

Marine & Boating Applications

Table of Contents

1. **Short Instructions**
2. **Moored Boats**
3. **Trailer Boats**
4. **Personal Water Craft**

Short Instructions: TC-11 works best if a protective film is generated before the boat is used. This means that for the first application, it is advisable to wash down the boat to remove any dirt and debris that may be covering the boat's mechanical components. The wash down applies only to the areas to be treated, which include the engine compartment, the transmission, prop assembly, and control systems. ICC recommends that you use the TC-11 Degreasing Surface Cleaner or a similar environmentally friendly cleaner and that you comply with all applicable environmental regulations.

After the boat has been washed down and allowed to dry, spray an even coat of TC-11 on the carburetors, throttle cable, choke cable, carburetor linkages, throttle and choke cable ends, throttle assembly, engine head, block, covers, and mounts; exhaust components, transmission, steering assemblies, through hull bearing, prop shaft, prop, pump assembly, rudder and fittings. You should also use TC-11 on reels, pulleys, metal joints, fasteners and other exposed metal parts that require protection.

Moored Boats: Moored boats are very challenging from a corrosion control standpoint. If the mechanical components on a boat have a robust coat of paint, TC-11 will effectively prevent corrosion from occurring where the paint film has small pores, cracks and fissures. Corrosion can become a major problem even if the paint film is 99.99% impermeable to oxygen, water, and salt. As soon as the tiniest corrosion cell forms, the corrosion can become quite serious. Moored boats are exposed to salt-water and a salt breeze 100% of the time. Unless all of the metal components on the boat are made out of 316 stainless steel (or even more exotic and expensive metals such as Hastelloy) the corrosion problems are going to be significant unless the paint is augmented with TC-11. Most of us know an owner who is meticulous about applying a corrosion inhibitor. These owners are able to maintain the original appearance of performance of their boat mechanical components indefinitely. If you ask them how often they had to apply the corrosion inhibitor, the interval is usually about three weeks. TC-11 can last 28 weeks or more. We recommend a 12 week interval between applications to insure that corrosion is eliminated

Marine & Boating Applications

100%. Before using TC-11, we recommend that you go through your boat and check the condition of the paint. If the paint is not in good condition, TC-11 is very useful in lifting off the corrosion that is in place and in assisting in the preparation of the surface prior to priming. If your boat is new, or if the paint is in excellent or good condition, please skip the next section. The best way to test the integrity of a paint or film is to wash down the area with a solid stream of water. If the water stream lifts the paint off of the surface, the paint film has failed. If it is not possible to remove the paint with a stream of water, the paint is in good shape.

Cleaning, Priming, and Painting

The importance of a good coat of paint cannot be overemphasized. This topic is discussed in detail on the [painting](#) web page. Although paint is only a few molecules thick, it can provide years of protection if it is properly applied and if the coat is maintained.

Cleaning the mechanical components of a moored boat is quite problematic. If you use a lot of water to do the job, you will end up with a lot of bilge water that you don't want. If your bilge is pristine, this is not a problem, because you can dump the water overboard. If your bilge water is full of oil and bacteria, you should try and improve the condition of the bilge water by eliminating oil leaks and/or making sure that no head fittings leak. A mild surface cleaner such as TC-11 Degreasing Surface Cleaner is recommended to remove accumulated oil and grease. Use a sponge to remove the dirt, but do not use the scour pad side of the sponge to remove dirt. Don't use a wire brush to remove dirt, because the bristles can go right through a coat of paint if you aren't careful. The idea is to use a small amount of surface cleaner, let it soak for a few seconds, and wash it off with a high pressure low volume water spray. If your engine electrical system is even slightly unreliable, run the engine while you rinse the cleaner off during this cleaning procedure. Once the electrical connectors have a coat of TC-11 on them, you no longer have to worry about electrical failures as a result of the system getting wet or inundated. The next thing to do is to see exactly how the paint is doing. If you have small amounts of corrosion around the fasteners and along the seams of assemblies, you have some real problems. The best way to deal with this situation is to apply a thick coat of TC-11. Let it sit for a few weeks, and hose off the TC-11. The TC-11 will actually pull the rust of the part. You will notice that the TC-11 film may take on a slight red hue or white hue. The coloration is from iron oxide or aluminum oxide that has gone into solution in the TC-11 film. When you rinse off the part with water, you also remove the

Marine & Boating Applications

corrosion. When you feel that the part is in good shape in term of removing existing corrosion in cracks and crevices, go over the rusted area with a small stainless steel wire brush. Yes, it is a lot like a toothbrush and it can be tedious, but the large amount of force over a very small area is enough to remove most corrosion. It also roughs up the surface so the paint will stick a lot better. If you have rust blisters, remove them with a chisel - don't ruin you screwdriver by using it for this purpose unless you have one that is no longer used. Ironically, the bigger the job, the more efficient your time is. The idea is to try and do as much of the boat as possible at the same time. If you do a lot of little jobs, the cost per square inch of surface treated can be very high. Wash off the part one more time. Let it dry very thoroughly. Even the smallest amount of water will totally ruin a paint job. The last drop to evaporate is the one that can do the most damage, since it is in a crack or crevice. Don't rush this part of the project. Use caution when applying paint in an enclosed area. The best approach is to set up a fan that will pull the fumes away from you. A respirator that is approved for organic vapors is highly recommended. The activated carbon the filter is 100% effective in removing hydrocarbon vapors. As soon as you smell even the tiniest trace of paint through the respirator, change it, because the carbon has broken through and the vapors will go through almost unabated after that point in time. Use a piece of cardboard to control over spray. It is a good practice to paint everything one color. That way over spray is not as much of an issue. Go ahead and paint hoses. Modern paints do not affect modern rubbers that are used in marine applications. A lot of hose failures are caused by hose fittings rusting and starting to leak. For some reason manufacturers use cadmium plated screws on stainless steel hose clamps. Make sure that all of your hose clamps are 100% stainless steel. The only cost a few cents more, and the are almost completely corrosion proof. Primer dries fairly quickly, but be careful. If the primer is not 100% dry, you will end up with a condition known as vapor entrapment. This means that the solvent in the primer gets trapped underneath the finish coat. This is a common panting error, and the entire film of paint never gets very hard. The finish coat goes so quickly and looks so good that it is almost fun to do. ICC strongly recommends that you purchase the finish coat paint from the same manufacturer that supplied the primer. The bond between the two coats of paint is the weakest link, and a properly matched finish coat and primer can be very durable.

