



# LLFA<sup>®</sup> Application Instructions / Manual

*“EXCELLENCE IN INNOVATION”*

## **FOR MORE INFORMATION**

GTG Engineering, Inc.; 4956-14 Old Long Beach Rd SE; PMB-144; Southport, NC; 28461

Phone/Fax: 877-569-8572

Email: [info@gtgengineering.com](mailto:info@gtgengineering.com)

Website: [LLFAtape.com](http://LLFAtape.com)

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## **LLFA® ELECTRICAL INSULATING INSTRUCTIONS**

# Introduction

GTG. Engineering Inc. has been in operation since October 2001.

GTG Engineering has developed LLFA<sup>®</sup> TAPE and, LLFA<sup>®</sup> SMOOTH (an insulating putty-like compound). Also, the new LLFA<sup>®</sup> GARDE™ solution provides advanced protection against abrasion. These three products can be used in cooperation as a long term repair solution for leak sealing as well as preventing moisture intrusion.

In addition, LLFA<sup>®</sup> Tape and LLFA Smooth are used as electrical splicing materials that provide electrical and mechanical protection of high, medium, and low voltage connections/terminations as well as cable jacket repair. LLFA<sup>®</sup> products provide this function even while exposed to severe environmental conditions and does so at a cost savings compared to other methods.

## Our Goals and Values:

- To provide the highest standard of quality and integrity of products, services, and communication to all of our clients and partners.
- To deliver on a culture of promise and trust. When we say we can, we do.
- To become the application and brand of choice in all appropriate markets.
- To be fiscally and operationally responsible as we strive for continued success and integrity through pro-active, creative, and innovative business ideas and practices.
- To be a responsible business and non-business community supporter.

# Uses for LLFA® TAPE

**LLFA® Tape Seals Leaks EVEN while under pressure or wet:**

Natural Gas  
Waterworks  
Steam

**LLFA® Tape can be applied on almost any surface\* material:**

Galvanized Pipes  
Copper  
PVC  
HDPE  
Cast Iron

\*Pipe requires sufficient integrity to withstand the compression of the tape.

**LLFA® Tape Insulates & Seals Electrical Connections/Terminations & Repairs  
Cable Jackets from Low Voltage up to 69KV**

**LLFA® Tape can be applied/used in severe environmental conditions:**

From -90°C to 260°C or -130°F to 500°F Submersible  
Suitable for Burial  
Abrasion & Tear Resistant  
UV & Ozone Resistant  
<<0.5% Water Absorption  
Self-Extinguishing

**LLFA® Tape is simple to apply and remove (and leaves NO residue)**

# How does LLFA<sup>®</sup> TAPE work?

## Compression

LLFA<sup>®</sup> Tape seals by compression. It must be pulled as tightly as possible when applying the “sealing layers” to achieve a proper leak seal. LLFA<sup>®</sup> amalgamates with itself, and its compression is maintained for many years. The quality of the seal does not depend on the pipe composition, nor does it rely on adhesive. LLFA<sup>®</sup> will fuse even in extreme cold, hot, or wet conditions.

For Insulating an Electrical Connection/Termination or Jacket Repair, only the initial layer is pulled tight. After the initial layer, LLFA<sup>®</sup> is wrapped with minimum stretch.

For a leak seal LLFA<sup>®</sup> is pulled to maximum stretch continuously until the leak is sealed and minimum distances are met. At least one final minimum stretch layer is required when using LLFA<sup>®</sup> as a leak seal, in order to provide abrasion resistance for the completed seal.

## Fusion

LLFA<sup>®</sup> Tape is an ultrafast self-fusing tape. Fusion begins immediately.

## Puncture Repair or Joint Leaks

The strength of LLFA<sup>®</sup> Tape makes it an invaluable puncture repair product. A punctured hose or pipe tightly wrapped with LLFA<sup>®</sup> Tape will immediately withstand internal pressure because the fusing action takes place so quickly.

## Cautions in using LLFA<sup>®</sup> Tape

**Dusty Environments:** Dust particles interfere with the fusion of LLFA<sup>®</sup> Tape . It is important to protect the work area as much as possible: use a plastic bag or sheet, or clean surfaces that are nearby. If necessary, use a wire brush to remove dirt or corrosion from the pipe surface, then clean with an alcohol wipe. It is imperative that the tape does not drag in soil or on the floor.

**Dirty/Oily Hands:** After preparing the surface and pipe area, clean hands using hand cleaner or alcohol wipes, as dirty/oily hands may prevent proper fusion. It is recommended to use isopropyl alcohol wipes (minimum 96% concentration); do not pour alcohol directly on LLFA products at any time.

**Soft Hoses:** Hoses that lack rigidity will collapse under the compression of the tape.

## Technical Specifications for LLFA<sup>®</sup> Tape

Temperature Range	-90°C through to 260°C or –130°F to 500°F
Tear Resistance	~ 125 lbf/in
Elongation	> 325%
UV Resistance	Highly UV resistant
Thermal Stability	-90°C through to 260°C Continuous or –130°F to 500°F
Tensile Strength	~ 1,200 PSI throughout temperature range
Breaking Strength	> 15 lbs
Durometer Hardness	55 – 65
Dielectric Strength	> 400Volts Per Mil
Volume Resistivity	~ 1 X 10E16 ohm.cm
Acids and Alkaline	No negative effect from brief exposure to acids and alkaline and can withstand submersion up to 3 days.
Self-Extinguishing	UL standard 94 rating V-O. Tested to IEEE383 and IEEE1202 for flammability, self-extinguishes and will not propagate a flame.
Water Adsorption	< 0.5%
Leachable Halides	< 200ppm

# Key Principles for Working With LLFA<sup>®</sup> Tape

## **HALF-LAP**

Always (except as noted below) wrap in a half-lap fashion (50% overlap), using the white line as a guide. The trailing edge of the tape should follow the white line of the previous layer. The exception to half lapping LLFA<sup>®</sup> is when sealing a high volume leak.

## **FUSION: “MAXIMUM STRETCH = MAXIMUM SEAL”**

Applying LLFA<sup>®</sup> Tape at maximum tension achieves the best fusion. When applying at minimum tension, ensure full contact with the previous layer by firmly massaging or applying pressure to the outer layer of LLFA<sup>®</sup> using your hand/fingers/thumb.

## **FORWARD ONLY**

DO NOT go backwards while wrapping. If you make a mistake, keep going forward and correct it. Because LLFA<sup>®</sup> fuses instantly, peeling some back will actually tear the wrap. This may cause the LLFA<sup>®</sup> to snap and possibly damage the wrap.

## **“CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE”**

Dust and dirt between the layers of LLFA<sup>®</sup> Tape will prevent fusion. Ensure pipe is clear of dirt, leak soap, and other debris by wiping with an isopropyl alcohol wipe (minimum 96% concentration). Wipe hands with a separate alcohol wipe before handling LLFA<sup>®</sup> Tape. Do not drag LLFA<sup>®</sup> Tape on the floor or in the dirt, and always store LLFA<sup>®</sup> Tape in the plastic bag/ hard case provided to keep it clean.

## **STOPPING AND STARTING - “TAG ON & CONTINUE”**

When starting a new piece of tape, “TAG ON”, fully covering the end of the last piece. “Tagging On” allows for the use of smaller pieces of tape. This prevents longer pieces from dragging on the ground or contacting dusty surfaces. 6”-8” pieces are recommended.

## **NUMBER OF LAYERS - “WRAP WIDTH = 2Xdiameter”**

For Leak Sealing applications, instead of counting number of layers applied, apply LLFA<sup>®</sup> Tape in the prescribed Half-Lap fashion, moving back and forth over the leak point, expanding the wrap by a half-lap at each pass. Continue in this manner until the width of the wrap is equal to twice the diameter of the pipe (to a minimum width of 2”).

For example:

When sealing a 1” pipe, extend wrap 1” beyond either side of the leak point = 2” width

When sealing a 4” pipe, extend wrap 4” beyond either side of the leak point = 8” width

When sealing a 3/4” pipe, extend wrap 1” beyond either side of the leak point = 2” width.

For Electrical applications, a minimum of 2 layers of LLFA tape are required for any Splice/Termination. Wrap a minimum of 1” onto the cable jacket or 1” on both sides of any damaged cable jacket. Layer recommendation based on voltage is as follows:  
480VAC – 3 layers; 5KV – 4 to 5 layers; 15KV to 25KV – 5 or 6 layers.

## **WHEN SPACE IS LIMITED, “COMPENSATE WITH LAYERS” (leak seal only)**

Where space does not permit the wrap to extend the required distance beyond the leak point (ie. Shut-off valve), compensate by adding more layers on the side of the wrap with limited space. This extra compression will help compensate for the wrap’s lack of width.

## **“PATCH & CHASE” HIGH PRESSURE (leak seal only)**

When dealing with a high pressure leak or a large hole (high volume), first make and apply a low tension patch of LLFA Tape over the leak site. Next, slowly chase the leak by starting at one end of the patch and moving across with maximum tension ¼ lap layers. In extreme cases, you may need to apply an additional 2-3 layers over the leak site before finishing the patch.

