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Aquawrap®

What is Aquawrap® ?

Aquawrap® is a product to make weak things strong: pipe, vessels or tanks or structures. Specifically, this is a factory-
pregged, field installed, room temperature curing, fiber-reinforced polymer (FRP) composite product line. It is ANSI/NSF 61
approved for contact with potable water.

It is NOT a leak repairing product, although it is often used after a leak has been stopped by other methods.

Many products on the market are very similar to **Aquawrap®** in that they are pre-pregged, water-activated, and are packaged
in a foil pouch. Although visually the same, many factors determine the characteristics of any composite product, including
strength, durability, and performance. **Aquawrap®** is specifically engineered to provide high strength, structural
reinforcement.

The **substrate** (“fabric”) element of **Aquawrap®** is an e-grade, premium fiberglass roving, in a woven, bi-axial fabric tape.
Standard thicknesses are quite a bit heavier than what is seen for other types of fiberglassing work, and there are many other
technical design factors that apply to the weave itself to achieve the high performance that **Aquawrap®** gives.

The standard product has no carbon fiber in it. Carbon and other fabrics are available when conditions warrant.

The **matrix** element of this product is a tough polymer system that is custom manufactured by Air Logistics. Our matrix is
virtually odorless, with zero VOC’s. The only vapor release is a small amount of carbon dioxide. You can use it anywhere with
just basic personal protective equipment.

Matrix materials are rated as to their “neat” (no fiber) physical properties. The **Aquawrap®** matrix is about as strong and
chemically resistant as any suitable system can be.

What is Aquawrap® used for?

It is usually meant to be applied at mild ambient temperature around pipe or other vessels that have become weakened for some
reason, or which need to be brought up to a higher pressure containment strength.

It can be applied to the outside of pipe and vessels, and to the inside of large pipe and vessels at a wide range of ambient
temperatures and even in the rain, or under water.

This product line is very useful for going over the top of and reinforcing other types of leak repairing patches and structures. It
can be used to reinforce a leaking thin line so that a larger steel enclosure can be installed and injected.

The **Aquawrap®** product line can also be applied to reinforce concrete piers and structures; flat walls and structures; utility
poles, etc. The **Aquawrap®** product line incorporates many different fabrics, each having a particular application that suits
their characteristics.



What isn't Aquawrap® used for?

It's not for stopping or otherwise fixing active leaks. When applied to an active leak, the resin can be washed away from the fabric, leaving a leak path. Thus, installation for this type of application is not recommended as a permanent or complete fix. Stop or fix the leaks in the conventional way, or with other **F.A.C.S.™** products, then reinforce that fix with **Aquawrap®** and reinforce the remainder of the pipe.

The standard product can readily deal with operating temperatures of 325° F, but for high strength performance and product durability, it should only be applied to surfaces that will not exceed 288° F. Application temperatures must be between 33° F and 211° F, which are the extreme ends of the freezing and boiling points for water, the primary activator.

Strong solvents, strong acids, strong bases, reactive chemicals, ammonia, chlorine & oxidizers are all beyond the capabilities of the standard product. If you have questions about chemical compatibility, please call 626-633-0294.

The standard product's matrix is moderately degraded by exposure to UV light (sunlight) and some other air pollution elements. Therefore, it is a good idea that any installation be painted or otherwise protected, immediately. Installers should take the responsibility of applying the coating. If not, we recommend you receive in writing that the owner of the pipeline will apply an acceptable coating within a reasonable amount of time, not to exceed seven days.

Aquawrap® is somewhat hard to install to the inside of pipe or vessels. All internal pipe, vessel and flat wall work requires special application techniques. This type of work should be discussed with an Air Logistics representative prior to committing to the project.

What are the Aquawrap® strengths?

Refer to the **Aquawrap®** Technical Data Sheet for information.

The application must be properly addressed to determine if **Aquawrap®** is the correct solution.

- Is there any strength left in the vessel being wrapped, which is to be taken into account when calculating the repaired strength?
- Is any of the strength of the **Aquawrap®** going to be eaten up by torsion (twisting), beam bending, chemical attack or other physical stress?
- What is the pipe/vessel preparation going to be? Sandblast? None?

Second, since we have the capability of providing as much strength that is required for the particular application, we only need to install what is necessary. This can save time and money when compared to other types of reinforcement or repair systems.

Customers are accustomed to the steel pipe industry. Steel pipe is not available in the correct (perfect) wall thickness for 10 psi, and 20 psi, and 30 psi, ... and 100 psi, and 110 psi ... and 600 psi, and 610 psi. For practical matters, they make their pipe in standard wall, XH and XXH. This means that the customer usually has much more wall thickness than is really required.

But with **Aquawrap®**, what is required is what is installed. We provide a Composite Reinforcement Calculator that can help determine how many layers are required to replace any strength that has been lost by the degradation of the steel. We take into account diameters, tensile strengths, wall thicknesses, etc. to make the determination.