Marine & Boating Applications

New Boats and Boats and Boats in Bristol Condition

It is a good practice to go over a boat and check that the factory paint job was done correctly. If you see any exposed steel, copper, bronze, brass, or cadmium, it is a good idea to clean, prime, and paint the surface. The level of finish can be quite uneven in even the best boats.

Marine engines have excellent paint jobs when they come from the factory, but the accessories may not be at quite the same level. Applying TC-11 is a simple matter of spraying a thin film of TC-11 on the surface you want to protect. Make sure that the surface is clean and dry. This is not critical, because the TC-11 will displace both dirt and water. The goal is to have a thin film of TC-11 a few molecules thick on every metal surface on the boat.

Every three months, it is a good idea to wash down all of the metal surfaces on the boat. This may generate minor bilge water problems, but this is more than offset by the fact that corrosion is eliminated 100%. The rinse water will contain trace amounts of TC-11 residue, which is referred to in the environmental lexicon as "**Total Residual Petroleum Hydrocarbons**" and it has an environmental impact similar to a Big Mac. The majority of the TC-11 will stay on the metal surface, the difference being that it has shed its film of salt and dirt. After the wash-down, let the metal parts dry and re-apply a thin film of TC-11. Once a year, it is a good idea to clean the metal surfaces with a mild surface cleaner. This gets rid of any dirt and salt that may accumulate, as well as inevitable oil leaks. By using the annual cleaning as an opportunity to touch up the paint, you can minimize the time and effort required to keep your boat in Bristol condition.

Electrical Systems and Connections

One area that deserves special attention is electrical connections. Some boats have fantastically engineered systems, but many boats have a multitude of spade connectors and terminal connectors that can have problems. By applying TC-11 it is possible to make the electrical system highly water resistant. Even if the connection gets wet, it will not short out, because TC-11 is an insulator. In addition, corrosion will not occur at the connector interface. Unless some preventive measure such as TC-11 is used, corrosion will start at the edge of a connector and work its way to the center. Once the exterior has corrosion, it is only a matter of time before the resistance across the junction is so high that the voltage drops below

Marine & Boating Applications

the design level. These problems can accumulate, since many circuits have several connectors. By using TC-11, the connector will not get wet, even if you flood the connector with a hose. This means that by using TC-11 you can use rinse water without worrying about generating electrical problems. Most electrical systems and components are not rated for a wash down. TC-11 overcomes this problem at a minimal cost.

Trailer Boats

TC-11™ is the best product available for the long-term protection of "high dollar" parts such as throttle and choke cables, carburetors, the engine and exhaust system externals, electrical components, steering components, latches, hinges, and fittings.

TC-11 was developed expressly for boats, especially boats used in salt water. A lot of boat failures are caused by tiny parts that either disintegrate or fuse themselves to another part because of corrosion.

This is a guideline for the long-term protection of your boat. Corrosion control starts when the boat is built and it is an important part of owning a boat. Salt water is a very aggressive corrosive environment, and unless an owner is diligent, the cost of repairs will take all the fun out of owning a boat. Ask any owner.

TC-11™ requires less than 2% of the time required to "clean up" a boat and represents less than 2% of the cost of the fuel and oil required to operate the boat. In return, you will enjoy increased reliability, significantly reduced repair costs, and the satisfaction of mechanical components that look brand new – permanently!

Short Directions

1. Wash down boat using your normal procedure.
2. Allow boat to dry.
3. Apply a thin film of TC-11 to all metal parts on the boat.
4. After use or at three month intervals, wash down boat and re-apply a thin film of TC-11.

Marine & Boating Applications

5. Once a year, clean metal surfaces with a mild surface cleaner, allow boat to dry, and re-apply TC-11 film.

Long Directions

Trailer boats are very easy to take care of because they are in "dry dock" most of the time. The same maintenance activity or repair that is problematic on a moored boat is quite simple on a trailer boat.

If you have a new boat, skip the following section. If you like the rest of us, the next section is very important.

TC-11 and Paint

It is very important to understand the relationship between paint and TC-11. Paint is a coating, and TC-11 is a bulk lubricant. Paint is an amazing product, since it is only a few molecules thick, and if properly applied it can provide many years of protection. TC-11 is not a substitute for paint. What TC-11 does is overcome the shortcomings in any coat of paint without shortening the life of the paint itself, which makes it an amazing product.

We will use the example of a marine engine to discuss the relationship between paint and TC-11. When a quality marine engine leaves the factory, it has an outstanding coat of paint. The entire engine has a robust layer of enamel on top of a primer that has been applied to a chemically cleaned surface. The paint itself may last twenty years or more, because engines operate out of the sunlight and sunlight is the reason that paint films fail.

Is the engine protected? No. Not really. Items such as the throttle cable, throttle pivots and choke cable simply cannot be painted. Neither can the throttle adjustment screws. The electrical system is prone to shorts if the engine compartment gets wet, and the connectors will corrode over time.

The situation gets worse when maintenance is performed. For example, if the belts are replaced on a routine basis (which is a great idea), all of the tensioning adjusters are no longer painted, and the fasteners used to secure the various accessories no longer have a contiguous coat of paint.

In spite of the best efforts of the factory, the engine will start to corrode.

Marine & Boating Applications

The cost of the corrosion problems is not insignificant. In addition, failures occur on a random basis, which means that an entire engine can fail because a five-dollar part decided to stop working.

Does TC-11 help in this situation? Absolutely.

If TC-11 is applied to the engine when the boat is new, the appearance and function of the engine will not change over time. The significance of this statement cannot be overemphasized. TC-11 is a film that sits on top of the paint. Any salt, water, or dirt that touches the engine doesn't really touch the engine: it sits on top of the TC-11 film. In essence, the engine has been "waterproofed". The carburetor linkage is completely protected if TC-11 is applied. TC-11 penetrates into the micro-cracks and crevices in the paint film.

