Koroseal®
Protective Linings

Application Guidelines

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INTRODUCTION

Koroseal® is a unique extruded sheet membrane manufactured by ProFusion Industries, LLC. It is manufactured from a series of proprietary formulations specifically developed for the containment of highly corrosive media, and has been proven to provide outstanding service. It combines the well-known chemical resistance of polyvinyl chloride with excellent flexibility and is especially designed to resist both oxidizing and non-oxidizing acids as well as mild alkalis and salts at temperatures up to 150°F.

For years, this proprietary flexible synthetic sheet lining has given remarkably effective protection to tanks and other equipment which hold corrosive agents. This success has been the result of intensive research and testing and the adaptability of the lining to the constantly changing corrosive services.

Koroseal Protective Linings are only as effective as the quality of the lining application. Accordingly, this summary of “Application Guidelines” is intended to provide the basics that are used when applying Koroseal lining.

The instructions and specifications in this manual are submitted with the understanding that their contents will not be divulged to others without the express written consent of ProFusion Industries, LLC.

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SUGGESTED TOOLS

Description	Source
Heat Sealing Gun (high production torch with 550 watt element) including various heat sealing tips.	Kamweld Industries, Inc. Norwood, MA https://www.kamweld.com/
Electric Spark Tester	Electro-Technic Product Chicago, IL https://www.electrotechnicproducts.com
2-1/2" Rubber Roller 2" Steel Roller 2" Diameter Stitcher Gooseneck Stitcher	Everhard Products, Inc. Canton, OH https://everhard. com/
Slotted Roller	Local Machine Shop
Electric Air Gun -(hair dryer type)	Master Appliance Co. Racine, WI https://www.masterappliance.com/
Rubber gloves Cement brushes & rollers Stanley razor knife Mill knife Skiving knives, 1" x 8" and 1" x 4" Shears Scraping tools Files Chalk line Dividers Safety goggles & shields Electric drill with attachments Lights (explosive proof) 12' steel tape Muslin cloth (lint free) Cheesecloth	Local Mill Supply House

NOTE: ProFusion Industries DOES NOT supply any of the suggested tools. These suggestions are for your convenience only and not intended as a recommendation or endorsement of the companies or their products.

FABRICATION

Steel Tanks

1. Material shall be new or equal full weight steel, free from lamination or other physical imperfections. All plate shall be flat with no appreciable buckle or warpage. All sharp edges on sheared plate must be removed, especially on inside of tanks. The thickness and weight per square foot shall be within the ASTM and AISI tolerances.
2. Tanks or welded parts shall be fabricated in accordance with standardized commercial practice to obtain a practical and uniform quality.
3. Rectangular open top tanks shall be properly reinforced with girth angles in accordance with accepted practice in order to provide adequate structural strength and prevent bulging.
4. All tanks shall be welded outside with full penetration welds. Inside welds are not required in order to facilitate a smooth butt joint of Koroseal sheet in all corners. However, if welding is required on inside corners, they should be ground to a minimum radius of 1/8". All welds must be smooth with no porosity, high spots, lumps, or pockets. Grinding is required to remove sharp edges, weld splatter and high spots. All weld splatter must be removed.
5. On tanks with dished heads, the head should be flanged in a manner as to eliminate wrinkles at the knuckle radius.
6. Partitions, braces, supports or other attachments on the inside of tanks must be fitted flush against the adjacent surface and full welded for strength. Welds are to be ground per No. 4 above.
7. The size, construction and location of outlets or openings shall be in accordance with instructions on the order and/or prints. All manholes in closed vessels shall not be less than 24" in diameter.
8. The applicator and/or end customer has the right to inspect all tanks at the vendor's plant, both during fabrication and on completion.

Note: These recommendations are intended to optimize the performance of and prevent damage to the Koroseal Lining. ProFusion Industries is not responsible for quality or performance of the metal tank.

PREPARATION

1. All metals should be inspected to determine that they meet "specifications" for welded steel tanks, wood tanks, or concrete tanks.
2. It is recommended that steel vessels to be lined are welded on the outside. If an inside welded tank is to be lined, the welds should be ground to obtain a smooth surface.
3. The metal surface to be blasted is to be free from oil, grease and chemicals. Cleaning the surface can be accomplished by using steam, flames or solvent.
4. Sand or grit blast steel to white metal finish in accordance with steel structures painting council SSPC No. 5 or NACE Standard No. 1-TM-01-70. All rust, scale, and dirt must be removed from metal surface.
5. After sandblasting, all remaining dust must be removed by brushing or vacuuming. Immediate metal priming is recommended to prevent oxidation of the metal surface.
6. The sandblasted finish should have an anchor profile of approximately .002" minimum depth.

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ENVIRONMENTAL CONDITIONS FOR ADHESIVE

Before any Koroseal cements or linings are applied or before any blasting is done, the following environmental conditions must be met:

- All substrates, cements, and linings must be at a temperature of at least 50° F but not greater than 90° F.
- The relative humidity must be less than 70%.
- The substrates, linings, and cements must be a minimum of 5% F above the dew point or wet bulb temperature.

