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Metal Finishing Systems

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OWNER'S MANUAL

For

BC40 & BC100 Tank Lines

Utilizing the TRU TEMP® Low Temperature Black Oxide Process

Please read this entire manual before beginning installation.

- I. Components of the System
- II. Assembly of Tank Line Components
- III. Charging the Tanks With Chemicals
- IV. Startup and Operation of Process Line

I. COMPONENTS OF THE SYSTEM: BC40 Tank Line

The BC40 tank line utilizes a total of seven tanks, each measuring 16" X 24" X 24" deep (ID). Total capacity is 33 gallons when filled to a depth of 20", allowing for a 4" freeboard to the top rim. The tank line occupies about 3' x15' of floor space.

Additional description follows:

Tank 1 - Alkaline Clean Tank: Steel tank. Supplied with one 304 stainless steel immersion heater (4.5 kW) and controller with resettable overtemp breaker, controller mounting bracket and thermocouple bracket; ¾" bottom drain on rear wall with stainless ball valve. Operating temperature: 150° F.

Tank 2 - Flowing Rinse Tank: Polypropylene tank. Fitted with ¾" water inlet and PVC ball valve control mounted to the front for easy access, with 4" x 12" external overflow trough, located on rear wall, with 1½" FPT outlet and hose barb connection, to be connected to drain header.

Tank 3 – Surface Conditioner Tank: Polypropylene tank. Fitted with 1" bottom drain on rear wall with PVC valve. Operating temperature: Room Temperature.

Tank 4 - Flowing Rinse Tank: Polypropylene tank. Same as Tank 2 above, to be connected to drain header.

Tank 5 - Blackening Tank: Steel tank, sheathed with 2" insulation. Supplied with two 304 stainless steel immersion heaters (9 kW total) and controller with resettable overtemp breaker, controller mounting bracket & thermocouple bracket. Fitted with 1" bottom drain on rear wall with stainless steel valve. Operating temperature: 200-205° F.

Tank 6 - Flowing Rinse Tank: Polypropylene tank. Same as Tank 2 above. To be connected to drain header.

Tank 7 - Sealant Tank: Steel tank. Fitted with 1" bottom drain on rear wall and stainless ball valve. This tank is supplied with a welded steel drain board that attaches to the side wall of the tank to direct excess sealant back into the tank.

Plumbing Connections: The BC40 tank line is supplied with water connections and utilizes ¾" nylon water line and compression fittings, along with all drain connections -- threaded hose barb fittings, flexible hose and clamps for connection to the drain header.

I. COMPONENTS OF THE SYSTEM: BC100 Tank Line

The BC100 tank line utilizes a total of seven tanks, each measuring 24" x 40" x 28½" deep (ID). Operating capacity is 100 gallons when filled to a depth of 24", allowing for a 4½" freeboard to the top rim. The tank line occupies about 4' X 20' of floor space.

Additional description follows:

Tank 1 - Alkaline Clean Tank: Steel tank. Supplied with one 304 stainless steel immersion heater (9 kW) and controller with resettable overtemp breaker, controller mounting bracket and thermocouple bracket; Fitted with 1" bottom drain on rear wall with stainless ball valve. Operating temperature: 150° F.

Tank 2 - Flowing Rinse Tank: Polypropylene tank. Fitted with ¾" water inlet and PVC ball valve control mounted to the front for easy access, with 4" x 12" external overflow trough, located on rear wall, with 1½" FPT outlet and hose barb connection. To be connected to drain header.

Tank 3 - Activation Tank: Polypropylene tank. Fitted with 1" bottom drain on rear wall with PVC valve. Operating temperature: Room Temperature.

Tank 4 - Flowing Rinse Tank: Polypropylene tank. Same as Tank 2 above. To be connected to drain header.

Tank 5 - Blackening Tank: Steel tank, sheathed with 2" insulation. Supplied with two 304 stainless immersion heaters (18 kW total) and controller with resettable overtemp breaker, mounting bracket and thermocouple bracket. Fitted with 1" bottom drain on rear wall with stainless steel valve. (Optional: Supplied with FloKing vertical recirculation pump (120 VAC). Operating temperature: 200-205° F.

Tank 6 - Flowing Rinse Tank: Polypropylene tank. Same as Tank 2 above. To be connected to drain header.

