfaces and other non-horizontal angles common in field repairs. Once applied, it stays in place.

In this test, the PowerPatch® Sealant is mixed and applied to a vertical metal platen. Displacement is measured and recorded.

Temperature	Displacement from Center
60°F	0 inches
75°F	1/16 inch
95°F	3/32 inch
110°F	3/16 inch

PowerPatch® Paste shows minimal sag within a large temperature range.

Paint Adherence:

PowerPatch® Sealant can be painted 15 minutes after application. In this test, the paste is applied, painted and the paint is allowed to dry for 24 hrs. Then, a cross-cut tape test is run.

Paint Type	Results
Enamel Paint	0% Paint Removed
Alkyd Paint	0% Paint Removed

Tested using ASTM D3359, Test Method B.

Both paints adhere well to the PowerPatch® Sealant.

Environmental Resistance:

Temperature Range:
Application: 40° F to 120° F
In Use: -40°F to 400°F

Temperature Cycle Testing:
Ten cycles at -22° F to 203° F showed no significant change in adhesion as shown below.

Material	Adhesion Compared to Non-Aged Control
Galvanized Steel	100 % (Pass)
Aluminum	100 % (Pass)
Ceramic	100 % (Pass)
Copper	100 % (Pass)
Stainless Steel	100 % (Pass)
Lead	100 % (Pass)

PowerPatch® Sealant is resistant to ultraviolet exposure and withstands direct sunlight with no decrease in functionality.

PowerPatch® Sealant has been outside aged for over five years with a temperature range from -25° F to 110° F. Conditions include rain, snow and sleet as well as exposure to direct sunlight. PowerPatch® shows no deterioration and cannot be physically pried from the surface. It shows only slight discoloration (<1/16" thickness).

Safety:

PowerPatch® Sealant has a low level of toxicity. Follow good industrial hygiene practice during use. Avoid inhalation of vapors and personal contact with the product. Use ventilation or respiratory protection against decomposition products during welding/flame operations on or near cured product (e.g., torches used to install heat shrink products). See MSDS for specific details.

Storage and Handling:

Keep containers cool, dry and away from sunlight. Keep containers tightly closed.

Product shelf life is 15 months.

Model Specification:

The statement below may be inserted into a customer specification to help maintain engineering standards and ensure work integrity.

Approved electrical repair compound is PowerPatch® Sealant. The electrical repair compound shall come in a system that contains everything needed for the repairs. The system shall contain an oil block to allow repairs on an active oil leak. The sealant shall not sag during cure so that it may be applied to the bottom side of leaking surfaces without running or dripping.

The adhesive repair patch shall have excellent adhesion to a variety of substrates with minimum peel strength of 100 pli on stainless steel, copper, and ceramic; and 40 pli on polyethylene when measured by ASTM C 794. The adhesive repair patch will retain 100% of peel strength adhesion after 5 freeze/thaw cycles and shall withstand in-use temperatures from -50°F to 250°F.

The adhesive repair patch shall seal mineral oil and polybutene dielectric fluid at up to 200 psi oil pressure without leakage. The cured repair patch shall be impervious to water, salt water, oils, and dilute acids and bases. It shall have a minimum flexural strain of 1.1 in/in as measured by ASTM D790.

The adhesive patch shall not contain any metals and shall not corrode. It shall be non-conductive with a minimum dielectric breakdown voltage of 40 kV as measured by ASTM D 149.

Order Information:

Cat #	Package Description
EP-KIT11 Single-Use Kit	2-Part PowerPatch® Sealant (parts A and B) 1-3/4" Putty Stick 2 Type TR Cleaning and Preparation Wipes 12" Strip Sanding Cloth 2 Mixing Sticks 1 Pair disposable gloves 1 Instruction sheet
EP-KITB6	Box of 6 Single-Use Kits, EP-KIT11
EP-KITB12	Box of 12 Single-Use Kits, EP-KIT11
EP-KIT51	6 sets Part A and B PowerPatch® Sealant 7" Putty Stick 12 Type TR Cleaning and Preparation Wipes 6 24" Strips Sanding Cloth 12 Mixing Sticks 6 Pairs disposable gloves 1 Instruction sheet

***Custom kits available. Call factory for details.*

***Slower curing version PowerPatch® Sealant available (EPSC). Call factory for details.*

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ Software

American Polywater® Corporation

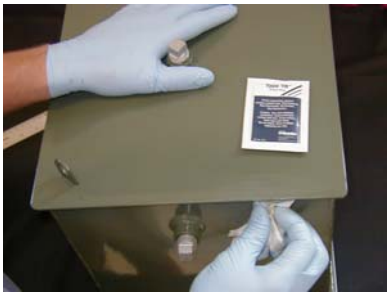
P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

From American Polywater® Corporation

powerpatch®

Leak Repair System Instructions

Sand or brush repair area



Clean area with Type TR™ before applying PowerPatch® Putty

Apply putty ½ inch beyond leak; ⅛ to ¼ inch thick

1. Clean surface with rag or American Polywater's Grime-Away™ Multi-Purpose Cleaner Wipes to remove dirt and grime.

2. Scrub the area to be sealed with a steel brush or sandpaper to remove loose particles and oxides, and to roughen the surface. Clean and abrade approximately 3" around the leak. If surface material is lead, follow prescribed work methods to avoid exposure to lead dust.

3. **Caution:** Wear nitrile gloves (provided) and safety glasses. Refer to MSDS of all products before handling.

For an active leak, apply PowerPatch® Putty to temporarily plug the fluid.

4. Cut off a portion of the PowerPatch® Putty Stick (approximately ½ inch), remove plastic wrap, and knead/mix by hand approximately 2 minutes, until material is well mixed and of uniform color. For a pinhole leak, shape putty into a plug the size of a large pea. For a leaking crack or seam, roll the putty into a rope about ⅛ to ¼ inch thick.

5. Wipe leak area with TR-1 solvent wipe to thoroughly clean the surface of contaminants, oils, and to displace any remaining water.

6. Apply the mixed PowerPatch® Putty plug or rope over the leak, spreading it out about ½ inch from all points of the leak area with a thickness of approximately ⅛ to ¼ inch. The putty will feel warm as it reacts. Apply constant pressure to this putty patch with the palm of the hand for 2–3 minutes until material feels firm. For the best, long-term seal, limit quantity of putty.

To seal polyethylene (or other low energy plastic), apply PowerPatch® Primer (EP-PRIMER) to prepared areas. This product is available separately and is not for use on metallic surface.

7. Use the second TR-1 cleaning wipe to clean surface again and let dry for 15 seconds. (On polyethylene apply primer after cleaning.)

Mix 2-part paste sealant to a uniform grey color

Apply PowerPatch® Sealant over putty patch or leak area

Smooth edges

Important: Mix and apply the PowerPatch® Sealant (steps 8 – 11) quickly.

8. Open one Part A Sealant cup (black paste) and one Part B Sealant cup (white paste). Remove the protective seal from the Part B Sealant cup and discard. A small amount of yellow skin or crust may form on contact with air. This will not harm the performance of the material. Discard any excess hard pieces.

9. Empty all the contents of the Part B Sealant Cup into the larger, Part A Sealant Cup. Mix for about 30–60 seconds until the mixture is a uniform color of gray. For larger repairs, two sets of Part A and B cups may be necessary.

10. Immediately apply the sealant to the prepared surface. Start with the edges of the putty patch and cover with PowerPatch® Sealant using light pressure. Spread the sealant to the surrounding area ½" to 1" beyond the leak or patch on all sides. Build a layer ¼ inch thick over the repair area.

11. Smooth the PowerPatch® sealant edges.

12. Application of the PowerPatch® Sealant should take about 2–3 minutes. The sealant has a working time of approximately 6 minutes and a functional cure in approximately 60 minutes, depending on ambient temperature. Do not move area of repair until functional cure is achieved. See chart below.

Temperature	Working Time	Functional Cure
35° F 2° C	40 Minutes	7 Hours
52° F 11° C	20 Minutes	3 ½ Hours
60° F 16° C	10 Minutes	1 ½ Hours
70° F 21° C	6 Minutes	60 Minutes
88° F 31° C	4 Minutes	40 Minutes

powerpatch®

Leak Repair Kit

Components for the repair of oil leaks in lead- sheathed enclosures, transformers, terminations and more.

American Polywater Corporation

Stillwater, Minnesota 55082 U.S.A.
1-800-328-9384 (USA & Canada only)
Telephone: 1-651-430-2270
FAX: 1-651-430-3634
www.polywater.com
custserv@polywater.com

APC R.M. #: 87351-001 11/04

American Polywater

powerpatch®

Leak Repair System
For
PILC (Paper Insulated Lead Cables)

Before ***After***

Features

Eliminate Hazardous Alternative Methods - Kit will eliminate lead wiping and heat sources in manhole.

Convenient - Kit contains all materials needed to fix leak while in the field.

Quick plugging action - Fast cure putty stops oil seepage.

Permanent seal - A quick curing 2-part paste overcoat forms a permanent seal.

Durable - Finished seal is impervious to water, oil and weather.

Fast - System can plug and seal active leaks in minutes.

PowerPatch® System

System contains necessary cable prep material for cleaning and sealing of cable. Use the PowerPatch® System's 2-part putty stick to block oil leaks. Then make a permanent patch with the fast cure, 2-part paste overcoat. Optimal mix and performance is ensured with pre-measured packaging.

Seals cracks and punctures in hard to reach areas. Fixes leaks fast. At 70°F, the putty and sealant harden in about 10 minutes. Repairs made at temperatures as low as 40° F have a slower cure. The finished patch is resistant to transformer oil and water and has held oil pressures in excess of 20 psi on lead.

Preparation is important, and the kit approach provides everything needed to do the job. Read detailed application instructions before using.

PowerPatch® Sealant Physical Properties

Color: Dark Grey
Viscosity: No-Sag, Thick Paste
Pot Life: 5 minutes @ 70°F/ 21°C
Dielectric Strength: 41 KV (ASTM D 149)
Cured Hardness: 75 (Shore D)
Durability: Resistant to UV, water, and oil
Adhesion to Metals: Good
Adhesion to Ceramic: Excellent

PowerPatch® Kit

The PowerPatch® Sealant is provided in a kit containing the preparation and patching materials necessary to repair oil leaks in transformers, lead-sheathed cables, potheads and other oil-filled, electrical equipment. Kits can be customized to end-user requirements.

Product Code	Description
EP-Kit11	**Contains**: 2 Part Sealant (Part A & B), Putty Stick (3-1/2"), 2 TR™ Cleaning and Preparation Wipes, 24" Sandpaper Strip, 2 Mixing Sticks, 1 Pair of Gloves, and Instructions. Single Use.
EP-Kit51	**Contains:** 6 sets 2 part Sealant (Part A&B), Putty Stick (7"), 12 TR™ Cleaning and Preparation Wipes, 6 Strips Sandpaper (24"), 12 Mixing Sticks, 6 Pairs of Gloves, and Instructions. Seals multiple leaks.
EP-KITB12	**Contains:** Twelve sealed plastic bags, each with 2-part sealant (part A & B), putty stick (~2"), 2 Type TR™ Cleaning and Preparation Wipes, 12' sandpaper strip, 2 mixing sticks, 1 pair gloves, and instructions. Box of 12 Single-use kits
EP-KIT51	**Contains:** 6 sets 2 part Sealant (Part A & B), Putty Stick (~7"), 12 TR™ Cleaning and Preparation Wipes, 6 Strips Sandpaper (24"), 12 Mixing Sticks, 6 Pairs of Gloves, and Instructions. Seals multiple leaks.

LIT-POWERPATPILC/12-06/internal(12-06)

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com (e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

AirRepair®

Pressurized Leak Repair System

FEATURES

Easy to apply paste — Seals hard-to-reach areas.

Fast cure — Typically ready for pressurization in under 15 minutes.

Seals many materials — Lead-sheathed cables and splice enclosures; polyethylene cable jackets, load coils, end-plates and more.

Saves money — Less expensive and faster than hot lead wiping.

Simple — No torches or power sources; no wrapping or clamping required.

Convenient — Kit contains all materials needed to seal multiple leaks.