Failure to comply with the above conditions can result in poor adhesion and blistering between the Koroseal Lining and metal substrate.

CEMENTING INSTRUCTIONS

1. Cut Koroseal to size before cementing. Usually, Koroseal sheets will contract approximately ¼" per foot of length and will expand slightly in width during preheating operation. Allowance for such dimension changes must be made when cutting sheets.
2. All cements should be thoroughly stirred and mixed sufficiently during use so solids will stay in suspension. When brushing cements, they should be of such consistency to give a smooth, uniform coverage. The brushing action should be gentle to prevent "brushing through" and removing the base coat. Use only brushes with nylon or animal bristle. When applying cements with a paint roller, use short nap roll cover (mohair, etc.) and pay special attention to see that excessive cement pick-up doesn't occur. Any rust spots that appear during or after the cementing application should be removed to clean metal. These areas should then be reprimed and/or recemented. In the event the lining cannot be applied for an extended period of time and the cement loses its tack, the cemented surface should be freshened or re-tackified by applying another coat of cement and/or cement solvent mixture. Cements are difficult to process at temperatures lower than 50°F or above 90°F. High temperatures will allow the cement to dry too quickly for easy working, and it may become necessary to provide cooling for the surface before application, provided that the temperature/humidity relationship is still within the specified parameters previously identified.
3. Drying times for cements vary somewhat depending on prevailing conditions. Drying time of cement should be long enough for the solvent to evaporate and form a dry or tacky/dry film. The rate of evaporation is influenced by temperature, humidity and thickness of wet film, etc., but normally 60 minutes is sufficient. Cemented parts should be kept free from all contamination during the drying and lay-over period.
4. Extreme care must be taken to prevent sweating of the metal surface if auxiliary cooling is necessary. The relative humidity should at no time be high enough to produce a dew point during cementing and cause moisture to deposit on the cemented surface. To prevent condensation, it is important that the substrate be a minimum of 5° F above the dew point or wet bulb temperature. Cemented surfaces should not be exposed to sunlight and/or weather.
5. Cements are not normally affected by temperature variations which commonly occur during shipping. Cements should be stored in a clean, cool, well-ventilated area. Storage at high temperatures may have a permanent effect on viscosity. To avoid solvent loss and consequent thickening of the cement, containers should be tightly sealed. When cements are transferred to smaller holding cans, the cans should be free from contamination and provisions should be made to close containers when not in use.
6. All blasted surfaces should be cleaned free of oil, dirt, dust, and moisture and be perfectly clean before applying the first coat of cement.
7. Swab surface of Koroseal sheet to be cemented with methyl ethyl ketone and allow to dry thoroughly.

8. Apply cement on blasted metal surface and swabbed side of Koroseal sheet with the following four (4) coats of cement:

		Drying Time for Normal Conditions		Drying
On Metal	On Swabbed Side of Koroseal Sheet	Minimum	Preferred	Maximum
1 coat A64B	1 coat A64B	6 Hours	24 Hours	96 Hours
1 coat 50/50 A64B/A730B	1 coat 50/50 A64B/A730B	1 Hour	2 Hours	24 Hours
2 coats A730B	2 coats A 730B	1 Hour	2 Hours	24 Hours

Cements may be thinned with solvent, if necessary, to a maximum of 10% by volume. Use methyl ethyl ketone for thinning A64B and isopropyl acetate for A730B. Stir thoroughly when thinning, adding solvent in small portions. Cement coverage is as follows:

Coverage Estimate

- A64B 60 sq. ft. of lined surface per gallon of cement. Cement coverage can vary significantly based upon substrate finish and material. Your own utilization rate/coverage should be confirmed prior to ordering adhesives.
- A730B 40 sq. ft. of lined surface per gallon of cement. Cement coverage can vary significantly based upon substrate finish and material. Your own utilization rate/coverage should be confirmed prior to ordering adhesives.

9. Cement A730B will jell or thicken somewhat at 45°F or lower, but if warmed slowly to 70°F maximum, it becomes liquid and suitable for use again. Stirring for 10 minutes with a high speed stirrer will improve quality of jelled cement which has been re-liquified. Cement A64B cannot be reclaimed if it has jelled or thickened.

SAFETY PRECAUTIONS

Solvent fumes from adhesive cements are flammable and may be explosive under certain conditions. Therefore, no flame, welding or smoking should be permitted during application. Precautions should be taken to ensure that all electrical switches or materials that could cause sparks are a safe distance from solvent fumes. Tanks, tables, and air-moving blowers should have ground wires to eliminate the possibility of static sparks during cementing operations. Operators should be provided with suitable masks and breathing equipment during cementing operation for protection against toxic solvent vapors. Adequate provisions for removal of solvent fumes by a suction blower and recirculation of fresh air should also be provided.