The engine electrical system is water resistant if TC-11 is applied. Many gasoline engines shut down if you spray them with a hose. As soon as water touches the distributor, it works its way under the boots and shorts out the spark plug wire. This does not happen if TC-11 is applied. When the water hits the distributor cap, the TC-11 prevents the water from working its way between the rubber boots and the cap itself. We do not recommend spraying hot engines with water (cold ones are OK), but engines can get wet in real world situations and engine failures due to electrical problems are not uncommon.

A new boat owner can use TC-11 and never have a corrosion problem related to TC-11. So what is a used boat owner to do? Start painting?

No, not really. TC-11 removes rust. This means that you should use TC-11 to remove the existing rust on your boat. Since TC-11 stops the rust that is in place, there is not an immediate requirement to improve the quality of the underlying paint job. Each time you apply TC-11 and wash it off, you are removing corrosion from the engine. TC-11 will not get rid of heavy rust deposits, but it definitely removes corrosion.

The best time to upgrade the paint is right after the recommended annual cleaning. Once you wash the engine with a mild surface cleaner and rinse it off, it is the perfect time to paint the engine. The preparation, which is 90% of the effort, has been done. By using a piece of cardboard as a shield, it is possible to spray paint the engine without getting over spray on the boat.

Marine & Boating Applications

If you have heavy corrosion deposits (more than 1/64th of an inch thick), use a chisel to remove the rust. Follow up with a small stainless steel wire brush. Make sure to rinse the area with water or wipe down the area with a cloth soaked with low odor mineral spirits. Keep wiping down the area until no additional dirt is picked up by a moist cloth soaked with a suitable solvent. Do not let the solvent contact your skin. Provide adequate ventilation.

Make sure that the engine is absolutely dry before painting. Any water on the engine will become trapped by the paint, which totally defeats the purpose of painting in the first place. This is one area that is often rushed, and it really degrades the performance of the paint film.

Also, do not paint in inclement weather. When the humidity approaches 100%, the amount of water on the surface of the engine is significant. This is one of the most common modes of paint failure.

It is necessary to apply a primer to the areas on the engine that have rusted and been cleaned. Use a high quality marine primer. The hardware store variety will not hold up in a marine environment. Don't over spray. In fact, it is usually better to use a small brush to apply the primer, since the areas to be primed are usually quite small. Let the primer dry thoroughly. If you don't, you will get vapor entrapment. The solvents in the primer will weaken the finish coat, and both coats will end up being too soft. The paint will fail within a year. This is a very common occurrence.

Zinc chromate is recommended for aluminum. This is a high quality primer, and it is well worth the price.

Primers for steel are a problem. In the "old days" the primers contained lead, which provided outstanding performance. The problem was that lead is one of the most toxic metals out there and it is totally illegal to put lead in paint. The modern primers don't offer truly outstanding performance, but they do the job. Use a white primer for light finish colors and gray primer for dark finish colors.

Try and use a finish enamel that is recommended by the primer manufacturer. Usually a marine paint manufacturer will manufacture a matching primer and finish paint. It is much better to have two thin finish coats than one thick one. Indeed, after all of the time and effort that has gone into painting the engine, it is a good idea to put on several coats. Follow the manufacturers recommendations about the interval between

Marine & Boating Applications

coats. Some paints require more time between coats than others.

Two part paints are for the professionals only. They offer spectacular performance, but they are very expensive and you really have to know what you are doing to use them.

TC-11

As you have probably figured out by now, using TC-11 is the easy part. And inexpensive.

The goal is to maintain a layer TC-11 between the surface of the paint film (or metal on unpainted surfaces) and the oxygen in the air, water, salt, and dirt. In addition, TC-11 is a non-conductor, which means that galvanic corrosion will not occur when the item gets wet.

TC-11 does remove light surface rust. Within reason, TC-11 can remove all of the corrosion on the boat. This does not hold true if the boat is heavily corroded, but it does hold true if the boat is in fairly decent condition.

Step One: Up, Out, and Under

Boats are not well suited for storage in the water. Water storage causes big problems, including leaks, marine growth, and corrosion. Make sure your boat is stored on a trailer if at all possible.

The best way to store a boat is in a garage. As a minimum, cover the boat with a high quality cover. It is important to have a cover that "breathes". This means that the spaces between the threads are small enough to keep out water droplets and large enough to let water vapor pass through the material. Also, the cover protects your boat from sunlight, which over an extended period is highly destructive to soft parts such as rubber and plastic. Finally, the cover protects your boat from dirt. It is easy to underestimate the corrosive effects of dirt. A combination of dirt and water will eventually lead to serious corrosion.

Store your boat in a nose-up position with the hull drain plugs open. This allows for water drainage through the hull drain plugs. In the case of an open hull, a nose down attitude can result in so much water in the boat that the hull can end up with structural problems.

Marine & Boating Applications

Step Two-Flush and Dry the Engine

Four stroke engines are much easier to deal with than two-stroke engines when it comes to flushing the engine. Two strokes have the potential to flood the cylinder, and they really do smoke a lot at idle.

The minimum flush time is ten minutes, fifteen minutes is better.

Salt-Away is an excellent product that should be used in conjunction with TC-11. Salt-Away addresses corrosion problems in internal engine cooling passages and exhaust component water jackets. Some owners get carried away and rinse the boat engine with Salt-Away every time they use it. This is not a bad practice, but it really isn't necessary. Salt-Away can be used every three months and achieve nearly the same results. Always use Salt-Away before the boat is going to be laid-up for the winter.

Wash-Down

By spending a few dollars for a hose splitter and an extra hose, the wash-down can be integrated with the engine rinse. While you at the hardware store, get a quality hose nozzle. This is real time saver, since the time required to wash-down the boat, the trailer, wet suits, life jackets, and all the rest of the gear is usually about the same time required to rinse out the engine internal passages.