Another definition of the word "strengths" refers to a product's marketing strengths. Here are some:

- No resins to measure, mix, or apply to the fabric. Just open the package and apply.
- You can apply it in the rain, or even under water.
- NSF-61 approved for contact with potable water.
- Hot or cold ambient temperatures don't speed up or slow down the cure very much.
- Is installed in the field, without interrupting the pipe/vessel operation.
- Has a life expectancy of at least 20 years, under normal operating conditions.
- Very high strength to cost ratio.



- Very high strength to weight ratio. Major repairs won't generally require special support.
- Protects the original pipe/vessel from further external degradation.
- Is environmentally friendly – no hazardous waste.
- Works over the top of & around irregularities and complicated piping configurations.

What are the **Aquawrap®** limitations?

The standard product cannot be installed onto sub-freezing surfaces or surfaces above 212F.

It's an unfamiliar concept to many customers and they don't have first hand "installed jobs" experience. Composites are becoming a viable alternative to more conventional methods of repair. Their cost and ease of application are making them more attractive to the industry, and thus their popularity is growing.

For buried service there needs to be a strict procedure to insure against back-fill rocks and debris impacting the repair. Sharp impacts from objects such as rocks can start micro fractures. For buried pipelines, standard adhesive tape wrap suitable for below ground use is advised as a final coating.

What are the "red flags" to be careful of?

See the section, above, "What isn't it used for"; and ...

Totally rotted away pipe, or surfaces that are so bad that they cannot be cleaned cannot possibly be bonded to fully. Therefore, if the bond is to dirt or rust, the leak-containment capability (leaking out the end) of the **Aquawrap®** is only equal to the strength of the dirt's or rust's bonding to the parent vessel wall.

"Emergency" situations where the customer has a vessel about to come flying apart. Composite systems all take at least 24 hours to develop any decent strength. **Aquawrap®** achieves about 60% of its ultimate strength in just 8 hours, at room temperature (quite fast) and has reached *full* design or "laboratory" properties after only 24 hours. Lower temperatures can add to this time. Therefore, if they're expecting **Aquawrap®** to keep their vessel "glued together" a couple of hours after we're off the jobsite, other alternatives or application techniques need to be addressed.

Applications where mechanical abrasion or other rubbing might occur (crossing pipe racks, etc.) are fine, but need to be equipped with armoring or employ other special components.

Work where the existing piping is being eroded, worn or abraded away by the internal product (like catalyst and slurry piping). For **Aquawrap®** to handle this type of service (resistant to abrasive erosion), an abrasive resistant coating must be applied first.

What are the variations on the basic product?

Many different substrates are available. The pricing is different for each type of fabric, and some are special order. This includes very thick fabrics (so each wrap equals several wraps of the thinner, standard product). Carbon Fiber is also available in different weaves. Consult with an Air Logistics representative if you encounter a project that may require a special fabric or weave.

Special length rolls or special width fabrics, by special order and pricing.

How is **Aquawrap®** priced?

Aquawrap® is sold by the roll. Sizes range from 2" wide x 5-feet long, up to 12" wide x 150-feet long.

We have a published distributor price list, showing a "recommended list price" for each size roll.

Factory discounts may be increased for large orders. Contact customer service for details.



How is it installed?

Refer to “**Aquawrap**® Installation Instructions.” Deviating from this procedure will probably cause an installation to be weaker than it should be or perhaps even fail. The most common “error or omission” for **Aquawrap**® installations is not using enough cure-actuating water. Surface preparation is also very important.

The question of “how clean do I have to get the pipe?” comes up all of the time. The best response is, “what do you really want the **Aquawrap**® to do?” The structural strength imparted by the **Aquawrap**® is generally not affected by poor pipe surface preparation (within reason). But, most customers are looking for the **Aquawrap**® to bridge from an area of good pipe, to another area of good pipe, bonding to those good areas, and taking over the duties of the weakened or damaged pipe between the two good areas. If that is what they are looking to do, then the preparation at the “good pipe” bonding sites is critical. Some type of abrasive blasting is mandatory in those cases if success is expected. **Aquawrap**® should not be used where internal erosion is expected to wear away the pipe wall completely during the expected life of the repair. **Aquawrap**® is best used on installations where external damage is present.

Dents, ridges, craters, etc., in the vessel/pipe walls must be brought to “smooth & level” with a high compressive strength filler material (9,000 psi minimum compressive strength rating). This is to provide load transfer between the pipe and the composite. Our BP-10 system is an excellent choice for this purpose.

What are some of the cost cutting factors?

High volume of rolls. Larger factory discounts may be given for large orders.



How do we stack up against the competition?

ARGUMENTS FOR PRODUCT A, AGAINST **Aquawrap®**

Product A	Aquawrap®
Exotic, non-crimped, multi-axis substrate.	Not applicable if there is not a high cyclical loading or vibration situation. If there is this problem, look at PowerSleeve®.
No wet chemicals in the field.	a). Not true. You have to mix their adhesive b). Aquawrap® is set up so that there is no measuring or mixing.
Factory cured, so there are no environmental affects to the structural properties.	Our factory-pregged system has fabulous field properties. Aquawrap® is engineered that way.
Goes on fast, often 4 linear feet at a time.	An experienced Aquawrap® crew can put down product very quickly and efficiently.