# STRETCH

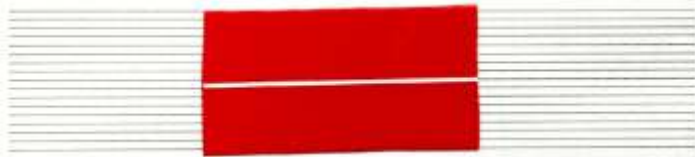
## Demonstration of Stretch Required

LLFA<sup>®</sup> Tape has very high tensile strength. It is very important to become familiar with how much “pull” is required.

The following diagrams demonstrate the amount of stretch required.

(Note: Each diagram shows the same piece of tape being stretched to different lengths.)

### Example of Tape at NO TENSION



### MINIMUM TENSION

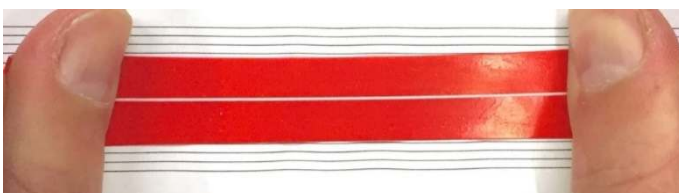
When applying with minimum tension, the abrasion resistance is significantly increased. This tension is like stretching the tape approximately 1/2", just enough to allow the tape to form to the surface below and dimensional changes of the fitting.

When used as a first layer at the beginning of a repair, LLFA<sup>®</sup> Tape acts as a relaxed O-Ring that is compressed into the surface by the following high tension layers. When used at the end of a repair, it provides abrasion protection. On the last layer, fusion must be aided by firmly pressing down on the tape.



### MAXIMUM TENSION - FULL STRETCH

**This is critical to create a seal.** When stretching you will notice that LLFA<sup>®</sup> has a stopping point, maximum tension is just a little beyond that. When stretched at maximum tension, you will notice the color of the LLFA<sup>®</sup> Tape change to a slightly lighter shade. Pulling harder than this may cause the tape to snap. Get familiar with working with LLFA<sup>®</sup> at this maximum tension





## LLFA<sup>®</sup> Tape FAQ

### **Q: How do I store LLFA<sup>®</sup> Tape?**

A: The only storage requirement is to keep LLFA<sup>®</sup> stored in its plastic bag or hard case, free from dust. Otherwise, LLFA<sup>®</sup> can be stored in extreme temperatures or humidity without concern.

### **Q: What is the shelf life of properly stored LLFA<sup>®</sup> Tape?**

A: Four years from the date of purchase. Batch codes can be used to determine age.

### **Q: Which side of the LLFA<sup>®</sup> Tape is up?**

A: The white line is a guideline for the half-lapping process and therefore it should be facing up, however it will fuse the same either way. LLFA<sup>®</sup> tape can be applied with the white line facing down on the last layer to help it blend in, if desired.

### **Q: Does the surface area of my pipe or electrical connection have to be cleaned before using LLFA<sup>®</sup> Tape?**

A: It is always best to remove as much dirt and particulate from the pipe using a wire brush or sanding cloth, and to wipe with alcohol wipes to remove the dust (DO NOT pour alcohol directly on LLFA<sup>®</sup> products). Water or rain on the pipe surface will not hinder fusion. Any electrical cable or termination or cable jacket should also be cleaned as a matter of good practice.

### **Q: How much LLFA<sup>®</sup> Tape is recommended to complete a repair properly?**

A: That depends on the size of the pipe or fitting that is being repaired or the voltage of the applicable cable (see instructions).

### **Q: How can I remove LLFA<sup>®</sup> Tape safely from my project?**

A: Removing LLFA<sup>®</sup> Tape is simple! Slice down the wrap with a razor or sharp knife, and the wrap will “pop” off. Be sure to not cut into the pipe or through cable jacketing. LLFA<sup>®</sup> Tape & LLFA<sup>®</sup> Smooth leave NO residue and comes off clean!

### **Q: Will LLFA<sup>®</sup> Tape ever come unraveled?**

A: Once the fusion is complete the tape becomes a solid mass of silicone rubber. If it does unravel it indicates that LLFA<sup>®</sup> was not clean upon application.

### **Q: How long does it take LLFA<sup>®</sup> Tape to fuse together?**

A: Fusion begins instantly, and continues to amalgamate into a solid mass of silicone rubber over a short time.

### **Q: Can you wrap LLFA<sup>®</sup> Tape on a live leak or in the rain? (leak seal only)**

A: YES!!! LLFA<sup>®</sup> Tape was designed to fuse in the harshest of environments. It can be applied to live leaks up to 150 psi, even when wet. Maximum tension is required.

GTG Flyers

# LLFA<sup>®</sup> TAPE

A Revolutionary product that will change the way industry insulates and seals electrical connections



- Easily applied, durable and resilient
- Long life in extreme environments
- Self-fusing layers form a compression sheath
- Suitable for high voltage insulation
- Used for sealing, harnessing, waterproofing and UV shielding



LLFA<sup>®</sup> TAPE is a self-fusing tape utilised to insulate and seal electrical cable splices where high and low temperature stability is needed, and where moisture, weather and radiation resistance is required.

Mechanically it provides a high tension wrap that creates an enduring seal under extreme environmental conditions. Due to its remarkable properties, it is also used to repair punctured water, air and hydraulic pipes that are subject to pressure and temperature variants.

## The High Performance Solution In The Market



LLFA<sup>®</sup> Compression TAPE exceeds NEMA Insulation "Class H" requirements and has a temperature range of -90°C to +260°C (500°F)

\*Based on the LLFA<sup>®</sup> 40 specification



LLFA TAPE



LLFA SMOOTH

[www.gtgenengineering.com](http://www.gtgenengineering.com)



Received "Top Products" Award  
by the "Professional Electrician"  
Magazine in Great Britain

• **Application**

LLFA<sup>®</sup>TAPE seals by compression. The tape is pulled as tightly as possible around the splice on the first layer, then with minimal tension on successive layers. The tape amalgamates with itself, and the tension is maintained indefinitely. The quality of the seal does not depend on the type of cable, nor does it rely on adhesive. In addition, LLFA<sup>®</sup>TAPE fuses even under cold, hot or moist conditions.

• **Fusion**

LLFA<sup>®</sup>TAPE is an ultrafast self-fusing tape. Similar products require a period of time in order to become a solid mass of rubber. With LLFA<sup>®</sup>TAPE this happens almost instantaneously. This is an important factor when splicing or protecting a connection that is subject to high humidity or even submergence.

• **Temperature Stability**

Unlike LLFA<sup>®</sup>TAPE, other products are less effective in extreme cold or humid conditions. With LLFA<sup>®</sup> the applying technician does not have to keep the tape warm in cold conditions or cool in hot conditions.

• **Water Absorption**

The specified water absorption for LLFA<sup>®</sup>TAPE is less than 0.5%. The Mil spec requirement for most other silicone based products is <3.0%. Based on the extremely low water absorption characteristic of LLFA<sup>®</sup>TAPE and its high tensile strength, water or moisture will not absorb through the tape or migrate between the cable jacket and the tape, thus maintaining an excellent water tight seal.

• **Submersion**

Rapid fusion allows a newly wrapped splice to be immediately submerged in water. You don't have to wait a few hours before declaring a circuit, pump motor, etc. operable. After you wrap it, you're ready to go.

• **Puncture Repair**

The strength of LLFA<sup>®</sup>TAPE makes it both a competent insulation solution and an invaluable puncture repair product. A punctured hose or pipe tightly wrapped with LLFA<sup>®</sup>TAPE will immediately withstand internal pressure because the fusing action takes place so quickly.

• **Ease Of Removal**

Unlike other jointing solutions, no adhesive is used to maintain the seal. With no sticky residue to clean, LLFA<sup>®</sup>TAPE can be removed quickly should re-entry to the joint be required. The use of adhesive in other jointing solutions results in sensitivity to humidity and temperature variations.

• **Abrasion Resistance**

Due to LLFA<sup>®</sup>TAPE's unique formulation and manufacturing process, it is resistant to abrasion and split propagation. It can be used as a stand alone product, requiring no protective jacketing tape.

• **Easy Release Liner**

LLFA<sup>®</sup>TAPE has an easy release liner. This means that you don't have to pick hard at the liner and try to remove it. It comes off quickly and has low static, unlike most other products. In addition, LLFA<sup>®</sup>TAPE's liner is black in color so that it's easy to see and clean up.