The first priority is to rinse the engine compartment. Use the spray to rinse every surface of the engine compartment. If the original air inlet system is in place, it is almost impossible to spray water into the engine intake. Aftermarket air filters can be a major source of water infiltration, even if the engine is off. If you have truncated cone style air filters (which are an excellent design since they function as velocity stacks), spring for a few dollars and buy sleeves for the air filters. The sleeves do not affect the flow of air through the filter, but they do keep water droplets (or spray) from entering the air filters.

Be sure to rinse the carburetors, exhaust system, engine block, motor mounts, and power-takeoff assembly. If the boat hull is divided into separate compartments, be sure to rinse each one thoroughly. Don't worry about the electrical system as long as it has been treated with TC-11.

The boat should have a slight nose-high attitude while it is being rinsed. Otherwise, the rinse water will accumulate in the hull.

Marine & Boating Applications

Rinsing works by dilution, so don't flood the boat hull thinking you are doing a good job of rinsing the boat. Break the rinse process up into several steps. This way, each time you send a sheet of water down the hull you are significantly increasing the dilution ratio.

Make sure to rinse the entire steering assembly. This includes any trim system cables and fittings you might have.

The Journey Home

Make sure to leave the hull drain plugs open on the trip home. This allows the residual water to drain out, particularly when going uphill.

Never cut a corner and leave the rear straps off. The straps limit the bounce height of the boat. Its not going over the bump that overstresses the trailer and boat; it is the uncontrolled bounce. The G forces can get a lot higher than you might think if the boat is unrestrained.

It's a great idea to fill up the gas tank on the way home. This way the boat is ready to go for the next trip. Also, it's a good idea to inspect the trailer, hitch, and straps before and after every trip.

TC-11 Application

Before you store your boat, make sure that the boat dries out completely. Storing the boat in a garage and letting the boat sit for a few hours with all of the covers open or off best accomplishes this. An alternative is to let the boat sit in the sun for an hour or two. You can get carried away and sponge out the bottom of the bilge, but this is time consuming and isn't necessary as long as the rinse water was diluted properly and the bilge water volume is limited to a few ounces.

In any event, once the boat has dried completely, it is time for the most important step of all: putting on the TC-11. Spray a coat of TC-11 on all of the metal parts. There is no harm in applying TC-11 to plastic and rubber parts, but they don't really need any corrosion protection. The idea is to coat all of the metal parts with a thin film of TC-11.

Marine & Boating Applications

One nice thing about the aerosol is that it sprays upside down. This means that you can apply TC-11 to hard to get to parts that require an up angle for the spray pattern.

You want the engine compartment to look as if you just applied a coat of clear paint. If you see areas that are not shiny, you haven't put enough on. If you see drips, sags, or puddles, you are putting on too much.

TC-11 is quite mobile when it is first applied. This means that it will work its way between every moving part on your boat – perfect lubrication! TC-11 also works its way into threads, and the spaced between different components. This is an extremely useful aspect of TC-11, since it prevents frozen fittings and frozen assemblies. TC-11 has significant penetrating capabilities, and this lasts for about a week after application.

TC-11 definitely frees frozen mechanisms. If the first application does not work, go back at a later date and re-apply an additional coat of TC-11. The interval is based upon how bad the corrosion is and how far the TC-11 has to penetrate to reach all of the rust. Once TC-11 penetrates into the rusted area, the mechanism will stay lubricated for months.

That's it! You just took an extra thirty seconds and spent less than a dollar, and your boat is now protected until the next time you use it. In addition, and during the next time you use it!

Close the engine cover, but do not secure the latches. If your boat has separate compartments, do not secure any of the latches. If the fire extinguisher is in a separate compartment, leave it slightly open.

Once the cover is re-attached, you are ready for your next trip. You should be fueled up, the oil tank is full, and you are ready for another day of fun.

Cleaning

One of the best things about TC-11 is that it doesn't come off with a water rinse, but it does come off with mild cleaners. This means that you can wash down your boat and not worry about removing the film of TC-11 on protected parts. On the other hand, if you want to focus entirely on the appearance of the boat (and ignore protection and lubrication) you can easily remove the TC-11 film with a cleaner such as Simple Green, Meguiar's Extras, or citrus based products.

Marine & Boating Applications

When you remove the TC-11 film, the boat really does look the same as the day it was purchased – if you used TC-11 from the time that it was new. This is the most amazing characteristic of TC-11. We strongly recommend that you re-apply a film of TC-11 immediately after cleaning, because corrosion will start to take place as soon as you remove the TC-11 film.

"Stickiness"

One common characteristic of effective film treatments is that they are "sticky". This means that they tend to accumulate dirt. This is not a problem in a marine environment, since marine environments are dust free (that's why your engine doesn't have an air filter).

During storage, this can be a problem if the boats are stored in a dusty environment. The dust is a really only a nuisance, and it can easily be removed with a spray nozzle on a garden hose.

Compatibility with Paints, Plastics, and Rubbers

TC-11 is compatible with the paints, plastics, and rubbers used to build boats. ICC has tested TC-11 for compatibility with latex, Nitrile, HDPE, neoprene, silicone, Buna-N, acrylic, polyester, PVC, nylon, Viton, epoxy, polystyrene, ABS, linoleum, Formica, varnish, and other plastics, paints, and rubbers without any indications of incompatibility.

Existing Corrosion

TC-11 will not magically remove existing corrosion. TC-11 is oriented towards preventing the corrosion in the first place. TC-11 will arrest the corrosion, which means that no further corrosion will occur. This provides ample time to properly clean, prime, and paint corroded areas. TC-11 will also remove light surface rust.

Electrical and Electronic Equipment

TC-11 is recommended for use with electrical equipment, but it is not recommended for use with electronic equipment. TC-11 is compatible with the materials used to assemble printed circuits, but the TC-11 film can interfere with the heat dissipation characteristics of the discrete components.

Marine & Boating Applications

TC-11 is a non-conductor. It is not recommended for use on electrical equipment with voltage potentials greater than 250 V.

Boat Trailers

Boat trailers are problematic from a corrosion control point of view. It is not feasible to wash off a boat trailer after it has been used to place a boat in the water. This means that the water film on the trailer will evaporate, and the salt concentration in the evaporating film will approach 100% as the water evaporates, even with fresh water. It is not unusual to see a boat that is in excellent condition sitting on a trailer that is falling apart from corrosion. All of us have either experienced axles breaking in half, springs breaking in half, and wheels falling off as a result of corrosion.