NOTE: Fabricator is responsible for conforming to best safety and environmental practices and state and federal law.

APPLICATION PROCEDURE FOR STEEL TANKS

1. Heat cemented Koroseal sheet to approximately 160°F - 180°F. A steam table, infrared heater or other suitable means of applying dry heat may be used for this purpose.

2. Cut panels and manually roll (2" rubber roller) into place against cemented steel while still hot. Use maximum pressure while rolling to avoid trapped air. To facilitate handling the cemented panels, roll them into fabric liners (cotton muslin) that are free from lint and loose ends and are tightly woven to prevent cement from sticking. While positioning the panels, turn back the fabric and unroll the Koroseal while removing the liner. Panels approximately 10 feet long are the maximum that can be applied without excessive cooling. Panels must be butted together in a straight and flush manner, making sure that the gap between panels doesn't exceed 1/8". Avoid application of lining under tension. Cut lining to suitable patterns to conform to dished heads and other similar surfaces. Apply lining first around irregular brackets/baffles, etc. Normally, the bottom of tank is lined first. Press and roll the lining into the corners in such a manner to prevent bridging. This operation should be done while the lining is hot. Panels, once placed, cannot be easily moved because of the tacky nature of the cements. In rolling out the air, always roll from the center of the panel out and progressively from one end to the other to avoid pocketing air. Butt panels tightly in the tank corners and avoid large gaps (not to exceed 1/8") in corners.

   Trim lining flush with nipple outlet openings, bolt holes, etc., using a sharp pointed knife. If the sheet cools somewhat while being placed or rolled down, use the hot air gun (hair dryer type) to heat up the cooled-off area. In areas that must be overlaid, such as vapor area above the liquid level in chrome plating tanks, the overlay should be cemented on the base sheet just as if it were metal, using the adhesives on both surfaces as outlined in Section 3. The overlay edge adjacent to the base sheet is then capped with a flat seaming strip and heat sealed in the standard manner. Take extra precaution to clean all cements off edges and areas to be heat sealed. Place a thin gauge copper wire in all butt seams to facilitate electric spark testing of the seams.

3. If there are outlets in the tank, roll hot cemented Koroseal in the cemented outlets and seal to lining in both tank and flange face with heat sealing gun. Use masking tape on the ends which are to be heat sealed for protection during cementing. Any area to be heat sealed cannot be properly heat sealed when cement is on the surface. The 0.0. of the Koroseal tubing should be just slightly smaller than the I.D. of the nozzle being lined. The Koroseal may be drawn into the nozzle using a narrow doubled liner to prevent it from sticking to the cemented nozzle before it is in place. The liner then can be easily removed and Koroseal rolled into place with a small roller or stitcher.

HEAT SEALING KOROSEAL

1. The surface of a Koroseal sheet which is to be heat sealed must be clean and free from cement and any foreign matter. Swab surface to be heat sealed (including seaming strips) lightly with methyl ethyl ketone and allow to dry thoroughly. Any cement on these surfaces must be removed or the seaming strips and base Koroseal sheet will not fuse together.

2. Heat sealing is accomplished by using a hot air gun and seaming strips die #145 / #127 or corner strip die #188 over butted edges or in corners. Koroseal is a thermoplastic; therefore, it can be fused to itself by heat and pressure without the use of an intermediate cement. Properly fused seams when pulled apart will cause a cohesive tear in the Koroseal instead of separating between the sheets. Fusing is accomplished by directing a stream of heated air into the angle formed between the sealing strip and the lining. When each surface is softened as evidenced by a glossy appearance and slight smoking, the two surfaces should be pressed together. The use of a metal roller following the strip will permit a continuous sealing operation. With proper heat and pressure, there should be a smooth shiny bead on each side of the seaming strip. Overheating must be avoided. Surface bubbling precedes charring, and a charred surface cannot be heat sealed.

3. The heat-sealing gun should heat the air to approximately 400°F - 450°F with an electrical heating element operating on 110 volts. When properly adjusted with two to three pounds air pressure, the stream of air can be just detected by the bare hand if held about 12" from the orifice. The heat gun should be moved slowly enough to fuse both surfaces as indicated by a shiny bead flowing just to the edge of the strips and fast enough to prevent charring. Gun adjustment should be made by making a sample seam and pulling it apart.

4. Test all heat-sealed joints with an electric spark tester to be sure there are no leaks through to the steel. Spark testing procedures are outlined in Section 5.

   Seams should be tested periodically during the heat-sealing operation and then completely after all joints have been seamed. All seams should then be retested again after the tank has been allowed to sit idle for two to three days, and before it is put into service. If a tank is to be moved, either within the customer's plant or by shipping from the applicator's shop, it should be retested 100% before being put into service.