Durable — Impervious to water and many other manhole contaminants.

AirRepair® Sealant

The AirRepair® Sealant is a 2-part, fast curing, gray paste. The AirRepair® 2-Part paste is packaged in an easy-to-use, field-friendly system. Premeasured packaging contains enough material to seal one typical leak, approximately 6 square inches at a coating thickness of ¼-inch.

Once mixed, the no-sag paste can be immediately applied to the cable or splice underside, along seams and in the "crotch" area. The sealant will hold air pressure within 10 minutes of mixing and application. The sealant cures at ambient temperatures as low as 40°F, forming a tough seal. The cured seal is resistant to water, salt, oils, and other manhole contaminants.

AirRepair® Sealant Physical Properties

Color: Dark Grey
Viscosity: No-Sag, Thick Paste
Pot Life: 5 Minutes @ 70°F / 21°C
Durability: Resistant to Water

Cured Hardness: 75 (Shore D)
Adhesion to Lead and Metals: Good
Adhesion to Plastic: Good (may require primer)

AirRepair® Kit

The kit contains the preparation and patching materials necessary to repair air leaks in lead-sheathed cables and splice enclosures. Support components may include cleaning wipes, plastic primer, abrasive cloth, mixing and application tools, gloves, and instructions.

The AirRepair® Sealant is provided in a kit **customized to end user needs**.

Single use kits also available.

Important Notice: The statements here are made in good faith based on tests and observations we believe to be reliable. However, the completeness and accuracy of the information is not guaranteed. Before using, the end-user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended use.

American Polywater expressly disclaims any implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater's only obligation shall be to replace such quantity of the product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injury, or direct, indirect, or consequential damages resulting from product's use, regardless of the legal theory asserted.

Lit-ARFLYER/5-03/quan(5/04)

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
custserv@polywater.com (e-mail) 1-651-430-2270
www.polywater.com fax 1-651-430-3634

powerpatch®

Pad N Pole™ Repair

American Polywater® Corporation

TECHNICAL DATA SHEET

Description:

The PowerPatch® Pad N Pole™ Repair system repairs and restores damaged utility enclosures, preventing human, water, pest or debris entry through the repaired defect.

The PowerPatch® Pad N Pole™ two-part adhesive bonds to fiberglass, polyethylene, metal, concrete and composites. Fiberglass cloth (saturated with the adhesive) provides structural integrity for a durable, long lasting repair

PowerPatch® Pad N Pole™ Repair comes in a kit that contains everything needed for a repair. The adhesive is easy to dispense and quickly wets the fiberglass cloth. The fiberglass can be layered as necessary to create a thicker and stronger structure. Repairs are quick and easy, and can be done in the field with a single visit.

Performance:

Repairs made with PowerPatch® Pad N Pole™ Repair withstand exposure to extreme outdoor temperatures, from -60° F to 200° F.

PowerPatch® Pad N Pole™ Repair is versatile with optional use of single or multiple layers of fiberglass material. Multiple layers are appropriate for increased strength over larger defects. A wide variety of defects from small cracks to holes up to six inches in diameter can be repaired.

PowerPatch® Pad N Pole™ Repair is quick, and many defects can be repaired in as little as 3 minutes. However, the PowerPatch® Pad N Pole™ mixed resin allows at least 30 minutes working time. Repairs reach full strength about 12 hours after application, but can be painted immediately after application so no return visit is needed.

Fiberglass cloth saturated with the high-strength, two-part resin makes the permanent PowerPatch® Pad N Pole™ Repair.

Product Benefits:

- Seals defects from unwanted entry
- Easy to use - quick repair
- Protects and seals enclosure
- Sunlight (UV) resistant
- Withstands environmental extremes
- Multiple use, field-ready kit
- Complete field repair in a single visit

Typical Applications:

PowerPatch® Pad N Pole™ Repair may be used on a variety of outdoor enclosures including:

- Transformer Pads & Enclosures
- Lighting Pedestals
- Telecom Junction Enclosures
- Above Ground Conduits

Component Physical Properties:

The PowerPatch® Pad N Pole™ Adhesive is a 2-part thixotropic paste packaged in a cartridge applicator. The supplied mixing nozzles ensure proper mixing as the product is extruded from the cartridge.

Property	Part A (Resin)	Part B (Curing Agent)
Color	Beige	Amber
Form	Thick Paste 700,000 cps	Liquid 900 cps
Odor	No Odor	No Odor
Specific Gravity (water = 1)	0.96	1.21

Typical Properties:

PowerPatch® Pad N Pole™ Adhesive cures to form a solid, durable seal.

Property	Typical Value
Color	Beige
Peak Exotherm @ 70º F	< 110º F
Hardness 7 Days @ 70º F (Shore A Durometer)	90
Flexibility 7 Days @ 70º F	Excellent
Tensile Strength (lap shear adhesion, Aluminum @ 77º F)	1400 lbs/in^2
Dielectric Strength (ASTM D149):	450 Volts/Mil
Peel Adhesion (ASTM D1876)	34.3 lb/in
Impact Resistance (ASTM G 14):	
On Fiberglass	>100 in-lbs
On Galvanized Steel	>100 in-lbs
On Polyethylene	>100 in-lbs

Materials:

PowerPatch® Pad N Pole™ Repair adheres to:

- Fiberglass
- Steel
- Composites
- PVC
- Polyethylene
- Concrete
- Steel
- Aluminum

Environmental Resistance:

PowerPatch® Pad N Pole™ Repair withstands the typical rigors of the enclosure environment.

It shows no significant change in adhesion in temperature cycle testing (0° F/130° F for 10 cycles).

It shows no significant change in adhesion in 12 month exposure to sunlight (some darkening of color).

Chemical Resistance:

The chemical resistance of a stainless steel screen to fiberglass bond (with the Pad N Pole™ adhesive) was tested by comparing peel adhesion after reagent immersion to non-immersed adhesion. Samples were immersed in the reagent at 70° F for 3 months.

Chemical Exposure	Percent of Control
Salt Water (4%)	95%
Alkaline Soap Solution (pH = 12)	100%
Odorless Mineral Spirits	90%

The PowerPatch® Pad N Pole™ Repair shows good resistance to salt water, alkaline soap solutions and mineral spirits (paraffinic solvent).

Application:

PowerPatch® Pad N Pole™ Repair is easy to use.

If necessary, dig out sod and soil to reveal at least 2 inches of undamaged surface around the defect. Abrade the area to be repaired for approximately 1½ inch around the damage using the abrasive cloth included in the kit. Clean and dry the abraded area with the Type HP™ Tandem Pack (HP-P158ID), removing all dirt and other contaminants. As in any repair involving adhesive application, starting with a clean surface is very important

Cut the fiberglass cloth to overlap the damage by approximately 1 inch all the way around. Generously apply the two-part Pad N Pole™ Adhesive Resin to the cleaned surface around the damaged area. Lay the fiberglass fabric over the damaged area, pressing the edges into the Pad N Pole™ Resin. Smooth and press down with the foam brush. The patch will cling to the adhesive covered area and quickly saturate with the Pad N Pole™ Resin.

Generously apply additional Pad N Pole™ Resin to the top of the fiberglass cloth (including the cloth over the hole) and smooth with the brush until the cloth is fully saturated. Brush the Pad N Pole™ Resin ½ inch past the edges of the cloth, feathering the resin and ensuring that the edges of the cloth are well adhered to the surface. Pad N Pole™ Adhesive Resin will set in about 30 minutes and reach full strength in about 12 hours.

Larger repairs (> 2") will benefit by adding additional layers of cloth material. Additional layers can be added at any time, before or after the first layer has cured.

The repair area may be spray painted immediately (before full cure), and soil may be replaced at this time, enabling even a complex repair to be done in a single visit.

For additional installation information, please see the Pad N Pole™ Usage Instructions at:
www.polywater.com/BRKinstructions.pdf

Cure Rate:

PowerPatch® Pad N Pole™ Adhesive Resin has a working time of 30 minutes at 70° F, allowing ample time to perform repairs with care and precision. After thickening beyond the point that it can be spread, the product continues to cure, reaching maximum strength in 12 hours at 70° F.

Working and set time variation with temperature is shown below.

Temp.	Working Time	Set Time
40° F (4° C)	90 Minutes	24 Hours
52° F (11° C)	70 Minutes	20 Hours
60° F (16° C)	40 Minutes	16 Hours
70° F (21° C)	30 Minutes	12 Hours
88° F (31° C)	20 Minutes	8 Hours

Storage and Handling:

Keep cartridge tightly closed in a cool, dark, dry location. Reseal cartridge after use. All cartridges should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Unopened product has a shelf life of one year.

Safety:

PowerPatch® Pad N Pole™ Repair has a low level of toxicity. Use good industrial hygiene practice and follow any precautions during use. Avoid personal contact with the uncured product. See MSDS for specific details.

Model Specification:

The statement below may be inserted into a customer specification to help maintain engineering standards and ensure work integrity.

The approved enclosure repair system is PowerPatch® Pad N Pole™ Repair. The repair system shall come in a multiple-use kit that will provide the materials needed for the repair.

The packaging shall automatically mix and meter the two-part repair adhesive. The cure rate of the adhesive shall allow 30 minutes of working time (at 70° F) to apply and smooth the repair. The repair shall be spray paintable immediately after application with no reduction in ultimate strength. Product shall be suitable for use on various enclosure materials, including fiberglass, HDPE, concrete, steel, aluminum, and composites.

Once cured, the repair shall be watertight. The bond shall be strong enough to withstand an impact of over 100 in-lbs on fiberglass as measured by ASTM G14.

The cured product shall be resistant to water, salt water, oils and ultraviolet degradation. The cured bond shall withstand temperature extremes from -60° F to 200° F. It shall withstand multiple freeze-thaw cycles. The cured product shall be non-conductive with a minimum dielectric strength of 450 Volts/Mil as measured by ASTM D149.

Order Information:

Cat #	Package Description
BRK-KITG (1 unit/case)	Kit contains: 1 PowerPatch® Pad N Pole™ Repair Adhesive Cartridge 6 Mixing Nozzles 1 Strip of Sanding Cloth 6 HP™ Tandem Cleaning and Drying Wipes (HP-P158ID) 6 Foam Brushes 1 Square Foot Patch Material 1 Instruction Sheet 1 Dispensing Tool
BRK-KIT (1 unit/case)	Kit contains: 1 PowerPatch® Pad N Pole™ Repair Adhesive Cartridge 6 Mixing Nozzles 1 Strip of Sanding Cloth 6 HP™ Tandem Cleaning and Drying Wipes (HP-P158ID) 6 Foam Brushes 1 Square Foot Patch Material 1 Instruction Sheet (Dispensing tool not included.)
BRK-KITB6G (1 unit/case)	Bulk kit contains 6 Individual Kits, BRK-KIT 1 Dispensing Tool Included
BRK-KITB6 (1 unit/case)	Bulk kit contains 6 Individual Kits, BRK-KIT (Dispensing tool not included.)
BRK-TOOL50 (1 unit/case)	1 Dispensing Tool
BRK-INSERT21 (1 unit/case)	Plunger insert for applicator, BRK-TOOL50

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

FST™ Foam Sealant

American Polywater® Corporation

TECHNICAL DATA SHEET

Description:

FST™ Sealant is a two-part, high-expansion foam duct sealant. It keeps water, acids, dust, gases, insects, and rodents out of the duct. FST™ Foam expands and hardens to a "closed cell", rigid structure. This permanent, but removable, seal blocks both water and gas under moderate pressure.

