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METHOD STATEMENT

POWERSLEEVE®
W-11 FABRIC with X-TEMP-2 RESIN

- Installation Guide
- SDS Sheets
- Data sheet

AN ISO 9001 : 2008 CERTIFIED SUPPLIER.

PowerSleeve® Installation Manual for Repairing Damaged Piping and Pipelines

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INTRODUCTION

PowerSleeve® is a high strength, field-applied composite system that is used for structural reinforcement of damaged piping. It is a wet layup, or field-pregged, fiber-reinforced polymer (FRP) system that consists of custom blended epoxy and unique fiber reinforcements tailored for piping repair. These products are suitable for pipes with leaks or which may develop leaks. A broad line of unique epoxy matrix systems and fabrics are available to handle a wide variety of high heat applications, harsh chemical environments, and underwater installations.

PowerSleeve® Fabrics -
Three fabric types are available. The most common system is our high strength W-11 substrate, which is an E-glass premium fiberglass roving, alloyed with Kevlar®, in a stitched, tri-axial, non-crimped, fabric This fabric is radically different than common fiberglass in a woven configuration .The standard W-11 tri-axial fabric is designed for application to straight piping systems. The custom woven G-03 tape fabric is a lighter weight bi-axial fabric designed for smaller pipe diameters and difficult geometries such as elbows. The G-22 Bear™ fabric is a highly conformable knitted fabric designed for very difficult geometries such as tees and couplings. All three fabric styles can be used with any of the following epoxy matrix systems. The C-2 and C-3 carbon is a biaxial, high strength, high modulus weave suitable for applications where strength and stiffness are important.

PowerSleeve® Standard Matrix –
The Standard Matrix is designed for general use. The system has good chemical resistance and structural properties and has a cure time of approximately 30-60 minutes at 77°F. This system has a Heat Distortion Temperature of 300°F for the W-11 fabric. Ships DOT Non-Hazardous. **If the standard resin is allowed to cool to 50^{O} F it may coagulate. If this occurs the resin should be heated to a temperature of 150 ^{O} for at least two hours and allowed to cool. This will not affect the performance of the resin.**

PowerSleeve® with 439 Matrix–
The 439 system is a medium temperature epoxy/novolac hybrid which cures at room temperature, yet has a much higher HDT than the Standard Matrix. The addition of novolac gives it better chemical resistance in cases where contact, whether external or internal, may occur. This system requires post cure in order to achieve the best chemical resistance properties. The HDT for the W-11 fabric is 425°F. Ships DOT Hazardous (corrosive).

PowerSleeve® with 70079 Matrix –
70079 Matrix is a premium two-component, epoxy/novolac hybrid system with excellent exposure resistance to most military and civilian fuels and a vast array of chemicals, including sulfuric acid. It is also resistant to moisture and humidity effects. It contains no solvents, is 100% solids, and contains zero VOC's. Ships DOT Non-Hazardous.

PowerSleeve® with X-TEMP-2 Matrix –
The X-TEMP-2 system is designed for use where high service temperatures and harsh chemicals will be encountered. This system requires a minimum of 150°F to initiate the cure. It can be installed on temperatures up to 220°F, but special precautions need to be observed. It cures in about 80 minutes at

150°F. The HDT of this system with W-11 fabric is 575° F. This system requires post cure in order to achieve the best chemical resistance properties. Ships DOT Hazardous (corrosive).

PowerSleeve® with X-100 UW Matrix –
The X-100 UW matrix is designed for applications on wet pipes or pipes under water. Ships DOT Non-Hazardous.

PowerSleeve® has gone through numerous field trials, in-house testing, and third party testing. These tests have demonstrated that it possesses those performance qualities required for the repair of corrosion damage, both internal and external. The material can be applied both circumferentially and helically along the pipe. Its low profile enables use in tight locations, within an inch of an obstruction in some cases.

All of our PowerSleeve® products are available in a packaged kit format. This packaging format has many advantages. It eliminates field measuring of the epoxy components, and the possibility of calculation errors. It also greatly reduces the possibility of having too much or too little fiber to resin content, which can adversely affect the properties of the final composite layup. Special components and tools are provided in the kit to encourage proper installation techniques. The kit concept minimizes waste, both for application and disposal. The correct amount of material is provided in every kit to cover a pre-determined area, which assures the requisite amount of material is installed.

PowerSleeve® can be used to repair the following types of damage:

- External Corrosion (ASME PCC-2 Type A Repair)
- Internal Corrosion (ASME PCC-2 Type B Repair)
- External Mechanical Damage (dents, gouges, fretting, wear, etc.)
- Cracks
- External Coating Damage
- Internal Corrosion/Erosion
- Manufacturing or Fabrication Defects
- Leaks (if completely stopped prior to composite application)

TRAINING

As with any product, proper training is essential to ensure a quality installation. This installation manual is meant to be used as a guide and reference tool to backup hands-on training. All personnel using PowerSleeve® must attend a training course presented by a certified trainer. The course outlines safe handling of the product, product selection, surface preparation, and multiple installation techniques. Many more topics are covered in the training course than is practical to include in this manual.

It is not recommended for untrained personnel to attempt installation of any of the PowerSleeve® products until they are fully and properly trained. Doing so can create an unsafe situation for the installer, as well as an inadequate repair.

HAZARDS ASSOCIATED WITH A PRESSURIZED SYSTEM

As with any repair on a pressurized system, certain precautions need to be observed when installing a composite system on a damaged pipeline or pipework. The level of damage should be considered and properly addressed. Has the structural integrity of the pipe been compromised? If the wall thickness has been degraded to a point where the pressure in the line presents an unsafe situation, the pressure may need to be reduced during the installation. This also applies to dents and other types of mechanical damage.

If the wall thickness is such that a leak may occur, but structural integrity of the system is still within safe limits, installation should be done with caution. It is good practice to apply a stiffener material, such as the high strength epoxy that is used as a load transfer compound. This will help keep the area intact and lessen the possibility of creating a through wall defect during the installation.

Proper surface preparation procedures should always be used, however, they need to be tailored to the type of defect being repaired. For instance, sandblasting would not be a wise choice of surface preparation if certain areas of the pipe are in danger of collapse. If a hole should occur on a pressurized system during the surface preparation, it could create a dangerous situation and may make the installation of a composite material impossible.

HEALTH, SAFETY, AND ENVIRONMENT

Always read and understand the MSDS and Product Data Sheet prior to attempting an installation.

Proper personnel protective equipment (PPE) should always be used. It must be appropriate for the conditions being encountered during the installation. Evaluating the risks of a possible line breach and release of the lines contents should also be considered. At minimum, latex gloves, long sleeves, and safety glasses must be worn.

Skin sensitivity to epoxy resins may occur in some people. Care should be taken to avoid contact with any of the composite components.

Cutting of glass fibers may release tiny particulates. If cutting large quantities of fiber while it is dry, wear minimum FP1 or preferably FP2 EEC approved dust masks. Type 3M 8710 or 3M 9900 respirators are approved according to American National Institute for Occupational Safety and Health (NIOSH). Masks should also be worn if cutting or sanding the material after it has been cured.

Dispose of all material according to local and federal regulations. PowerSleeve® kits are designed to generate minimal waste. All jars or cans containing epoxy should be thoroughly emptied during use, and only remnants will be left. Generally these small amounts are acceptable to dispose of in waste containers, but check with local authorities for confirmation. Always refer to the MSDS sheet for the material you are working with. Specific hazards relating to handling, disposal, and transportation will be listed.

TEMPERATURE GUIDELINES

If the standard resin is allowed to cool to 50^{O} F it may coagulate. If this occurs the resin should be heated to a temperature of 150 ^{O} and allowed to cool. This will not effect the performance of the resin.

Temperature is a very important factor when considering the use of composites for structural reinforcement. Epoxies are very temperature sensitive. Too much heat and they will cure too quickly. If it is too cold, they may not cure at all.

Cure Time

A rule to remember for epoxy systems is that for every 18° F temperature change, either up or down, the working time (pot life) will half or double. For example, if you are working with a system that has a 30 minute working time at 77° F, and you use it on an application in 95° F weather, the working time now decreases to approximately 15 minutes. Conversely, if you are installing the same system in 59° F weather, the working time extends to nearly 60 minutes. One should be conservative in estimating installation time when dealing with elevated temperatures. When the epoxy begins to gel, or become unworkable, it can happen very quickly, and you may not have time to properly finish your installation.

Pot Life

The volume of material you are mixing will affect the pot life. Mixing large quantities generates a higher exothermic reaction, and can decrease the pot life significantly. One should never mix more than what can be used within the pot life of the material. When using large quantities of epoxy, mix thoroughly and spread it out onto the working surface or fabric immediately. Do not let large amounts remain in a container. Dangerous temperatures can be generated by the curing action of the mixed components. Temperatures exceeding 300° F have been observed.

Physical Properties

Temperature not only has an affect on the cure time, but also the physical properties. When exposed to warm temperatures, epoxies will begin to lose their viscosity. Cold temperatures will greatly increase their viscosity. Typical centipoise values for our mixed epoxy systems at 77° F range between 2,500 and 10,500 for mixed components. The resin, or part A side, usually is more viscous than the hardener, or part B side.

Cold epoxies are difficult to work with and warming them properly to an appropriate mixing temperature may take hours. It is best to keep these products as close to ambient temperature as possible, both when in storage and when mixing. Do not mix when the temperature of the materials are below 55° F. Improper blending of the two components may occur due to the increased viscosity. When temperatures are low, difficulty in wetting out the fabric may be observed. The thickened epoxy will not wet out the fabric as easily and this could lead to performance reductions for the completed application. The surface to be prepared should also be at least 55° F. Lower temperatures could inhibit the cure of the epoxy, even though the air temperature is warmer.

Epoxies are an excellent heat sink. Warmed epoxy components may take hours to cool to an appropriate mixing temperature. Mixing components while they are warmed above 77° F can

significantly reduce the pot life and working time of the material. Air temperature can also decrease the working time. Never leave components in direct sunlight, or in an area where temperatures will exceed 90° F. When working in warm climates keep the materials in a portable cooler or air conditioned area to maintain a reasonable temperature. When applying epoxies to a warm surface, the material will thin and may become runny. In some cases, additives are combined with the resin to minimize this thinning effect. Be aware that at temperatures exceeding 180° F, the material can go from workable to unworkable in a matter of seconds. Plan your installation accordingly, accounting for all temperature parameters for your given situation. Once the gel state of the material initiates, immediately stop working with the material and complete your installation. Trying to work with material or fix any problems after this point will only make matters worse.

Surface Temperature

Surface temperatures need to be carefully considered. Just because you have a system that is rated up to 300° F, does not mean it can be installed at that temperature. Read and understand the Technical Data Sheet for the system you are using prior to application. Installation temperature recommendations are listed and can be used as guidelines. Fast cure times can be detrimental in a few ways. First, it may have a negative effect on the properties of the material while it is going through its cure process. Also, the material needs time to bond with the surface. If it cures too quickly, it will not have time to wick into the surface to create the bond. Proper installation is another reason. When working on a surface that is hot, the installation time is reduced. This can lead to a hasty application that may not be done correctly.