Some owners have enough foresight to purchase an aluminum trailer. Some aluminum alloys are almost completely immune to corrosion. The rest of us get by with galvanized trailers or painted steel trailers. Even aluminum trailers have corrosion problems, because the springs, shackles, wheels, bearings, axles, lug nuts, trailer hitch, winch, and many other parts are made of steel.

A major source of corrosion is the small holes that manufacturers are required to place in all structural members that form an enclosed space. The manufacturers are required to do this, because if they didn't, the sealed space would be classified as a pressure vessel. The reason that the hole is put into the structure is to prevent a pressure buildup in case of a fire. If the holes are not there, in case of a fire the pressure would build up to hundreds of pounds per square inch, and when the structure failed the effect would be similar to a bomb going off, complete with shrapnel. The best solution is to use silicone sealant to seal the holes. The silicone will blow out at about 20 pounds per square inch, so it does not present a safety hazard. ICC recommends using the extension tube to introduce a large amount of TC-11 into the closed space. Allow at least 24 hours for the solvent to evaporate before sealing off the structure with silicone. An alternative approach is to flush the closed space with water and to apply a thick film of TC-11. The silicone sealant is a more effective approach. Be sure to inspect the silicone seal at least once a year. If the upper seal fails and the lower seal is intact, the seal functions as a water trap and the silicone will accelerate corrosion rather than preventing corrosion due to trapped water.

Marine & Boating Applications

One long-standing myth is that it is not necessary to paint galvanized metal. This is entirely incorrect. Although it is necessary to wait six months after galvanization to paint a galvanized surface, most new trailers are more than six months old when the customer takes possession of the trailer. The layer of zinc on a galvanized trailer is only a few molecules thick, and it will eventually fail. The failure can be delayed indefinitely by painting the galvanized surface. Silver paint has the same appearance as a galvanized surface.

It is still advisable to apply a heavy coat of TC-11 to the trailer, even if it is galvanized and painted. **Never apply TC-11 to a surface that will be stepped on.** The surface is a slipping hazard if it is in an area of potential foot traffic and it has a coat of TC-11 on it.

Be sure to apply a heavy coat of TC-11 to the moving parts, such as the springs, shackles, and lug nuts. ICC advises applying a very heavy coat of TC-11 to the undercarriage of the trailer, i.e. the cross members and axles. Once the surface takes on a black color, it will not rust. If the surface takes on a whitish color, it is advisable to apply more TC-11.

Apply a light coat of TC-11 to moving parts such as the winch, the front wheel strut, and the trailer tongue. ICC recommends wiping down the trailer ball and putting on a light coat of TC-11 every time you hitch the trailer to the tow vehicle. A dry trailer ball hitch will grind away on the trailer tongue. The chrome plating will be worn off fairly quickly in this situation, and then the ball and tongue will suffer from abrasion and corrosion.

If these procedures are followed, it is possible to extend the lifetime of the trailer indefinitely at a minimal cost. The appearance surfaces such as the side and top of the side frame members should be painted and TC-11 free, and the non-appearance surfaces should have a heavy coat of TC-11 on them.

Personal Water Craft (PWCs)

ICC is compelled to make a comment about PWC. The manufacturers of TC-11 decided to take advantage of a loophole in the environmental regulations to produce two-stroke engines long after they had been banned from most other applications, even though they had clean four-stroke engines at their disposal. Two-stroke engines generate as much as 200 times the pollution of a four-stroke engine with the same output. This decision resulted in PWC being banned from many locales, and with good reason. The manufacturer's have come to their senses and now they offer

Marine & Boating Applications

only four-stroke engines, but they waited until it was much too late to avoid a negative perception of PWC.

Short Directions

1. Wash down boat using normal procedure.
2. Allow boat to dry with covers open.
3. Shake aerosol two or three times.
4. Apply a thin film of TC-11 to metal parts.
5. At three-month intervals, wash down boat and re-apply TC-11.
6. Once a year, clean boat interior with a surface cleaner.
7. Allow boat to dry. If the paint needs any work, the metal parts are dirt free, oil free, and corrosion free at this point.
8. Re-apply TC-11 film.

Long Directions

TC-11™ is the best available product for the long-term protection of "high dollar" parts such as throttle and choke cables, carburetors, the engine and exhaust system externals, the pump, steering components, latches, hinges, and fittings.

TC-11™ was developed expressly for PWC used to surf second and third reef waves, i.e. waves with routine face heights of 20 to 40 feet and occasional face heights of up to 80 feet. Because this type of boat is designed and built so that salt water enters the engine compartment on a regular basis, corrosion can be more of a problem on this type of boat than on other types.

In addition, many owners make the mistake of closing up the boat when they store it. The boats are so well sealed that the water is trapped in the hull and the level of corrosion is almost unbelievable. The life of a PWC can be as short as two years, and four years is considered to be normal. Two PWC treated with TC-11 are still "like new" after nine years of use in

Marine & Boating Applications

salt water and storage in a salt breeze. The hulls show their age, but when the engine cover is removed the engines look as if they just got out of the factory.

This is a guideline for the long-term protection of your PWC. PWC maintenance starts before the boat is completely finished and is an important part of owning a boat. Salt water is a very aggressive corrosive environment, and unless an owner is diligent, the cost of repairs will take all the fun out of owning a boat.

TC-11™ requires less than 2% of the time required to "clean up" a boat and represents less than 2% of the cost of the fuel and oil required to operate the boat. In return, you will enjoy increased reliability, significantly reduced repair costs, and the satisfaction of an engine compartment that looks brand new – permanently!

Step One: Up, Out, and Under

PWC are not well suited for storage in the water. Water storage causes big problems, including leaks, marine growth, and corrosion. Make sure your PWC is stored on a trailer.