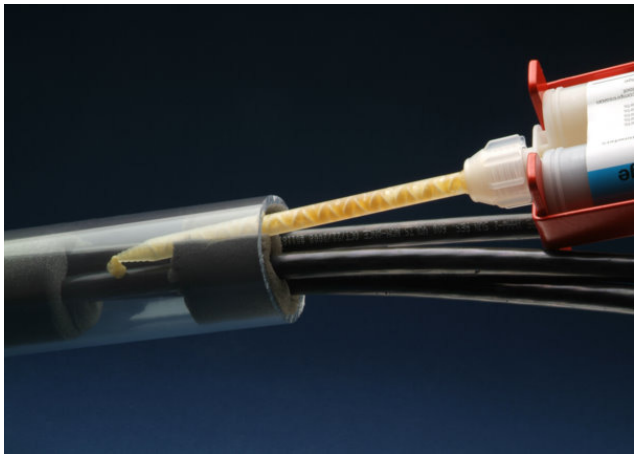
FST™ Sealant comes in a multi-use, dual plunger side-by-side cartridge or a multi-use single plunger caulking tube package. The foam wets and adheres to metals, plastics, and concrete, and can seal ducts of different sizes, base materials, and shapes. It will conform around complex cable fill configurations. A kit contains everything required to install the duct block (single or dual plunger application tool available separately).

Water Blockage:

FST™ Sealant is an excellent water block. To test water blocking performance, it is installed into a conduit according to standard procedures, forming a 3-inch plug. Water is added to the system and then pressurized to create a "water-head".

Condition	Result
PVC Conduit, No Cables	Holds 28 days at 7.25 psi (16.4 feet of water)
PVC Conduit, 3 MDPE Cables	Holds 15 min at 40 psi (90 feet of water)
PVC Conduit, 3 MDPE Cables *bent* at 45° angle in opposite directions for 5 minutes	Holds 15 min at 40 psi (90 feet of water)
PVC Conduit, 3 MDPE Cables *pulled* with 15 pounds axial force for 4 hours	Holds 15 min at 40 psi (90 feet of water)
HDPE Duct, (SDR 13.5) No Cables	Holds 7 days at 30 psi (70 feet of water)

FST™ Sealant blocks considerable water-head pressure, even when forces are placed on the cable to stress the seal.



The FST Sealant comes in a side-by side (two plunger) system, as shown above, or a caulking style (one plunger) tube. The mixing is done in the nozzle as the sealant is injected.

Product Benefits:

- Creates a strong, resilient, chemically resistant seal
- Holds 15 feet of water-head pressure over extended time
- Expands, cures and seals even when water is present
- Controlled injection quantity – no waste
- Seal tolerates cable movement and environmental extremes
- Compatible with common cable and wire jackets
- Single cartridge can seal multiple ducts
- Re-enterable – seal can be removed

End Use:

FST™ Sealant creates a conduit block and acts as a removable seal to:

- Block water
- Deter theft
- Seal out rodents, dirt, and gases

Component Properties:

FST™ Sealant is a two-part, “blown” urethane foam. The liquid Part A and B are formulated to be mixed at a 1/1 ratio using the side-by-side cartridge or the two-part coaxial caulking tube with the static mixing nozzle provided.

Property	Part A (Resin)	Part B (Curing Agent)
Color	Amber	Clear
Form	Viscous Liquid 250 cps	Viscous Liquid 900-1200 cps
VOC Content:	0 g/L	0 g/L
Specific Gravity	1.2	1.1

Cured Properties:

FST™ Foam Sealant cures to a solid, closed-cell foam.

Property	Typical Result
Appearance	Light yellow color with small, even cells
Closed Cell Percent	98%
Density	6 lbs/cu. ft.
Compressive Strength (ASTM D1691)	330 psi
Tensile Strength (ASTM 1623)	270 psi
Flexural Strength (ASTM D790)	460 psi
Seal Strength Water	40 feet intermittent 15 feet continuous
Seal Strength Air	>5 psi

Cable Compatibility

FST™ Sealant is compatible with common cable jacket materials. The cured foam is an inert solid that does not affect jacket materials.

Chemical Resistance

FST™ Sealant is chemically resistant to gasoline, oils, dilute acids and bases, and most unsaturated hydrocarbons.

Seal Strength - Air and Other Gases:

FST™ Sealant can seal out various manhole gases. To test seal strength, a 3-inch FST seal is installed into conduit according to standard directions. The conduit is sealed and pressurized with both air and helium. Helium is a small molecule, less than half the size of methane gas, and was used in place of methane.

Condition	Result
Air, 10 psi, 168 hours	Holds Seal
Helium, 5 psi, 72 hours	Holds Seal

The FST™ Sealant closed cell foam will block air and other gases for an extended period of time.

Cable Removal Testing

FST™ Sealant acts as a theft deterrent by sealing cables into the conduit and making them difficult to remove unless the seal is removed. To test this, a 3-inch plug of FST is used to seal 3 cables in a PVC conduit according to standard procedures. The force to pull out each cable is measured.

Cable Type	Average Pull Out Tension (lb_f)
2 AWG THHN	171
4/0 XHHW	320

FST™ Sealant increases the force required to remove cables to make removal by hand very difficult.

Environmental Resistance:

FST™ Sealant withstands the rigors of the conduit exposure environment.

Sealant Temperature Use Range
-20° F to 200° F (-29° C to 93° C) Continuous
-40° F to 250° F (-40° C to 121° C) Peak

FST™ Sealant does not lose function in direct sunlight. Reacted foam that is exposed to uv will yellow. However, the foam seal retains its hardness and continues to act as a duct block, and any discoloration does not affect performance.

The foam sealant can be protected with a weather proofing paint. Both urethane and epoxy based products have been tested with good results and excellent adhesion to the foam.

Application:

Field-Ready Kit
The FST Sealant kit includes all materials required to install a finished duct block.

Seal Length
It is most important to make a seal of adequate length by using and properly spacing the damming strips.

Application Temperature
Working temperature for Polywater® Foam Sealant FST is 35° F to 95° F (2° C to 35°C).

Water in Duct
FST™ Sealant will cure and seal duct with small amounts of water present. The water should not be flowing, and should be relatively clean. The FST foam will incorporate water into its cure. However, excessive water will weaken the seal.

For full installation information, please see the FST Installation Instructions.
(www.polywater.com/FSTuse.pdf

Cure Rate:

The FST™ Sealant can be used in temperatures down to 35° F (2° C). At low temperatures, the reaction is slow, but the sealant will completely foam and cure with time. At cold temperatures, the sealant components become more viscous and flow through the mixing nozzle at a slower rate. Cure times are as follows:

	Reaction Time (Minutes)	
	40° F (4° C)	70° F (21° C)
Foaming, Expansion Complete	8 - 9	4 – 5
Hard, Non-sticky Skin Formation	15 – 18	7 – 9

Installation
Once a skin has formed, the foam may be visually inspected to determine whether the seal has completely filled the void. After the sealant has cured, the positioning rod or a screwdriver can be used to check for voids in the finished seal.

To decrease cure time in cold temperatures, warm FST Sealant cartridges prior to use.

Clean-up

Any unreacted material may be cleaned from surfaces with a solvent wipe such as Polywater's Type HP™ Cleaner/Degreaser. The part A amber resin will react with water if surfaces are washed with a soap and water solution. Once reacted, the foam has strong adhesion, and may be scraped or cut from surface.

Removal:

FST™ Sealant can be mechanically removed with some effort. Use a long screwdriver to puncture holes throughout the seal. With a hammer, punch the screwdriver through the foam, twist it to enlarge the cavity, and pull out. Once the foam is weakened, it can be chipped away, and the cable should break free.

Safety:

FST™ Sealant is a two-part urethane foam containing highly reactive chemicals. Polyurethanes are common in the construction industry and have been used for many years. Some individuals may become sensitized to components in the unreacted resin. Precautions must be observed during use and handling of these materials.

The use of FST in the prepackaged cartridge controls and reduces exposure. Once reacted, the foam is a solid, closed-cell polyurethane. The finished product may be considered non-toxic. See MSDS for more information.

Combustion of Cured Foam
Irritating and toxic smoke and vapors may form during combustion of cured FST Foam Sealant. If burning the sealant material cannot be avoided, provide appropriate ventilation/respiratory protection against decomposition products during flame cutting operations.

Storage and Handling:

Keep containers cool, dry and away from sunlight. Leave cartridges in the protective foil pouch until ready to use/reuse.

Product shelf life is one year.

Model Specification:

The statement below may be inserted into a customer specification to help maintain engineering standards and ensure work integrity.

The foam duct sealant shall be FST™ Sealant. The foam duct sealant shall be a two-part "blown" urethane foam with 98% closed cell content. The foam duct sealant shall have a compressive strength of 300 pounds (ASTM D1691), and shall have a tensile strength of 250 pounds (ASTM D1623). The foam duct sealant shall have a flexural strength of 450 pounds (ASTM D790), and shall withstand temperatures from -20° F to 200° F. The foam duct sealant shall be chemically resistant to gasoline, oils, dilute acids and bases.

The foam duct sealant shall be available as a kit suitable for sealing various sized ducts. The product shall foam and react in five to ten minutes at 70° F.

When installed, the sealant shall be capable of holding 7.25 psi air pressure continuously (equivalent of 16.4 feet water-head pressure).

Order Information:

Cat #	Package Description
FST-250 (12 units/case)	8½-oz two-part Foam Sealant caulking tube style with resealing cap 1 ea Static mixing nozzle
FST-250KIT (6 units/case)	8½-oz two-part Foam Sealant caulking tube style with resealing cap 3 ea Static mixing nozzles 4 ea 24-inch Foam damming strips 1 Pair disposable gloves 1 Position rod 1 Pre-treating wipe 1 Instruction sheet
FST-180 (12 units/case)	6-oz cartridge Foam Sealant, side-by-side tubes with resealing cap 3 ea Static mixing nozzles
FST-180-KIT (6 units/case)	6-oz cartridge Foam Sealant side-by-side tubes with resealing cap 3 ea Static mixing nozzles 2 ea 24-inch Foam damming strips 1 Pair disposable gloves 1 Position rod 1 Pre-treating wipe 1 Instruction sheet
FST-TOOL (1 unit/case)	Ratchet application tool for FST-180
FST-TOOL250 (1 unit/case)	Ratchet application tool for FST-250
FST-10NOZZLE (1 unit/case)	Mixing nozzle 10-pack for FST-180 or FST-250
FST-DAM (24 units/case)	24-inch Foam damming strip
HP-P158ID (144 units/case)	Conduit pre-treatment, cleaning wipe

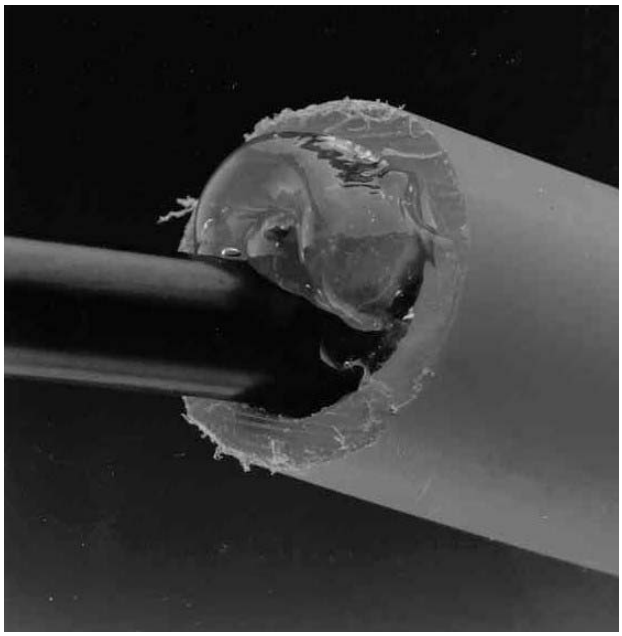
***Custom kits available. Call factory for details.*

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

IceFree™
Antifreeze Gel System



A specialty, non-freezing gel which is pumped into conduits (around cable) to prevent water ingress and subsequent ice formation.

This system has successfully protected fiber optic cable in thousands of bridges exposed to below freezing temperatures.

- Prevents water ingress and ice formation in innerducts and conduits
- Protects fiber optic cable from ice-pressure-induced microbends
- Compatible with cable jacket and duct
- Safe for the environment
- Patented system
- Avoids system downtime due to cold-weather signal degradation
- Protects all cable from ice damage
- Soft gel allows cable removal for repair or upgrade
- Install once for multi-year protection
- Installation video and literature available

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

Lit-WSFlyer/1-03/internal(1/03)

Reprint from: *Outside Plant Magazine* May, 1993

What To Do When Ol' Man Winter Freezes Fiber Transmission

Fiber optic cable is susceptible to freezing in a way that traditional copper cables are not.

by Ben Osborne and Win Miller

Since the advent of fiber optic cables, major communications companies have replaced embedded copper cable with fiber optic cables to achieve better quality transmissions and higher transmission speeds. Along with improved quality and efficiency, however, have come some unanticipated problems related to installation and maintenance of fiber optic cables.