ARGUMENTS FOR **Aquawrap®**, AGAINST PRODUCT A

Aquawrap®	Product A
Can accommodate diameter deviations, offsets, elbows (& all fittings), branches, tapers and non-round shapes.	Unable to handle such variations. And, the kits are very size specific. Any little deviation once you get out on the jobsite, and problems can develop. Elbows and tees are impossible to completely cover.
Field modifications take only scissors and a razor knife.	Field modifications, other than length of the sleeve sections, are very difficult. These modifications require power saws, power drills, etc.
We can easily bump up strengths, at selective spots or on selective axis, with field placement of extra composite	Possible, but this would take extreme planning and sales people or a customer that really understood composite engineering.
Our shipping & handling is easier, although total weight per foot shipped is about the same.	Their product ships in semi-rigid cylinders, the diameter of the pipe to be repaired x 4-feet long. The adhesive and accessories ship in a separate box.
What you need is what you get, in terms of thicknesses applied.	Product A comes in "standard" wall thicknesses, and you must apply at least two of them so that the seams get offset and bridged. Sometimes this isn't a big factor, but on a long repair, it could be a huge difference.



ARGUMENTS FOR PRODUCT B, AGAINST **Aquawrap®**

Product B	Aquawrap®
Uni-directional, extreme hoop-strength product.	Yes ... and that means that it <u>provides almost zero axial, bending and torsional strength</u> . Aquawrap® has a bi-directional (bi-axial) design with substantial strength properties in bending and torsion. Uni-directional fabric is available for high hoop strength where applicable.
It's pultruded.	Exactly. And pultrusion severely limits the type of substrate and matrix that can be used, thereby limiting this product to mostly mild or buried applications. The pultrusion process actually limits the degree of product fiber and matrix sophistication and strength that can be achieved.
It is qualified by DOT for pipeline rehabilitation.	Aquawrap® also qualifies to the DOT rule.
Factory cured, so there are no environmental affects to the structural properties.	Our material is factory pregged, with specific matrix to fabric ratios. Wide installation parameters are acceptable, such as wet, dry, hot, or cold.
No handling chemicals in the field.	a). Not true. You have to mix their adhesive b). Aquawrap® is set up so that there is no measuring or mixing.
It's a continuous wrap around the pipe, without seams or start/stops.	Yes, but study after study has shown that overlapped composite joints are very close to the same strength.
It's "heat treated" in the factory.	Their manufacturing process requires heat or "heat treating" for a couple of reasons. We can achieve the same strengths and properties without the heat.
Fully cured and ready to backfill in just minutes.	Their system that glues the layers of the wrap together in the field does not cure much faster than our matrix.



ARGUMENTS FOR **Aquawrap®** AGAINST PRODUCT B

Aquawrap®	Product B
Our Aquawrap® is meant to provide structural repair and reinforcement to anything containing pressure or needing structural help.	For all practical purposes, they are limited to fixing flaws, dents or other minor defects in very small areas of piping. If you need to cover more than 1-foot, you start having problems. Tees & obstructions are difficult.
We're better for above grade installations because we can tailor our components to radical industrial exposures; and we provide bending and torsional reinforcement, along with hoop strength.	Not too good for many industrial exposures and provides nothing but hoop strength.
Field modifications take only scissors and a razor knife.	No modifications or changes in shape, length or fit are permitted.
We can fit anything from tiny pipe to storage tanks, and any shape from round to square, flat or convoluted.	Limited to pipe sizes from about 4", up to medium-large. Object to be repaired must be very close to round.
Our product is meant to "go the distance"; including joint overlaps, staggered layer phases and the usual large area composite methods.	When covering more than 1-foot, linear, of pipe, getting joint overlap between the kits is impossible.
We can accommodate huge diameter deviations, offsets, elbows (& all fittings), branches, tapers and non-round shapes, all out of the same kit.	Cannot handle complete coverage of any elbows, tees, etc., nor any branches, flanges, tapers, offsets or reducers.
Up through 20" pipe, we can get under a pipe with only 6" clearance (less if we really had to). For larger sizes, the clearance goes up, but certainly not higher than 1-foot of clearance.	Often requires serious excavation, relative to the pipe size.
Aquawrap® is easily and successfully installed in the rain or under water.	Even high humidity can affect the strength of the field glue. Underwater is a real problem.
We can supply 2", 3", 4", 6", 8", 10", and 12" widths off the shelf	Some special small widths, but generally, 1-foot wide is the only choice.

Aquawrap® is an excellent choice for rehabilitating weakened structures. With proper training and application, using this type of repair can add years of life to structural components, saving a lot of money in the long run.

If there is ever a time where an installation is of a concern, please contact our office. We are here to support your installations so they go as smooth as possible, with minimal difficulty.