APPLICATION FOR CONCRETE TANKS

The instructions are the same as those for steel tanks, except:

1. Concrete must be dry, dense, clean, sand finish (rather than glazed or water finish) and free from dust and loose particles on the surface. Concrete should be cured a minimum of 28 days. It is advisable to neutralize the surface with a 5% muriatic acid solution, followed by a water rinse and thorough drying.

2. In order to spark test a Koroseal lined concrete tank, a light gauge copper wire should be installed at the butt joints of the Koroseal sheet before the sealing strips are applied.

APPLICATION FOR WOOD TANKS

The instructions are the same as those for steel tanks, except:

1. Wood must be free from pitch/resin and must be smooth and clean. Cracks in wood should be filled with plastic wood or epoxy.

2. Different wood surfaces absorb varying amounts of cement, and it may be necessary to apply several coats of A-64-B cement.

3. Wood tanks are not normally blasted.

4. All joints need to be wire traced in order to permit spark testing.

NOTE: Fabricator is responsible for conforming to best safety and environmental practices and state and federal law.

SPARK TESTING OF KOROSEAL LINED VESSELS SECTION 5

SPARK TESTING

1. After heating sealing, all seams must be 100% tested with a high frequency, high voltage spark tester. The purpose of the test is to determine the presence of pin hole leaks, punctures, cuts, etc., that expose passage to base metal.
2. The recommended voltage for spark testing Koroseal is in the 10,000 to 15,000 volt range. After the spark tester has been adjusted for the desired voltage, the electrode should be kept in light contact with the lining and moved back and forth at the rate of approximately one foot per second. If faults or pin holes are present, the corona discharge will start to fade and the spark will change to a white color and pass in a straight line to the metal ground.
3. When testing seams over a non-metallic base, a ground must be provided for the spark tester. Ground connections can be made by running a wire or metal foil beneath the butted joints.

NOTE: Fabricator is responsible for conforming to best safety and environmental practices and state and federal law.

SHIPPING AND STORAGE OF KOROSEAL LINED VESSELS SECTION 6

SHIPPING AND STORAGE

1. Koroseal lined vessels should always be protected from strong sunlight while being shipped and stored. Direct sunlight will heat and soften the adhesive bond between the Koroseal sheet and metal surface causing the Koroseal to loosen and blister.
2. Koroseal lined vessels, when being transported from the applicator's shop to the final destination, should be protected from direct sunlight by placing a protective covering such as a tarpaulin over the entire lined surface. All flanges should be covered with wooden flange covers or covered with flat boards secured with "C" clamps. When possible, it is desirable to transport Koroseal lined vessels at night.
3. Koroseal lined vessels that need to be stored for long periods of time must be protected and stored, preferably indoors. If stored outside, the vessel should be covered with a tarpaulin-type cover and all flanges covered with plywood covers.
4. If possible, the vessel may be filled with water to minimize the heat on the lining. It is also suggested that the exterior of the vessel be painted white or a light color to reduce the temperature at the substrate.

REPAIRS

Regardless of all precautions taken in the original lining and maintenance of Koroseal lined equipment, most linings will eventually require repairs. The method of repairs is usually dictated by the type of repair required. The various types of repairs are described in the following guidelines:

REPAIRS OF FLAT SEAMING STRIP BY USING KOROSEAL INLAYS

1. Remove defective Koroseal to good adhesion.
2. Buff, grind or sandblast exposed metal until clean. If metal is damaged, pitted, etc., Koroseal should be removed back to good adhesion or 6" beyond metal damage. Damaged metal may be either cut out and replaced or ground smooth. If old metal is pitted and corroded and left in for repairs, it should be neutralized with soda ash before further preparations are made.
3. Cut necessary inlays from Koroseal sheet.
4. Swab all edges and one side of inlay Koroseal sheet with Methyl Ethyl Ketone.
5. Cement exposed blasted or ground metal surfaces and one side of Koroseal patch material with the following:

   1 coat A-64-B Primer

   1 coat 50/50 mixture A-64-B and A-730-B

   2 coats A-730-B

   Note: See Cementing Instructions Section 3 for drying times.
6. Lay in Koroseal pre-cut patch, butted tightly to old Koroseal and roll into place, making sure all air is removed.
7. Swab all areas to be heat sealed, including new seaming strip, with Methyl Ethyl Ketone and allow to dry thoroughly.
8. Heat seal all seams with proper flat or corner strip using same guidelines included in Lining Application Section 4.
9. Spark test all seams per Spark Testing Section 5.

REPAIRS TO LEAKS IN SEAMING STRIPS

When a pin hole leak is found in a seaming strip, it can be repaired by covering the pin hole with another strip or by cutting the old strip out and replacing with a new strip.

1. Applying Another Strip Over the Pin Hole Leak

   Bevel edge of strip where leak is located by heating the edge with a heat gun. Swab the edge of old strip and the new strip with Methyl Ethyl Ketone and allow to dry thoroughly. Heat seal the new strip over the leak using standard method of heat sealing as outlined in Lining Application Section 4.
2. Cutting Out Old Seaming Strip and Replacing With New Strip

   - Cut off old seaming strip with sharp flat knife.
   - Replace old cut off strip with new seaming strip.
   - Use standard heat-sealing practices as outlined in Section 4.