SURFACE PREPARATION

Surface preparation is critical to success when high performance composites are applied in the field. Bad surface preparation can result in premature failure or weakened properties of the repair system. Please contact our office for information on preparation when encountering questionable conditions.

1. Major surface contamination buildup should be removed prior to any high quality cleaning. This is often done with water-based pressure washer machinery and high-alkalinity detergent wash.
2. Paint may or may not need to be removed, depending on the type of repair. Generally any paint or coating must be removed. All pipeline tape wraps, bitumen coatings, insulation, etc. must be removed.
3. Abrasive blast to a near white (NACE No.2/SSPC-SP 10) level all surfaces that the composite will contact. This is adequate for most work. Installations requiring structural adhesion, or for isolated patch applications where the patch is held to the work surface by its adhesion, must be white metal blasted (NACE No.1/SSPC-SP 5). Where abrasive blasting is dangerous or impossible, surfaces that the composite will contact should be abraded (scratched up) with the equivalent of an 80-grit abrasive and the metal surfaces should be brought to the equivalent of the appropriate NACE level mentioned above. If abrasive cleaning is not allowed, chemical cleaning of the affected are must be done. In addition, a high strength, high build epoxy should be applied over the worst areas and allowed to cure before the application of the composite reinforcement. (Fig.1 and Fig. 2)

Fig. 1

Fig. 1 – The sandblasting done on this line revealed more damage than was visible during the initial inspection. Proper cleaning is essential to a sound repair.

Fig. 2

Fig. 2 – Surface preparation as shown is generally unacceptable. In cases where the pipe cannot be properly cleaned, it should be noted that the final ultimate properties of the composite layup may be compromised (such as bonding to the steel surface).

4. Excess dust and residue from the abrading should be blown or wiped away with oil-free compressed air or new, clean solvent wipes. Cleaning preparations such as degreasing fluids which may leave a residue should not be used. Special precautions should be observed when cleaning surfaces operating at high temperatures (above 100°F), or for applications where a low flash point solvent is inappropriate. For this type of cleaning, use of Bromothane S solvent is recommended. It is non-flammable and leaves no residue on the surface.
5. All sharp corners, corrosion pits, dents, leak repairing patches and wall/diameter offsets greater than 1/8th-inch (3mm) (1/16th-inch for fluid-tight installations) should be smoothed with a high compressive and high flexural strength filleting and filling compound. The recommended filler compound for structural applications is BIO-FIX 911 or BIO-DUR 563 (Fig. 3 and Fig. 4). Alternative fillers may be used only for non-structural applications. Most circumferential piping welds and the like require no special filleting or smoothing. Check with a straight edge to confirm the surface is level.

Fig. 3 – The defect must be completely filled in and the compound must be smoothed and leveled out. Remove high spots and fill any low spots

Fig. 4 – Use a straight edge to confirm evenness.

6. After filling and smoothing, wipe the surface again with a clean cloth and a solvent cleaner. Remove any dust or foreign matter from the surface of the pipe in the area of the repair.
7. Application of the primer and composite should begin within eight hours of the final cleaning, unless special preparations have been made. This time may be reduced in high humidity areas where flash rusting can occur.

MATERIAL PREPARATION

All of the PowerSleeve® components are best used when they are at ambient temperature (65°F-90°F). Using the materials within this temperature ranges allows for good mixing and fabric wet-out. Cooling or warming techniques should be implemented in an attempt to bring the materials into the optimum temperature range. If this is not possible, care should be taken to ensure that the components thoroughly interact with one another. In cooler temperatures, the resin and hardener of the epoxy system will become thicker, thus requiring a longer mixing time. Wet out of the fabric will also require more time, as the thicker epoxy will require a longer dwell time to impregnate into the fabric. When warmer temperatures are encountered, the epoxy resin may begin to react more quickly than anticipated. This lessens the working time of the material and may make installation difficult.

The fabric should be wetted out on a clean surface that is free from dust and foreign residue. Surfaces should be kept cool, or warm, depending on air temperatures. In warmer temperatures, a light colored material can be placed under plastic sheeting to reflect the warming rays of the sun. In cool temperatures, a darker colored material can make the surface warmer. The wet-out surface should be protected from wind gusts and rain. Contact with water will adversely affect the fabric and the resin and will render it useless.

Be sure all components are available prior to any mixing or application. Time management is important when working with epoxy materials. Once the process has started, you must finish, or get to a specific hold point before the material begins to gel (cured to a point where the epoxy does not flow freely).

Confirm that each section of fabric has its corresponding epoxy kit (parts A&B). Our kits are set up to have a one-to-one ratio. Each section of fabric will have its own epoxy kit that is pre-portioned and

weighed to provide the correct epoxy/fabric fraction. It is important not to mix and match kits, as this will adversely affect the properties of the composite.

As part of the material preparation, the installer should check and verify the defect parameters. Current wall thickness, depth and length of defect, pressure, operating temperature, etc. The application temperature of the surface to be repaired should be checked with a calibrated temperature sensing device. Surface temperatures have a greater effect on the cure time than air temperature. All of this information should be confirmed against the application parameters obtained during the repair assessment. Verify the materials you have are correct before proceeding.

For wet or underwater applications with the X-100 UW resin the resin must be mixed and the fabric wetted in dry conditions and then applied to the wet or submerged pipe. In cases where W-11 or C-2 fabric are to be installed, the primer must be applied to the pipe before wrapping is started. A short nap paint roller works well for this purpose.

Remember the five P's… ***P**roper **P**reparation **P**revents **P**oor **P**erformance*

MATERIAL APPLICATION

The following instructions should be carefully read and understood prior to beginning the installation. Also read and understand the MSDS sheets for these materials. Proper factory training is required, as these instructions cover only the basic steps of proper installation. Any modification to these instructions should be approved by Air Logistics Corporation. If you have technical questions, please call Air Logistics Technical Support at 626-633-0294. Latex gloves, long sleeves, and safety glasses are mandatory, along with any other PPE specific to your application environment.

<u>Standard W-11 Fabric and C-2 Fabric, Kits</u>

1. Follow the appropriate cleaning and preparation instructions listed above.

2. All sharp corners, dents, leak repairing patches and wall/diameter offsets greater than 1/8th-inch (1/16th-inch for fluid-tight installations) should be smoothed with a rapid-setting filleting and filling compound. Alternately, other non-structural F.A.C.S.™ products may be used to create smooth contours of the repair surfaces. Good consolidation between the layers of the composite and to the surface being repaired is essential to sound repair. Voids within the layup should be avoided.

3. For the Standard Matrix, 439 Matrix, X-100 UW Matrix and the 70079 Matrix, it is best that PowerSleeve® be applied between 60°F and 110°F (16°C - 44°C). If higher than this range, the X-TEMP-2 Matrix should be used. Also, all of the PowerSleeve® Kit components should be maintained between 65°F and 90°F (18°C - 32°C) during the actual matrix mixing and wet-out procedure.

4. In most cases, the primer system will be the same material as the main matrix in the kit. However, in certain instances, it may be different. For this reason, always use the epoxy kit marked "Primer" for priming the surface of pipe. Mix the primer by pouring all of the contents

of the Part B container into the Part A container. Mix thoroughly for at least 3 minutes. Mixing should be done slowly to avoid air bubble formation. Coat all surfaces that the PowerSleeve® will be applied to with a thorough application of primer, as furnished with the kit. Most primers should be over wrapped with at least the first layer of the main PowerSleeve® material while the primer is still wet. If applying to a flat surface, you may let the primer become slightly tacky, but not to a point where it becomes unmovable. If using a primer that is different than the main matrix system, you should allow the primer to cure before continuing. When priming for Carbon fiber use, the substrate must be coated with an epoxy. Carbon fiber must never be applied on a bare steel surface.

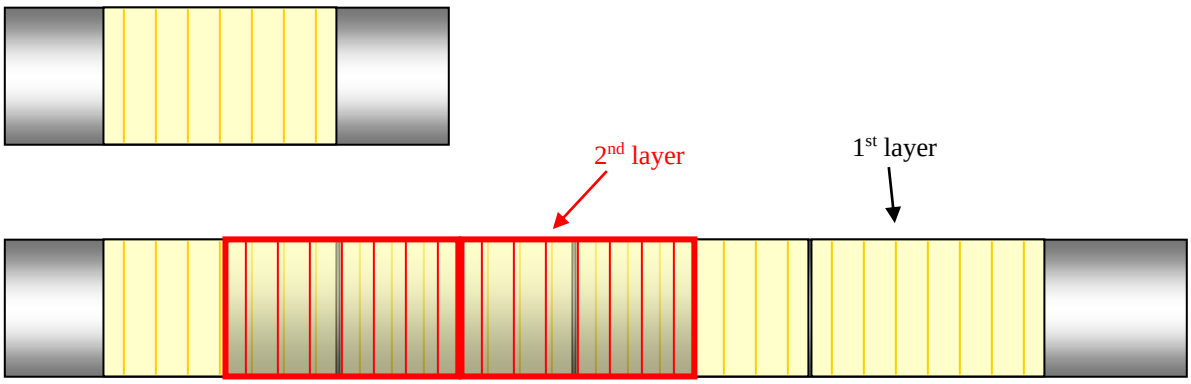
5. Unroll and lay out one segment of the PowerSleeve® substrate ("fabric") on the wet-out work surface, 45x45 side up, and the yellow striping side down.

6. Pour all of the contents of one of the Part B matrix containers into one of the Part A matrix containers. Mix thoroughly for at least 3 minutes. Mixing should be done slowly to avoid air bubble formation.

7. Pour about half of the mixed matrix onto the PowerSleeve® segment laid out on the wet-out work surface, and with the furnished squeegee, distribute the matrix evenly over the entire PowerSleeve® segment, using slow spreading strokes. Spreading speed and volume should be adjusted to matrix temperature. Flip the segment over. Repeat the wet-out spreading on this side using the balance of the mixed matrix. The total mix amount in a single module is appropriate for a single PowerSleeve® segment.

8. Roll up the resin-wetted PowerSleeve® segment and transport to the application site (45x45 side out).

9. Within 10 minutes of wetting-out, unroll the segment onto the surface to which the PowerSleeve® is being applied (45x45 side down). Press it into the application surface with the squeegee or your gloved fingers, working any trapped air bubbles to the edge and forcing the PowerSleeve® into tight contact with the surface below.



10. Repeat for all PowerSleeve® segment layers remaining in the kit. It is best to set the starting point of each layer at a different location around the vessel. For example, start the first layer at

the 12-o'clock position, the second layer at the 3-o'clock position, etc. If several kits are to be applied to a section of pipe, apply the first layer to the entire length of pipe to be sleeved, then start the second layer, offsetting the edges of the layers by at least 6 inches or half the width of a segment (as in laying courses of brick). Choose a segment of pipe short enough that you can install all four layers of material prior to any part of the installation entering its gel point. Overlap successive sections by at least two inches.