The best way to store a PWC is in a garage. As a minimum, cover the boat with a high quality cover. It is important to have a cover that "breathes". This means that the spaces between the threads are small enough to keep out water droplets and large enough to let water vapor pass through the material. Also, the cover protects your boat from sunlight, which over an extended period is highly destructive to soft parts such as rubber and plastic. Finally, the cover protects your boat from dirt. It is easy to underestimate the corrosive effects of dirt. A combination of dirt and water will eventually lead to serious corrosion.

Store your boat in a nose-up position with the hull drain plugs open. This allows for water drainage through the hull drain plugs. If the boat is stored nose down, water will accumulate on the deck area, which won't really hurt the boat but it can lead to stains from mold and mildew. In the case of an open hull, a nose down attitude can result in so much water in the boat that the hull can end up with structural problems.

Step Two-Flush and Dry the Engine

Marine & Boating Applications

If you use a single hose, the boat engine should be rinsed with a slight nose down attitude. If the boat is nose-up, the engine rinse water flows straight out the back of the pump and does not rinse the pump assembly. If the boat is nose-down, the rinse water flows past the prop and out through the intake grate.

The minimum flush time is ten minutes, fifteen minutes is better.

First, connect the water hose line to your boats flush fitting. If your boat doesn't have one, get one from you dealer. Make sure that the hose is secured to a solid structure with a tie wrap. You don't want it bouncing around and causing problems.

Never turn the hose on with the engine off. In this situation, water can travel down the head pipe and into the exhaust manifold. If the piston happens to be near bottom dead center, the water will flow right on into the cylinder. When you turn the starter, the water volume is larger than the volume of the combustion chamber at top dead center. This condition is known as "hydraulic" and it can result in a broken piston or a bent connecting rod, or both.

Start your engine, and let it idle. If a boat engine is operated for more than 20 seconds without the water on, you can cause major damage to the engine from overheating.

Once the engine is on, turn on the hose. Make sure you have a solid stream of water coming out of the bypass fitting on the side of the hull. There are many ways to clog a cooling system, and inadequate rinsing is definitely one of them.

Another way is to run the boat with the intake grate too close to the bottom. The intake grate is like an underwater vacuum cleaner, and it will pull sand, dirt, and rocks off of the bottom for a distance of almost two feet. The sand is forced into the cooling line, and it settles out of the cooling water flow in the engine's internal cooling passages. This is a slow process that leads to cumulative damage.

Another way to clog the cooling system is to get a rock stuck in the water supply line. If the rock is a little bigger than a pea, it can be forced into the cooling line and cause almost complete blockage. This type of blockage can occur very suddenly. Usually you can tell it has happened because the thermal sensor will limit the engine speed to idle.

Marine & Boating Applications

After the engine has been rinsed for fifteen minutes, turn off the water. Blip the throttle eight to ten times to blow all of the water out of the cooling system and exhaust system. Remember the 20-second rule: don't run the engine for more than 20 seconds once the water supply has been shut off.

Disconnect the hose and make sure the rinse -fitting cap is re-attached. Lots of boats have flooded because the owner didn't re-attach the rinse-fitting cap. Some boats have check valves to prevent this problem. On some boats, the check valve is bypassed if the rinse hose fitting is left on.

Salt-Away is an excellent product that should be used in conjunction with TC-11™. Salt-Away addresses corrosion problems in internal engine cooling passages and exhaust component water jackets. Some owners get carried away and rinse the boat engine with Salt-Away every time they use it. This is not a bad practice, but it really isn't necessary. Salt-Away can be used every three months and achieve nearly the same results. Always use Salt-Away before the boat is going to be laid-up for the winter.

The last, and most important, step in rinsing the engine takes place about 45 minutes later. This one isn't in the factory manual, but it should be!

After the engine has completely cooled, start up the engine and blip the throttle a few times. If water comes out of the exhaust, you haven't properly dried the engine internal passages. Blip the throttle five or six times, and let the engine cool down again. Repeat this process until no water comes out of the exhaust when you start up the boat and blip the throttle.

ICC can't overemphasize how important this step is. If any water at all remains in the cooling lines, block, exhaust system cooling jackets, or muffler; you create a condensing environment on the internal wetted surfaces of the engine. This means that water droplets will condense on the internal passages and remain there until the next time the boat is used. Even if the droplets evaporate, the damage is significant. The total dissolved solids, or salinity, of the water droplets will get very high as the water droplet evaporates.

Engine fogging, while a good practice, is not a substitute for proper drying of the internal water passages. Engine foggers are sometimes used more than they should be. They are designed to be used before the boat is laid up for storage. The "fog" is deposited on the engine and evaporates very slowly, which means that the cylinder walls will have a film of oil on them to

Marine & Boating Applications

prevent corrosion. For "normal" use – once per month – the two-stroke oil in the gasoline provides a sufficient level of protection and engine fogging isn't really necessary.

Wash-Down

By spending a few dollars for a hose splitter and an extra hose, the wash-down can be integrated with the engine rinse. While you at the hardware store, get a quality hose nozzle. Having a splitter and two hoses is real time saver, since the time required to wash-down the boat, the trailer, wet suits, life jackets, and all the rest of the gear is usually about the same time required to rinse out the engine internal passages. Also, it is a good practice to wash down the pump assembly for a good 30 seconds with a solid stream of water – more on this later.

The first priority is to rinse the engine compartment. Use the spray to rinse every surface of the engine compartment. If the original air inlet system is in place, it is almost impossible to spray water into the engine intake. Aftermarket air filters can be a major source of water infiltration, even if the engine is off. If you have truncated cone style air filters (which are an excellent design since they function as velocity stacks), spring for a couple of bucks and buy sleeves for the air filters. The sleeves do not affect the flow of air through the filter, but they do keep water droplets (or spray) from entering the air filters.

Be sure to rinse the carburetors, exhaust system, engine block, motor mounts, and power-takeoff assembly. If the boat hull is divided into separate compartments, be sure to rinse each one thoroughly. Don't worry about the electrical system – the designers do a great job of making them waterproof.

The boat should have a slight nose-high attitude while it is being rinsed. Otherwise, the rinse water will accumulate in the hull.

Rinsing works by dilution, so don't flood the boat hull thinking you are doing a good job of rinsing the boat. Break the rinse process up into several steps. This way, each time you send a sheet of water down the hull you are significantly increasing the dilution ratio.