TELECOMMUNICATIONS

ELECTRICAL

SEALING AIR, STEAM AND WATER LEAKS

Temperature Range	-90°C through to 260°C
Dielectric Strength	400VPM LLFA <sup>®</sup> 40
Tear Resistance	> 125 lbf/in
Water Absorption	<< 0.5%
Elongation	> 325%
Track Resistance	Will prevent electrical conduction along its surface
UV Resistance	Highly UV resistant
Adhesion (Fusion)	Standard requirement: "Tape shall not unwind more than 1.0 inch after 3 minutes with an attached load of 600g." Result: LLFA <sup>®</sup> TAPE < 1 inch
Thermal Stability	-90°C to 260°C continuous
Tensile Strength	> 1200 PSI throughout temperature range
Breaking Strength	> 15 lbs
Durometer Hardness	55 - 65
Acids and Alkaline	No negative effect from brief exposure to acids and alkaline and can withstand submersion up to 3 days
Corona Resistance Partial Discharge	Corona resistant; wrapping tension minimizes voids in which corona exists
Ozone Resistance	Highly ozone resistant
Self-Extinguishing	UL standard 94 rating V-O. Tested to IEEE383 and IEEE1202 for flammability, self-extinguishes and will not propagate a flame
Standard Compliance	ASTM D2240, A-A-59163, ASTM D-149, MIL-I-46852, ASTM D2148, ASTM D3767 (LLFA <sup>®</sup> TAPE specifications meet other international standards not included in this list.)

# ALFA<sup>®</sup> TAPE

A Revolutionary product that will change the way industry seals natural gas leaks



## EMERGENCY NATURAL GAS SEALING SOLUTIONS

LLFA<sup>®</sup> TAPE is a self-fusing silicone based tape designed to seal leaks in harsh weather conditions and is currently used as a permanent repair for natural gas leaks. LLFA<sup>®</sup> Tape can also be used as a temporary repair by first responders.

Mechanically, LLFA<sup>®</sup> Tape provides a high tension compressive wrap that creates an enduring seal under extreme environmental conditions. Due to its remarkable properties LLFA<sup>®</sup> Tape is also used to repair punctured water, air and hydraulic pipes that are subject to pressure and temperature variants.



- ▶ LIVE LEAK SEALING <150PSI
- ▶ STRAIGHT FORWARD APPLICATION, MINIMAL PREP
- ▶ STABLE FROM -130°F TO 500°F
- ▶ HIGHLY UV & OZONE RESISTANT
- ▶ NO STORAGE REQUIREMENTS, 4 YEAR SHELF LIFE



**ALFA<sup>®</sup> TAPE**  
Emergency Natural Gas Sealing Solutions



UV & OZONE RESISTANT



<< 0.5% WATER ABSORPTION



-90°C TO +260°C



SELF-EXTINGUISHING



TENSILE STRENGTH > 1200 PSI\*



TEAR RESISTANCE > 125 lb/in



SUBMERSIBLE



SUITABLE FOR BURIAL



ABRASION RESISTANT

## APPLICATION

LLFA® Tape seals by fusion and compression. The tape is pulled as tightly as possible during application. The tape then fuses and amalgamates with itself, and compresses onto the pipe, sealing up to 150psi of live pressure.

## PREPARATION

"Clean Surface - Clean Hands - Clean Tape." Clean the pipe surface with a wire brush or grit paper, then wipe with an isopropyl alcohol wipe to remove all loose debris and traces of leak soap. Wipe hands with a separate alcohol wipe. Keep tape in its plastic bag or hard case. Good to go.

## TEMPERATURE RANGE

LLFA® Tape is proven stable from -130°F to 500°F. While the properties of some products are altered by extreme cold or heat & humidity, LLFA® Tape applies and performs as well in the dead of winter as it does in mid-summer heat.

## STORAGE REQUIREMENTS

The only storage requirement for LLFA® Tape is to keep it in its included plastic bag or hard case, to prevent exposure to dirt & dust, which interfere with fusion. There are no temperature or humidity control requirements. LLFA® Tape can be left in the bed of your truck in winter, or on the dash in summer. Shelf life is 4 years.

## FUSION

LLFA® Tape is an ultra-fast self-fusing tape, and utilizes no adhesives. Its performance is consistent regardless of pipe composition. Therefore it is safe to use on any range of pipe: Steel, HDPE, Cast Iron, ABS, Copper, Galvanized, etc. The pipe only needs the structural rigidity to withstand the compression of LLFA® Tape (ie. no garden hoses).

## WATER ABSORPTION

LLFA® Tape's water absorption rate is <<0.5%, meaning it creates a watertight seal and will not contribute to pipe corrosion. Because of its unique formula and ultra-fast fusion rate, LLFA® Tape can be applied in the rain or snow.

## CHEMICAL/UV RESISTANCE

LLFA® Tape maintains its properties when exposed to CH<sub>4</sub>, H<sub>2</sub>S and O<sub>2</sub>, and is highly UV resistant.

## ABRASION RESISTANCE

For abrasion resistance, apply two layers at minimum tension over the entire wrap. For buried applications, or where there is a concern of excessive interference or impact (ie. weedeater on a riser at ground level), use FiberArmour® for advanced abrasion protection.

## REMOVAL

Simply cut along the wrap using a knife or razor blade to remove LLFA® Tape. Because there is no adhesive it comes off clean. NOTE: Use caution when removing LLFA® Tape as it is under tension and releases from the pipe with great force.



### TENSILE STRENGTH

>1200 psi  
(ASTM D412, A-A-59163)

### TEAR RESISTANCE

> 125 lbf/in  
(ASTM D625, A-A-59163)

### BREAKING STRENGTH

> 15 lbs

### ELONGATION

> 325%

### ADHESION (FUSION)

Standard requirement: "Tape shall not unwind more than 1.0 inch after 3 minutes with an attached load of 600g."  
Result: LLFA® Tape < 1 inch.

### TEMPERATURE RANGE

-130°F through to 500°F.

### THERMAL STABILITY

-130°F to 500°F continuous.

### SELF-EXTINGUISHING

UL standard 94 rating V-0. Tested to IEEE383 and IEEE1212 for flammability –self extinguishes and will not propagate a flame.

### UV RESISTANCE

Highly UV resistant (ASTM D4352)

### WATER ABSORPTION

<< 0.5% (Fed Test Standard No. 601)

### ACIDS AND ALKALINE

No negative effect from brief exposure to acids and alkaline, and can withstand submersion up to 3 days.

### OZONE RESISTANCE

Highly ozone resistant. (ASTM D4325)

### DUROMETER HARDNESS

55 – 65

### STANDARD COMPLIANCE

ASTM D2240, A-A-59163, ASTM D-149, ASTM D-412, MIL-I-46852, ASTM D2148, ASTM D3767  
(LLFA® Tape specifications also meet other international standards not included in this list)



GTG Engineering, Inc.  
[www.LLFATAPE.com](http://www.LLFATAPE.com)  
1.877.569.8572

# ALFA<sup>®</sup> TAPE

*The Professional Solution*

For crisis and long-term applications

- Stops nasty leaks under pressure without having to turn off the water source.
- Will seal leaks to 150 PSI (water, air, steam).
- Self-fusing layers form a waterproof long-term compression seal.
- Good to 500°F / 260°C.
- Suitable for burial with no jacketing.
- Environmentally safe and non-toxic.
- Helps prevent corrosion.
- Safe for drinking water.
- Great on galvanized, copper, PVC, cast iron, etc.



[WWW.LLFATAPE.COM](http://WWW.LLFATAPE.COM)



Seals

Gas  
Liquid  
Steam  
Electricity

LLFA<sup>®</sup>SMOOTH is a revolutionary putty that stays flexible and works with the tape. An ideal option for filling rough and uneven surfaces before using LLFA<sup>®</sup>TAPE. 2" LLFA<sup>®</sup>TAPE for larger diameter repairs.



**NO** Mess

**NO** Gloves

**NO** Chemicals

**NO** Waiting

# LLFA<sup>®</sup> TAPE

## Technical Notes

### • Application

LLFA<sup>®</sup> TAPE (said, "alpha") can be applied on almost any material, from galvanized and cast iron to copper and all types of plastics or rubber. It contains no adhesive, so pulling the tape as tight as possible on all layers allows it to seal by compression (the harder you pull the greater the compression). Fusing into a mass of silicone, LLFA<sup>®</sup> forms a heavy duty bond on the leak or connection that can be used as an emergency or long-term repair.

### • Abrasion Resistance

When applied properly, LLFA<sup>®</sup> TAPE can be used as a stand alone solution. For really rough situations, use an extra layer or two of LLFA<sup>®</sup> TAPE at low tension to create an abrasive resistant layer on the outside of the area it is sealing.

### • Strength

Like an Olympic gymnast, LLFA<sup>®</sup> TAPE is strong (tensile), and flexible. These two characteristics are valuable for creating a long-term solution which helps ensure additional repair is not required. Even after a 20 year aging test LLFA<sup>®</sup> TAPE remains strong.

### • Temperature Stability

Unlike LLFA<sup>®</sup> TAPE, other products are less effective in extreme cold or humid conditions. LLFA<sup>®</sup> TAPE can be stored on the dashboard of your truck on the hottest day, or in your toolbox on the coldest day.

### • Drinking water

LLFA<sup>®</sup> TAPE meets the stringent standard requirements of the United Kingdom's BS6920:2000 test as monitored by the Water Regulations Authority which looks for 13 contaminants as well as taste and color of the water. The test indicated that LLFA<sup>®</sup> TAPE was suitable for use with cold and hot drinking water to 85°C. Similar tests do not exist in the USA or Canada.