11. Once the PowerSleeve® segments are all installed, starting at one edge, begin spiral wrapping the Stricture Banding™, stretching it and pulling loosely at first, then tightly around the assembly, proceeding down to the other end, and back to the starting point. The Stricture Banding™ must be wrapped in the same direction around the pipe as the PowerSleeve® The direction. Do at least four complete layers, but more does not hurt and can actually improve the compression on the layup.
(NOTE: If the temperature and length of the installation causes the first layer of PowerSleeve® to begin hardening before installation of subsequent layer can be installed, stop and do the Stricture Banding™ procedure and allow the installed layers to compress and cure until they hold their shape dependably. Be certain to remove all Stricture Banding™ before adding additional layers of PowerSleeve®. Any time installation progress is delayed for more than 24 hours, all cured composite surfaces must be sanded to break the "glaze" of the surface, prior to application of subsequent PowerSleeve® layers. Under certain circumstances, this periodic Stricture Banding™ process may have to be done several times.)

12. Allow the PowerSleeve® to cure until it is dry to the touch and does not indent when pressed with a finger nail.

13. Completely remove the Stricture Banding™.

14. Paint the entire PowerSleeve® installation with PowerCoat™ paint, furnished in the kit, or factory approved UV & weather barrier coating. Two coats are recommended.

15. CAUTION: When cured only a few hours ("dry to the touch") the standard PowerSleeve® system is NOT fully cured and has NOT reached its full strength. Under circumstances where full structural strength is required prior to some action (such as re-pressurizing a leaking pipeline) a longer cure is required. Contact Air Logistics Technical Support for details.

<u>Standard G-03 - C-3 Carbon Fabric</u>

1. Follow the appropriate cleaning and preparation instructions listed above.

2. All sharp corners, dents, leak repairing patches and wall/diameter offsets greater than 1/8th-inch (1/16th-inch for fluid-tight installations) should be smoothed with a rapid-setting filleting and filling compound. Alternately, other non-structural F.A.C.S.™ products may be used to create smooth contours of the repair surfaces. Good consolidation between the layers of the composite and to the surface being repaired is essential to sound repair. Voids within the layup should be avoided.

3. For the Standard Matrix, 439 Matrix, X-100 UW and the 70079 Matrix, it is best that PowerSleeve® be applied between 60°F and 110°F (16°C - 44°C).). If higher than this range, the X-TEMP-2 Matrix should be used. Also, all of the PowerSleeve® Kit components should be maintained between 65°F and 90°F (18°C - 32°C) during the actual matrix mixing and wet-out procedure.

4. In most cases, the primer system will be the same material as the main matrix in the kit. However, in certain instances, it may be different. For this reason, always use the epoxy kit marked "Primer" for priming the surface of pipe. Mix the primer by pouring all of the contents of the Part B container into the Part A container. Mix thoroughly for at least 3 minutes. Mixing should be done slowly to avoid air bubble formation. Coat all surfaces that the PowerSleeve® will be applied to with a thorough application of primer, as furnished with the kit. Most primers should be over wrapped with at least the first layer of the main PowerSleeve® material while the primer is still wet. If applying to a flat surface, you may let the primer become slightly tacky, but not to a point where it becomes unmovable. If using a primer that is different than the main matrix system, you should allow the primer to cure before continuing. . When priming for Carbon fiber use, the substrate must be coated with an epoxy or a layer of glass composite. Carbon fiber must never be applied on a bare steel surface.

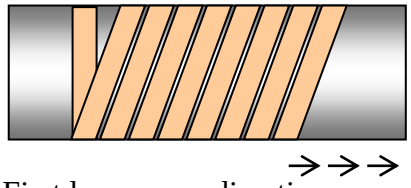
5. Unroll and lay out one segment of the PowerSleeve® G-03-C-3 substrate ("fabric") on the wet-out work surface.

6. Pour all of the contents of one of the Part B matrix containers into one of the Part A matrix containers. Mix thoroughly for at least 3 minutes. Mixing should be done slowly to avoid air bubble formation.

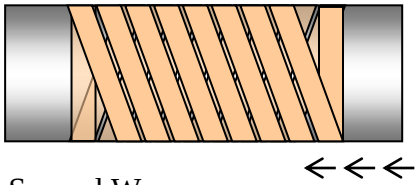
7. Pour about half of the mixed matrix onto the PowerSleeve® G-03-C-3 segment laid out on the wet-out work surface and distribute the matrix evenly over the entire PowerSleeve® G-03-C-3 segment, using slow spreading strokes. You may use light hand pressure or a soft spreading tool. Spreading speed and volume should be adjusted to matrix temperature. Flip the segment over. Repeat the wet-out spreading on this side using the balance of the mixed matrix. The total mix amount in a single module is appropriate for a single PowerSleeve® G-03-C-3 segment.

8. Roll up the resin-wetted PowerSleeve® G-03-C-3 segment and transport to the application site.

9. Within 10 minutes of wetting-out, unroll the segment onto the surface to which the PowerSleeve® G-03-C-3 is being applied. Press it into the application surface with your gloved fingers, working any trapped air bubbles to the edge and forcing the PowerSleeve® G-03-C-3 into tight contact with the surface below. This fabric is best applied using a spiral wrap technique.



First layer wrap direction



Second Wrap

Starting at one end of the repair area, spiral the material around the pipe, laying each subsequent wrap adjacent to the other, without overlapping. Upon reaching the other end of the repair, make one complete spiral around the pipe and continue back the other direction. Never exceed a 45° angle during installation.

10. Repeat for all PowerSleeve® G-03-C-3 segments required for your installation. When finished with one roll, begin the next roll by overlapping a minimum of 3" from the previous end point. Choose a segment of pipe short enough that you can install at least two layers of material prior to any part of the installation entering its gel point. Overlap successive sections of material by at least two inches.

11. Once the PowerSleeve® G-03-C3 segments are all installed, starting at one edge, begin spiral wrapping the Stricture Banding™, stretching it and pulling loosely at first, then tightly around the assembly, proceeding down to the other end, and back to the starting point. The Stricture Banding™ must be wrapped in the same direction around the pipe as the PowerSleeve® was wrapped. Do at least 4 complete layers, but more does not hurt and can actually improve the compression on the layup. Always wrap the Stricture Banding™ in the same direction as the PowerSleeve® G-03-C3 as wrapped.
{NOTE: If the temperature and length of the installation causes the first layer of PowerSleeve® G-03 to begin hardening before installation of subsequent layer can be installed, stop and do the Stricture Banding™ procedure and allow the installed layers to compress and cure until they hold their shape dependably. Be certain to remove all Stricture Banding™ before adding additional layers of PowerSleeve® G-03-C3. Any time installation progress is delayed for more than 24 hours, all cured composite surfaces must be sanded to break the "glaze" of the surface, prior to application of subsequent PowerSleeve® G-03-C3 layers. Under certain circumstances, this periodic Stricture Banding™ process may have to be done several times.)

12. Allow the PowerSleeve® G-03-C-3 to cure until it is dry to the touch and does not indent when pressed with a finger nail.

13. Completely remove the Stricture Banding™.

14. Paint the entire PowerSleeve® G-03-C-3 installation with PowerCoat™ paint, furnished in the kit, or factory approved UV & weather barrier coating. Two coats are recommended. Other coatings may be used. Please contact Air Logistics if another type of coating is desired for use.

15. CAUTION: When cured only a few hours ("dry to the touch") the standard PowerSleeve® G-03-C-3 system is NOT fully cured and has NOT reached its full strength. Under circumstances where full structural strength is required prior to some action (such as re-pressurizing a leaking pipeline) a longer cure is required. Refer to the product technical data sheet for "full cure" properties.

<u>G-22 Bear™</u> Fabric:

1. Follow the appropriate cleaning and preparation instructions listed above.

2. All sharp corners, dents, leak repairing patches and wall/diameter offsets greater than 1/8th-inch (1/16th-inch for fluid-tight installations) should be smoothed with a rapid-setting filleting and filling compound. Alternately, other non-structural F.A.C.S.™ products may be used to create smooth contours of the repair surfaces. Good consolidation between the layers of the composite and to the surface being repaired is essential to sound repair. Voids within the layup should be avoided.

3. For the Standard Matrix, 439 Matrix, X-100 UW Matrix and the 70079 Matrix, it is best that PowerSleeve® be applied between 60°F and 110°F (16°C - 44°C). If higher than this range, X-TEMP-2 Matrix should be used. Also, all of the PowerSleeve® Kit components should be maintained between 65°F and 90°F (18°C - 32°C) during the actual matrix mixing and wet-out procedure.

4. The Bear™ fabric is designed for use in tight areas where flexibility and drapeability are important. As such the wrap must be planned before the fabric is impregnated. It is important to model the wrap, usually by placing the material on the surface to be wrapped so that the fit and cuts can be planned. It is usually better to impregnate the fabric before cutting it to fit.

5. In most cases, the primer system will be the same material as the main matrix in the kit. However, in certain instances, it may be different. For this reason, always use the epoxy kit marked "Primer" for priming the surface of pipe. Mix the primer by pouring all of the contents of the Part B container into the Part A container. Mix thoroughly for at least 3 minutes. Mixing should be done slowly to avoid air bubble formation. Coat all surfaces that the PowerSleeve® will be applied to with a thorough application of primer, as furnished with the kit. Most primers should be over wrapped with at least the first layer of the main PowerSleeve® material while the primer is still wet. If applying to a flat surface, you may let the primer become slightly tacky, but not to a point where it becomes unmovable. If using a primer that is different than the main matrix system, you should allow the primer to cure before continuing.

6. Unroll and lay out one segment of the Bear™ substrate ("fabric") on the wet-out work surface.

7. Pour all of the contents of one of the Part B matrix containers into one of the Part A matrix containers. Mix thoroughly for at least 3 minutes. Mixing should be done slowly to avoid air bubble formation.

8. Pour about half of the mixed matrix onto the Bear™ segment laid out on the wet-out work surface, and with the furnished squeegee, distribute the matrix evenly over the entire Bear™ segment, using slow spreading strokes. Spreading speed and volume should be adjusted to matrix temperature. Flip the segment over. Repeat the wet-out spreading on this side using the balance of the mixed matrix. The total mix amount in a single module is appropriate for a single Bear™ segment.

9. Roll up the resin-wetted Bear™ segment and transport to the application site.

10. Within 10 minutes of wetting-out, unroll the segment onto the surface to which the Bear™ is to be applied. Press it into the application surface with the squeegee or your gloved fingers,

working any trapped air bubbles to the edge and forcing the Bear™ into tight contact with the surface below.

11. Repeat for all Bear™ segment layers remaining in the kit. It is best to set the starting point of each layer at a different location around the vessel. For example, start the first layer at the 12-o'clock position, the second layer at the 3-o'clock position, etc.