3. Repairs to Corner Strip

   - Remove defective corner strip plus a three inch (3") section of old Koroseal on vertical and horizontal side and bottom of tank.
   - Replace removed section with a one-piece Koroseal inlay.
   - Use flat seaming strip to seal inlay joints.
   - Spark test every seam after repairs to ensure there are no cracks or defective seams. It is also a good practice to spark test the entire vessel after completion of the repair job.

NOTE: Fabricator is responsible for conforming to best safety and environmental practices and state and federal law.

RELINING USED TANKS SECTION 8

Relining Steel Tanks

Remove old Koroseal lining from steel surfaces by cutting and scoring the lining on approximately one foot centers and pull off. The loosening of the bond between the Koroseal sheet and steel may be enhanced by heating the outside substrate. Old adhesives may be removed by heating, scraping, grinding, buffing, or sandblasting. The steel surfaces should be neutralized with soda ash after adhesives have been removed. The tank then should be thoroughly dried before starting the final sandblast for relining. All metal surfaces to be Koroseal lined must be sandblasted to a white metal blast in accordance with Steel Structure Painting Council SSPC No. 5 or NACE Standard No. 1-TM-01-70. The metal should be free from all rust, dirt, dust, etc. Compressed air that is used for blasting should be kept free from oil and water contamination. Blasting should not be done under conditions of high humidity. See Section 2, Metal Preparation. If sandblasting is not permissible or available, metal surfaces may be cleaned by grinding, buffing, sanding or wire brushing. There will be somewhat of a decrease in the adhesion level between Koroseal and steel when metal is prepared without sandblasting.

Relining Concrete Tanks

Remove old Koroseal lining from concrete tanks by pulling off in the same manner as outlined for steel tanks. If the concrete surface has been severely saturated with chemicals or damaged in any way, it should be ground down and refinished with new concrete. The surface must be a smooth sand finish and free from dust, dirt, sharp edges, etc. Any contaminated surfaces should be neutralized before refinishing.

The cementing, lining application, and testing of used tanks should be done in accordance with instructions as outlined in Sections 3, 4, and 5.

Relining Wood Tanks

Remove old Koroseal lining from the wood surfaces in the same manner as on steel tanks per above. If the wood has been saturated with chemicals, it may be necessary to refinish the surfaces to be relined by overlaying with ¼" to ½" marine plywood and then prepared in the same manner as new wood tanks. If the old surface is severe enough, it may be necessary to coat the surface with a chemical resistant material or fiberglass coating.

NOTE: Fabricator is responsible for conforming to best safety and environmental practices and state and federal law.

SERVICE LIFE

Increased service life of the lining will usually result from the following suggestions. These factors are primarily within the control of the user. Intelligent maintenance policies will add years to Koroseal lined equipment.

- Avoid physical damage of Koroseal by cables, sharp instruments, impact and heat. Koroseal is not a structural material and can be damaged.
- Avoid installing Koroseal lined tanks on unsubstantial bases. Rocking or moving during operation may allow joint failure.
- Allow adequate clearance for regular, periodic inspections. Inspections should include visual examination and spark testing. Minor damage, such as ruptured blisters or loose seams, should be corrected promptly.
- Avoid operating Koroseal lined vessel at higher than recommended temperature.
- Avoid welding Koroseal lined metals, except as an emergency measure.
- Avoid exposing Koroseal lined tanks to direct sunlight.

SOLUTIONS OF INORGANIC ACIDS

	Maximum Concentration	Maximum Deg. Fahr.*
Arsenic	Any	150
Carbonic	*Saturation at Atmospheric Pres.*	90
Chlorine Water (Hypochlorous Acid)	*Saturation at Atmospheric Pres.*	90
Fluoboric	Any	150
Hydrofluoric	60%	90
Hydrofluoric	25%	150
Hydrogen Sulfide Water	*Saturation at Atmospheric Pres.*	90
Muriatic (Hydrochloric)	37%	150
NITRIC	10%	150
NITRIC	20%	120
NITRIC	40%	90
Phosphoric	75%	150
Sulfuric	50%	150
SULFURIC	70%	90
Sulfurous (Sulfur dioxide water)	*Saturation at Atmospheric Pres.*	90
CHROMIC ACID	40%	140
HYDROGEN PEROXIDE **	30%	90

STAINLESS STEEL PICKLING SOLUTION

Nitric	16%	165 ①
Hydrofluoric	5%	

① Koroseal widely used for this mixture when protected by 9" of carbon brick sheathing.