In the past few years, some fiber optic cables have mysteriously failed for no apparent reason, returning in most cases to full speed in a short time. Some failures have been a degradation of speed and quality, while in other instances complete failures have occurred. Since these service interruptions tended to happen during winter months, the weather was a prime suspect.

After extensive investigation it has been determined that these failures are the result of water freezing within the fiber optic conduit.

Water in Ducts

Freezing within an innerduct or conduit has been occurring for as long as cables have been put in duct, but fiber optic cable is susceptible to freezing in a way that traditional copper cables are not; fiber optic strands may be bent by the tremendous forces that occur when water crystallizes into ice. These microbends in the fiber optic strands can cause various degrees of signal degradation. Signal strength usually returns to normal when the ice melts.

Driven by intense competition, several companies have installed fiber optic systems in the most economical way possible, with extensive construction along railroad rights-of-way until an obstacle such as a bridge or culvert is encountered. Bridge or culvert crossings of fiber optic cables are usually accomplished by attaching carrier pipes to the sides of the bridge or by laying a carrier pipe on the bridge deck. This is far more economical than placing the cable underground by means of a directional boring device.

Driven by economics, the use of carrier pipes quickly became the industry standard. It was not apparent that these bridge crossings could in fact result in fiber optic transmission speed and quality problems by exposing water-filled ducts to freezing temperatures.

How does water get into innerducts? It gets in by infiltration and condensation. An innerduct is like a garden hose laid out along a railroad track, with occasional access points. Water may infiltrate at these access points and flow down hill, which may result in hundreds of gallons of water being present in the system. As long as the innerduct is buried below the frost line, no freezing will occur. But where a cable is exposed to freezing temperatures, such as at an exposed bridge crossing, ice will form in the duct. Field experience has shown many cases where, upon entry to an innerduct, water has gushed out for several minutes.

Condensation is another possible culprit, especially at exposed bridge crossings where differences between the ambient temperature and the inside innerduct regularly exist. Just as dew forms on grass, or condensation forms on a cold glass, so too, does condensation form inside innerducts and conduits.

Although ambient temperatures in the contiguous forty-eight states may reach -40°F, with a wind chill exceeding -80°F, the temperature inside a buried conduit will not drop below somewhere around 25°F. Fiber optic cable in a conduit exposed to the elements on a bridge crossing will not experience temperatures below the ambient outside temperature; wind chills do not affect unexposed surfaces.

Most fiber optic freeze-ups occur two to three feet within the head wall of a bridge. Freeze-ups are similarly a problem in abandoned pipelines where the pipes are exposed or placed on a cantilever when they cross creeks or rivers.

Solutions

Upon defining the problem, a major communications company retained C&S Contract Services of Crest Hill, Illinois, to resolve these freeze-up problems. After an investigation that included an inventory of the fiber optic systems, C&S recommended two alternative solutions.

The first solution was the option of rerouting cables by means of horizontal boring at each bridge crossing. This would insure that cables would be below the frost line at all times, and that any water present in the system would not freeze. This is an expensive solution, costing between $200,000 to $1 million per bridge, depending on the location, length, geology and so forth. Given that a typical 100-mile cable route may have 100 to 150 bridge or culvert crossings, this solution could be very expensive.

The second alternative was to apply some type of freeze-proof material that would displace water and fill the void between the cable and the innerduct as these crossings.

C&S determined that such a product did not exist at that time, and contacted American Polywater of Stillwater, Minnesota, a specialty chemical manufacturer with broad experience in underground cable systems. A detailed description of the needed material was developed during discussions between C&S and American Polywater laboratory personnel.

A critical part of the discussions at the beginning of the discussions was the engineering firm's ability to describe the needs of the customer in a way that allowed the chemical firm's lab personnel to focus on specific characteristics of the needed material. While the material development was underway, C&S worked with a fiber optic placement contractor to develop application and insertion methods. As a result of these efforts, the laboratory worked toward creating a material that would: have a freezing point below -40°F; be capable of dissolving ice; be long-lived (preferably having the same expected useful life as

the cable); work with applications methods developed, and be environmentally safe.

In a matter of days the American Polywater laboratory created a material called IceFree™ Antifreeze Gel, which met the necessary requirements for field use. IceFree is made from materials that have been extensively used and have known compatibility with cable.

Essentially similar to aircraft wing de-icing, the idea is to insert a material that will dissolve ice and prevent ice from forming. In addition, the material should combine in a predictable way with any water that finds its way into the innerduct at a later time.

Ongoing testing over the following months confirmed the predicted compatibility with the cable jacket and innerduct materials. Confidence in the life of the material is based on accelerated aging tests and because products with similar composition have been observed to last in excess of 10 years.

Blocking Ingress and Egress

To keep the total cost of fixing the freezing problem as low as possible, the material would be applied only within the innerduct along the bridge crossings to a point on each side of the bridge where the cable would be below the frost line. A method of confining the product in that location without migration was achieved by installing split duct plugs at each end of the bridge, beyond the frost line. This required excavation at the ends of the carrier pipes in the railroad bed on each side of the bridge for access to the innerduct below the frost line. The innerduct was then opened, IceFree™ Antifreeze Gel injected, and split duct plugs applied. Cost per bridge using this methodology was about $1,000 to $20,000 per location, including all materials and labor - a substantial saving over the horizontal boring alternative.

The procedure worked well, but, due to railroad safety, railroad traffic downtime, and the hazards of excavating fiber optic cables, an improved method that would not require digging on the railroad bed itself but would rely on access from the carrier pipe was envisioned by C&S: a chemical plug would be used to hold the product in place. An obvious time savings would result if the antifreeze material

could be held in place by a chemical duct plug that would not inhibit future cable removal and could be placed in the innerduct along with the antifreeze.

Such a duct plug material would be re-enterable, allow future access to the duct or cable, and would not interfere with cable removal if that was ever required.

Collaboration between C&S and American Polywater resulted in the development of IceFree Chemical Duct Block in a matter of days.

The chemical duct plug is a thick, dough-like material that absorbs water and IceFree™ Antifreeze Gel, and which has an antifreeze character of its own. The plug expands when water contacts it, improving its effectiveness as a barrier. Because it is inserted with the IceFree, both time and money are saved.

Use of the chemical duct plug reduced the cost of installation at each bridge site by about 50 percent, from $500 to $10,000 per location.

Results

From January to August 1992, the product was installed in over 1,200 fiber optic bridge crossings from two to eight years old in Michigan, Wisconsin, Illinois, Indiana, Iowa, Nebraska, Minnesota, South Dakota and Kentucky. During the installation process, 85 percent of the systems were found to have water trapped within the innerduct, proving the widespread nature of the problem. Installations made from January to April were complicated by the presence of ice in many innerducts; 20 percent of all innerducts had to be thawed with steam before IceFree™ Gel could be inserted.

In addition, 50 percent of the locations had one or more maintenance items such as loose or missing hanger brackets, broken rollers, bad extension joints, or a broken carrier pipe that needed fixing.

Leaving over 1,000 bridges (85 percent of the 1,200 bridges) with trapped water in the innerduct would be like gambling that 1,000 backhoes could excavate buried cable without an accident. The likelihood of multiple cable failures is high whenever cold weather hits, and--with ever-increasing volumes of traffic on fiber networks, and monumental downtime costs--proper maintenance against the cold weather culprit is cheap insurance.

During the past winter, areas treated with the new product experienced no difficulties from freezing. In one particular case a bridge crossing was treated with the antifreeze product on one side and with weep holes and foam duct block on the other side. This bridge froze up at the end of January 1993. Visual inspection confirmed that the freeze up occurred on the side with the weep holes and foam duct block, while the side treated with the new gel did not freeze up.

Drilling weep holes in the carrier pipe has proved unsuccessful because this does not eliminate water in the innerduct, plus elevation differences in the carrier pipe can trap water where it cannot drain out. Weep holes also become a maintenance problem when they become clogged due to freezing.

Foaming the carrier pipe ends or the entire pipe did not solve the problem because water was still trapped within the innerduct.

In another instance, a treated cable had to be removed for a reason unrelated to freezing, and no problems were encountered in removing the cable; the chemical duct block came out in chunks with the cable.

Results from the new technology appear promising, with the probability that many additional installations will occur. Fiber optic lines can now be operated at maximum efficiency regardless of the weather.

Reprint from: *America's Network Magazine* May 15, 1997

Fiber's Fragile When it Freezes

When the weather outside is frightful, there are ways to protect your fiber cable. Now is the best time to ensure that the outside plant fiber optic cable (and the millions of dollars you've invested in it) is ready for next winter's weather.

- -

When it's freezing cold outside, fiber optic cable enclosed in innerduct systems that are not buried beneath the frost line--for example, innerduct strung under bridges--is at risk. Because it is made of glass, fiber cable resting in exposed innerduct--in which water has collected--can perform poorly or be damaged when that water turns to ice. As ice crystallizes, it can exert crushing pressure on the fiber cable inside the conduit. That pressure can cause microbends in the fiber and degrade the signal, especially as higher speeds are reached; or it can break the fiber and kill the signal, according to Win Miller, finance director, and plant operations manager for American Polywater Corp., a Stillwater, MN-based specialty chemical manufacturer.

"The freezing phenomenon was discovered several years ago by a large telephone company, which noticed that its fiber optic network lost signal attenuation on cold nights in certain parts of its network," Miller says. "As it warmed up, signal clarity would come back."

For years, the carrier blamed everything on network electronics. Eventually, technicians traced the problem to a site where the cable was encased in conduit that ran across a bridge. Technicians discovered ice had formed inside the innerduct. As they removed the fiber cable from the innerduct, they found that the cable's plastic jacket had scarred. Solving the attenuation problem meant finding a way to remove the water and keep it out of the exposed innerduct system.

Nix Icky-Pick

Copper and fiber cable are protected from water damage by a substance known as "icky-pick," which resides between a cable's plastic jacket and its "strength jacket." However, icky-pick does not protect fiber cable from ice formation. Rather than reroute the exposed cable--an expensive solution--technicians tried blowing out the water and sealing the innerduct system with foam, according to Ben Osborne, director of operations for C&S Contract Services, Inc., (Martinsville, IN). When that didn't work, C&S tried installing French drains at each end of the bridge where the innerduct system plunged below the frost line--again, to no avail, he says.

American Polywater had experience dealing with cold weather problems in Canada and Northern Europe. The contractor and vendor developed IceFree™ Antifreeze Gel, which could be pumped into the space between the fiber and the innerduct to force water out and form a protective barrier between the fiber and any ice that might form in the conduit. Since then, service providers around the world have pumped the patented gel into vulnerable innerduct systems, Miller says.

Although the fiber optic outside plant that is prone to ice formation is a tiny percentage of most carriers' networks, it is just such a weak link that can cost millions of dollars in lost revenues from a network outage (not to mention the trust of their biggest customers). "People are surprised about the amount of water in their innerduct systems, but the majority of them do hold water," Miller notes.

The Fix

According to Miller, two-and-a-half gallons of IceFree™ Gel will pack 100 feet of 1-inch innerduct containing 5/8-inch of fiber cable (see Figure 1). A 55-gallon drum of IceFree™ Gel costs approximately $1,000. Miller recommends preparing for winter early; once cold weather returns, costs for labor and equipment to install the gel will increase, because any ice in the innerduct has to be melted before the gel can be injected.