Tank 7 - Sealant Tank: Steel tank. Fitted with 1" bottom drain on rear wall and stainless ball valve. This tank is supplied with a welded steel drain board that attaches to the side wall of the tank to direct excess sealant back into the tank.

Plumbing Connections: The BC100 tank line is supplied with water connections and utilizes ¾" nylon water line and compression fittings, as well as all drain connections -- threaded hose barb fittings, flexible hose and clamps, for connection to the drain header.

II. ASSEMBLY OF TANK LINE COMPONENTS

MATERIALS REQUIRED

Pressure-treated wood timbers: 6" X 6" X 52-80 lineal feet (see below).

PVC pipe cement.

Hand tools.

ASSEMBLY GUIDELINES

Please find the appropriate tank line footprint for your installation:

BC40 seven tank line: 25 inches (front-to-back) x 13 feet long.

BC100 seven tank line: 41 inches (front-to-back) x 18 feet long.

1. **Select a location** that can be served by water, drain and electrical utilities. If the line is to be set up against a wall, leave a minimum of 3 feet clearance between the tanks and the wall to allow for easy access to the utility hookups.
2. **Line up the wood timbers** in three parallel rows running the length of the line, evenly spaced.
3. **Set the tanks on the timbers**, beginning at one end. Butt the tanks together, with the edges of the top rims touching. Allow the front edge of the tanks to extend over the front timber by 3" to provide toe space for the operator. Attach the drainboard to the steel oil tank.
4. **Assemble the water supply system**. The flowing rinse tanks are designed to be fed with fresh water from a common supply line, with a main ball valve. The tanks interconnect by means of flexible nylon tubing and compression fittings. This configuration supplies fresh water, in series, from one tank to the next, etc. The tanks are designed so that fresh water can be supplied from the front or rear. Choose the one which best fits your circumstances and plug the other inlet. The nylon tubing can be routed through the tank rim gussets to the next rinse tank and secured using the plastic compression fittings provided. (Tighten fittings to finger-tight + ¼ turn. **DO NOT OVERTIGHTEN!**)
5. **Assemble the drain system**.
The drain system can now be assembled, using flexible hose, clamps and PVC piping. Each rinse tank overflow trough is supplied with a 90° threaded elbow with a hose barb. Assemble these fittings, using Teflon tape, pointing the hose barbs downward. Clamp a length of flexible hose onto each hose barb. Trim these hoses so that each successive one is about ½" longer than the preceding one. This will result in a sloped drain header.

ASSEMBLY GUIDELINES (CONTINUED)

Assemble the PVC drain header, using PVC pipe cement, locating the hose barb tees in the appropriate locations to accept the hoses from the rinse overflows. Finish the assembly by clamping the hoses onto the tees, making sure to maintain downward slope in the line. Connect the end of the drain line to the drain.

6. **The Immersion Heaters**

Mount the immersion heaters at the rear of the heated tanks in a location that will not interfere with the parts load. Bolt the heaters to the rim of the tank. Tank 1 (Cleaning tank) operates at 150° F and utilizes one immersion heater, powered by the controller. Tank 5 (black oxide tank) operates at 200° F and utilizes two immersion heaters, powered by a single controller.

Mount the control boxes either on the plastic brackets provided, (bolted to the rear wall rim) or on the wall, if preferred. Connect to an appropriate power supply panel.

CAREFULLY route the copper thermocouple tubes through the brackets in the tank.

Note: These thermocouples are made of copper tubes – not wire. Handle with care and do not kink them. They are covered by a protective Teflon sheath. Do not damage or remove this covering.

III. CHARGING THE TANKS WITH CHEMICALS

Note: Please consult with your BIRCHWOOD CASEY representative for guidance in choosing and mixing the appropriate chemical products for your application.

Now that the mechanical systems of the tank line are operational, the tanks can be filled with chemicals to prepare for actual processing. Each tank uses a different solution, as follows:

Tank 1 - Cleaning Tank

If you are using SAFE SCRUB® ST liquid cleaner, mix the product at 20% by volume:

For a BC40 tank, put about 10 gallons of water into the tank, carefully add 7 gallons of SAFE SCRUB ST liquid, then finish filling the tank with water to a level 4" from the top rim.

For a BC100 tank, put about 20 gallons of water into the tank, carefully add 20 gallons of SAFE SCRUB ST liquid, then finish filling the tank with water to a level 4 ½" from the top rim.