ORGANIC MATERIALS

	Maximum Concentration	Maximum Deg. Fahr.*
Amyl Alcohol	Any	90
Butyl Alcohol	Any	90
Casein	Any	90
Castor Oil	–	90
Citric Acid	Up to Saturation	150
Cottonseed Oil	–	90
Coconut Oil	–	90
Ethyl Alcohol	Any	90
Ethylene Glycol	Any	90
Food Products	–	90
Gallic Acid	Up to Saturation	150
Glucose	Any	150
Glue	Any	150
Glycerine	Any	90
Hydroquinone	Any	90
Lactic Acid	Any	90
MalicAcid	Any	90
Methyl Alcohol	Any	90
Mineral Oils	Any	90
Oleic Acid	Any	90
Oxalic Acid	Any	90
Propyl Alcohol	Any	150
Soaps	Any	90
Tannie Acid	Up to Saturation	90
Tartaric Acid	Up to Saturation	90
Triethanolamine	Any	150

SOLUTIONS OF INORGANIC SALTS AND ALKALIS

	Maximum Concentration	Maximum Deg. Fahr.*
Aluminum Chloride	Up to Saturation	150
Aluminum Sulfate	Up to Saturation	150
Alums	Up to Saturation	150
Ammonium Chloride	Up to Saturation	150
Ammonium Hydroxide	Up to Saturation	150
Ammonium Sulphate	Up to Saturation	150
Barium Sulfide	Up to Saturation	150
"Black Liquor" NaOH, Na_2S, Na_2CO_3, Na_2SO_3	Up to Saturation	150
Calcium Bisulfite	Up to Saturation	150
Calcium Chloride	Up to Saturation	150
Calcium Hypochlorite	Up to Saturation	150
Caustic Soda (Sodium Hydroxide)	35%	90
Caustic Soda (Sodium Hydroxide)	10%	150
Caustic Potash (Potassium Hydroxide)	35%	90
Caustic Potash (Potassium Hydroxide)	10%	150
Copper Chloride (Cupric)	Up to Saturation	150
Copper Cyanide (in solution with alkali cyanides)	Up to Saturation	150
Copper Sulfate (Cupric)	Up to Saturation	150
Disodium Phosphate	Up to Saturation	150
Ferric Chloride	Up to Saturation	150
Ferrous Sulfate (Copperas)	Up to Saturation	150
Nickel Acetate	Up to Saturation	150
Potassium Cuprocyanide	Up to Saturation	150
Potassium Dichromate	Up to Saturation	150
Sodium or Potassium Antimonate	Up to Saturation	150
Sodium or Potassium Bisulfate	Up to Saturation	90
Sodium or Potassium Acid Sulfate	Up to Saturation	150
Sodium or Potassium Chloride	Up to Saturation	150
Sodium or Potassium Cyanide	Up to Saturation	150
Sodium or Potassium Hypochlorite	Up to Saturation	150
Sodium or Potassium Sulfide	Up to Saturation	150
Sodium or Potassium Thiosulfate	Up to Saturation	150
Tin Chloride [Stannous **or** Stannic] - Any aqueous solution	Up to Saturation	150
White Liquor (NaOH, Na_2S, Na_3CO_3)	–	90
Zinc Sulfate	Up to Saturation	150

PLATING SOLUTIONS

Plating Material	Maximum Deg. Fahr.*
Brass, Cadmium, Copper, Lead, Nickel, Tin or Zinc	150
Chrome	140
Gold, Indium, Rhodium, Silver ***	150

* **Call the experts at Koroseal Protective Linings (800-323-5676) for recommendations, particularly when the working fluid is a multiple chemistry environment or in an elevated temperature environment, both of which can affect service life.**

** Koroseal not affected, but prospective user should test lining for possible effect on stability of hydrogen peroxide.

*** Call Profusion regarding these solutions

ProFusion Industries, LLC
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PAYMENT AND SHIPPING TERMS
All terms are net 30 days from date of shipment as indicated in ProFusion's invoice, F.O.B. shipping point. Title and risk of loss shall pass to Customer upon delivery to the common carrier. All shipments will be made to those locations specified in Customer's purchase order or telephone order. Delivery is subject to availability and lead times required by ProFusion's production schedule.

PRICES
All prices quoted on a Price List or Quotation are subject to change by ProFusion without notice. The prices quoted herein do not include any taxes or duties (including without limitation any sales taxes on the Product(s) or freight) or any handling, rigging, uncrating, storage, or other charges incidental to shipment, delivery, storage, or use of the Product(s). ALL PRICES ARE SUBJECT TO ADJUSTMENT TO COMPENSATE FOR ANY INCREASE IN RAW MATERIAL COSTS OR ANY TAXES OR LEVIES EFFECTIVE THROUGH THE DATE OF SHIPMENT OF ANY PRODUCTS SOLD HEREUNDER.

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ProFusion may establish and change the credit and payment terms extended to Cuslomer when in ProFusion's sole opinion Customer's financial or previous payment record warrants such action, and Customer's order of Products hereunder constitutes an agreement to honor the credit and payment terms so established or changed. Customer will provide promptly upon request such financial information as may be reasonably required by ProFusion to complete its credit review of Customer.