Gallons of IceFree™ Gel per 100 Feet				
Duct Size	Cable Size			
	1/2"	5/8"	3/4"	1"
1"	3.0	2.5	1.8	N/A
1¼"	5.3	4.8	4.0	2.3
2"	15.3	14.7	14.0	12.2
3"	35.7	35.1	34.4	32.6
4"	64.2	63.6	62.9	61.2

Figure 1. IceFree™ Gel -- Volume Estimates

A pump, air compressor, duct block hose and gel-insertion hose are used to tackle the job in 180-foot segments. After carefully opening the conduit and the innerduct, the duct block hose is inserted into the innerduct and used to place IceFree™ Chemical Duct Block at the far end of the system. The duct block, which expands on contact with water, can hold the IceFree™ Gel in place in each segment.

"You want to go at least 20 feet to 30 feet inside the headwall of the bridge and past the frost line," Miller advises.

Once the block is set, the gel-insertion hose is pushed all the way into the innerduct. As the gel is pumped into the system, the hose and any water inside are pushed out. Duct block is inserted at the open end of the system once the segment has been filled with gel, and the innerduct and conduit are closed in a manner that allows re-entry.

The non-toxic gel is dyed red for easier leak detection, Miller says. The substance is applied as a gel to make it less likely to seep out of any cracks or holes in the innerduct. The gel protects the cable from ice formation to temperatures of at least -45°F. The gel reportedly does not damage cable jackets, and innerduct systems that have been filled with the gel can be re-entered for cable removal and reinsertion.

"To date, everything we have treated has not experienced any further freezing problems," Osborne says.

Although the process has become a standard operating procedure for some telephone companies, the Rural Electrification Association rejected a proposal to require telcos to adopt the solution, Osborne notes.

The frost line was higher than usual this past winter in many areas because of heavy snow. The frost line can vary from about 6 to 7 feet below the ground in such northern states as Minnesota, to just about 1 foot below ground in the mid-central part of the United States. But ice-related fiber cable problems are not limited to the northern states; sites in Florida, Georgia, Texas and Mississippi--anywhere freezing temperatures are recorded--are at risk, Miller says.

"Lots of those southern states have a preponderance of water, especially where fiber in innerduct systems is hung on bridges and where aerial fiber that transitions to buried fiber via innerduct systems is mounted on poles," Miller notes.

Floods that have ravaged many areas this winter are bringing water into contact with fiber cable that had never before been exposed to large volumes of water.

Alternatives

Companies seeking an alternative to using the gel may be able to drill "weep holes" into the conduit or use high-maintenance air pressurized cable systems. Weep holes are teardrop-shaped drainage holes that are drilled into exposed conduit. Although weep holes are used by many major telephone companies, Miller says he does not consider them acceptable over the long term. "The whole concept of fiber optic cable is a closed system, so weep holes are counter-intuitive," he says. "They tend to get plugged up by debris and insects, so they often stop working."

Yet, IceFree™ is only six years old, so its longevity is still unproven. "The goal is for the gel to last as long as the fiber optic cable, which is about 25 years," Miller says. "The thing that breaks [the gel] down most readily is sunlight, and there isn't any sunlight inside an innerduct. Therefore we expect it will have a very long life." Although the IceFree™ Gel liquifies as it breaks down, the gel retains its antifreeze capability, he maintains.

American Polywater's

BonDuit®

Conduit Adhesive

A High Strength Adhesive for Bonding Polyethylene, PVC, Fiberglass, Metals and Composites

EC&M Product of the Year 05 Category Winner

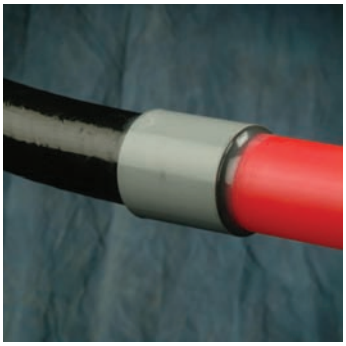
BonDuit® Conduit Adhesive Bonds Polyethylene To:

- PVC Couplings
- Above Ground Conduit
- Steel Sweeps and Elbows
- FRE & Composite Connections
- Transition Couplings

BonDuit® Conduit Adhesive Creates Strong, Long-Lasting Bonds

BonDuit® Adhesive creates airtight and watertight splices. Bonds are durable with high tensile strength within an hour. The strong bonds withstand movement and vibration.

Polyethylene to Polyethylene



Polyethylene to Fiberglass

Polyethylene to Steel

BonDuit® Conduit Adhesive Is Easy to Use and Cost Effective

BonDuit® Adhesive requires no special training and minimal labor. Total installation time is less than 5 minutes. Convenient kit contains all material to make the connection. BonDuit® provides a low cost solution compared to alternative methods.

Applications Per Kit

Conduit Size	Coupling Length	Insert Depth	Applications per BT-KIT
1-¼ inches	2 inches	1 inch	30 – 40
1-½ inches	2 inches	1 inch	25 – 35
2 inches	3 inches	1-½ inches	20 – 30
2-½ inches	3 inches	1-½ inches	15 – 25
3 inches	4 inches	2 inches	12 – 18
4 inches	6 inches	3 inches	8 – 12
6 inches	6 inches	3 inches	3 – 6

BonDuit® Conduit Adhesive Kit Ordering Information

Part #	Description
BT-KITG	Kit contains 2 adhesive cartridges, 8 mixing nozzles, 1 strip of sanding cloth, 8 TR-1 cleaning wipes, and 1 dispensing tool.
BT-KIT	Kit contains 2 adhesive cartridges, 8 mixing nozzles, 1 strip of sanding cloth and 8 TR-1 cleaning wipes. (Dispensing tool not included.)
BT-KITB6G	Bulk kit contains 12 adhesive cartridges, 48 mixing nozzles, 6 strips of sanding cloth, 48 TR-1 cleaning wipes, and 1 dispensing tool.
BT-KITB6	Bulk kit contains 12 adhesive cartridges, 48 mixing nozzles, 6 strips of sanding cloth and 48 TR-1 cleaning wipes. (Dispensing tool not included.)
BT-TOOL	1 Dispensing Tool
BT-10NOZZLE	10 Mixing Nozzles
BT-CART12PK	12 Adhesive Cartridges in a Package

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A.

800-328-9384
1-651-430-2270
fax 1-651-430-3634

custserv@polywater.com (e-mail)
www.polywater.com (URL)

Lit-BonDuitFLYER/11-06/C1000(9-06)

BonDuit® Conduit Adhesive

American Polywater® Corporation

TECHNICAL DATA SHEET

Description:

BonDuit® Conduit Adhesive joins polyethylene duct to PVC, fiberglass, and metal duct using standard PVC couplings. This rapid-cure, two-part resin adhesive forms a durable bond for a strong, permanent, water-tight joint.

BonDuit® Conduit Adhesive is a versatile field-friendly conduit joining solution. It works for multiple conduit types and sizes. It is easy to use and no special training is required.

Adhesive Shear Strength:

Typical bond strengths were measured by joining two pieces of HDPE conduit with a PVC coupling and BonDuit® Adhesive. The force required to pull apart the joint after 24 hours at 70° F was measured.

Conduit Diameter	Pullout Force
1 Inch	724 lbs_f
1½ Inch	1233 lbs_f
2 Inch	2,025 lbs_f
4 Inch	5,333 lbs_f

Results based on 3rd-party laboratory testing.

Hydrostatic (Pressure) Testing:

BonDuit® Conduit Adhesive forms a water-tight joint. HDPE duct was joined to PVC duct with a PVC coupling and the adhesive. The ducts were filled with water, sealed, pressurized to 60 psi, and observed over time for leakage. The joint was then subjected to a short duration, high pressure test.

Test Duration	Result
1,000 Hours	No Leaks

Continuous pressure test based on ASTM D1598, "Time to Failure of Plastic Pipe Under Constant Internal Pressure".

Short Duration High Pressure (Burst Test)

Maximum Pressure	Result
>250 psi	No Leaks

Burst test based on ASTM D1599, "Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing and Fittings (Burst Test)".

Bonduit® Conduit Adhesive is supplied in a two-part cartridge and is mixed as it is applied.

Product Benefits:

- Easy to use
- Fast cure
- Durable bond
- Water-tight and air-tight seal
- High tensile strength
- Suitable for most common ducts

End Use:

BonDuit® Conduit Adhesive bonds polyethylene to:

- PVC Couplings
- Concrete Vaults
- Transition Couplings
- Above Ground Conduits
- Steel Sweeps and Elbows
- Fiberglass and Composite Connections

Component Physical Properties:

BonDuit® Conduit Adhesive is a 2-part resin. Both parts are thin pastes packaged in a mixing cartridge.

Property	Part A (Resin)	Part B (XL Agent)
Color	Dark Grey/Black	White/Light Yellow
Form	Paste	Paste
Odor	No Odor	Slight Sulfur Odor
VOC:	0 g/L	0 g/L
Specific Gravity	< 2	< 2

Typical Cured Resin Properties:

BonDuit® Conduit Adhesive cures to form a solid, durable resin seal.

Typical Property (7 Days cure @ 70º F)	
Color	Grey
Peak Exotherm @ 70º F	< 200º F
Hardness (Shore D Durometer)	70 – 80
Flexibility (ASTM D790)	> 2%
Dielectric Strength (ASTM D149)	450 Volts/Mil (Nonconductive)
Air-tight (no leakage):	120 psi

Typical Adhesive Shear Strength:

Substrate	Result
HDPE to PVC	275 lbs/in^2
HDPE to Steel	550 lbs/in^2
HDPE to Aluminum	325 lbs/in^2
HDPE to Fiberglass	175 lbs/in^2
Fiberglass to Steel	525 lbs/in^2
Fiberglass to PVC	125 lbs/in^2
Fiberglass to Fiberglass	375 lbs/in^2

Tested using ASTM D1002. Samples sanded, cleaned and cured for 24 hours.

Typical Impact Resistance:

Substrate	Result
HDPE	24.8 in-lbs
PVC	37.2 in-lbs
Galvanized Steel	22.3 in-lbs
Fiberglass	37.2 in-lbs

Tested using ASTM G14. Samples are sanded, cleaned and allowed to cure for 24 hours.

Bonding Materials:

BonDuit® Conduit Adhesive adheres to:

- Polyethylene
- PVC, CPVC
- Composite
- PEX
- ABS
- Polypropylene
- Fiberglass
- Concrete
- Porcelain
- Steel
- Aluminum
- Copper

Environmental Resistance:

BonDuit® Conduit Adhesive can withstand the typical rigors of the conduit environment.

Temperature Cycle Testing: 10 cycles from 0º F to 130º F showed no significant change in adhesion

BonDuit® Adhesive, if applied and frozen before cure, shows no significant change in adhesion when warmed and allowed to cure at a later time.

BonDuit® Conduit Adhesive withstands ultraviolet and direct sunlight exposure with no decrease in functionality.

Chemical Resistance:

The chemical resistance of a polyethylene to PVC bond (joined with BonDuit® Adhesive) is tested by measuring shear strength after exposure to the reagent compared to a non-exposed control. The joint is allowed to cure 7 days, immersed in the reagent, and then aged at ambient temperature for 3 months.

Chemical Exposure	Percent of Control
Salt Water (4%)	85% (Pass)
Alkaline Soap Solution (pH 12)	100% (Pass)
Odorless Mineral Spirits	>100% (Pass)

The BonDuit® Adhesive bond shows good resistance to salt water, alkaline solutions, and odorless mineral spirits (paraffinic solvent). A 6-month water & oil soak test also shows no significant change in adhesion compared to a control.

Application:

BonDuit® Adhesive is easy to use. For full installation information, please see BonDuit® Usage Instructions. *(www.polywater.com/BTinstructions.pdf)*

One 50-ml cartridge will produce a ¼-inch bead of the mixed adhesive approximately 42 inches long.

Preparation:
Proper surface preparation ensures a strong, long-lasting, airtight and watertight bond. The surface should be sanded and cleaned with a TR™ Cleaner Wipe to remove oils and displace any remaining water. Adhesion using different surface preparation methods was tested using a lap shear test. In this test, BonDuit® Conduit Adhesive is applied to create an overlapping bond between HDPE and PVC.

Surface Preparation	Percent of Control Bond Shear Strength
No Preparation	100% (Control)
Cleaner Only	120%
Sanding Only	410%
Cleaner & Sanding	480%

Application Temperature
Working temperature for BonDuit® Conduit Adhesive is 35°F to 95°F (2°C to 35°C).