Make sure to rinse the entire steering assembly. This includes any trim system cables and fittings you might have.

Marine & Boating Applications

The pump assembly rinse is very important, especially if you are rinsing the boat with a nose up attitude. The boat is supposed to be rinsed in a nose down attitude in order to wash the salt out of the pump assembly. In this case, the only rinse water for the prop, rear bearing, and jet intake is the water that you spray into the pump assembly with a hose. Thirty seconds with a solid stream of water is a good idea.

The Journey Home

Make sure to leave the hull drain plugs open on the trip home. This allows the residual water to drain out, particularly when going uphill.

Never cut a corner and leave the rear straps off. The straps limit the bounce height of the boat. Its not going over the bump that overstresses the trailer and boat; it is the uncontrolled bounce. The G forces can get a lot higher than you might think if the boat is unrestrained.

It's a good idea to fill up the gas tank and oil tank on the way home. This way the boat is ready to go for the next trip, and you won't forget a critical item like TCW-3 oil. Also, it's a good idea to inspect the trailer, hitch, and straps before and after every trip.

TC-11 Application

Before you store your boat, make sure that the boat dries out completely. This is best accomplished by storing the boat in a garage and letting the boat sit for a few hours with all of the covers open or off. An alternative is to let the boat sit in the sun for an hour or two. You can get carried away and sponge out the bottom of the bilge, but this is time consuming and isn't necessary as long as the rinse water was diluted properly and the bilge water volume is limited to a few ounces.

In any event, once the boat has dried completely, it is time for the most important step of all: putting on the TC-11™. Spray a coat of TC-11 on all of the metal parts. There is no harm in applying TC-11 to plastic and rubber parts, but they don't really need any protection. The idea is to coat all of the metal parts with a thin film of TC-11.

You want the engine compartment to look as if you just applied a coat of clear paint. If you see areas that are not shiny, you haven't put enough on. If you see drips, sags, or puddles, you are putting on too much.

Marine & Boating Applications

TC-11 is quite mobile when it is first applied. This means that it will work its way between every moving part on your boat – perfect lubrication! TC-11 also works its way into threads, and the spaced between different components. This is an extremely useful aspect of TC-11, since it prevents frozen fittings and frozen assemblies. TC-11 has significant penetrating capabilities, and this lasts for about a week after application.

TC-11 definitely frees frozen mechanisms. If the first application does not work, go back at a later date and re-apply an additional coat of TC-11. The interval is based upon how bad the corrosion is and how far the TC-11 has to penetrate to reach all of the rust. Once TC-11 penetrates into the rusted area, the mechanism will stay lubricated for months.

That's it! You just took an extra thirty seconds and spent less than a dollar, and your boat is now protected until the next time you use it and during the next time you use it!

Close the engine cover, but do not secure the latches. If you boat has separate compartments, do not secure any of the latches. If the fire extinguisher is in a separate compartment, leave it slightly open.

Once the cover is re-attached, you are ready for your next trip. You should be fueled up, the oil tank is full, and you are ready for another day of fun.

Cleaning

One of the best things about TC-11 is that it doesn't come off with a water rinse, but it does come off with mild cleaners. This means that you can wash down your boat and not worry about removing the film of TC-11 on protected parts. On the other hand, if you want to focus entirely on the appearance of a the boat (and ignore protection and lubrication) you can easily remove the TC-11 film with a cleaner such as Simple Green, Meguiar's Extra, or citrus based products.

When you remove the TC-11 film, the boat really does look the same as the day it was purchased – if you used TC-11 from the time that it was new. This is the most amazing characteristic of TC-11. I.C.C. strongly recommend that you re-apply a film of TC-11 immediately after cleaning, because corrosion will start to take place as soon as you remove the TC-11 film.

"Stickiness"

Marine & Boating Applications

One common characteristic of effective film treatments is that they are "sticky". This means that they tend to accumulate dirt. This is not a problem in a marine environment, since marine environments are dust free (that's why your engine doesn't have an air filter).

During storage, this can be a problem if the boats are stored in a dusty environment. The dust is really only a nuisance, and it can easily be removed with a spray nozzle on a garden hose.

Compatibility with Paints, Plastics, and Rubbers

TC-11 is compatible with the paints, plastics, and rubbers used to build heavy construction equipment. I.C.C. has tested TC-11 for compatibility with latex, Nitrile, HDPE, neoprene, silicone, Buna-N, acrylic, polyester, PVC, nylon, Viton, epoxy, polystyrene, ABS, linoleum, Formica, varnish, and other plastics, paints, and rubbers without any indications of incompatibility.

TC-11 has no effect on the expanded polystyrene used to provide flotation in PWC.

Existing Corrosion

TC-11 will not magically remove existing corrosion. TC-11 is oriented towards preventing the corrosion in the first place. If corrosion has started, it is very difficult to remove. TC-11 will arrest the corrosion, which means that no further corrosion will occur. This provides ample time to properly clean, prime, and paint corroded areas.

TC-11 and 0000 steel wool do an amazing job of removing corrosion. If the corrosion is really heavy, a small stainless steel wire brush and TC-11 can remove even the most stubborn stains. Wipe off the area with a cloth and it will look like new. The nice thing about TC-11 is that it leaves a film that prevents the corrosion from returning.

Electrical and Electronic Equipment

TC-11 is recommended for use with electrical equipment, but it is not recommended for use with electronic equipment. TC-11 is compatible with the materials used to assemble printed circuits, but the TC-11 film can interfere with the heat dissipation characteristics of the discrete components.

Marine & Boating Applications

TC-11 is a non-conductor. It is not recommended for use on electrical equipment with voltage potentials greater than 220 V.

The Achilles Heel

One area of PWC corrosion that cannot be addressed with any product, including TC-11, is the impeller housing. I used to think that Yamaha's were the only PWCs that suffered from impeller housing corrosion. That's until one of my tow-in buddies mentioned that his Sea-Doo had torn the flexible coupling apart when the prop seized up from impeller housing corrosion. And this was with a plastic liner!