12. Repeat for all Bear™ segment layers remaining in the kit. It is best to set the starting point of each layer at a different location around the vessel. For example, start the first layer at the 12-o'clock position, the second layer at the 3-o'clock position, etc. If several kits are to be applied to a section of pipe or tee, apply the first layer to the entire section of pipe to be sleeved, then start the second layer, offsetting the edges of the layers by at least 6 inches or half the width of a segment (as in laying courses of brick). Choose a segment of pipe short enough that you can install all four layers of material prior to any part of the installation entering its gel point. With tee's or other complicated geometries it may be helpful to secure portions of the wrap with Powersleeve® roll fabric kits.

13. Once the Bear™ segments are all installed, starting at one edge, begin spiral wrapping the Stricture Banding™, stretching it and pulling loosely at first, then tightly around the assembly, proceeding down to the other end, and back to the starting point. The Stricture Banding™ must be wrapped in the same direction around the pipe as the Bear™. The direction Do at least four complete layers, but more does not hurt and can actually improve the compression on the layup.

14. NOTE: If the temperature and length of the installation causes the first layer of Bear™ to begin hardening before installation of subsequent layer can be installed, stop and do the Stricture Banding™ procedure and allow the installed layers to compress and cure until they hold their shape dependably. Be certain to remove all Stricture Banding™ before adding additional layers of Bear™. Any time installation progress is delayed for more than 24 hours, all cured composite surfaces must be sanded to break the "glaze" of the surface, prior to application of subsequent Bear™ layers. Under certain circumstances, this periodic Stricture Banding™ process may have to be done several times.

15. Allow the Bear™ to cure until it is dry to the touch and does not indent when pressed with a finger nail.

16. Completely remove the Stricture Banding™.
    Paint the entire Bear™ installation with PowerCoat™ paint, furnished in the kit, or factory approved UV & weather barrier coating. Two coats are recommended.

    CAUTION: When cured only a few hours ("dry to the touch") the standard Bear™ system is NOT fully cured and has NOT reached its full strength. Under circumstances where full structural strength is required prior to some action (such as re-pressurizing a leaking pipeline) a longer cure is required. Contact Air Logistics Technical Support for details.

Post Curing:
The 439 and X-temp-2 systems require post curing in order to achieve the best chemical resistance properties. Post curing may be done in accordance with the following table, however these products will post cure to the operating temperature of the system as it is returned to service and heats up. Note that post curing does not have to be done immediately after the initial cure of the resin system. Delays of over a month can be tolerated.

External Coatings

Choosing the proper final coating is imperative to a successful long term repair. The composite should be coated if any of the following will be present during the lifetime of the repair:

- Ultraviolet Light (natural or man-made) – Use PowerCoat™ or equivalent
- Chemical fallout or mist – Use a coating resistant to chemical in question
- Submersion in water (ground water, tidal areas, saturating rain) – Use BP4 Primer/Coating
- Heavy abrasion (sand, rocks, other metal piping) – Depending on application, abrasive resistant coatings or other products should be used
- High heat from an external source (fire, exhaust) – Use an intumescing type of coating

Applications at High Temperatures

When using the X-TEMP-2 Matrix, it is best to install at temperatures between 150°F and 220°F (60°C – 104°C). At the upper limit of this range, using Stricture Banding™ may become difficult. As the temperature rises, the working time of the matrix is reduced. The matrix may even cure before you have completely installed your section of fabric, which is not preferred.

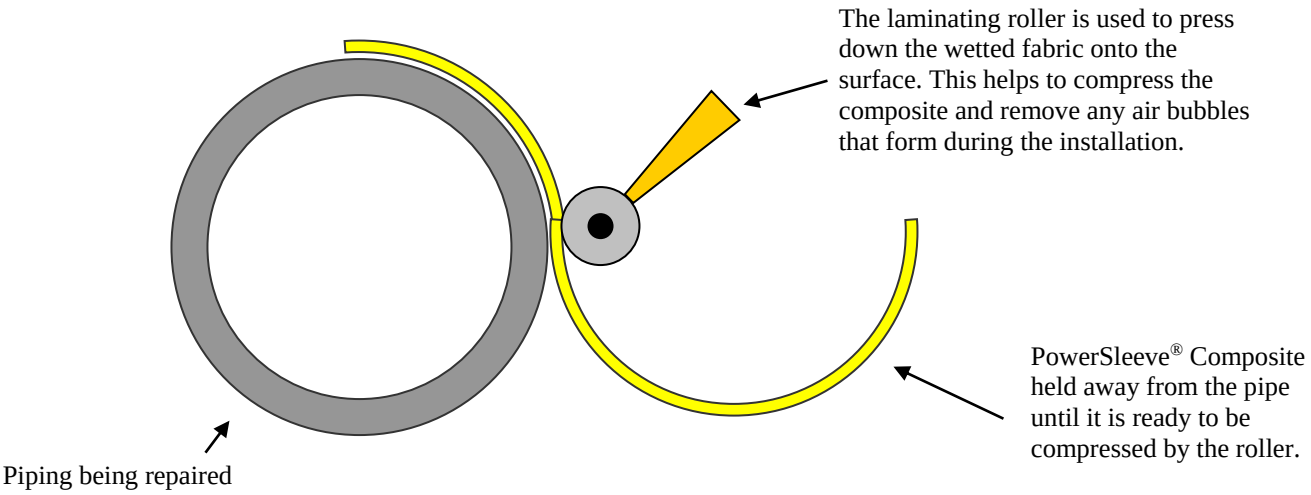
When encountering an application such as this, a laminating roller may be used.

Fig. 5 – A laminating roller can make installations onto high temperature surfaces much easier. This tool can also be used on large flat surfaces where Stricture Banding™ cannot be effective.

This tool will allow the composite to be compressed and air bubbles to be forced out of the layup. When working at the higher temperatures, the layup method for either the W-11 fabric or the G-03 fabric can be modified as listed below:

Starting at the 12 o-clock position, place 4-6” of the fabric down onto the surface of the pipe. Do not allow the rest of the roll to come into contact with the pipe at this time. Using a

laminating roller, apply pressure to this small section and allow it to cure (approximately 2-3 minutes, depending on temperature).
Begin unrolling the fabric around the pipe. Using the roller, continuously apply pressure to all areas that are in contact with pipe. Only allow enough fabric to come into contact with the pipe that is able to be compressed with the roller in 1-2 minutes. Otherwise, sections that have touched the pipe may cure prior to them being compressed. Continue until the entire fabric section is laid up and cured.



DOCUMENTATION

It is good practice to record all data related to the repair. This documentation should be retained by the installer and/or the owner of the pipeline for at least the lifetime of the repair. A unique identifier should be generated for each repair application and location. At a minimum, records should be kept that include the following information:

Design Records

- Location of the repair
- Defect type and dimensions
- Design data and related calculations
- Level of surface preparation
- Cure procedure
- Number of layers required
- Axial length of repair
- Completed F.A.C.S.™ Pipe Repair Data Sheet

Material Records

- PowerSleeve® matrix and fabric used (include part number if available)
- Lot numbers and/or batch numbers from kit

Quality Control and Installation Records

- Repair reference number
- Report of visual inspection
- Number of layers actually installed
- Temperature at time of installation (air temperature and pipe surface temperature)
- Final repair dimensions
- Personnel completing the installation
- Re-inspection intervals

INSTALLATION CHECKLIST
PowerSleeve®

Instructions should be carefully read and understood prior to beginning the installation. Also read and understand the MSDS sheets for these materials prior to beginning the installation. Proper factory training is required, as the following checklist covers only the basic steps of proper installation. If you have technical questions, please call Air Logistics Technical Support at 626-633-0294. Chemical gloves and safety glasses are mandatory, along with any other PPE specific to your application environment.

- ☐ Measurements, Temperatures, and Product in line confirmed
- ☐ Proper repair materials confirmed
- ☐ Level work surface prepared for fabric wet-out
- ☐ Pipe surface preparation
- ☐ Filler material applied and smoothed
- ☐ Mix primer and apply
- ☐ Wet-out fabric and install onto piping
- ☐ Apply Stricture Banding™
- ☐ **Hold –** composite should cure to "fingernail" hard before proceeding
- ☐ Remove Stricture Banding™ completely
- ☐ Check for voids and unacceptable imperfections
- ☐ Apply PowerCoat™ Paint or other environmentally suitable coating
- ☐ PowerSleeve® should be allowed to completely cure (up to 7 days at 77°F) before exposure to maximum design conditions.

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SAFETY DATA SHEET

PowerSleeve™ X-Temp-2 Matrix-Part A

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: PowerSleeve™ X-Temp-2 Matrix-Part A
MFR'S NAME: Air Logistics Corporation, 925 North Todd Avenue, Azusa CA 91702
EMERGENCY PHONE: 800.424.9300 (CHEMTREC) **GENERAL INFORMATION**: 626.633.0294
USE OF THE SUBSTANCE: Epoxy resin for use with fiberglass or carbon fabric for the repair of pipelines or other structures.

SECTION 2: HAZARDS IDENTIFICATION

OSHA/HCS status: No information available.

GHS Label Elements:
Hazard Pictograms:

Signal Word: Warning! Dangerous to the environment.

Hazard Statements and GHS Classifications:

H315, H319	Causes skin and serious eye irritation.	Category 2
H317	May cause an allergic skin reaction.	Category 1
H411	Toxic to aquatic life with long-lasting effects.	Category 2, Chronic
H332	Harmful if inhaled.	Category 4
H312	Harmful if in contact with skin.	Category 4
H302	Harmful if swallowed.	Category 4

Precautionary Statements:

Prevention:
P261: Avoid breathing fumes, mist, vapors and spray.
P264: Wash hands thoroughly after handling.
P270: Do not eat, drink or smoke when using this product.
P271: Use only outdoors or in a well-ventilated area.
P273: Avoid release to the environment.
P280: Wear protective gloves, clothing, and eye/face protection.

Responses:
P301+P312: IF SWALLOWED: Call POISON CENTER and/or get medical assistance if you feel unwell.
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P333+P313: If skin irritation or rash occurs, get medical attention.
P362+P364: Take off contaminated clothing and wash it before reuse.
P304+P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337+P313: If eye irritation persists, get medical attention.
P391: Collect spillage.

Storage: P403+P233: Store in a well-ventilated place. Keep containers tightly closed.
P405: Store in a secure area.

Disposal: P501: Dispose of contents and containers in accordance with all local, regional and international regulations.

Other Hazards: None known.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture: Mixture.

Ingredient	% by WT	CAS #	67/548/EEC	Regulation (EC) 1272/2008 (CLP)
Bisphenol-A Epoxy Resin	30-45	25068-38-6 (US) 25085-99-8 (EC)	No Data Available.	No Data Available.
Epoxy Phenol Novolac Resin	40-65	28064-14-4		
Aliphatic Epoxy Resin	5-15	2425-79-8		

Occupational Exposure Limits, if available, are listed in Section 8.