Cool Weather Application
In cool weather (below 60°F, 16°C) keep BonDuit® Conduit Adhesive warm before using, above 60°F (16°C). Keep couplings in a warm area before use. It may be necessary to heat the transition joint to force adhesive cure. Below 35ºF (2°C), the joint should be heated to cure the adhesive.

Warm Weather Application
In warm weather (above 85°F, 29°C), keep BonDuit® Conduit Adhesive cool, below 70°F (21°C). This will help keep the adhesive from curing before coupling is attached. If possible, use adhesive to make bonds in the cooler mornings and out of direct sunlight to slow down cure rate.

Safety:

BonDuit® Conduit Adhesive has a low level of toxicity. Good industrial hygiene practice and appropriate precautions should be employed during use. Provide appropriate ventilation/respiratory protection against decomposition products during welding/flame operations (i.e. torches used to install heat shrink products) on or near cured product. See MSDS for specific details.

Cure Rate:

BonDuit® Conduit Adhesive develops a strong bond, allowing movement or burial quickly.

Temp.	Working Time	Set Time
35°F (2°C)	40 min	7 hrs
52°F (11°C)	20 min	3 ½ hrs
60°F (16°C)	10 min	1 ½ hrs
70°F (21°C)	6 min*	60 min
88°F (31°C)	4 min*	40 min

After one hour at 70°F (21°C), the BonDuit® Resin will reach approximately 50% of its cure strength and will "set". It will continue to cure and will reach maximum bond strength after approximately 24 hours at 70°F (21°C).

Once cured, conduit joints made with BonDuit® Adhesive will hold adequate air pressure for cable blowing operations.

Cure Time at 70°F	Air Pressure	Result
90 Minutes	150 psi	Pass
120 Minutes	200 psi	Pass

The prepared conduit system holds the above pressure for 10 minutes.

Installation:
Joints made with BonDuit® Conduit Adhesive can be placed into position once the connection is made. The adhesive will cure under water or under ground. Conduits can be put into service once full cure is reached.

** BonDuit® Conduit Adhesive is available with a slower-cure rate for larger applications that may require more working time. (Product Code BTSC)*

Storage and Handling:

Keep cartridge tightly closed in a cool, dark, dry location. Reseal cartridge after use. Keep away from sources of ignition and protect from freezing. All cartridges should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Unopened product has a shelf life of 18 months.

Model Specification:

The statement below may be inserted into a customer specification to help maintain engineering standards and ensure work integrity.

Approved conduit joining system is BonDuit® Conduit Adhesive. The conduit adhesive shall come in a multiple-use cartridge to bond various conduit connections without special fitting or positioning jigs. The packaging shall automatically mix and meter the adhesive. The cure rate for the adhesive shall be fast, reaching 50% of final strength in one hour (@ 75° F), and 80% of final strength in two hours (@ 75° F). The peak exotherm temperature of mixed product shall not exceed 200° F (20 gram sample.) Product shall be suitable for use on various duct materials, multiple duct sizes and connection types.

Once cured, the adhesive seal shall be airtight and watertight. A one-inch, PVC coupling sealed to a polyethylene duct with the adhesive shall hold 120 psi air pressure after curing one hour at 75° F. The pull-out strength of a two-inch polyethylene duct sealed to a PVC coupling shall be at least 910 lbs force after curing one hour at 75° F and at least 1820 lbs force after curing for 24 hours. The adhesive shall have a minimum flexural strain of 2% as measured by ASTM D790.

The cured adhesive shall be resistant to water, salt water, oils, and uv degradation. The cured bond shall withstand temperature extremes from -60° F to 250° F. It shall withstand multiple freeze-thaw cycles. The cured product shall be non-conductive with a minimum dielectric strength of 450 Volts/Mil as measured by ASTM D149.

Order Information:

Cat #	Package Description
BT-KITG	Kit contains: 2 50-ml BonDuit® Adhesive Cartridges 8 Mixing Nozzles 1 Strip of Sanding Cloth 8 TR-1 Cleaning Wipes 1 Instruction Sheet 1 Dispensing Tool
BT-KIT	Kit contains: 2 50-ml BonDuit® Adhesive Cartridges 8 Mixing Nozzles 1 Strip of Sanding Cloth 8 TR-1 Cleaning Wipes 1 Instruction Sheet (Dispensing tool not included.)
BT-KITB6G	Bulk kit contains 6 Individual Kits, BT-KIT 1 Dispensing Tool Included
BT-KITB6	Bulk kit contains 6 Individual Kits, BT-KIT (Dispensing tool not included.)
BT-TOOL	1 Dispensing Tool
BT-10NOZZLE	10 Mixing Nozzles
BT-CART12PK	12 50-ml BonDuit® Adhesive Cartridges in a Package

***Slower curing version BonDuit® Conduit Adhesive available (BTSC). Call factory for details.*

Makers of Polywater® and Dyna-Blue® Cable Lubricants and Pull-Planner™ Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

BonDuit® Conduit Adhesive

American Polywater's

BONDS to Polyethylene, PVC, Fiberglass, Metals and more

BonDuit® Conduit Adhesive is a unique two-part adhesive system used to transition-splice conduits (innerducts) of different types. BonDuit® Adhesive makes a strong, durable splice that is air/water tight in less than 5 minutes. The joint is up to 400% stronger than mechanical screw couplings, and requires no expensive equipment.

Estimated Load Capacity and Usage

Conduit Diameter	Polyethylene Conduit to PVC Standard Coupling		Polyethylene Conduit to PVC Long Coupling	
	Coupling length	Pullout Force	Coupling length	Pullout Force
1 ¼ inch	2 ⅛ inch	760 lbs_f	3 inch	1,140 lbs_f
1 ½ inch	2 ⅜ inch	1,140 lbs_f	3 ¼ inch	1,410 lbs_f
2 inch	2 ½ inch	1,520 lbs_f	3 ½ inch	2,130 lbs_f
2 ½ inch	3 inch	2,280 lbs_f	4 ¼ inch	3,230 lbs_f
3 inch	3 ¼ inch	2,950 lbs_f	6 ⅜ inch	5,710 lbs_f
4 inch	3 ¾ inch	4,560 lbs_f	6 ⅞ inch	8,220 lbs_f
6 inch	4 ⅝ inch	8,220 lbs_f	8 inch	14,610 lbs_f

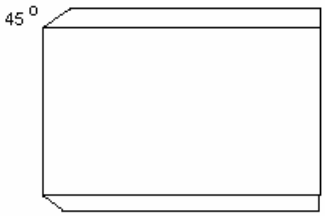
Results are based on careful surface preparation and a 24-hour cure at 70° F. Under these cure conditions; the load will reach 80% capacity after one hour and 50% capacity after ½ hour. Load capacity will increase by an additional 20% as the joint continues to cure. To create air-tight joints for air-assisted cable installation, a cure time of 2 hours at 70°F is recommended. BonDuit® Conduit Adhesive is not designed for high stress pulls, such as those in HDD installations.

Kit Contents

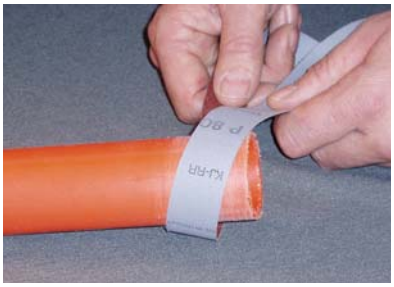
BonDuit® Conduit Adhesive Kits contain the materials necessary to prepare plastic and metal surfaces for bonding. By following the instructions, a strong joint takes just minutes. Each kit contains enough material for numerous applications, depending on the size of each coupling or joint.

Conduit Size	Standard Coupling Length	Applications per Kit
1 ¼ inch	2 ⅛ inch	30-40
1 ½ inch	2 ⅜ inch	25-35
2 inch	2 ½ inch	20-30
2 ½ inch	3 inch	15-25
3 inch	3 ¼ inch	12-18
4 inch	3 ¾ inch	8-12
6 inch	4 ⅝ inch	3-6

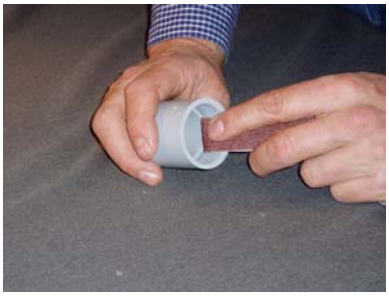
BonDuit® Application Instructions



Taper End of Conduit



Sand Conduit



Sand Coupling

Clean Coupling and Conduit with Type TR™

1. Cut conduit to the desired length. If possible, use a pipe cutter or a miter saw to cut the conduit at a 90° angle. A good, straight cut will maximize adhesion area and improve the connection considerably.

2. For conduit over 3 inches, taper the end at a 45° angle with a rasp or knife. This will help when the conduit is inserted into the coupling.

   Surface preparation is critical for a good bond. Abrade and clean both adhesion surfaces well.

3. Clean both conduit and coupling with a rag or American Polywater's Grime-Away™ Multi-Purpose Cleaner Wipes to remove dirt and grime.

4. Use 80-grit abrasive cloth to sand the outside of conduit ½ inch beyond the depth of insertion into the coupling. Using same cloth, thoroughly sand inside of the coupling. Be sure all the polish is removed.

5. Clean the adhesion surfaces of both the conduit and coupling with Type TR™ Cleaner Wipe to remove any oils and displace water. Gloves are recommended.

   Note: Prepare as many conduit and coupling sets as possible and have them ready to assemble in advance. This will reduce BonDuit® Conduit Adhesive waste.

6. Place the BonDuit® Conduit Adhesive cartridge into dispensing tool and snap it into place. See instructions on page 4 for more information on the use of the dispensing tool.

7. Twist cap 90° counterclockwise to remove from cartridge. Place mixing nozzle onto tool and lock into place by twisting clockwise. Save cap for later storage.

8. Depress handle on dispensing tool until BonDuit® Conduit Adhesive comes out of nozzle tip. Pump 1 or 2 more times to make sure you are getting an even mixture. Dispense and discard this excess material.

   The BonDuit® Conduit Adhesive should be a uniform light gray color with no streaking when it comes out of the nozzle tip.

Close Tool

Apply BonDuit® Adhesive

Smooth Excess Material

9. Place BonDuit® Conduit Adhesive in a ⅛- to ¼-inch bead using a zigzag pattern the depth of the connector insert. The pattern should be about ⅜-inch in width and extend to the outer edge of the conduit. The end of the mixing nozzle may be trimmed off up to the last notch to place a larger bead for larger diameter conduits.

10. Twist the coupling **immediately** onto the conduit. You must twist the coupling to be sure that BonDuit® Conduit Adhesive is well mixed and spread evenly on the inside of the splice.

    For conduits over 3 inches, it may be necessary to use a come-along or other mechanical assistance to pull the splice together.

11. Smooth any excess BonDuit® Conduit Adhesive. Gloves are recommended.

12. BonDuit® Conduit Adhesive develops a strong bond, allowing movement or burial quickly. See chart below for temperature dependence. Do not move joint until set.

Temp.	Working time	Set time before movement
35° F 2° C	40 Minutes	7 Hours
52° F 11° C	20 Minutes	3 ½ Hours
60° F 16° C	10 Minutes	1 ½ Hours
70° F 21° C	6 Minutes	60 Minutes
88° F 31° C	4 Minutes	40 Minutes

    Note: If material in the mixing nozzle has set up, replace the mixing nozzle.

13. To store cartridge, remove mixing nozzle and replace the cap on cartridge.

Application Temperature

Working temperature for BonDuit® Conduit Adhesive is 35°F to 95° F (2° C to 35°C).

Cool Weather Application

In cool weather (below 60° F) keep BonDuit® Conduit Adhesive warm before using (above 60° F or 17°C). Keep couplings in a warm area before use. It may be necessary to heat the transition joint to force the BonDuit® Adhesive cure. Below 35º F, the joint should be heated to cure the adhesive.