Yamaha impeller housings rust out every two years, no matter what you do. The housing develops bumps about 40 thousandths high where water has worked its way between the aluminum case and the stainless steel liner. Other boats are more forgiving, but they suffer from the same problem.

If you hear more than the normal light tingling noise from the prop bouncing off the wall of the impeller housing it is time to start thinking about replacing the impeller housing. If your prop sounds a bit like a coffee grinder, it is time to replace the impeller housing. If the prop shaft or through hull bearing is warm to the touch, do not operate the boat until the impeller housing has been replaced.

If you let the impeller housing corrosion go too far, you will ruin the prop. If you can see more than a sliver of daylight (about 30 thousandths) around the prop when you put in the new liner you should replace the prop if you are looking for top performance. The amount of power that "leaks" through the annular gap is simply amazing..

If you have an exotic impeller housing material such as a composite housing you will not have this problem.

The Big Kapu (Hawaiian for Don't Do It)

Boat owners are sometimes tempted to re-fuel their boats on the open water. This is an invitation to disaster. The gas cap is located relatively close to the waterline. Unless you are extremely careful, it is not uncommon for a wave to break over the nose of the boat during the re-fueling process. If even the tiniest amount of water gets into the fuel tank, you have set the stage for a real disaster.

Marine & Boating Applications

Usually it is a slow-motion disaster. You can go days, weeks, and even months before the problem shows up. What happens is that you get a bubble of water in the bottom of the fuel tank. One day when you switch from the main fuel pickup to the reserve fuel pickup, the blob of water gets sucked into the fuel distribution system. It is very common for the engine to stop dead when the water gets to the carburetor. If you are using the PWC to surf or to tow-in, it is not uncommon for the boat to get blasted by the white water, and the boat usually gets completely flooded..

The initial problem of the boat stopping dead in the water is fairly minor in comparison to what follows: carburetor destruction. The carburetor internals are steel, brass, and aluminum. When these metals come into contact with one another and water (a conductor), you generate a serious galvanic corrosion problem. The situation gets worse as the water evaporates and the Total Dissolved Solids concentration increases. The bottom of the float bowl and the metering jets are the hardest hit items. Unless you have ample time and are mechanically inclined, this requires that the carburetors be replaced.

When the gasoline in a two-stroke carburetor evaporates, it leaves behind a film of two-stroke oil, which is effective at controlling internal corrosion until the next time the carburetor is used. The gasoline itself is a non-conductor, so internal corrosion problems are usually not too big a problem unless the boat is laid up for a long time. If the boat is to be out of operation for more than a month, it is a good idea to use an engine-fogging product to protect the internal surfaces of the engine.

Winterizing

Laying a boat up for winter is one of the most important aspects of having a trouble free boat.

Make absolutely sure that no water remains in any of the wet internal passages, including the muffler.

The first problem is gasoline. As gasoline decomposes, it turns into varnish. If you let an untreated tank of gasoline sit for the entire winter, you may end up with varnish deposits in the tank, fuel lines, and carburetor. The most practical approach is to add a fuel stabilizer designed expressly

Marine & Boating Applications

for this application.

Remove the spark plugs. Spray a small amount of TC-11 into the spark plug holes. Turn the engine over a few times with the starter, but don't get too carried away and blow all of the TC-11 out of the engine with the starter. Replace the spark plugs, remembering to turn a plug with a used gasket 1/16th of a turn after you feel stiff resistance.

The battery should be disconnected. This makes it easy to remove the battery to for storage and to check the electrolyte levels every three months. Battery tenders are great.

Apply an extra coat of TC-11 to all of the metal components of the PWC. This will insure that the protection lasts an entire six months. Be sure to cover all of the components of the engine, exhaust, steering, pump assembly. It is also a good idea to treat the trailer wheel lug nuts, the trailer hitch, the trailer third wheel assembly, and your trailer ball with TC-11.

When you put your boat cover on, you are pretty much set until next year's season.

Starting Off the New Season

When summer finally returns and it is time to get out there and ride, there are several steps you should follow to avoid problems.

First, check the charge level of your battery. Does the battery hold a charge? If there is any question, replace the battery. Battery failures are the worst kind of failures.

Gel type batteries are the best bet for PWC. Stock batteries are really motorcycle batteries, and they often fail catastrophically when a plate fractures. This kind of failure gives you no warning whatsoever, and it is a common failure mode.

Gel batteries are much more durable, since the jell is an effective shock absorber. In addition, problems with electrolyte levels and sulfuric acid concentrations are eliminated.

Remove those spark plugs. This time. use an engine fogger to coat the cylinder walls with a light coat of oil or pour some TCW-3 into the spark

Marine & Boating Applications

plug hole. Don't get carried away and pour a bunch of oil in your spark plug hole thinking, "If a little is good, a lot is great!" You will just blow oil all over the place and make a mess.

It's a good idea to see if the engine turns over before you hit it with the starter. If your rings have frozen (very unlikely) or corrosion in your impeller housing has locked the prop (more than likely) you can avoid some major problems by taking your time to sort the problem out before you turn the engine over.

Once the engine turns over freely, run the starter for about ten seconds with the plugs out. The discharge from the spark plug hole should change from droplets to a fine mist. Insert the old plugs loosely and turn over the starter for five seconds. A fine mist of oil should blow out from the plug threads.

One more note of warning: starter motors are normal motors that have been "over-wound". This means that they can only be used for a short period of time without overheating. This works fine as long as the engine starts easily. Starters get burned out when an owner has a compression, fuel, or ignition problem. The owner grinds away with the starter, even though the engine has clearly demonstrated that it will start without some sort of fix. If you burn out a starter motor it is not covered by the warranty. And it isn't cheap. And starters have a nasty habit of "welding" themselves to the engine block with corrosion.

Now put in a new set of plugs. Start the engine carefully. Don't blip the throttle. Just crack the throttle a few times to put some revs on the engine.

You are ready for a new season!

Summary

As you can see, in spite of the small amount of time and money involved, TC-11 plays a critical role in controlling PWC corrosion. To put the cost of TC-11 into perspective, it represents about 2% of the cost of a full tank of gas and oil. This is a very small price to pay for the increased reliability and reduced repair costs associated with a corrosion free boat.