Or, if you are using PRESTO KLEEN® HP powdered cleaner, mix the product at 8 oz. per gallon of water. The powder dissolves best when it is stirred into warm water, as follows:

Fill the tank about 2/3 full with tap water. Start the heater and raise the temperature to about 130°F. Carefully stir in the PRESTO KLEEN powder.

For a BC40 tank, add 16 pounds of PRESTO KLEEN HP powder and stir well to dissolve.
For a BC100 tank, add 50 pounds of PRESTO KLEEN powder and stir well to dissolve.
When the powder is dissolved, finish filling the tank with water to a level 4" from the top rim.

Tank 2 - Overflow Rinse Tank

Open the water valve and fill the tank with water to the level of the overflow slots on the rear wall of the tank.

Tank 3 - OXYPRIME® Primer/PrepTank

When using OXYPRIME® POWDER, mix the product at 1 lb/gallon.

For a BC40 tank, fill the tank about 2/3 with tap water. Carefully stir in 33 pounds of OXYPRIME POWDER.

For a BC100 tank, fill the tank about 2/3 with tap water. Carefully stir in 100 pounds of OXYPRIME POWDER.

When the powder is dissolved, finish filling the tank with water to a level 4" from the top rim.

Tank 4 - Overflow Rinse (see Tank 2)

Tank 5 – TRU TEMP®XL Black Oxide Tank

When using TRU TEMP XL, mix the product at 50% by volume.

For a BC40 tank, put about 10 gallons of water into the tank. Carefully stir in 17 gallons of TRU TEMP XL concentrate. Then fill the tank with water to normal operating level. Stir well.

For a BC100 tank, put about 20 gallons of water into the tank. Carefully stir in 50 gallons of TRU TEMP XL concentrate. Then fill the tank with water to normal operating level. Stir well.

Tank 6 - Overflow Rinse (see Tank 2)

Tank 7 - Sealant Tank

Fill the tank with appropriate sealant product to normal operating level - 4" below the top rim. Please see the operating instructions for the individual sealant product for mixing details.

The tank line is now fully charged and ready for operation. If other chemical products are being used in the line, please consult with your BIRCHWOOD CASEY representative for charging and operating instructions.

Please note: When turning the immersion heaters on, please remember that the dials on the controllers are rheostats. As such, the power is either on or off. When ready to heat up the tank, turn the dial to the desired operating temperature - no higher. Dialing in a higher temperature will not heat the tanks any faster - it will result in a higher temperature which may be too high for proper operation of the chemical solution, or localized heating, which may damage the chemical product in the tank.

IV. STARTUP AND OPERATION OF PROCESS LINE

The tank line is now fully charged and ready for operation. Though there are process cycle parameters that can be used, here are a few guidelines:

Start all heaters. Adjust heater rheostats to raise the temperature to the proper operating levels. Once the tanks reach normal operating temperatures, stir the bath well to equalize the temperature throughout the tank. This is important for good operation of the product.

Open water valves and adjust, if necessary, to obtain correct flow rates. Since the three rinse tanks are fed with water *in series*, you may need to throttle back on the first one in line in order to equalize the flow to the other two tanks. Adjust water flow to achieve 1-3 gpm in each rinse.

Parts can be processed on racks, in baskets or in rotating barrels. Each load should be designed to minimize or eliminate flat against flat contact or poor drainage problems etc. High value or delicate parts should be hung individually on hooks. Other small parts can be processed in bulk. Your BIRCHWOOD CASEY representative can assist in determining the best parts handling techniques.

In most cases, the parts are free of noticeable rust and are coated with a machining or stamping fluid. The basic TRU TEMP black oxide process utilizes the following steps:

1. **Clean** the parts to remove oils, dirt and other surface soils by soaking in the cleaning solution at 150° F for 5-8 minutes. Most parts clean up very well in this way; however, parts that carry heavy oils, grease, drawing lubricants, etc., are more difficult to clean and may require longer times or some agitation of the solution in order to make the cleaning more aggressive.
2. **Rinse** in cold, overflowing tap water tank; 20 seconds.
3. **Prime & Prep** the surface for blackening by immersing parts in OXYPRIME Primer/Prep Solution at Room Temperature for 5-8 minutes
4. **Rinse** in cold, overflowing tap water tank; 20 seconds.
5. **Blacken** the parts by immersing them in the TRU TEMP solution at 200-205° F for 10-12 minutes.
6. **Rinse** in cold, overflowing tap water tank; 20 seconds.
7. **Seal** the finish and displace water by immersion in BIRCHWOOD CASEY sealant of your choice. Allow parts to drain or dry.