### • Fire Resistant

LLFA<sup>®</sup> TAPE easily passed testing equivalent to IEEE 1202 and FT4 also exceeding IEEE 383. LLFA<sup>®</sup> TAPE is self-extinguishing and will not propagate a flame. It has also been found to meet NFPA #130 requirements.

### • Electrical

Just two layers of LLFA<sup>®</sup> TAPE has a dielectric value of up to 32 KV, and is suitable for many electrical applications including: insulating motor leads, joints, terminations and cable jacket repairs.



	Temperature Range	-90°C to 260°C / -130°F to 500°F
	Tear Resistance	~ 125 lbf/in
	Elongation	> 325%
	UV Resistance	Highly UV resistant.
	Adhesion (Fusion)	Standard requirement: "Tape shall not unwind more than 1.0 inch after 3 minutes with an attached load of 600g." Result: LLFA <sup>®</sup> TAPE < 1 inch
	Thermal Stability	-90°C to 260°C / -130°F to 500°F continuous
	Tensile Strength	~ 1200 PSI
	Acids, Alkaline and Chlorine	No negative effect from brief exposure to acids, alkaline or chlorine and can withstand submersion up to 3 days.
	Self-Extinguishing	UL standard 94 rating V-O. Tested to IEEE383 and IEEE1202 for flammability, self-extinguishes and will not propagate a flame.
	Standard Compliance	ASTM D2240, A-A-59163, ASTM D-149, MIL-I-46852, ASTM D2148, ASTM D3767 (LLFA <sup>®</sup> TAPE specifications meet other international standards not included in this list.)



[WWW.LLFATAPE.COM](http://WWW.LLFATAPE.COM)

**GTG**  
ENGINEERING



# GTG LLFA<sup>®</sup> Leak Sealing Instructions

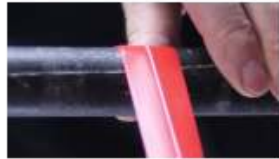
## SEALING PROCEDURE FOR AN INLINE LEAK

*These steps are used in most repairs, and are referenced throughout the Training Manual.*



### 1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE

Remove particles from the pipe surface using a wire brush or grit paper. Clean the pipe surface using an alcohol wipe (minimum 96% concentration). Use an additional alcohol wipe to clean hands. Keep LLFA<sup>®</sup> Tape in the plastic bag or hard case provided.



### 2. Starting with a 6-8" piece of LLFA<sup>®</sup> Tape, **APPLY ONE (1) LAYER AT MINIMUM TENSION DIRECTLY OVER LEAK POINT.**



### 3. **BEGINNING DIRECTLY OVER LEAK POINT, WRAP AT MAXIMUM TENSION**, moving back and forth, expanding the width of the wrap by 1/2 lap on each pass, using the white center line as a guide.



### 4. **CONTINUE WRAPPING AT MAXIMUM TENSION** until the tape covers the leak point, and the width of the wrap is equal to twice the diameter of the pipe (minimum 2" wide).



### 5. **TEST FOR LEAKS\*\*** by using leak soap or combustible gas detector to ensure a complete seal. Before proceeding to Step 6 you **MUST** completely clean the soap off with a clean towel and **WIPE** with alcohol solution (minimum 96% concentration) - **DO NOT** pour alcohol directly over wrap.

*\*\*If the seal is not verified after leak test, an additional two (2) maximum tension layers must be applied. Then repeat Step 5.*



### 6. **APPLY ONE OR MORE (1+) LAYERS AT MINIMUM TENSION** over the entire wrap, to provide abrasion protection.



### 7. **APPLY A MINIMUM OF FOUR (4) LAYERS OF LLFA GARDE, IN 1/2 LAP FASHION OVER THE ENTIRE SURFACE OF LLFA<sup>®</sup>**, if a Shield of protection against impact for buried or exposed pipe, is required.

**SEE FOLLOWING PAGES FOR FITTING SPECIFIC SEALING PROCEDURES**

*"EXCELLENCE IN INNOVATION"*

## SEALING PROCEDURE FOR MINIMAL OFFSETS (Small Fittings)



**1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE**  
(Remove Particles) (Use Alcohol Wipe) (Keep in Bag)



**2. SURFACE PREPARATION - USE SHARP KNIFE, WIRE BRUSH, OR GRIT PAPER TO CLEAN THE SURFACE AND REMOVE CORROSION & SHARP EDGES FROM PIPE.** This will smooth the pipe and provide a solid surface for the LLFA<sup>®</sup> to seal.



**3. BEFORE APPLYING LLFA<sup>®</sup> SOLUTION, ENSURE LEAK SOAP IS COMPLETELY CLEANED FROM THE PIPE SURFACE BY WIPING WITH ISOPROPYL ALCOHOL SOLUTION OR AN ALCOHOL WIPE** (minimum 96% concentration).



**4. APPLY ONE (1) LAYER AT MINIMUM TENSION OVER THE PIPE AT THE BASE OF THE FITTING.** The low tension tape acts as a relaxed O-ring, which will be compressed into the threads or corrosion by the high tension layers that follow.



**5. TRANSITION TO MAXIMUM TENSION, AND WRAP UP AGAINST THE FACE OF THE FITTING, ALLOWING THE TAPE TO FOLD ONTO ITSELF. CONTINUE UNTIL TAPE HAS BUILT UP TO THE HEIGHT OF THE FITTING.** This will create a "ramp", providing a level surface between the fitting and pipe over which sealing layers can be applied.



**6. If working with a round fitting, APPLY ONE (1) LAYER AT MINIMUM TENSION OVER THE FITTING.** If working with a nut, or if round fitting has extensive damage (ie. Pipe wrench gouges), **APPLY THREE (3) LAYERS AT MINIMUM TENSION OVER NUT/FITTING.** Setup Layers are complete.

**7. PROCEED TO STEP 3 OF "SEALING PROCEDURE FOR AN INLINE**

# ALFA TAPE

# ALFA SMOOTH

## SEALING PROCEDURE FOR LARGER OFFSETS

(COMPRESSION COUPLING)



**1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE**  
(Remove Particles) (Use Alcohol Wipe) (Keep in Bag)



**2. SURFACE PREPARATION - USE SHARP KNIFE, WIRE BRUSH OR GRIT PAPER TO CLEAN THE SURFACE AND REMOVE CORROSION & SHARP EDGES FROM PIPE.** This will smooth the pipe and provide a solid surface for the LLFA<sup>®</sup> to seal.



**3. BEFORE APPLYING LLFA<sup>®</sup> SOLUTION, ENSURE LEAK SOAP IS COMPLETELY CLEANED FROM THE PIPE SURFACE BY WIPING WITH ISOPROPYL ALCOHOL SOLUTION OR AN ALCOHOL WIPE** (minimum 96% concentration).



**4. ROLL A PIECE OF LLFA<sup>®</sup> SMOOTH INTO A SMALL ROPE** (approximately 1/4"), AND FIRMLY PRESS INTO PLACE AT THE BASE OF THE FITTING. When using LLFA<sup>®</sup> Smooth, always remember that "Less is More." LLFA<sup>®</sup> Smooth is a putty-like compound that will be compressed into the leak path by the high tension layers that follow. **APPLY ONE LAYER OF LLFA<sup>®</sup> TAPE AT MEDIUM TENSION OVER THE LLFA<sup>®</sup> SMOOTH**, fully encapsulating it.



**5. TRANSITION TO MAXIMUM TENSION, AND WRAP UP AGAINST THE FACE OF THE NUT, ALLOWING THE TAPE TO FOLD ONTO ITSELF. CONTINUE UNTIL TAPE HAS BUILT UP TO THE HEIGHT OF THE NUT.** This will create a "ramp", providing a level surface between the nut and pipe over which sealing layers can be applied.



**6. APPLY THREE (3) MINIMUM TENSION LAYERS OVER THE ENTIRE NUT.** This completes the *Setup Layers*.



**7. APPLY SEALING LAYERS STARTING DIRECTLY OVER THE LEAK POINT AT THE EDGE OF THE NUT.** Continue maximum tension 1/2 lap layers, expanding the width of the wrap by 1/2 lap on both sides at each pass. Extend to 2" beyond both sides of the leak point.



**8. TEST FOR LEAKS\*\*** by using leak soap or combustible gas detector to ensure a complete seal. Before proceeding to Step 9 you MUST completely clean the soap off with a clean towel and WIPE with alcohol solution (minimum 96% concentration) - **DO NOT** pour alcohol directly over the wrap. **\*\*If the seal is not verified after leak test, an additional two (2) maximum tension layers must be applied. Then repeat Step 8.**



**9. APPLY ONE OR MORE (1+) LAYERS AT MINIMUM TENSION** over the entire wrap, to provide abrasion protection.



**10. APPLY A MINIMUM OF FOUR (4) LAYERS OF LLFA GARDE, IN 1/2 LAP FASHION, OVER THE ENTIRE SURFACE OF LLFA<sup>®</sup>,** if a Shield of protection against impact for buried or exposed pipe, is required.