SECTION 4: FIRST AID MEASURES

Description of necessary first aid measures:

General Get medical attention immediately for any person who is having trouble or not breathing, or any unconscious person. Provide oxygen or artificial respiration to a person if they have trouble breathing. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Place an unconscious person in a recovery position, maintain an open airway and loosen tight clothing.

Inhalation Remove victim to fresh air and keep warm and at rest in a position comfortable for breathing. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin Contact Immediately remove contaminated clothing and shoes. Wash the affected area with plenty of soap and water until no evidence of the chemical remains (at least 15-20 minutes). Launder clothing before reuse. Get medical attention if symptoms occur.

Eye Contact Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids and roll eyes in a circular motion. Check for and remove any contact lenses if easy to do. Continue to rinse for at least 15 minutes. Get medical attention.

Ingestion Wash out mouth with water. Remove dentures, if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. DO NOT induce vomiting. Get medical attention.

Most Important Symptoms/Effects, Acute and Long –Term:

Potential Acute Health Effects:

Inhalation Exposure to decomposition products may cause a health hazard. Serious effects may be delayed after exposure. Harmful if inhaled in high airborne concentrations.

Skin Contact Causes skin irritation. May cause an allergic skin irritation. Pre-existing skin problems may be aggravated.

Eye Contact Irritating and may cause redness and pain.

Ingestion May cause discomfort if swallowed.

Overexposure Signs/Symptoms:

Inhalation No specific data.

Skin Contact Adverse symptoms may include the following: Irritation and/or Redness.

Eye Contact Adverse symptoms may include the following: Pain or Irritation. Watering. Redness.

Ingestion No specific data.

Indication of Immediate Medical Attention and/or Special Treatment needed:

Notes to Physician Treat symptomatically. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be under medical surveillance for up to 48 hours.

Specific Treatments No specific treatment(s).

See also Toxicological Information in **Section 11.**

SECTION 5: FIRE FIGHTING MEASURES

Extinguishing Media Dry chemicals, water spray, foam or carbon dioxide. Spray containers with water to keep cool and avoid rupture due to pressure buildup.

Unsuitable Media None known.

Specific Hazards Material is not considered a fire hazard but will burn if ignited.

National Fire Protection Association (USA):

Labeling: No data available.

Hazardous Thermal Decomposition Products

Irritating or toxic substances may be emitted upon burning or decomposition. See **Section 10** for additional information.

Special Protective Actions for Fire Fighters

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special Protective Equipment for Fire Fighters

Fire Fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in a positive pressure mode during the attack phase of firefighting operations. During cleanup, if area is poorly ventilated, SCBA should be used. See **Section 9** for additional information.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Keep unauthorized persons away. Provide adequate ventilation and avoid breathing vapors. Put on appropriate personal protective equipment (see **Section 8**). If spilled in an enclosed area, ventilate area or use SCBA. Remove potential ignition sources.

Environmental Precautions

Avoid dispersal of material and runoff from contact with soil, waterways, drains and/or sewers.

Methods and Materials for Containment and Cleaning Up (Small or Large Spill)

Stop leak if possible without risk. Move containers from spill area. Absorb spilled material with vermiculite, dry sand or earth, put into closed containers, store in a safe location and dispose of via a licensed waste disposal contractor. Do not allow water runoff into sewers or water sources

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling/Personal Hygiene
Use good laboratory/workplace procedures. Use appropriate personal protective equipment as per **Section 8**. Keep in the original container or an approved alternative; keep containers tightly closed when not in use.

Keep away from heat, sparks and open flame. Eating, drinking and/or smoking should be prohibited where this material is being used. Workers should remove contaminated clothing/protective equipment and wash hands and face and before entering eating areas and eating, drinking and/or smoking.

Conditions for Safe Storage, including any Incompatibilities
Keep away from heat, sparks and open flames. Store in sealed original containers, or approved alternatives, when not in use in a dry, well-ventilated area. Protect containers from direct sunlight. Do not allow to freeze or exceed 40^0C (~110^0F). Do not reuse containers.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Occupational Exposure Limits

Ingredient	CAS#	Exposure Limits (ACGIH-TWA or ACGIH-STEL)
Bisphenol A Epoxy Resin	25068-38-6 (US) 25085-99-8 (EC)	Not Available
Epoxy Phenol Novolac Resin	26064-14-4	
Aliphatic Epoxy Resin	2425-79-8	

Appropriate Engineering Controls
Good general ventilation should be sufficient to control worker exposure to any airborne contaminants. If working in enclosed spaces, provide additional local ventilation. Eyewash fountains and safety showers are recommended, as well as good laboratory/shop procedures and care.

Exposure controls

Respiratory Protection
If necessary, a properly-fitted vapor mask/respirator (organic vapor respirator) or SCBA should be used.

Hand Protection
Impervious, chemical-resistant gloves (such as nitrile rubber PVC, etc. of .35mm thickness or similar) should be worn when handling this material. Contaminated gloves should be disposed of properly.

Body Protection
Chemically resistant long-sleeved shirts and long pants or lab coats are recommended. Contaminated clothing should be washed separately from other clothes before reuse. Footwear appropriate for the work being performed should be worn and cleaned carefully if contaminated, before reuse. Heavily contaminated clothing or footwear should be disposed of properly.

Eye/Face Protection
Safety eyewear and face shields appropriate for the work being performed should be used. Ordinarily, this means a minimum of safety eyewear or splash goggles.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Viscous liquid	**Color:**	Clear amber
Odor:	Mild	**Odor Threshold:**	N/A
pH	N/A	**Melting Point:**	N/A
Boiling Point:	>200^{0}C (424^{0}F)	**Flash Point:**	>110^{0}C (~250^{0}F)
Evaporation Rate:	N/A	**Vapor Pressure/Density:**	<1mm Hg at 20^{0}C Heavier than air.
Relative Density	1.18	**Viscosity:**	19,000 cP at 25^{0}C
Auto-Ignition Temp.	N/A	**Decomposition Temp.**	>200^{0}C
Solubility:	Negligible.	**VOC Content:**	N/A-none.

SECTION 10: STABILITY AND REACTIVITY

Reactivity: Exothermic reactions including polymerization may occur in contact with amines, strong acids or bases, alcohols, strong oxidizing agents and excessive heat.

Chemical Stability: This product is stable under normal conditions.

Possibility of Hazardous Reactions: See "Reactivity" above for cautions.

Conditions to Avoid: Excessive heat and ignition sources.

Incompatible Materials: Strong acids, bases, oxidizing agents, alcohols and amines.

Hazardous Decomposition Products: Thermal decomposition may produce smoke, oxides of carbon, aldehydes, phenolics and other products of incomplete combustion.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Toxicity

Product/Ingredient	LC_{50} Inhalation	LD_{50} Oral (Rat)	LD_{50} Dermal (Rabbit)
Bisphenol-A Epoxy Resin	N/A	>2,000mg/kg	>2,000 mg/kg
Epoxy Phenol Novolac Resin	N/A	>2,000mg/kg	>2,000mg/kg
Aliphatic Epoxy Resin	>250 ppm (6 hours)	1,134 mg/kg	1,130 mg/kg

Skin Corrosion/Irritation: Skin Irritation-Category 2

Serious Eye Damage/Irritation: Eye Irritation-Category 2

Respiratory or Skin Sensitization: Skin Sensitization-Category 1

Mutagenicity: No specific data. **Carcinogenicity:** No specific data.

Reproductive Toxicity: No specific data. **Teratogenicity:** No specific data.

Aspiration Hazard: No specific data.

Specific Target Organ Toxicity (Single and Repeated Exposure): No specific data.

Information on the Likely Routes of Exposure: Eyes, skin, inhalation and ingestion.

Potential Acute Health Effects and Related Symptoms:

See **Section 4**.

Delayed, immediate and chronic effects from short and long term exposure:

Some persons may become sensitized after chronic exposure and may exhibit moderate to severe allergic reactions when exposed.

SECTION 12: ECOLOGICAL INFORMATION

Toxicity, Persistence and Degradability:

Product / Ingredient	LC_{50} 96 Hours (Fish)	EC_{50} 24 Hours (Daphnia)	IC_{50} 96 Hours (Bacteria)	Biodegradability
Bisphenol-A Epoxy Resin	2.4 mg/L	3.6 mg/L	>100 mg/L	Not
Epoxy Phenol Novolac Resin	>1-10 mg/L	>1-10 mg/L	N/A	Readily
Aliphatic Epoxy Resin	24 mg/L	75 mg/L	N/A	Biodegradable

Bioaccumulative Potential:

Ingredient	$LogP_{ow}$	BCF	Potential
Bisphenol-A Epoxy Resin	3.242	31	Low
Epoxy Phenol Novolac Resin	N/A	N/A	N/A
Aliphatic Epoxy Resin	-0.15	N/A	N/A

Mobility in Soil (soil / water partition coefficient-K_{OC}):
Bisphenol A Epoxy Resin: 445.
No specific data for other ingredients.

Other Adverse Effects: Other information is not available. No information is available regarding classification of materials as PBT or vPvB.

SECTION 13: DISPOSAL CONSIDERATIONS

Dispose of unused contents (incineration) in accordance with national and local regulations. Dispose of container in accordance with national and local regulations. Ensure the use of properly authorized waste management companies, where appropriate. See **Section 8** for recommendations on the use of personal protective equipment.

SECTION 14: TRANSPORTATION INFORMATION

UN No's: DOT/TG: UN3082 IMDG: 3082 ICAO: 3082

DOT/TDG Proper Shipping Name:
ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Epoxy Resin)

Hazard Classes: DOT: Not Regulated. TDG: Not Regulated. IMDG: 9 ICAO: 9

Hazard Labels: DOT: N/A TDG: N/A

Pack Groups: DOT: N/A IMDG: III AIR: III

Environmental Hazards: Marine Pollutant: Yes **Hazardous Substance (USA):** No.

Transporting in Bulk according to Annex II of MARPOL 73/78 and the IBC Code: No specific data.

Surface Shipment within the US: Not regulated.

Label for Conveyance: (Not for DOT or TDG surface-Air and Marine ONLY)

Other Information: Not regulated for shipment within the United States.

SECTION 15: REGULATORY INFORMATION

INTERNATIONAL REGULATIONS:

International and US Inventory Lists

Canada Inventory (DSL)	All components listed or exempt.	**EU-ELINCS**	Not listed.*
Canada Inventory (NDSL)	Not listed.*	**EU-EINECS**	Listed or Exempt
US Toxic Substances Control Act (TSCA)	All components listed or exempt.	**REACH, Annex XIV and Annex XVII**	Not listed*
Other	Not determined, no additional information is available.		

***Note:** There is no listing on the public inventory, no information is available or the component has not been reviewed.

Substances of Very High Concern: No information is available.

Other Information: Material is not listed as a CA Prop 65 chemical, and has no reportable quantity listings.