DEFAULT
Security interest and right of possession to the Products sold hereunder shall remain with ProFusion until all payments hereunder (including deferred payments whether evidenced by notes or otherwise) shall have been made in full in cash, and Customer agrees to do all acts necessary to perfect and maintain such security right and title in ProFusion. If Customer does not pay any amount when due or does not meet any other obligation hereunder, then (in addition to any other remedies available at law or in equity) ProFusion may accelerate any balance due and require immediate payment thereof, may enter Customer's premises peacefully and remove the Product(s), may repossess the Product(s), and may resell the Product(s). The net proceeds of any such resale, after ProFusion's cost of repossessing, removing, transporting, reconditioning, storing, and reselling the Product(s), and all other associated costs, will be applied to the unpaid balance owed by Customer. Customer will remain liable for any deficiency which remains after such resale, and Profusion will return to Customer all net proceeds in excess of Customers unpaid balance. With respect to any delinquent payment(s), Customer will pay a finance charge at the rate of one and one-half percent (1-1/2%) per month, or at the maximum applicable lawful monthly rate of interest permitted by the laws of the state to which the Product(s) are shipped, if lower, computed from the date each delinquent payment or accelerated balance shall have become due. Furthermore, in any action initiated to enforce the terms and conditions hereof following Customer's default, ProFusion shall recover as part of its damages all costs, expenses, and attorney fees incurred in connection with any actions taken on account of such default.

WARRANTY
ProFusion warrants to Customer that the Products sold by Profusion will be free from defects in materials and workmanship. The warranty for any Product commences on the date it is shipped and expires 12 months after such date.

In the event ProFusion determines that any Product supplied by ProFusion does not meet any warranty, ProFusion will replace each such Product under the following conditions:

- Customer shall have notified Profusion in writing prior to the warranty expiration date and shall have received a written Returned Goods Authorization (RGA) from ProFusion referencing the Product(s) covered by warranty: and
- Customer shall have returned such Product(s) to ProFusion, referencing Customer's RGA, freight collect via common carrier specified by ProFusion (or freight prepaid and returned via any other carrier).

If ProFusion determines that a returned Product is covered under ProFusion's warranty and if such Product is received by ProFusion within 14 months of the date of shipment. then ProFusion shall replace the same at no additional cost to Customer. CUSTOMER ACKNOWLEDGES AND AGREES THAT ITS FAILURE TO FOLLOW THE WARRANTY CLAIM PROCEDURE SET FORTH ABOVE, INCLUDING, WITHOUT LIMITATION, THE PROCESS BY WHICH IT REPORTS ANY ALLEGED DEFECTS IN MATERIALS OR WORKMANSHIP AND OBTAINS ITS RGA FROM PROFUSION, SHALL CONSTITUTE A RELEASE AND WAIVER OF ALL WARRANTY OBLIGATIONS OF PROFUSION HEREUNDER.

This warranty is subject to the condition that Customer notifies ProFusion immediately in the event any Product at any time demonstrates any defect in materials or workmanship. This warranty is subject to the further condition that Customer does not store the Product(s) at temperatures exceeding 140°F.

Warranty coverage does not include any defect or performance deficiency which is the direct or indirect result, in whole or in part, of accident, abuse, misuse, vandalism, or other damage or alteration of the Product(s) by persons other than ProFusion employees, combining incompatible products, fires, floods, and other similar and dissimilar natural causes, damage, neglect, alteration, or any impairment of the Product(s) resulting from causes or conditions not associated with ordinary storage, handling, installation, maintenance, service, or use, maintenance or service by any party other than Customer, or any acts, omissions, causes, or events beyond the control of ProFusion. Furthermore, warranty coverage does not extend to dimensional changes directly or indirectly caused by storage, handling, or processing the Product(s) under environmental conditions exceeding those recommended by ProFusion or generally accepted by the industry for the Product(s) or for any storage, handling, manufacturing, or fabrication process used by Customer involving the Product(s).

THE WARRANTIES SET FORTH ABOVE ARE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE, EVEN IF SUCH PURPOSE IS KNOWN TO PROFUSION, AND IN LIEU OF ANY OTHER OBLIGATIONS OR LIABILITY ON THE PART OF PROFUSION. PROFUSION NEITHER ASSUMES (NOR HAS AUTHORIZED ANYONE TO ASSUME FOR IT) ANY OTHER WARRANTY OR LIABILITY IN CONNECTION WITH ITS PRODUCTS.