**JOB COMPLETE !!!**



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## SEALING PROCEDURE WHERE SPACE IS LIMITED ("Compensate With Layers")



**1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE**  
(Remove Particles) (Use Alcohol Wipe) (Keep in Bag)



**2. PERFORM FITTING-APPROPRIATE "SETUP LAYERS" PROCEDURE** (Large or Minimal Offset, Round Fitting or Nut).



**3. APPLY "SEALING LAYERS" STARTING DIRECTLY OVER THE LEAK POINT AT THE EDGE OF THE FITTING/NUT.** Continue maximum tension 1/2 lap layers, expanding the width of the wrap by 1/2 lap on both sides at each pass as far as possible. When space is exhausted on one side, **COMPENSATE FOR LACK OF WIDTH BY APPLYING ADDITIONAL LAYERS DIRECTLY OVER THE FITTING/NUT.** Example: if wrap was extended by 2 laps on one side, compensate by adding 2 layers over the fitting/nut on that return pass. If wrap is extended by 3 laps on the next pass, compensate by adding 3 layers over the fitting/nut for that return pass. **CONTINUE UNTIL WRAP HAS EXTENDED 2" BEYOND LEAK POINT ON SIDE OF WRAP WITH SPACE.**



**4. TEST FOR LEAKS\*\*** by using leak soap or combustible gas detector to ensure a complete seal. Before proceeding to Step 5 you **MUST** completely clean the soap off with a clean towel and **WIPE** with alcohol solution (minimum 96% concentration) - **DO NOT** pour alcohol directly over the wrap.  
*\*\*If the seal is not verified after leak test, an additional two (2) maximum tension layers must be applied. Then repeat Step 4.*



**5. APPLY ONE OR MORE (1+) LAYERS AT MINIMUM TENSION** over the entire wrap, to provide abrasion resistance.



**6. APPLY FOUR (4) OR MORE LAYERS OF LLFA GARDE, IN 1/2 LAP FASHION OVER THE ENTIRE SURFACE OF LLFA<sup>®</sup>,** if a Shield of protection against impact for buried and exposed pipe, is required.

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# ALFATAPE

# ALFA SMOOTH

## Sealing Procedure For Heavily Corroded/High Volume Leaks ("Patch & Chase")



**1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE**  
(Remove Particles) (Use Alcohol Wipe) (Keep in Bag)

**2. SURFACE PREPARATION - USE SHARP KNIFE, WIRE BRUSH, OR GRIT PAPER TO CLEAN THE SURFACE AND REMOVE CORROSION & SHARP EDGES FROM THE PIPE.** This will smooth the pipe and provide a solid surface for the LLFA<sup>®</sup> to seal.



**3. BEFORE APPLYING LLFA<sup>®</sup> SOLUTION, ENSURE LEAK SOAP IS COMPLETELY CLEANED FROM THE PIPE SURFACE BY WIPING WITH ISOPROPYL ALCOHOL SOLUTION OR AN ALCOHOL WIPE** (minimum 96% concentration).



**4. CUT THREE TO FOUR (3-4) PIECES OF TAPE TO A LENGTH THAT IS 4x THE DIAMETER OF THE PIPE. ON A CLEAN SURFACE, 1/2 LAP THE PIECES ONTO EACH OTHER TO CREATE A PATCH.** Add more pieces if patch is require to be wider to extend over a crack or larger area of corrosion. **APPLY PATCH AT MINIMUM TENSION OVER THE ENTIRE CORRODED SURFACE.** The patch acts as a relaxed O-ring which will be compressed into the pitting or threads by the high tension layers that follow.



**5. SLOWLY "CHASE" THE LEAK BY APPLYING LLFA<sup>®</sup> AT MAXIMUM TENSION, WRAPPING IN 1/4 LAP FASHION.** This will **slowly** reduce the size of the hole as you move across the leak point, in order to seal in one pass. Moving too quickly (1/2 lap), or not pulling hard enough can cause the patch to balloon. If this happens, remove the entire LLFA<sup>®</sup> wrap and start over. In extreme cases, additional layers may be required over the leak area before continuing down the remainder of the patch.



**6. APPLY SIX (6) LAYERS AT MAXIMUM TENSION IN 1/2 LAP FASHION, EXTENDING BEYOND THE CORRODED AREA BY AT LEAST 1".** For larger pipes, extend beyond the corrosion on each end by a distance that is equal to the diameter of the pipe (minimum 1").  
\*\*larger diameter pipes may also require additional layers.

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## Sealing Procedure For Heavily Corroded/High Volume Leaks ("Patch & Chase")



7. **TEST FOR LEAKS\*\*** by using leak soap or combustible gas detector to ensure a complete seal. Before proceeding to Step 8 you **MUST** completely clean the soap off with a clean towel, and **WIPE** with alcohol solution (minimum 96% concentration) - **DO NOT** pour alcohol directly over the wrap.

*\*\*If the seal is not verified after leak test, an additional two (2) maximum tension layers must be applied. Then repeat Step 7.*



8. **APPLY ONE OR MORE (1+) LAYERS AT MINIMUM TENSION** over the entire wrap, to provide abrasion protection.



9. **APPLY A MINIMUM OF FOUR (4) LAYERS OF LLFA GARDE IN 1/2 LAP FASHION OVER THE ENTIRE SURFACE OF LLFA<sup>®</sup>**, if a Shield of protection against impact for buried or exposed pipe, is required.



**JOB COMPLETE !!**

# LLFA TAPE

# LLFA SMOOTH

## Sealing Procedure for a Corroded Shut-off Valve



**1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE**

(Remove Particles) (Use Alcohol Wipe) (Keep in Bag)

**2. SURFACE PREPARATION - USE SHARP KNIFE, WIRE BRUSH, OR GRIT PAPER TO CLEAN THE SURFACE AND REMOVE CORROSION & SHARP EDGES FROM PIPE.** This will smooth the pipe and provide a solid surface for the LLFA<sup>®</sup> to seal.

**3. BEFORE APPLYING LLFA<sup>®</sup> SOLUTION, ENSURE LEAK SOAP IS COMPLETELY CLEANED FROM THE PIPE SURFACE BY WIPING WITH ISOPROPYL ALCOHOL SOLUTION OR AN ALCOHOL WIPE** (minimum 96% concentration).

**4. ROLL A PIECE OF LLFA<sup>®</sup> SMOOTH INTO A SMALL ROPE** (approximately 1/4"), AND FIRMLY PRESS INTO PLACE AT THE BASE OF THE FITTING. When using LLFA<sup>®</sup> Smooth, always remember that "Less is More." LLFA<sup>®</sup> Smooth is a putty-like compound that will be compressed into the leak path by the high tension layers that follow.

**APPLY ONE (1) LAYER OF LLFA<sup>®</sup> TAPE AT MEDIUM TENSION OVER THE LLFA<sup>®</sup> SMOOTH**, fully encapsulating it.

**5. TRANSITION TO MAXIMUM TENSION, AND WRAP UP AGAINST THE FACE OF THE NUT, ALLOWING THE TAPE TO FOLD ONTO ITSELF. CONTINUE UNTIL TAPE HAS BUILT UP TO THE HEIGHT OF THE NUT.** This will create a "ramp", providing a level surface between the nut and pipe over which sealing layers can be applied.

**6. APPLY THREE (3) MINIMUM TENSION LAYERS OVER THE ENTIRE NUT.** This completes the *Setup Layers*.

**7. APPLY SEALING LAYERS STARTING DIRECTLY OVER THE LEAK POINT AT THE EDGE OF THE NUT.** Continue maximum tension 1/2 lap layers, expanding the width of the wrap by 1/2 lap on both sides at each pass. Extend to 2" beyond both sides of the leak point.

**8. TEST FOR LEAKS\*\*** by using leak soap or combustible gas detector to ensure a complete seal. Before proceeding to Step 9 you MUST completely clean the soap off with a clean towel and WIPE with alcohol solution (minimum 96% concentration) - **DO NOT** pour alcohol directly over wrap.

**\*\*If the seal is not verified after leak test, an additional two (2) maximum tension layers must be applied. Then repeat Step 8.**

**9. APPLY ONE OR MORE (1+) LAYERS AT MINIMUM TENSION** over the entire wrap, to provide abrasion protection.

**10. APPLY A MINIMUM OF FOUR (4) LAYERS OF LLFA GARDE, IN 1/2 LAP FASHION OVER THE ENTIRE SURFACE OF LLFA<sup>®</sup>** as a Shield of Protection against impact for buried or exposed pipe, is required.

**JOB COMPLETE !!**

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## Sealing Procedure for a Corroded Posi-Lock



- 1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE**  
(Remove Particles) (Use Alcohol Wipe) (Keep in Bag)



- 2. SURFACE PREPARATION - USE SHARP KNIFE, WIRE BRUSH, OR GRIT PAPER TO CLEAN THE SURFACE AND REMOVE CORROSION & SHARP EDGES FROM PIPE.** This will smooth the pipe and provide a solid surface for the LLFA<sup>®</sup> to seal.