The processing steps are explained in more detail below:

Tank 1 - Cleaning Tank: 150°F; 5-8 minute immersion.

The function of this step is to remove oil and surface soils from the parts by emulsifying them and suspending them in the solution. The heat and alkaline chemicals do most of the work, although agitation is generally helpful.

The best temperature here is 150°F. Lower temperatures slow down the cleaning action, but may be suitable for easily removed soils such as water soluble oils or synthetic machining fluids. Higher temperatures may be necessary for difficult soils such as drawing lubricants. In these cases, 160-180°F, or higher concentrations, may be needed. Your BIRCHWOOD CASEY representative can guide you in this area.

Avoid overheating the solution, as this can lead to flash drying of the parts before they can be rinsed. Once the cleaning solution has hot dried on the parts, it is generally difficult to rinse off in a cold rinse tank. So, use the lowest temperature that will do the job.

The PRESTO KLEEN HP or SAFE SCRUB ST solutions are both heavy duty cleaners with high oil-holding capacity, designed for use with the TRU TEMP process. They remove the oil from the parts by emulsifying it and suspending it in the solution.

When the cleaning solution begins to be saturated with oil, an oil-slick may form on the liquid surface. This oil slick should be skimmed off the surface to avoid the possibility of re-depositing it on the cleaned parts.

Tank 2 - Overflowing Rinse Tank: Room Temperature; 20 second immersion.

The objective here is to remove all cleaner residues from the parts before proceeding to the next tank. This rinse tank can also serve as a checkpoint, or an indicator of part cleanliness. If the part is completely clean and free of oil, the water will sheet off uniformly when the part is removed from the tank. Any water beading up on the surface normally indicates the presence of oil and the need for more cleaning, in the form of longer cleaning times, higher temperatures or cleaner solution maintenance. Keeping an eye on the sheeting action of the rinse water is a good way to monitor the effectiveness of the cleaning solution in tank 1.

Tank 3 - OXYPRIME Primer/Conditioner: 5-8 minute immersion.

This tank operates at a mildly acidic pH to serve two functions: it neutralizes any alkaline cleaner residues on the parts, but its main function is to pre-activate the surface of the iron or steel part by coating it with iron oxalate. This makes the steel more receptive to the blackening reaction to follow. Normally, the steel parts will darken slightly during this operation. Or, they may take on a frosty, gray appearance. No etching takes place here.

A general rule is: More reactive alloys, such as low Carbon steels, cast irons and powder metals reactive quickly and require only 2-4 minutes immersion in this tank. Middle of the road alloys, such as heat-treatable grades, medium Carbon steels are somewhat less reactive and will require 5-8 minutes immersion. Low reactive alloys, such as O1, A2, D2, M2 may require 10-15 minute immersions in this tank to make them reactive enough to blacken well. Here, again, your BIRCHWOOD CASEY representative can offer guidance.

Tank 4 - Overflowing Rinse Tank: room temperature; 20 seconds.

This rinse removes OXYPRIME residues before the parts enter the blackening tank. Keeping it clean helps ensure that the chemical balance of the blackening solution is maintained at proper levels.

Tank 5 – TRU TEMP Black Oxide Tank: 200-205°F, 10-12 minutes.

The parts are now free of oil and chemically prepared for blackening. They are ready for TRU TEMP black oxide, which converts the metal surface to black magnetite.

The TRU TEMP black oxide bath can be operated as a semi-permanent bath in the line, requiring only periodic replenishment with fresh concentrate. BIRCHWOOD CASEY supplies test kits which allow the user to determine the strength of the bath and make proper additions.

Tank 6 - Overflow Rinse Tank: room temperature; 20 second immersion.

This rinse step is somewhat less critical than the others in the line. However, blackening residues must be rinsed off prior to the sealing steps.

Tank 7 - Sealant Tank: room temperature; 1 minute immersion.

Because the black coating has a porous crystal structure, it acts as an excellent absorbent base for a protective oil, wax or other suitable top coating. In fact, the coating lets the steel hold more oil than it normally would and results in a dramatic increase in corrosion resistance.

The type of sealant used is determined by the end use of the part. It is possible to produce a variety of finish properties by choosing the appropriate sealant.