SECTION 16: OTHER INFORMATION

ABBREVIATIONS:
ACGIH: American Conference of Governmental Industrial Hygienists
ADR/RID: European dangerous goods transport, road and rail, regulations
CAS: Chemical Abstract Service Registry
DOT: Department of Transportation (U.S.)
GHS: Globally Harmonized System of Classification and Labeling of Chemicals
IATA: International Air Transport Association
ICAO: International Civil Aviation Organization
IMDG: International Maritime Dangerous Goods code
OEL: Occupational Exposure Limits
OSHA: Occupational Safety and Health Administration (U.S.)
PEL: Permissible Exposure Limit
SDS: Safety Data Sheet
STEL: Short Term Exposure Limit (15 minute Time Weighted Average)
TDG: Canadian Transportation of Dangerous Goods Act and Regulations
TPQ: Threshold Planning Quantity
RQ: Reportable Quantity
UN: United Nations
U.S.: United States
N/A: Not available or not applicable.

Revision Date: 31 May 2015
Revision: 0
Reason for Revision: N/A

Notice:
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END OF SDS

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Phone (626) 633-0294 Fax (626) 633-0791

SAFETY DATA SHEET

PowerSleeve™ X-Temp-2 Matrix-Part B

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: PowerSleeve™ X-Temp-2 Matrix-Part B Hardener
MFR'S NAME: Air Logistics Corporation, 925 North Todd Avenue, Azusa CA 91702
EMERGENCY PHONE: 800.424.9300 (CHEMTREC) **GENERAL INFORMATION**: 626.633.0294
USE OF THE SUBSTANCE: Hardener for X-Temp epoxy resin used with fiberglass or carbon fabric for the repair of pipelines or other structures.

SECTION 2: HAZARDS IDENTIFICATION

OSHA/HCS status: No information available.

GHS Label Elements:
Hazard Pictograms:

Signal Word: Danger!

Hazard Statements and GHS Classifications:

H314	Causes severe skin burns and eye damage	Category 1
H312	Harmful in contact with skin.	Category 4
H302	Harmful if swallowed.	Category 4

Precautionary Statements:

Prevention:
P260 Do not breathe mists.
P264 Wash hands thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves, clothing, and eye/face protection.

Responses:
P310: Immediately call a poison center or seek medical attention.
P301+P312+P330+P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Call POISON CENTER or get medical attention if you feel unwell.
P303+P352+P353+P361+P362+P364 IF ON SKIN: Immediately remove all contaminated clothing and wash before reuse. Rinse skin with water/shower and wash with plenty of soap and water.
P333+P313: If skin irritation persists, seek medical attention.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313: If eye irritation persists, seek medical attention.
P391: Collect spillage.

Storage:
P403+P233: Store in a well-ventilated place. Keep containers tightly closed.
P405: Store in a secured area.

Disposal: P501: Dispose of contents and containers in accordance with all local, regional and international regulations.

Other Hazards: None known.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture: Mixture.

CHEMICAL NAME	CAS NUMBER	CONTENT
2-Ethyl-4-methylimidazole	931-36-2	75-100%

Amounts specified are typical and do not represent a specification. Remaining components are proprietary and non-hazardous or present at amounts below reportable limits.

SECTION 4: FIRST AID MEASURES

Description of necessary first aid measures:

General Get medical attention immediately for any person who is having trouble or not breathing, or any unconscious person. Provide oxygen or artificial respiration to a person if they have trouble breathing. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Place an unconscious person in a recovery position, maintain an open airway and loosen tight clothing.

Inhalation Remove victim to fresh air and keep warm and at rest in a position comfortable for breathing. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin Contact Immediately remove contaminated clothing and shoes. Wash the affected area with plenty of soap and water until no evidence of the chemical remains (at least 15-20 minutes). Launder clothing before reuse. Get medical attention immediately.

Eye Contact Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids and roll eyes in a circular motion. Check for and remove any contact lenses if easy to do. Continue to rinse for at least 15 minutes. Get medical attention immediately.

Ingestion Wash out mouth with water. Remove dentures, if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. DO NOT induce vomiting.

Most Important Symptoms/Effects, Acute and Long –Term:

Potential Acute Health Effects:

Inhalation Exposure to decomposition products may cause a health hazard. Serious effects may be delayed after exposure. Harmful if inhaled in high airborne concentrations. Persons with sensitive airways (e.g., asthmatics) may react to vapors. May cause burns to nasal passages, throat and respiratory tract.

Skin Contact Causes skin irritation or burns. May cause an allergic skin irritation or aggravate existing conditions through prolonged/repeated contact.

Eye Contact Irritating and may cause burns, redness and pain.

Ingestion May cause discomfort if swallowed.

Overexposure Signs/Symptoms:

Inhalation No specific data.

Skin Contact Adverse symptoms may include the following: Irritation and/or Redness.

Eye Contact Adverse symptoms may include the following: Burns, Pain or Irritation. Watering. Redness.

Ingestion No specific data.

Indication of Immediate Medical Attention and/or Special Treatment needed:

Notes to Physician Treat symptomatically.

Specific Treatments No specific treatment(s).

See also Toxicological Information in **Section 11.**

SECTION 5: FIRE FIGHTING MEASURES

Extinguishing Media Dry chemicals, water spray, foam or carbon dioxide. Spray containers with water to keep cool and avoid rupture due to pressure buildup.

Unsuitable Media None known.

Specific Hazards Material is not considered a fire hazard but will burn if ignited.

National Fire Protection Association (USA):

Labeling: No data available.

Hazardous Thermal Decomposition Products
Irritating or toxic substances may be emitted upon burning or decomposition. See **Section 10** for additional information.

Special Protective Actions for Fire Fighters
Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special Protective Equipment for Fire Fighters
Fire Fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in a positive pressure mode during the attack phase of firefighting operations. During cleanup, if area is poorly ventilated, SCBA should be used.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures
Keep unauthorized persons away. Provide adequate ventilation and avoid breathing vapors. Put on appropriate personal protective equipment (see **Section 8**). If spilled in an enclosed area, ventilate area or use SCBA. Remove potential ignition sources.

Environmental Precautions
Avoid dispersal of material and runoff from contact with soil, waterways, drains and/or sewers.

Methods and Materials for Containment and Cleaning Up (Small or Large Spill)
Stop leak if possible without risk. Move containers from spill area. Absorb spilled material with vermiculite, dry sand or earth, put into sealed containers, store in a safe location and dispose of via a licensed waste disposal contractor. Do not allow runoff into sewers or water courses

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling/Personal Hygiene
Use good laboratory/workplace procedures. Use appropriate personal protective equipment as per **Section 8**. Keep in the original container or an approved alternative; keep containers tightly closed when not in use.

Keep away from heat, sparks and open flame. Eating, drinking and/or smoking should be prohibited where this material is being used. Workers should remove contaminated clothing/protective equipment and wash hands and face and before entering eating areas and eating, drinking and/or smoking.

Conditions for Safe Storage, including any Incompatibilities

Store in sealed original containers, or approved alternatives, when not in use in a dry, well-ventilated area. Protect containers from direct sunlight in a dry, cool and well ventilated area. Do not allow to freeze or exceed 40^0C (~110^0F). Do not reuse containers.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Occupational Exposure Limits:

CHEMICAL NAME	CAS NUMBER	ACGIH TWA	ACGIH -STEL
2-Ethyl-4-methylimidazole	931-36-2	N/A	N/A

Appropriate Engineering Controls
Good general ventilation should be sufficient to control worker exposure to any airborne contaminants. If working in enclosed spaces, provide additional local ventilation. Eyewash fountains and safety showers are recommended, as well as good laboratory/shop procedures and care.

Exposure controls

Respiratory Protection
If necessary, a properly-fitted vapor mask/respirator (organic vapor respirator) or SCBA should be used.

Hand Protection
Impervious chemical-resistant gloves (such as nitrile rubber, PVC, etc. of .35mm thickness or similar) should be worn when handling this material. Contaminated gloves should be disposed of properly.

Body Protection
Chemically resistant long-sleeved shirts and long pants or lab coats are recommended. Contaminated clothing should be washed separately from other clothes before reuse. Footwear appropriate for the work being performed should be worn and cleaned carefully if contaminated, before reuse. Heavily contaminated clothing or shoes should be disposed of properly.

Eye/Face Protection
Safety eyewear and face shields appropriate for the work being performed should be used. Ordinarily, this means a minimum of safety eyewear or splash goggles.

General
Use good laboratory/workplace procedures. Easy access to eyewash fountains and/or safety showers is recommended.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid	**Color:**	Yellow amber
Odor:	Amine	**Odor Threshold:**	N/A
pH	10.7 @100 g/L	**Melting Point:**	36-42^{0}C (~97-108^{0}F)
Boiling Point:	270-276^{0}C (~520^{0}F)	**Flash Point:**	>155^{0}C (~340^{0}F)
Evaporation Rate:	N/A	**Vapor Pressure/Density:**	<1mm Hg at 25^{0}C Heavier than air.
Relative Density	>1 at 20^{0}C	**Viscosity:**	5950 cP at 25^{0}C 569 cP at 40^{0}C
Auto-Ignition Temp.	475^{0}C (887^{0}F)	**Decomposition Temp.**	N/A
Upper/Lower Flammability or Explosive Limits LEL: 1.5 vol% UEL: 13 vol%			
Solubility: 180 g/L (n-octanol/water Partition Coefficient: 1.64)			
VOC Content: N/A-none.			

SECTION 10: STABILITY AND REACTIVITY

Reactivity: Exothermic reactions including polymerization may occur in contact with strong acids or bases, alcohols, strong oxidizing agents and excessive heat. This material will auto-polymerize at very high temperatures.

Chemical Stability: This product is stable under normal conditions.

Possibility of Hazardous Reactions: See "Reactivity" above for cautions.

Conditions to Avoid: Avoid moisture, excessive heat and ignition sources.

Incompatible Materials: Strong bases, acids, acid chlorides or anhydrides, oxidizing agents, amines and alcohols.

Hazardous Decomposition Products: Thermal decomposition may produce smoke, oxides of carbon and nitrogen and other products of incomplete combustion.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Toxicity

CHEMICAL NAME	LC_{50} INHALATION (RAT)	LD_{50} ORAL (RAT)	LD_{50} DERMAL (RABBIT)
2-Ethyl-4-methylimidazole	N/A	731 mg/kg	>400 mg/kg

Skin Corrosion / Irritation: Skin Irritation-Category 1

Serious Eye Damage / Irritation: No specific data.

Respiratory or Skin Sensitization: No specific data.

Mutagenicity: No specific data. **Carcinogenicity:** No specific data.

Reproductive Toxicity: No specific data **Teratogenicity:** No specific data.

Aspiration Hazard: No specific data.

Specific Target Organ Toxicity (Single and Repeated Exposure): No specific data.

Information on the Likely Routes of Exposure: Eyes, skin, inhalation and ingestion.

Potential Acute Health Effects and Related Symptoms:

See **Section 4**.

Delayed, immediate and chronic effects from short and long term exposure:

Some persons may become sensitized after chronic exposure and may exhibit moderate to severe allergic reactions when exposed.