Warm Weather Application

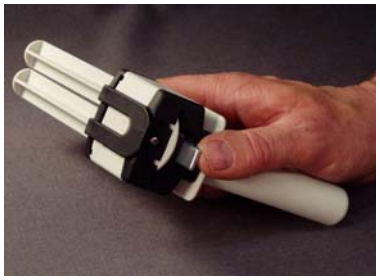
In warm weather (above 85° F), keep BonDuit® Conduit Adhesive cool, below 70° F (21°C). This will help keep the adhesive from curing before coupling is attached. If possible, use adhesive to make bonds in the cooler mornings and out of direct sunlight to slow down cure rate.

Dispensing Tool Assembly Instructions

1. To assemble the dispensing tool, insert the piston. Rotate the black retaining collar forward. While lifting the metal tab, slide piston with ratchet teeth side down, into the slot through the front end. Push the piston all the way through and gently release the metal tab. The metal tab should catch on the ratchet teeth.

2. Insert BonDuit® Conduit Adhesive cartridge into the wide opening on the black retaining collar. Push the collar back and press firmly to snap into place.

3. Twist cap 90° to remove from cartridge. Place mixing nozzle onto cartridge and lock into place by twisting. Save cap for storage of unused material.



Insert Piston

Lift Metal Tab

Insert Cartridge

Secure Collar

BonDuit®

Conduit Adhesive

BONDS Polyethylene to PVC, Fiberglass, Metals & more

Contains: 1 Kit

Kit Contains:

2 -- BonDuit® Conduit Adhesive
1.7oz (50ml) cartridges
8 -- Mixing Nozzles
1 – 1” X 24” 80-grit Sandpaper Strip
8 -- TR-1 Cleaning Wipes

Before using this product the end user should conduct whatever evaluations are necessary to determine that the product is suitable for the intended end use. American Polywater expressly disclaims the implied warranties and conditions of merchantability and fitness for a particular purpose. American Polywater’s only obligation shall be to replace such quantities of this product proven to be defective. Except for the replacement remedy, American Polywater shall not be liable for any loss, injure or direct, indirect, or consequential damages resulting from product use, regardless of the legal theory asserted.

American Polywater® Corporation

Stillwater, Minnesota 55082 U.S.A.
1-800-328-9384 (USA & Canada only)
Telephone: 1-651-430-2270
FAX: 1-651-430-3634
www.polywater.com
custserv@polywater.com

APC RM# 87601-003

Polywater® FTTx

Cable Pushing/Pulling Lubricant

Polywater® FTTx Fiber Lubricant makes the installation of fiber drops easy. The lubricant is concentrated; only a thin film is required for immediate tension reduction that lasts even as the lubricant dries. Spray or wipe the cable or conduit. Quick and easy to use without mess or excess lubricant. Works well for placing fiber in HDD-installed conduit.

- **Perfect for Fiber Optic Drops (FTTx)**
- **Easy Application with Spray or Wipe**
- **Lubricates with Very Thin Film, Performs After Drying**
- **Use for Push or Pull**
- **Non-Staining, Quick Clean-Up**
- **Compatible with Common Cable Jackets - Including Polyethylene**

Application and Usage Recommendations

Polywater® FTTx Spray Lubricant remains effective with very thin, molecular-level films, so it continues to lubricate even when it cannot be detected.

Polywater® FTTx Lubricant is easy to apply. It can be sprayed into conduit or wiped onto cable, making the installation of multiple drops quick and convenient. Use Polywater® FTTx lubricant for better installations without having to handle bulky pails on shorter runs or in small enclosures.

Spray

Inject 5 to 10 sprays directly into conduit just before pulling or pushing. For larger conduit or longer pulls, spray additional lubricant onto the cable or into the conduit during the pull to reduce the tension throughout the length of the pull.

Wipe

Wipe cable as it enters conduit or attach wipe to pulling line to prelubricate conduit. One towel is sufficient for small cable and for installations or drops of less than 200 feet. Use additional lubricant wipes on longer pulls or when tension increases.

Polywater® FTTx Lubricant Ordering Information

Part #	Description	Case Quantity
FTTx-35LR	1-Qt (.95 *liter*) Bottle with Pump Sprayer	12/Case
FTTx-D20	Canister with 20 saturated wipes	12 Canisters/Case

Lit-FXFLYER/7-06/CURTIS/7-06

Makers of Polywater® J and Dyna-Blue® Cable Lubricants and Pull-Planner™ 2000 Software

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384

custserv@polywater.com (e-mail
www.polywater.com (URL)

1-651-430-2270
fax 1-651-430-3634

Polywater® FTTx Installation Products

Polywater® FTTx Cable Lubricant

For pushing or pulling small cables into ducts by spraying or wiping lubricant onto them. Perfect for drops and HDD installed conduit applications.

FTTx-35LR 1-Qt Spray
FTTx-D20 Saturated Wipes

Polywater® F Cable Pulling Lubricant

Polywater® F is a high performance, pourable liquid lubricant recommended for longer outside plant fiber optic cable pulls. It is also suitable for use on other types of communication cable, including coaxial and copper pair. Available in winter grade.

F-640	5-Gal. Pail
F-320	2.5-Gal. Jug
F-128	1-Gal. Jug
F-35	1-Qt. Bottle

Hydrasol® Cable Gel Remover

Hydrasol® is water-based so it's less harsh on hands and skin while cleaning gel-filled cables. Hydrasol® Gel Remover is amazingly effective at dissolving and removing the different types of filling greases used by cable manufactures.

HS-640	5-Gal. Pail
HS-128	1-Gal. Jug
HS-32LR	1-Qt. Spray
HS-16LR	1-Pint Spray
HS-1	Saturated Wipe

Type FO™ 99.8% Alcohol Cleaner

Type FO™ anhydrous alcohol is great for cleaning glass fiber, connector end faces, and test equipment for better light transmission and performance. Type FO™ quickly removes dust, oils and contaminants, while leaving no residue. Pre-saturated wipes are convenient for field use.

FO-32	1-Qt Bottle
FO-16	1-Pint Bottle
FO-1	Saturated Wipe

Polywater® FST Duct Sealant

Polywater® Duct Sealant, Water Block Foam Kit is a multi-use, quick-setting, two-part, cured foam duct sealing system. Seals water, dirt, oil, rodents or other contaminants out of conduit/duct. Foam expands and cures quickly even when water is present. Kit seals up to 3 large 4" ducts. Cartridge injection system allows partial use of foam base – no wasted reacted material.

FST-180-KIT	6-Oz Foam Kit
FST-180	6-Oz Cartridge
FST-DAM	24" Foam Strip
FST-TOOL	Applicator Tool

BonDuit® Conduit Adhesive

BonDuit® Conduit Adhesive is a high strength adhesive for bonding polyethylene, PVC, fiberglass, metals and composites. BonDuit® creates **airtight** and **watertight** splices. Bonds are durable with high tensile strength within an hour. The strong bonds withstand movement and vibration.

BT-KIT	Adhesive Kit
BT-KITG	Kit With Tool*
BT-KITB6	Bulk Kit
BT-KITB6G	Kit With Tool*
BT-TOOL	Dispensing Tool
BT-10NOZZLE	10 Nozzles

*Subject to Int'l Shipping Restrictions

American Polywater® Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A.

custserv@polywater.com (e-mail)
http://www.polywater.com (URL)

1-800-328-9384
1-651-430-2270

LIT-FTTxProdflyer/4-06/internal/4-06

Polywater® FTTx Communications Lubricant

American Polywater® Corporation

TECHNICAL SPECIFICATION

Description:

Polywater® FTTx Lubricant is a high performance, liquid cable pulling lubricant designed specifically for communication cable installations. Lubricant FTTx is highly concentrated and works with only a thin coating. It can be sprayed or wiped for easy application. It has excellent cling and wetting, evenly coating the entire cable jacket surface. Lubricant FTTx works even after it has dried. The residue is a thin, slippery film that retains lubricity for months after use.

Polywater® FTTx Lubricant is recommended for quick and easy lubrication with no mess. The lubricant is suitable for all types of communication cable installations.

Friction Testing:

Friction is determined using a standard Telcordia test procedure[1]. The duct is wrapped 420° around a three-foot-diameter cylinder. A variable incoming weight is attached to the cable as it is pulled at a set rate of 65 feet per minute. A load cell takes pulling tension data which is used to determine a "dynamic" friction coefficient.

Coefficient of Friction for MDPE-Jacketed Cable on HDPE Continuous Innerduct

Back Tension	Wipe Application	Spray Application
8 lb_f	.09	.09
25 lb_f	.08	.07

[1] Telcordia Standard TR-NWT-002811, Section 4.1.3 and 4.1.4; Generic Requirements for Cable Placing Lubricants.

Product Benefits:

- Easy spray or wipe application
- Lubricates with a thin film
- Excellent friction reduction
- Performs after drying
- Compatible with cable jackets
- Clean and non-staining

End Use:

Use for all types of cable installations, including:

- Fiber optic drops (FTTx)
- High performance data cable
- Textile innerduct

Performance Properties

Wetting – Continuous Coat:
Wetting is a measure of the lubricant's ability to coat the jacket as a thin film for continued lubricity on longer pulls.

Polywater® FTTx Lubricant will wet out evenly on all surfaces. It will not bead up or rub off of the cable jacket. Lubricant will completely coat a one-inch diameter PVC-jacketed cable dipped six inches into the lubricant; then withdrawn within 10 seconds. The lubricant coating shall cover 100% of the cable jacket without dripping off or pulling away from the edges as it is held horizontally for one minute (at 70°F).

Combustibility:
Lubricant has no flash point and dried residue is non-flammable.

Sprayability:
Low viscosity lubricant allows product to flow through spray head. Lubricant will not clog valves or atomizers.

Physical Properties:

Property	Result
Appearance:	Slightly thickened, white liquid
Percent Non-Volatile Solids:	3 %
VOC Content:	0 gms/liter
Viscosity:	250 – 750 cps @10rpm
pH:	6.5 – 8.0

Application Properties:

Temperature Use Range:
20°F to 120°F (-5°C to 50°C).

Temperature Stability:
No phase-out after five freeze/thaw cycles or 5-day exposure at 120°F (50°C). *Will not phase out or separate during the shelf life of lubricant.*

Clean-Up:
Non-staining. Complete clean-up with water.

Storage and Shelf Life:
Store tightly sealed, away from direct sunlight. Lubricant shelf life is one year past the date of manufacture.

Cable Compatibility:

Polyethylene Stress Cracking:
Polywater® FTTx does not cause environmental stress cracking of polyethylene jackets commonly found on communications cables. Untreated polyethylene (Union Carbide DYNK) and MDPE jacket material were both tested according to ASTM standard method.[1] After 168 hours exposure none of the test specimens showed failures.

Polycarbonate Stress Cracking:
Polywater® FTTx will not stress crack polycarbonate. Polycarbonate bars are bent to a defined strain and exposed to lubricant as described in the Telcordia standard[2], Section 8.2, Stress Cracking of Polycarbonate. After 48 hours, none of the test specimens showed signs of crazing or cracking.

Corrosion of Copper and Steel:
Polywater® FTTx will not corrode copper after 24-hour exposure as described in the Telcodia standard[2], Section 8.3, Copper Mirror Test.

[1] ASTM Test Method D1693, Environmental Stress-Cracking of Ethylene Plastics.

[2] Telcordia Standard TR-NWT-002811; Generic Requirements for Cable Placing Lubricants.

Directions for Use:

Polywater® FTTx Lubricant can be sprayed or wiped directly onto the cable as it enters the conduit.

For normal cable pulls, prelube the conduit by spraying five to ten squirts of pulling lubricant into the conduit before pulling. Saturate a wipe by spraying with lubricant and lightly wipe lubricant on jacket to fully coat the cable as it enters the conduit.

For more difficult cable pulls, completely prelubricate the conduit. Squirt appropriate amount of lubricant into the conduit and pull through a sponge or lubricant spreader to coat the interior of the entire length. Wipe lubricant on cables as they enter the conduit as described in above.