LIMITATION OF LIABILITY
CUSTOMER'S SOLE REMEDIES RELATING TO THE PRODUCTS ARE SET FORTH HEREIN. PROFUSION WILL HAVE NO LIABILITY FOR ANY CONSEQUENTIAL INCIDENTAL OR SPECIAL DAMAGES BY REASON OF ANY ACT OF OMISSION ARISING OUT OF OR IN CONNECTION WITH ITS PRODUCTS, OR THE SALE, DELIVERY, INSTALLATION, MAINTENANCE, OPERATION, PERFORMANCE, OR USE OF ITS PRODUCTS, INCLUDING BY WAY OF EXAMPLE AND NOT BY WAY OF LIMITATION, DAMAGES, EXPENSES, OR LOSSES INCURRED BY REASON OF LOSS OF USE, LOST REVENUES, LOST PROFITS, DAMAGE TO ASSOCIATED EQUIPMENT OR TO FACILITIES, COSTS OF CAPITAL, COSTS OF REMOVAL OR REINSTALLATION OF PRODUCTS, ANY LABOR COSTS, COSTS OF SUBSTITUTE PRODUCTS OR FACILITIES, COSTS OF REPLACEMENT PRODUCTS, COSTS ASSOCIATED WITH DOWN TIME, AND ANY SIMILAR AND DISSIMILAR DAMAGES, EXPENSES, OR LOSSES, WHETHER ANY SUCH LIABILITY IS BASED ON CONTRACT, TORT, OR OTHER LEGAL OR EQUITABLE PRINCIPLES, AND IN NO EVENT SHALL PROFUSION'S LIABILITY EXCEED THE PURCHASE PRICE OF THE PRODUCT(S) IDENTIFIED OR INVOLVED IN ANY DISPUTE.

RETURN OF GOODS
In the event Customer wishes to return any Product(s) supplied by Profusion because of overstock, etc., Customer shall first notify ProFusion in writing and shall have received a written Return Goods Authorization (RGA) from ProFusion. Profusion's issuance of the RGA shall be subject to ProFusion's inspection of the Product(s) for resellability. In the event that the Product(s) are returned to ProFusion, (i) a 25% restocking fee shall be charged to Customer; (ii) any quantity discount extended to Customer shall be recalculated and the increased cost charged to Customer; and (iii) Customer shall pay the cost of shipping the Product(s) to ProFusion, including ProFusion's shipping costs if ProFusion paid for the Product(s) to be delivered to the Customer.

MISCELLANEOUS
ProFusion may change the construction, design, or configuration of the Product(s) without notice to Customer as long as the general function of the Products is not thereby altered.

In the event any Product sold hereby is used by the Customer In a manner causing patent infringement, Customer shall hold harmless and indemnify ProFusion as to any and all damages and costs for which ProFusion may become liable because ProFusion is charged with contributing to or inducing said infringement, provided that said infringement is not caused solely by the construction or composition of the Product, regardless of the manner in which it is used.

Non assignment -Any assignment of this order, or of any rights or obligations hereunder, by the customer, without the written consent of ProFusion shall be void.

These terms and conditions are to be interpreted under the laws of the State of Ohio without regard to that state's choice of law principles.

The invalidity or unenforceability of any provision hereof will not affect any other provision and all terms and conditions will be construed in all respects as if any invalid or unenforceable provision(s) were omitted. The failure of Customer or ProFusion at any time to require the performance of any obligation will not affect the right to require such performance at any time thereafter. The waiver of any remedy with respect to any default will not be taken as a warver of any remedy for any succeeding default. Unless otherwise provided herein, no limitation or restriction on the remedies available to either party is intended by these terms and conditions. Clerical errors are subject to correction.

Course of dealing, course of performance, course of conduct, prior dealings, usage of trade, community standards, industry standards, and customary practice or interpretation in matters involving the Product(s) or the design, sale, delivery, installation, use or maintenance of the Product(s) or of similar or dissimilar goods shall not serve as references in interpreting the terms and conditions hereof.

Notwithstanding any other provisions, and in addition to all other conditions and exclusions set forth, ProFusion will not be liable for any delay or default in performance caused by events beyond its control, including by way of example and not by way of limitation any acts of God, any acts of third parties, acts of Customer or any of Customers employees, agents, or representatives, acts of civil or military authorities, fires, floods, and other similar and dissimilar natural causes, riots, wars, sabotage, vandalism, embargoes, labor disputes, strikes, lockouts, lack or shortage of transportation, labor, materials, supplies, fuel, or power, delays in receiving any permits or licenses, delays caused by any laws, regulations, proclamations, ordinances, or any government action or inaction, delays caused by contractors and subcontractors, or any other cause or condition beyond Pro Fusion's control In the event of any such delay or default, the time for performance of obligations of ProFusion will be extended for a commercially reasonable period of time

ProFusion reserves the right to allocate its available supplies among its customers on such basis as ProFusion may deem fair and practical under the circumstances without liability for any resulting failure of performance.

Customer's obligations hereunder are independent of any other obligations Customer may have under any other contract or account with any division of Profusion Customer will not exercise any right of offset In connection with any balances due under the terms and conditions hereof or under any other contract or account with Profusion.