SECTION 12: ECOLOGICAL INFORMATION

Toxicity:

CHEMICAL NAME	TEST	SPECIES	RESULT
2-Ethyl-4-methylimidazole	LC_{50} (96 hrs)	Fish	>46-100mg/L
	EC_{50} (48 hrs)	Daphnia	2003 mg/L
	EC_{10} (18 hrs)	Algae	79 mg/L

Persistence and Degradability:

CHEMICAL NAME	TEST	PERIOD	RESULT
2-Ethyl-4-methylimidazole	Not readily biodegradable	N/A	N/A

Bioaccumulative Potential:

CHEMICAL NAME	Log K_{ow}	BCF	POTENTIAL
2-Ethyl-4-methylimidazole	1.64	N/A	N/A

Mobility in Soil: No information is available.

Other Adverse Effects: Other information is not available. No information is available regarding classification as PBT of vPvB.

SECTION 13: DISPOSAL CONSIDERATIONS

Dispose of unused contents (incineration) in accordance with national and local regulations. Dispose of container in accordance with national and local regulations. Ensure the use of properly authorized waste management companies, where appropriate. See **Section 8** for recommendations on the use of personal protective equipment.

SECTION 14: TRANSPORTATION INFORMATION

UN No's: DOT/TG: UN2735 IMDG: 2735 ICAO: 2735

DOT/TDG/UN Proper Shipping Name: Amines, Liquid, Corrosive, N.O.S. (Contains 4-Methylimidazole)

Hazard Classes: DOT: 8 TDG: 8 IMDG: 8 ICAO: 8 ADR/RID: 8

Hazard Labels: DOT: 8 TDG: 8

Pack Groups: DOT: III IMDG: III AIR: III

Environmental Hazards: **Marine Pollutant:** No. **Hazardous Substance (USA):** No.

Special Precautions for User: No information is available.

Transporting in Bulk per Annex II of MARPOL73/78 and IBC: No information is available.

Label for Conveyance:

SECTION 15: REGULATORY INFORMATION

International and US Inventory Lists

Canada Inventory (DSL)	All components listed or exempt.	**EU-ELINCS**	Not listed.*
Canada Inventory (NDSL)	Not listed.*	**EU-EINECS**	Listed or Exempt
US Toxic Substances Control Act (TSCA)	All components listed or exempt.	**REACH, Annex XIV and Annex XVII**	Not listed.*
Other	Not determined, no additional information is available.		

***Note:** There is no listing on the public inventory, no information is available or the component has not been reviewed.

Substances of Very High Concern: None of the components are listed.

Other Information: Material is not listed as a CA Prop 65 chemical, and has no reportable quantity listings.

SECTION 16: OTHER INFORMATION

ABBREVIATIONS:

ACGIH: American Conference of Governmental Industrial Hygienists
ADR/RID: European dangerous goods transport, road and rail, regulations
CAS: Chemical Abstract Service Registry
DOT: Department of Transportation (U.S.)
GHS: Globally Harmonized System of Classification and Labeling of Chemicals
IATA: International Air Transport Association
ICAO: International Civil Aviation Organization
IMDG: International Maritime Dangerous Goods code
OEL: Occupational Exposure Limits
OSHA: Occupational Safety and Health Administration (U.S.)
PEL: Permissible Exposure Limit
RQ: Reportable Quantity
SDS: Safety Data Sheet
STEL: Short Term Exposure Limit (15 minute Time Weighted Average)
TDG: Canadian Transportation of Dangerous Goods Act and Regulations
TPQ: Threshold Planning Quantity
RQ: Reportable Quantity
UN: United Nations
U.S.: United States
N/A: Not available or not applicable.

Revision Date: 31 May 2015
Revision: 0
Reason for Revision: N/A

Notice:

The information contained herein is provided is correct to the best of our knowledge, information and belief at the date of publication. However, Air Logistics Corporation (ALC) makes no representation as to its completeness and accuracy. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release. This information is not to be considered a warranty or quality specification. Since the conditions of handling and use are beyond ALC's control, we make no guarantee of results and assume no liability for damages incurred by use of this material. This information relates only to the specific material designated and may not be valid if used in combination with any other materials or in any process not specified in the text. It is the responsibility of the user to comply with all applicable federal, state and local laws and regulations.

END OF SDS

AIR LOGISTICS CORPORATION – F.A.C.S. Group
925 North Todd Avenue • Azusa, California 91702 USA
Phone (626) 633-0294 Fax (626) 633-0791

SAFETY DATA SHEET

PowerSleeve™ W-11 Glass Woven Fabric

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: PowerSleeve™ W-11 Glass Woven Fabric
MFR'S NAME: Air Logistics Corporation, 925 North Todd Avenue, Azusa CA 91702
EMERGENCY PHONE: 800.424.9300 (CHEMTREC) **GENERAL INFORMATION**: 626.633.0294
USE OF THE SUBSTANCE: Standard fiberglass fabric used with PowerSleeve Resin™ systems to repair piping and other infrastructure which requires leak protection or an epoxy resin matrix.

SECTION 2: HAZARDS IDENTIFICATION

OSHA/HCS status: Not considered hazardous. However, proper handling measures are important to observe and are covered herein.

GHS Label Elements:
Hazard Pictograms:

Signal Word: Warning!

Hazard Statements and GHS Classifications:

H316	Causes mild, mechanical skin irritation.	Not Categorized
H320	(May) cause mechanical eye irritation (dust).	Not Categorized
H335	May cause mechanical respiratory irritation (dust).	Not Categorized

Precautionary Statements:

Prevention:
P261: Avoid breathing dust.
P264: Wash hands thoroughly after handling.
P270: Do not eat, drink or smoke when using this product.
P280: Wear protective clothing, gloves and eye protection.

Responses:
P301+P313+P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. Seek medical attention if irritation occurs and persists.
P302+P352+P333+P313: IF ON SKIN: Rinse skin with water/shower and wash with plenty of soap and water. If skin irritation or rash occurs, get medical attention.
P362+P364: Take off contaminated clothing and wash it before reuse.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+P313: If eye irritation persists, get medical attention.
P391: Collect spillage.

Storage:
P403+P233: Store in a well-ventilated place. Keep containers tightly closed.

Disposal: P501: Dispose of contents and containers in accordance with all local, regional and international regulations.

Other Hazards: None known. Exposure may aggravate pre-existing skin, eye, or respiratory conditions.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture: Substance.

CHEMICAL NAME	CAS NUMBER	CONTENT
Polyester Yarn	25038-53-9	0-5%
Sizing	N/A	0-5%
Polyester Veil	25038-536-9	0-20%
Fiber Glass, continuous filament, non-respirable	65997-17-3	80-100%

Occupational Exposure Limits, if available, are listed in Section 8.

SECTION 4: FIRST AID MEASURES

Description of necessary first aid measures:

General Get medical attention immediately for any person who is having trouble or not breathing, or any unconscious person. Provide oxygen or artificial respiration to a person if they have trouble breathing. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Place an unconscious person in a recovery position, maintain an open airway and loosen tight clothing.

Inhalation Remove victim to fresh air and keep warm and at rest in a position comfortable for breathing. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin Contact Remove contaminated clothing and shoes. Wash the affected area with plenty of soap and water. Launder clothing before reuse. Get medical attention if irritation persists.

Eye Contact Flush eyes with plenty of water, occasionally lifting the upper and lower eyelids and rolling eyes in a circular motion. Check for and remove any contact lenses. Continue to rinse for at least 15 minutes, or longer if there is any indication that material remains in the eye. Get medical attention if irritation persists.

Ingestion Wash out mouth with water. Remove dentures, if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. DO NOT induce vomiting. Get medical attention if irritation occurs or persists.

Most Important Symptoms/Effects, Acute and Long –Term:

Potential Acute Health Effects:

Inhalation Dust in high concentrations may irritate respiratory system. Exposure to decomposition products may cause a health hazard. Serious effects may be delayed after exposure. Harmful if inhaled in high airborne concentrations. Persons with sensitive airways (e.g., asthmatics) may react to dust.

Skin Contact May cause skin irritation. May cause an allergic skin irritation or aggravate existing conditions through prolonged/repeated contact.

Eye Contact Irritating and may cause redness and pain.

Ingestion May cause discomfort if swallowed.

Overexposure Signs/Symptoms:

Inhalation Mechanical irritation of nasal passages, mouth and throat.

Skin Contact Adverse symptoms may include the following: Irritation and/or Redness.

Eye Contact Adverse symptoms may include the following: Pain or Irritation. Watering. Redness.

Ingestion No specific data.

Indication of Immediate Medical Attention and/or Special Treatment needed:

Notes to Physician Treat symptomatically.

Specific Treatments No specific treatment(s).

See also Toxicological Information in Section 11.

SECTION 5: FIRE FIGHTING MEASURES

Extinguishing Media Dry chemicals, foam, water spray or carbon dioxide.

Unsuitable Media None known, consider presence of other materials.

Specific Hazards Material is not considered a fire or explosion hazard AND will not burn. Material may smoke due to sizing and polyester content.

National Fire Protection Association (USA):

Labeling: Not rated.

Hazardous Thermal Decomposition Products
Irritating or toxic substances may be emitted upon burning or decomposition. See **Section 10** for additional information.

Special Protective Actions for Fire Fighters
Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special Protective Equipment for Fire Fighters
Fire fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in a positive pressure mode during the attack phase of firefighting operations.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures
Keep unauthorized persons away. Provide adequate ventilation and avoid breathing dust. Put on appropriate personal protective equipment (see **Section 8**). If spilled in an enclosed area, ventilate area or use SCBA.

Environmental Precautions
No special precautions are necessary.

Methods and Materials for Containment and Cleaning Up (Small or Large Spill)
Dust particles will settle out of the air. Vacuum area to remove particles. Pick up larger pieces and dispose of as solid waste in accordance with local, state or national regulations.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling/Personal Hygiene
Use appropriate personal protective equipment as per **Section 8**. Keep in the original container or an approved alternative; keep containers closed when not in use. Do not reuse containers without cleaning carefully with soap and water.

Avoid creating dust. Eating, drinking and/or smoking should be prohibited where this material is being used. Workers should remove contaminated clothing/protective equipment and wash hands and face and before entering eating areas and eating, drinking and/or smoking.

Conditions for Safe Storage, including any Incompatibilities
Store in sealed original containers, or approved alternatives, when not in use in a dry, well-ventilated area. Protect containers from direct sunlight in a dry, cool and well ventilated area around 25^0C (~77^0F) and 65% relative humidity for best performance.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Occupational Exposure Limits:

CHEMICAL NAME	CAS NUMBER	ACGIH TWA	NIOSH REL (TWA)
Fiber Glass (if respirable)	65997-17-3	3mg/m^3	10 mg/m^3
Polyester	25038-59-9	Not Established	Not Established

Appropriate Engineering Controls
Good general ventilation should be sufficient to control worker exposure to any airborne contaminants. If working in enclosed spaces, provide additional local ventilation. Eyewash fountains and safety showers are recommended, as well as good laboratory procedures and care.