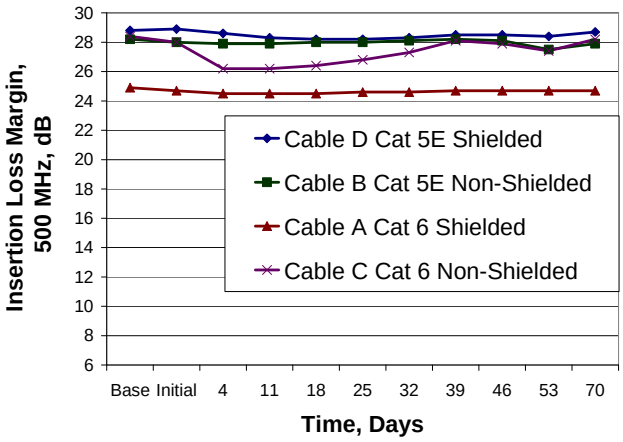
High efficiency spray pulling lubricants are effective with very thin coats in the range of 1 to 5 mg/cm^2 of jacket surface. See product usage section for lubricant quantity formulas.

Product Usage and Application Systems:

Polywater® FTTx Lubricant is innovative. It is intended for flexibility and ease in use. It is a very thin liquid that can be sprayed or wiped directly onto the cable jacket. Polywater® FTTx can be used to facilitate cable pushing shorter installations. It can be poured or sprayed into conduit for longer, outside plant installations.

High Performance Data Cables:
Polywater® FTTx is recommended for high performance data cables. It has a minimal effect on the data carrying capacity of high speed, Cat. 5E, 6 and 6A copper cable. As a "thin-film" lubricant, FTTx has a limited effect on cable signal attenuation.

Data Cables in 100 ft., Closed Conduit



Polywater® FTTx shows dramatic friction reduction in data cable installations. Data cable pulled through EMT conduit with two 90° bends and a back tension of 14 lbs.

Coefficient of Friction
Data Cable in EMT Conduit

Unlubricated	.33
Polywater® FTTx	.10

For more information and full test results, please see *TIA Paper TR42.7, PN SP-3-0177, "The Effect of Lubricants on High Frequency Data Cables."*

The lubricant may be sprayed on a towel or an FTTx-D20 wipe can be used to efficiently apply the lubricant to the cable jacket. The pre-saturated wipe lays down a thin, even coat of lubricant. The towel material is specifically formulated to release lubricant without mess.

Wipe Application

Quantity Formula for High Performance Data Cables

Q = 4 X n X D

Where:
Q = Quantity lubricant, fluid ounces per 100 ft
n = Number of cables in conduit
D = Average cable diameter in inches

Approximate quantity will vary by complexity of pull and field conditions.

Cable Pushing and Fiber Drops:
Polywater® FTTx Lubricant eases short installations of fiber where the fiber is pushed up to 300 feet. It effectively lowers friction so that the cable can be pushed farther distances, eliminating the need to blow or rod in pulling tapes.

The FTTx-35LR comes with an easy application trigger sprayer. The trigger head is industrial-quality, high volume. Use this package to apply FTTx Lubricant directly to the cable or to inject into conduit.

Spraying Action

Note: A high-volume trigger sprayer injects one fluid ounce per 20 sprays.

Product Usage and Application Systems:

Textile Innerduct:
Proven to reduce friction on these specialty fabrics, Polywater® FTTx Lubricant is perfect for use with textile innerducts. FTTx is directly applied to cable, dramatically lowering friction.

Friction is determined using a modification of Telcordia test procedure[1]. In this test, a fabric inner duct is placed inside a continuous HDPE conduit. The MDPE-jacketed cable is lubricated with Polywater® FTTx and pulled through a fabric cell.

Coefficient of Friction in MaxCell™ Fabric Innerduct

Back Tension	Polywater® FTTx Wipe
25 lb_f	.08

[1] Telcordia Standard TR-NWT-002811, Section 4.1.3 and 4.1.4; Generic Requirements for Cable Placing Lubricants.

MaxCell is a trademark of The MaxCell Group, Wadsworth, OH

Polywater® FTTx doesn't leak or squeeze into neighboring cells, causing them to seal shut. Use of a "thin-film" lubricant such as FTTx is ideal for this end use.

Prelubricated Duct:
Polywater® FTTx Lubricant is compatible with prelubricated duct.

Traditional Outside Plant Cable Installation:
For traditional cable installations, Polywater® FTTx Lubricant can be pumped, poured or sprayed into the innerduct.

Quantity Formula for Fiber Cable Installation

Q = K X L X D

Where: Q = Quantity of lubricant gallons (liters)
L = length of conduit in feet (meters)
D = Cable diameter in inches (mm)
K = .00038 (.0002 if metric)

Appropriate quantity for use on any given pull can vary from this recommendation by 50%, depending on complexity. Adjust the volume of pulling lubricant based on cable stiffness, conduit type and condition, conduit fill, and pulling environment.

Model Specification:

The statement below may be inserted into a specific job specification to help maintain engineering standards and ensure project integrity.

The cable pulling lubricant shall be Polywater® Lubricant FTTx. Lubricant has a low viscosity that may be sprayed without clogging valves or applicators. It shall coat and cling to the cable. It shall be non-staining. Lubricant shall produce a low coefficient of friction on communication cable jacket materials and shall lubricate at low coating thickness. Lubricant shall continue to reduce friction after it has dried. It shall conform to the physical and performance requirements of Telcordia Standard, TR-NWT-002811, Generic Requirements for Cable Placing Lubricants. It shall have a limited effect on data cable signal attenuation. It shall not contain solvents and shall not have a flash point.

No substitutions are permitted without certification from an officer of the manufacturer that the substitute product meets all of the requirements of this specification

Order Information:

Cat #	Package Description
FTTx-D20	20-ct wipe canister 12/case
FTTx-35LR	1-quart spray bottle (.95 Liter) 12/case
FTTx-128	1-gallon pail (3.78 Liter) 4/case
FTTx-640	5-gallon pail (18.9 Liter)

American Polywater® Corporation
P.O. Box 53
Stillwater, MN 55082
U.S.A
1-800-328-9384
1-651-430-2270
fax 1-651-430-3634
http://www.polywater.com(URL) custserv@polywater.com(e-mail)

CableFree®

Loosener

A Revolutionary Cable Removal Aid

- ***LOOSENS*** stuck cables by softening binding agents such as wax, rust, soap, dirt, bitumen.
- ***LUBRICATES*** to minimize the force required to pull the cable out once it has broken free.
- ***LEAVES*** empty conduit undamaged and ready for re-use after cleaning and drying.
- ***LOWERS*** duct reclamation costs by eliminating expensive cut-ins.

CableFree® Loosener is designed to loosen and remove cables that are held in conduits by wax, rust, dirt, soap, or other adhesive residues. CableFree® Loosener will dissolve a great variety of binding agents. However, because of the large variety of causes of "stuck" cable, 100% success cannot be guaranteed.

The money saved by a successful removal of stuck cable(s) can be very high. Even a partial success rate can make the investment of time and effort worthwhile. The end-user must make this determination, however, based on the potential economic alternatives to any particular cable removal.

Limitations: The use of CableFree® Loosener is not intended to allow re-use of the cable being removed. The cable(s) being removed may be ruined by the solvent nature of the product and the high pulling forces required for removal.

Also, the removal of a single cable from a group of cables is usually not possible. All the cables in a conduit should be removed in bulk, and new cables installed.

Ordering Information

Quantity: As a rule of thumb, one quart of CableFree® Loosener should be used for every 50 feet of 1" conduit (1 liter per 15 m of 2.5 cm conduit). For larger conduits, the following equation provides a starting estimate of the amount of Loosener for a particular cable removal.

$$Q = .02 \times L \times D$$

Metric Formula: $Q = .024 \times L \times D$

Q = quantity required in quarts (liters for metric)
L = length of the conduit in feet (meters for metric)
D = diameter of the conduit in inches (centimeters for metric)

Standard Package	Product Number	Product Description
Pail	CF-640	5-gallon (18.9 liter) Pail of CableFree® Loosener
4 Cans/Case	CF-128	1-gallon (3.78 liter) Can of CableFree® Loosener
12 Bottles/Case	CF-35	1-quart (.95 liter) Bottle of CableFree® Loosener

Use Procedure

Preparation

A. All circuits should be de-energized for safe operation. **Do not work with liquid chemicals around live circuits.** Critical switch gear, etc., should be covered and protected from spillage and drippage.

B. NOTE: Caution should be exercised when working with these liquid materials. Wear protective goggles and gloves at all times. Consult the material safety data sheets for more complete details.

Application

C. Fish a tape through the conduit system, if possible. Attach a sponge or a rag to the tape, sized to fit snugly in the conduit. If the conduit cannot be fished, see step E.

D. Pour, pump, or squirt the appropriate quantity of CableFree® Loosener into the higher end of the conduit system. Spread the cleaner throughout the conduit by pulling the sponge or rag back and forth with the tape(s).

E. Another practical way to spread the Loosener is to use air pressure to "blow" it through the system. If only small amounts of CableFree® Loosener can be loaded at one time, alternate air blasts with doses of Loosener. For long segments, the Loosener can be blown in from both ends of the conduit.

F. The objective is to get the CableFree® Loosener to all points of the conduit so it can dissolve the binding materials. This may take several swab pull-throughs or air blasts, as well as some persistence.

G. If there are pull-through boxes with access, treat each segment separately, performing the procedure for each segment.

H. Place the cable puller, if required, at the optimal pulling location. For easier removal, the cable should be pulled out at the lower end of a vertical conduit system. It is also best to have any bends in the system as far away from the puller as possible. Attach a hydraulically crimped pulling eye or other strong fastening method to the cable conductors. Pull on the conductors (metal) to take advantage of their strength.

Removal

I. Once the CableFree® Loosener has been spread through the conduit, allow it to sit in the system as long as possible (for at least 2 but preferably 24 hours). The older the system, the longer the time required. For long waiting times or hot conduit systems, the conduit ends should be plugged with a rag to trap vapors inside. After waiting, attempt to free the cables by pulling on them. Twisting the cables in one direction can help break them free. Also, pulling on individual cables and breaking them free one at a time sometimes works.

J. If the cables fail to move, attach a hydraulic jack or try pulling from the opposite end. Raise and maintain high tension on the cables. Try pulling again after a 20-to-30 minute waiting period under tension. Increase tension and repeat steps, if necessary. Introduce "vibration" by hitting the tight cables with a pipe or bat. Such vibration can help break the cables free.

K. If the cable is still stuck, cut the conduit somewhere where it's accessible and try pulling the cables out from the middle. Repeat the loosening process with additional CableFree® Loosener, if necessary. Keep trying the procedures above until you break the cable free.

Cleanup

L. Once the cable is removed, pull a water-soaked rag through the conduit, then pull a drying swab back and forth until the conduit is dry. Blow air through the conduit until no CableFree® Loosener odor remains.

View the CableFree® Loosener flyer online at
http://www.polywater.com/cablfree.html

American Polywater Corporation

P.O. Box 53
Stillwater, MN 55082
U.S.A

custserv@polywater.com(e-mail)
http://www.polywater.com(URL)

1-800-328-9384
1-651-430-2270
fax 1-651-430-3634

LIT-CFFLYER/1-03/QUAN(1/03)

American Polywater® Corporation

REQUEST for QUOTE FORM
on
Polywater® Products

Complete the request for quote form below. Someone will respond within 24 hours. Please provide enough information for us to develop a quote and be able to respond to you.

Name: _____

Title: _____

Company: _____

E-mail: _____

Address: _____

Phone: _____

Fax: _____

Catalog Number: _____

Product Description: _____

Package Size: _____

Quantity Required: _____

Date Required: _____

Number of Releases: _____

Shipping Method: _____

Preferred Distributor: _____

Project Name: _____

State or Country of Use: _____

Known Competitors: _____

Specification Details: _____

Other Comments: _____

☐ Please check this box if you wish to subscribe to our FREE quarterly newsletter on electrical subject matter-- ***Technical Talk***.

☐ Please check this box if you wish to subscribe to our FREE quarterly newsletter on communications subject matter-- ***TeleTopics***.

You may also print this page and fax to 1-651-430-3634, or call customer service at 1-800-328-9384 (1-651-430-2270 OUS) to submit your RFQ over the phone.