- 3. BEFORE APPLYING LLFA<sup>®</sup> SOLUTION, ENSURE LEAK SOAP IS COMPLETELY CLEANED FROM PIPE SURFACE BY WIPING WITH ISOPROPYL ALCOHOL SOLUTION OR AN ALCOHOL WIPE** (minimum 96% concentration).



- 4. WRAP LLFA<sup>®</sup> TAPE AT MINIMUM TENSION OVER THE ENTIRE PIPE SURFACE THAT IS CORRODED.** This allows the low tension tape to act as a relaxed O-ring, which will be compressed into the corrosion (or threads) by the high tension layers that follow.



- 5. APPLY SIX (6) LAYERS AT MAXIMUM TENSION, WRAPPING IN 1/2 LAP FASHION AND EXTENDING BEYOND THE CORRODED AREA BY AT LEAST 1".** For larger pipes, extend beyond the corrosion on each end by a distance that is equal to the diameter of the pipe (minimum 1 inch).



- 6. TEST FOR LEAKS\*\*** by using leak soap or combustible gas detector to ensure a complete seal. Before proceeding to Step 7 you **MUST** completely clean the soap off with a clean towel, and WIPE with alcohol solution (minimum 96% concentration) - **DO NOT** pour alcohol directly over the wrap.

*\*\*If the seal is not verified after leak test, an additional two (2) maximum tension layers must be applied. Then repeat Step 6.*



- 7. APPLY ONE OR MORE (1+) LAYERS AT MINIMUM TENSION** over the entire wrap, to provide abrasion protection.



- 8. APPLY A MINIMUM OF FOUR (4) LAYERS OF LLFA GARDE, IN 1/2 LAP FASHION OVER THE ENTIRE SURFACE OF LLFA<sup>®</sup>,** if a shield of protection against impact for buried and exposed pipe, is required.

**JOB COMPLETE!!!**

## Sealing Procedure for a Flange Fitting

**1. CLEAN SURFACE - CLEAN HANDS - CLEAN TAPE**

(Remove Particles) (Use Alcohol Wipe) (Keep in Bag)



**2. SURFACE PREPARATION - USE SHARP KNIFE, WIRE BRUSH OR GRIT PAPER TO CLEAN THE SURFACE AND REMOVE CORROSION & SHARP EDGES FROM PIPE.** This will smooth the pipe and provide a solid surface for the LLFA<sup>®</sup> to seal.

**3. BEFORE APPLYING LLFA<sup>®</sup> SOLUTION, ENSURE LEAK SOAP IS COMPLETELY CLEANED FROM THE PIPE SURFACE BY WIPING WITH ISOPROPYL ALCOHOL SOLUTION OR AN ALCOHOL WIPE** (minimum 96% concentration).



**4. ROLL A PIECE OF LLFA<sup>®</sup> SMOOTH INTO A SMALL ROPE (approximately 1/4"), AND FIRMLY PRESS INTO THREADS AT THE BASE OF THE FLANGE.** When using LLFA<sup>®</sup> Smooth, always remember that "Less is More." LLFA<sup>®</sup> Smooth is a putty-like compound that will be compressed into the leak path by the high tension layers that follow.



**5. APPLY ONE LAYER OF LLFA<sup>®</sup> TAPE AT MEDIUM TENSION OVER THE LLFA<sup>®</sup> SMOOTH,** fully encapsulating it.



**6. BEGINNING AT THE BASE OF THE FLANGE, APPLY MAXIMUM TENSION LAYERS IN 1/2 LAP FASHION, UTILIZING THE "COMPENSATE WITH LAYERS" SEALING PROCEDURE:** when expanding the wrap by two (2) laps away from the flange, apply two (2) layers directly at the base of the flange on the return pass. When expanding the wrap by three (3) laps away from the flange, apply three (3) layers directly at the base of the flange on the return pass, etc.

**\*IMPORTANT:** Working around the bolts on the flange can be difficult. **USE ONE HAND TO STRETCH THE TAPE. USE SECOND HAND TO PRESS DOWN THE END OF THE LLFA WRAP FURTHER UNDER THE BOLT, ALLOWING FIRST HAND TO MOVE THE STRETCHED TAPE AROUND THE NEXT BOLT WITHOUT MOVING AWAY FROM THE LEAK EDGE.** Work **PATIENTLY** to avoid Tape folding on itself, or being nicked against one of the bolts.

**7. When leak is presumed to be sealed, APPLY TWO (2) ADDITIONAL INSURANCE LAYERS AT MAXIMUM TENSION.**

**8. TEST FOR LEAKS\*\*** by using leak soap or combustible gas detector to ensure a complete seal. Before proceeding to Step 9 you **MUST** completely clean the soap off with a clean towel and **WIPE** with alcohol solution (minimum 96% concentration) - **DO NOT** pour alcohol directly over the wrap.

**\*\*If seal is not verified after leak test, an additional two (2) maximum tension layers must be applied. Then repeat Step 8.**



**9. APPLY ONE OR MORE (1+) LAYERS AT MINIMUM TENSION** over the entire wrap, to provide abrasion resistance.

**10. APPLY A MINIMUM OF FOUR (4) LAYERS OF LLFA GARDE IN 1/2 LAP FASHION OVER THE ENTIRE SURFACE OF LLFA<sup>®</sup>,** if a Shield of protection against impact for buried or exposed pipe, is required.

# GTG LLFA<sup>®</sup> Electrical Insulating Instructions

## Generic LLFA<sup>®</sup> Tape Application Procedure

1. Fill in and around all irregular surfaces using LLFA<sup>®</sup> SMOOTH compound in order to fill gaps, voids, severe dimensional changes (i.e. bolts, screws, nuts, terminal lug, butt splice, electrical connector, etc.) and to create a smooth evenly tapered surface, prior to application of LLFA<sup>®</sup> TAPE. Note: As an alternative, LLFA<sup>®</sup> TAPE can be used. When using tape for this purpose, simply stretch and push tape into cavity using finger or thumb pressure
2. Cut an appropriate length of tape from the roll and remove the black liner, taking care not to allow the tape to fold over onto itself.
3. Begin wrapping the first layer of tape onto the wire or connection by holding the lead end on the surface and stretching the tape around until it touches itself. The first layer of tape should be stretched continually so that the tape reduces to < 1/2 its original width. The tape should be applied until it extends a minimum of 1 inch past any bare, un-insulated conducting surface. Note: Tape should be wrapped in a half-lapped fashion.
4. Wrap a second layer of tape over the entire surface of the first layer. Second and succeeding layers of tape should be wrapped with minimal stretch. Continually use finger or thumb pressure when applying tape in order to prevent air voids and to prevent endlifting before fusion takes place. Note: when applying tape as joint insulation, the tape thickness should be two layers minimum or a thickness of 1.3 times the thickness of the original cable insulation, whichever is greater. As an alternative recommendation based on voltage is as follows: 480VAC – 3 layers; 5KVAC – 4 to 5 layers; 15KVAC to 25KVAC – 5 or 6 layers.

Note: the above procedure addresses direct application of LLFA<sup>®</sup> Tape and LLFA<sup>®</sup> Smooth on an unshielded cable joint/splice. If splicing a cable connection in which the cable contains semi-conducting layers and metallic shielding, then standard jointing practices should be utilized including, but not limited to: penciling of the cable insulation down to the cable connector, extending the semi-conducting layers across the joint with semi-conducting tape, extending the cable shield across the splice with shielding tape or a braided sock, stress cone buildup, etc. LLFA<sup>®</sup> Smooth should be used in any uneven surfaces or changes in dimension, LLFA<sup>®</sup> Tape should be used for cable insulation as well as cable jacketing (i.e. wrapped over cable shield and onto the outside cable jacket for a distance of greater than 1 inch). See following instructions of 1KV & 5KV shielded cable splices as an example.