Exposure controls

Respiratory Protection
If necessary, a properly-fitted vapor mask/respirator complying with an approved standard (NIOSH N95) should be used.

Hand Protection
Chemical-resistant (impervious) gloves (such as nitrile rubber of .35mm thickness or similar) should be worn when handling this material. Contaminated gloves should be disposed of properly.

Body Protection
Long-sleeved shirts and long pants or lab coats are recommended. Contaminated clothing should be washed separately from other clothes before reuse. Footwear appropriate for the work being performed should be worn and cleaned carefully if contaminated, before reuse.

Eye/Face Protection
Safety eyewear and face shields appropriate for the work being performed should be used. Ordinarily, this means a minimum of safety eyewear or splash goggles.

General
Use good laboratory/workplace procedures. Do not eat, drink or smoke during use.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Solid	**Color:**	Off-white
Odor:	None	**Odor Threshold:**	N/A
pH	N/A	**Melting Point:**	N/A
Boiling Point:	N/A	**Flash Point:**	N/A
Evaporation Rate:	N/A	**Vapor Pressure/Density:**	N/A
Relative Density	N/A	**Viscosity:**	N/A
Auto-Ignition Temp.	N/A	**Decomposition Temp.**	N/A
Upper/Lower Flammability or Explosive Limits N/A			
Solubility: Insoluble.			
VOC Content: None.			

SECTION 10: STABILITY AND REACTIVITY

Reactivity: Hazardous reactions will not occur under normal conditions.

Chemical Stability: This product is stable under normal conditions.

Possibility of Hazardous Reactions: N/A

Conditions to Avoid: Avoid excessive heat for prolonged periods, sunlight.

Incompatible Materials: N/A

Hazardous Decomposition Products: Thermal decomposition may produce smoke, small traces of oxides of carbon and nitrogen, and other products of incomplete combustion.

SECTION 11: TOXICOLOGICAL INFORMATION

There are no known health effects from the long-term use or contact with non-respirable, continuous filament glass fibers as manufactured and as directed for use in this application.

SECTION 12: ECOLOGICAL INFORMATION

Toxicity:
No known effects.

Persistence and Degradability:

CHEMICAL NAME	**OECD Derived from OECD 301F (Biodegradation Test)-28 Days**
All components	Not tested, but expected to be low based on similar substances.

Bioaccumulative Potential:
No information is available.

Mobility in Soil:	**Soil/Water Partition Coefficient (K_{OC})**
All Chemicals:	No information available.

Other Adverse Effects/Information: No other information is available.

SECTION 13: DISPOSAL CONSIDERATIONS

Dispose of unused contents (incineration) in accordance with national and local regulations.

SECTION 14: TRANSPORTATION INFORMATION

UN No's: N/A-not regulated

DOT/TDG/UN Proper Shipping Name: None assigned.(non-regulated)

Hazard Classes: N/A-not regulated.

Hazard Labels: N/A-not regulated.

Pack Groups: N/A-not regulated.

Environmental Hazards: **Marine Pollutant:** No. **Hazardous Substance (USA):** No.

Special Precautions for User: No information is available.

Transporting in Bulk per Annex II of MARPOL73/78 and IBC: No information is available.

Label for Conveyance: N/A-not regulated.

SECTION 15: REGULATORY INFORMATION

International and US Inventory Lists

Canada Inventory (DSL)	All components listed or exempt	**EU-ELINCS**	All components listed or exempt.
Canada Inventory (NDSL)	All components listed or exempt	**EU-EINECS**	All components listed or exempt.
US Toxic Substances Control Act (TSCA)	All components listed or exempt.	**REACH, Annex XIV and Annex XVII**	All components listed or exempt.

Substances of Very High Concern: N/A-none.

SARA: Section 311/312: No hazards noted. Section 313: Hazardous if respirable.

OSHA: 29 CFR 1910.1200: Considered hazardous if respirable.

WHMIS: No information available.

HMIS Ratings: Health: 1 Flammability: 0 Physical Hazard: 0
Personal Protection: X

Other Information: N/A

SECTION 16: OTHER INFORMATION

ABBREVIATIONS:
ACGIH: American Conference of Governmental Industrial Hygienists
ADR/RID: European dangerous goods transport, road and rail, regulations
CAS: Chemical Abstract Service Registry
DOT: Department of Transportation (U.S.)
GHS: Globally Harmonized System of Classification and Labeling of Chemicals
IATA: International Air Transport Association
ICAO: International Civil Aviation Organization
IMDG: International Maritime Dangerous Goods code
OEL: Occupational Exposure Limits
OSHA: Occupational Safety and Health Administration (U.S.)
PEL: Permissible Exposure Limit
SDS: Safety Data Sheet
STEL: Short Term Exposure Limit (15 minute Time Weighted Average)
TDG: Canadian Transportation of Dangerous Goods Act and Regulations
TPQ: Threshold Planning Quantity
RQ: Reportable Quantity
UN: United Nations
U.S.: United States
N/A: Not available or not applicable.

Revision Date: 03 February 2016
Revision: 0
Reason for Revision: Received updated manufacturer's SDS

Notice:
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END OF SDS

An ISO 9001:2008
Certified Supplier

PRODUCT TECHNICAL DATA SHEET

X-TEMP-2 Matrix

High Temperature System For Up To 232° C (450°F)

PowerSleeve® is a high strength, field-applied composite system that is used for structural reinforcement of damaged piping. It is a wet layup, or field-pregged, fiber-reinforced polymer (FRP) system that consists of custom blended epoxy and unique fiber reinforcements tailored for piping repair. This product is suitable for pipes with leaks of which may develop leaks. This produced meets the requirements of the ASME PCC-2 standard.

FEATURES

- **Complete Installation Kits**
- **High Strength Carbon Fiber Available**
- **Low Training Time**
- **Excellent Toughness-Resists Cracking**
- **Excellent Chemical Resistance**
- **Works Over Obstructions**
- **Factory Pre-Measured and Sealed Components**
- **High temperature installation**

A two-component, heat and chemical resistant matrix used in our PowerSleeve® composite reinforcement products. This elevated temperature cure matrix wets out easily and can be applied to our PowerSleeve® W-11, G-03, C-2 carbon and our highly conformable Bear™ Fabrics. To achieve its ultimate chemical resistance properties requires post cure per the instruction sheet. It is relatively fast setting, approximately 80 minutes at the minimum application temperature of 150° F. Designed for use where maximum service temperature of 450° F is desired. This product must be post cured in order to achieve the best chemical resistance properties. The color will be dark amber when temperatures rise above 200° F. This product ships DOT hazardous (corrosive).

EPOXY PROPERTIES			
Working (pot) Life:	12 hours at 25°C (77°F)	**Mix Ratio:**	Factory Ratioed
Application Temps:	66-104°C (150-220°F)	**Service Temps:**	66-232°C (150 – 450°F)
Cure Time (dry to touch)**:**	6 hours 66°C (150°F)	**Full Cure:**	14 hours at 66°C (150°F)
Kit Packaging:	Fabric cut and resin premeasured	**Shelf Life:**	1 year in sealed jar
Color:	Dark Amber	**Hardness:**	90-95 Shore D - ASTM D-2240

COMPOSITE LAMINATE PROPERTIES		
TEST	**W-11 FABRIC**	**G-03 FABRIC**
Ultimate Tensile Strength:	48613 psi (warp direction) per ASTM D-3039	45,643 psi (warp direction) per ASTM D-3039
Ultimate Tensile Strength:	12,909 (fill direction) per ASTM D-3039	18,987 (fill direction) per ASTM D-3039
Tensile Modulus:	2.86 x 10^6 psi (warp direction)	2.47 x 10^6 psi (warp direction)
Per Ply Thickness:	.034” nominal	.017” nominal
Load Per Ply:	1759 lbs.	771 lbs.
HDT:	575° F	500° F
CTE, inx10^{-6} /in/°F:	5.3	estimated 6.0

Tensile data was takes on panels typical of field lay-ups.

ATTENTION: All of the proceeding data are based on laboratory conditions, at room temperature. Field conditions can change the characteristics of this product. Higher temperatures will lessen the working life of the product. Allow adequate time for application. Field testing is strongly recommended prior to application.

Storage & Handling

Store at 60-90° F in a dry place. Do not freeze. Keep any leftover material in a tightly sealed container. Always use clean, dry tools when mixing and applying the matrix. Mix ratios are pre-determined and packaged accordingly. Normal mixing procedure is to pour the contents of the Part B container into the Part A container and mix thoroughly. Use immediately. Mixtures left in containers can obtain dangerous temperatures during cure and can cause damage to the container and surrounding items

Shelf Life

12 months from date of sale, in an unopened container, stored in cool warehouse conditions.

Caution

Read MSDS prior to use. Some persons may be irritated by these products. Use caution and PPE. This product is for industrial use by professionally trained personnel only. Please read and understand all application instructions prior to using.

Design and Application Instructions

Design guidelines, application notes and wrap calculations for various applications are available from the factory.

Warranty

The manufacturer warrants that the goods delivered hereunder shall be free from defects in material and workmanship. The WARRANTY shall extend for a period of one (1) year after date of delivery of such goods to customer. This warranty is void in the event that the protective pouch has been damaged. THE MANUFACTURER MAKES NO WARRANTY EXPRESS, IMPLIED, (INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR INTENDED PURPOSE), OR STATUTORY, OTHER THAN THE FOREGOING EXPRESS WARRANTY. Failure of customer to submit any claim hereunder within the Warranty Period after receipt of such goods shall be an admission by customer and conclusive proof that such articles are in every respect as warranted and shall release the manufacturer from any and all claims for damage or loss sustained by customer. In the event customer submits a claim for defective material within the required Warranty Period, the parties agree that customer's sole and exclusive remedy shall be the replacement of such defective goods or a refund of the price of the defective goods. To the greatest extent practical defective goods shall be returned to the manufacturer for analysis. IN NO EVENT SHALL THE MANUFACTURER BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OR SPECIAL, INDIRECT OR INCIDENTAL DAMAGES ARISING OUT OF, OR AS THE RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, LOSS OF USE OF GOODS OR ANY PART THEREOF, EVEN THOUGH THE MANUFACTURER HAS BEEN NEGLIGENT OR HAS BEEN INFORMED OF CIRCUMSTANCES WHICH MIGHT GIVE RISE TO SUCH DAMAGES.

Data and parameters listed herein and in our data sheets have been obtained by Air Logistics Corporation using materials under carefully controlled conditions. Data of this type should not be used by engineers as design specifications, but rather as indicative of ultimate properties obtainable. Before using, user should determine the suitability of the product for its intended use. In determining whether the material is suited for a particular use, such factors as overall application configuration and design, field conditions and environmental criteria to which it will be subjected should be considered by the user.

F. A. C. S.™
FIELD-APPLIED COMPOSITE SYSTEMS

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