WIRE SIZE (mm <sup>2</sup> )	1.5 to 6	10 to 16	25 to 35	50 to 95	120 to 150	185 to 300
<b>4 CORE A</b>	170mm	190mm	240mm	290mm	360mm	455mm
<b>3 CORE A</b>	140mm	155mm	195mm	235mm	290mm	365mm
<b>B</b>	25mm	30mm	40mm	40mm	45mm	50mm
<b>C</b>	25mm	25mm	25mm	25mm	25mm	25mm
<b>D</b>	30mm	35mm	45mm	55mm	70mm	90mm
<b>E</b>	½ connector length + 5%					

## JOINTING INSTRUCTIONS

Straight or branch joints for insulated cables up to 1kV with wire armour

[www.gtengineering.com](http://www.gtengineering.com)

Meets: BS EN 50393:2006

Type Test

**ASTA BEAB CERTIFIED**

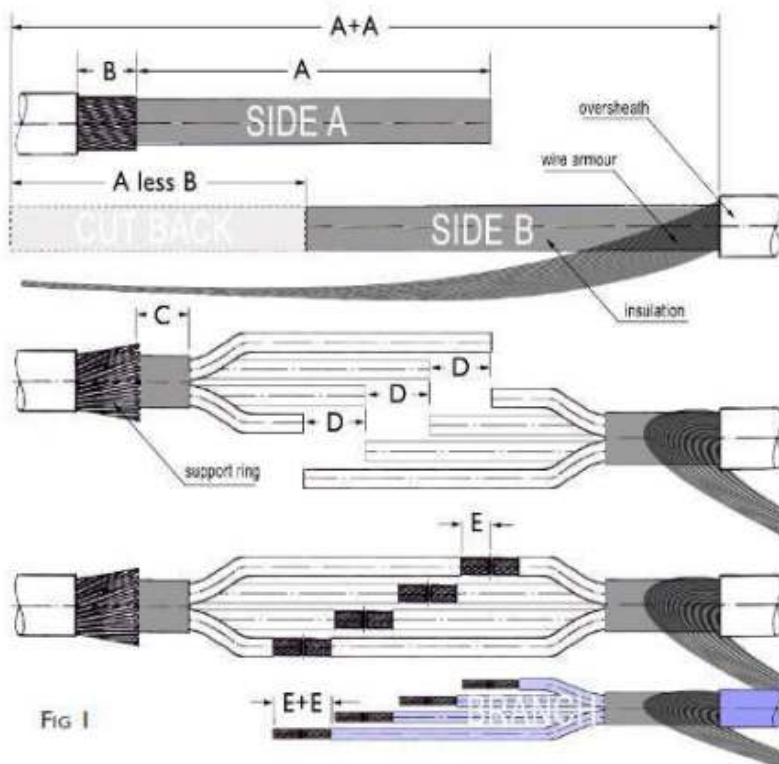


FIG 1

## PREPARATION

### 1. Remove the cable oversheath and wire-armor.

- **Side A (see diagram):** Cut back the oversheath by "B" using a hack saw. With this cut, score the underlying wire and remove by bending until it breaks away.
- **Side B (see diagram):** Remove the oversheath by "A+A". Separate the wire-armor from the inner cable, and bend away.
- **Branch (if required):** Same procedure as Side B.

### 2. Place under-armor-rings into position.

- Ensure that the rings are placed on the "B" side of the "B"/"C" line.
- If loose or if using constant force springs first wrap around the insulation with a piece of LLFA<sup>®</sup> Tape.
- Fill gaps between insulation and wire-armor with LLFA<sup>®</sup> Smooth or Tape.

## PREPARATION (continued)

### 3. Cut back insulation.

- **Side A:** Measure "C" away from the end of the wire-armor and remove the cable insulation. (Take care not to cut into the insulation around the conductors.)
- **Side B:** Cut back the cable by the sum of "A" minus "B". Remove the cable insulation by the sum of "B" plus "C".
- **Branch (if required):** Same procedure as Side B.

### 4. Strip back each conductor / wire.

- Remove insulation from each conductor according to the Fig. 1.

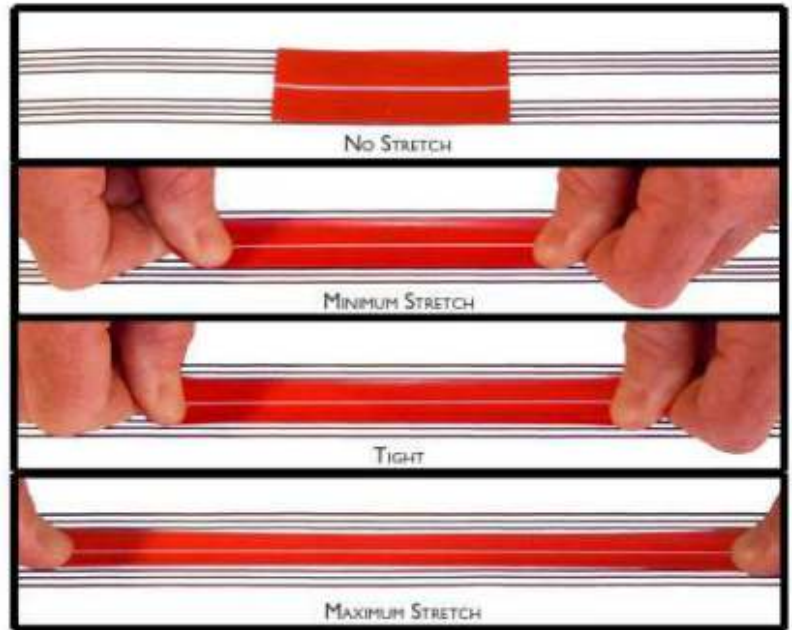
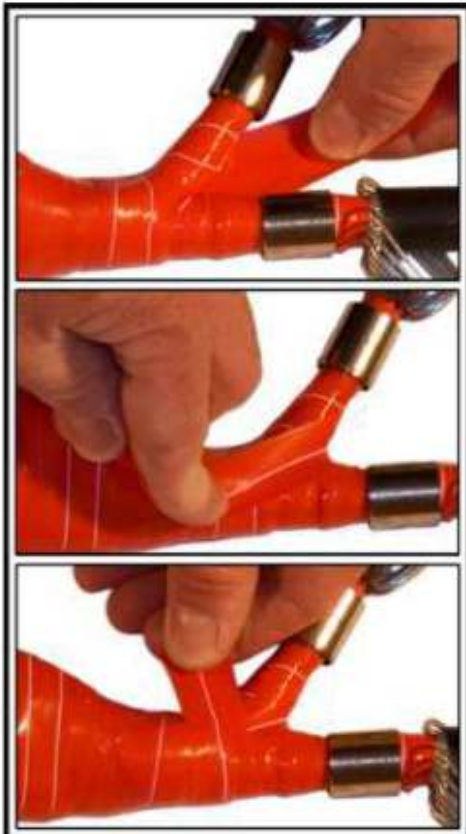
## LLFA<sup>®</sup> BASICS

### 1. Wrapping

- Always wrap in a half-lap fashion using the white line as a guide. (Trailing edge following the white line of the previous layer.)
- **Fusion:** Stretching the tape aides fusion. When applying the "minimum stretch" should be used to allow the tape to fuse evenly to previous layers.
- **Keep it clean:** The tape fuses with itself, any dirt between the fusing layers will reduce fusion.

### 2. How many layers?

- LLFA<sup>®</sup> Tape layers must be wrapped until the thickness of tape is 1.25 times the thickness of the cable insulation or two layers, whichever is greater.

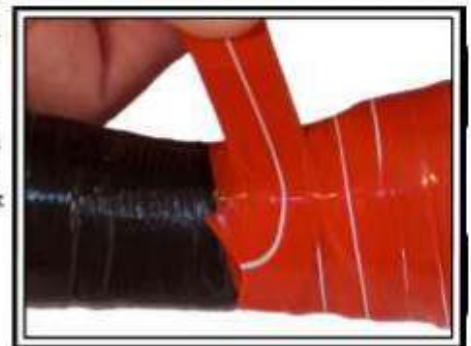


### 3. Branch Crotch Wrap

- Use short pieces of LLFA<sup>®</sup> Tape. Place the tape parallel to the splice, 50mm away from the crotch of the main and branch cable.
- Stretch the tape through the crotch and place down firmly on the other side. Repeat several times moving away from the centre of the crotch, up each side.
- Complete by wrapping in the normal direction, around the splice, to cover over these pieces of tape.

### 4. Stopping and Starting

- **Cover the start and end:** When starting a new piece of tape, fully cover the end of the last piece of tape and the start of the tape being wrapped before continuing with the wrap. (LLFA<sup>®</sup> is 1mm thick, if half the tape is covered, there remains a 1mm triangular hole - this creates a weak point.)
- **Place and turn:** When starting and stopping, reduce the length that needs to be covered by successive wraps by pulling the tape into a turn at the start and end of a wrap.



## STAGE 1: CONNECT AND INSULATE THE CONDUCTORS / WIRES

Connectors used must comply with EN 61238-1, or with another relevant standard or specification.

Connect and insulate one set of conductors at a time starting at one side (if the conductors have been staggered according to Fig. 1).

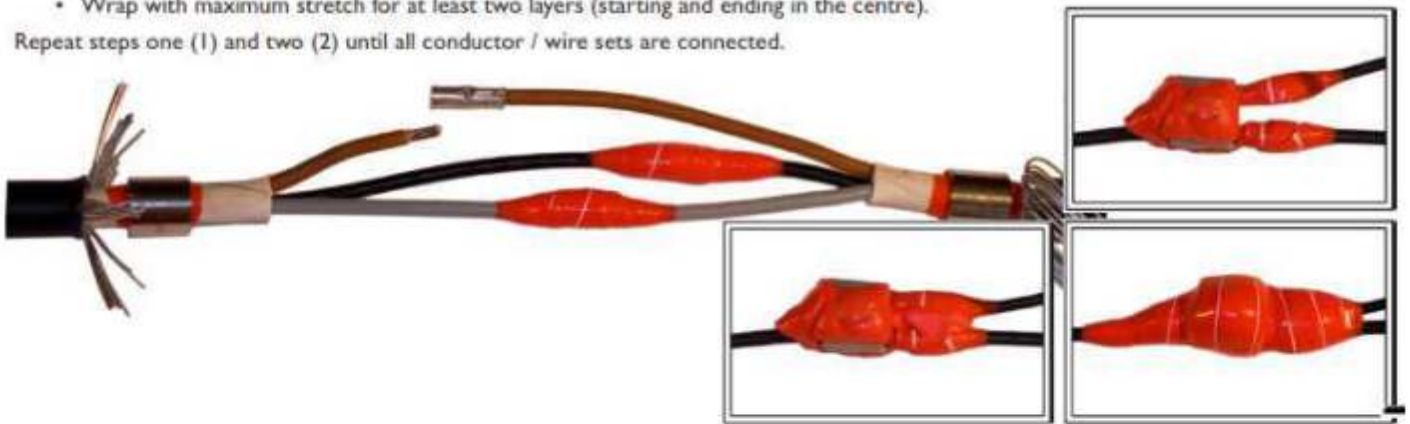
### 1. Connect conductors

- Use a crimp or suitable mechanical connector.
- Test the quality of the connection before proceeding.

### 2. Wrap with LLFA<sup>®</sup> Tape

- Fill gaps with LLFA<sup>®</sup> Smooth before wrapping.
- Branch Only: Wrap tightly over the insulation of the two "B" side conductors. Fill between the conductors with LLFA<sup>®</sup> Smooth. Then pull the conductors together with a tight wrap of LLFA<sup>®</sup> Tape.
- After removing the black liner hold LLFA<sup>®</sup> Tape on the crimped connector and wrap tightly around until the tape touches itself.
- Wrap 25mm (minimum) over the insulation / jacket of each of the conductors entering the connector.
- Wrap with maximum stretch for at least two layers (starting and ending in the centre).

Repeat steps one (1) and two (2) until all conductor / wire sets are connected.



## STAGE 2: BIND THE CONDUCTORS AND RESTORE THE INSULATION

### 1. Bind the conductors together

- After connecting all conductors / wires being spliced, bind them together tightly with LLFA<sup>®</sup> Tape.

### 2. Fill voids with LLFA<sup>®</sup> Smooth

- Use LLFA<sup>®</sup> Smooth as necessary to fill voids and create an even taper end to end.

### 3. Wrap LLFA<sup>®</sup> Tape from end to end

- Wrap from armour ring to armour ring being careful to apply as much tension as possible around the insulation on either end.
- Wrap "Tight".

### 4. Branch

- Complete a BRANCH CROTCH WRAP after completing Step 3.



## Stage 3: Join and Re-establish the Wire Armour

### 1. Bend wire armour into position

- Bend the wire armour from side "B" and the "BRANCH" down over the joint to side "A". Hold in position with a short piece of standard vinyl / PVC tape.
- If the wire armour extends beyond the far side of the under armour ring (Side A), cut to the correct length.
- Arrange the armour in a manner that will allow even coverage over the entire joint.

### 2. Wrap with wire mesh tape

- Wrap wire mesh tape in a half lap fashion from end to end.
- Wrap over with standard vinyl / PVC tape (mechanical barrier against stray wire ends).
- Branch: Bring the branch and main cable together and wrap together.

### 3. Position constant force springs

- Wrap constant force springs over the under-armour ring position on each end.
- Wrap over with standard vinyl / PVC tape (mechanical barrier against sharp edges).



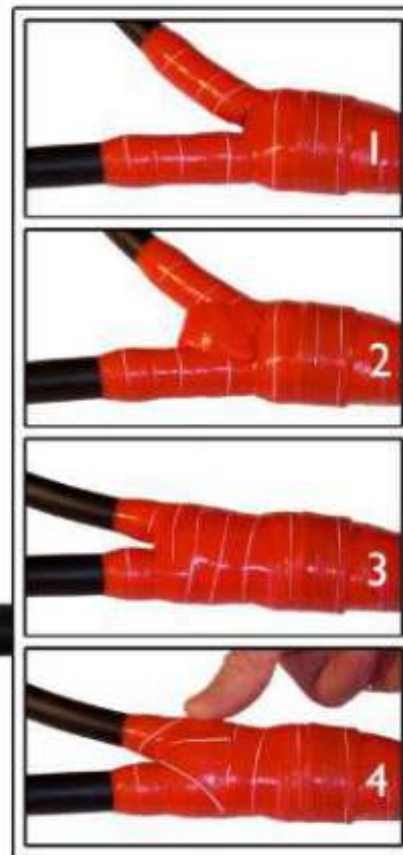
## Stage 4: Re-establish the Oversheath

### 1. Wrap with 2 layers of LLFA® Tape

- Start in the centre - end in the centre.
- Apply in a half lap fashion with maximum stretch on the first layer.
- Wrap over the cable jacket a minimum distance of 25mm.
- For abrasion resistance wrapping with minimum stretch on successive layers (however ensure that the tape is fusing evenly to the previous layers).
- Pay attention to the ends; make sure that two layers are fully applied before wrapping back towards the centre.

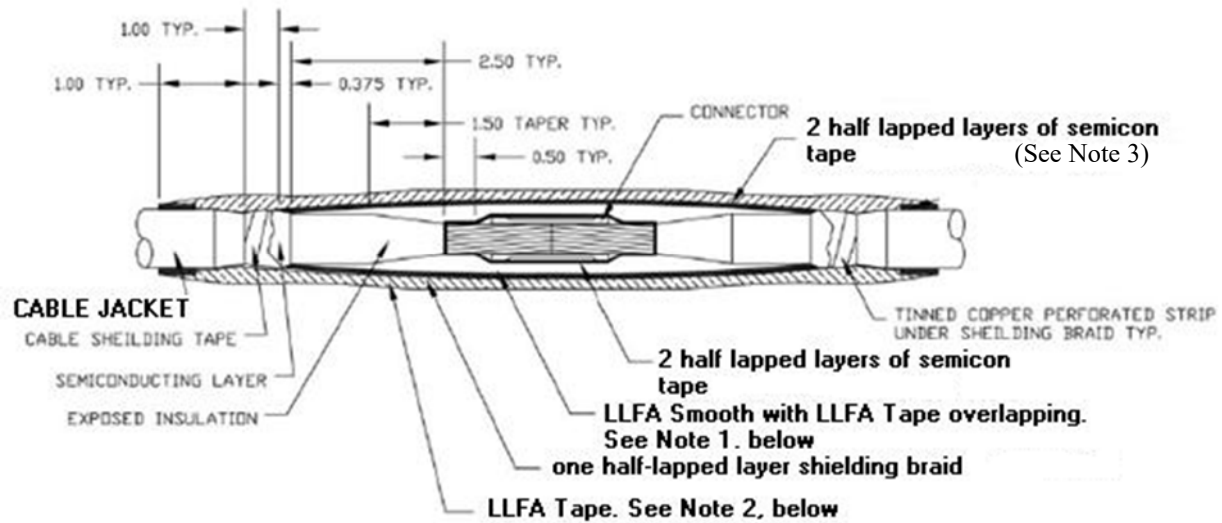
### 2. Branch: Wrapping the oversheath crotch

- On the branch side, wrap over the insulation of both the branch and main by 50mm as per Step 1.
- Fill LLFA® Smooth between the branch and main 25mm from the crotch area.
- Bind the branch and main tightly together over the smooth.
- Pull the branch cable away from the main and complete a BRANCH CROTCH WRAP.





## GTG LLFA® 5 to 6.9KV Shielded Cable Splice Instructions



### Notes:

- 1) Wrap minimum 3 layers of LLFA® Tape for the cable insulation, on top of the semi-conducting tape and up onto the cable insulation. The first layer of LLFA® Tape should be wrapped at maximum stretch. The second and succeeding layers should be wrapped with minimum tension to reduce the width of the tape to approximately 80% of its original width. Care must be taken to avoid buckling of the tape or stretching across cavities to create pockets of air. After each layer has been applied use fingers and thumbs to push down or compress the tape to minimize voids.
- 2) Prior to applying LLFA® Tape on the finishing or jacketing layers, it is recommended that 1 layer of standard PVC tape be applied on top of the shielding braid (basically to hold it in place and cover sharp edges). Then wrap a minimum of two layers of LLFA® Tape. The first layer of LLFA® should be applied at maximum stretch and should be wrapped a minimum distance of 1.5 inches onto the cable jacket. The second layer of LLFA® should be wrapped at minimum stretch. Minimum stretch is the lowest amount of tension that can be applied while still avoiding buckling of tape or the creation of air pockets or voids. If further mechanical protection is desired, a 3<sup>rd</sup> layer of LLFA® tape may be applied.
- 3) If the connector being utilized is a terminal lug, use LLFA® smooth to level out the cavity between the barrel of the lug and the bolt. Then apply the semi-conducting tape over the LLFA® Smooth. This is not necessary when using a butt splice style connector. The semi-conducting tape should be wrapped around the existing semi-conducting layer in the cable, continuing across the connector and ending with the semi-conducting layer of the cable on the opposite side.