CASWELL MEGA BLACK MANUAL

TABLE OF CONTENTS

WHAT IS COLD CHEMICAL BLACKENING

Cold black oxidation is a room temperature conversion process for steel/iron. Chemically, a slight dissolution of the surface takes place; Copper from the solution precipitates on the sample and reacts directly with selenium to form a **black copper-selenide layer** (sometimes with traces of iron selenide). So it is not Fe_3O_4 oxide as with hot black oxide.

Caswell Mega Black gives a deep black finish with a corrosion resistance comparable to conventional hot black oxide processes after being treated with a suitable sealer.

The layer is very thin and porous and must always be sealed for corrosion protection.

It is suitable for:

- Cold and hot-rolled carbon steel
- Alloy steel
- Tool steel
- cast iron
- Forged steel
- sintered metal
- A2 tool steel (without additional preparation, possibly with a little bit of smut).

Note: This product cannot be used on stainless steel, use Caswell Stainless Steel Blackener for this.

It complies with the Living Building Challenge Red List and is suitable for interior applications if carefully cleaned and sealed.

EQUIPMENT REQUIRED

For the solution, you use:

- acid-resistant tanks, turntables, baskets, hooks and racks
- Dip baskets made of PP (polypropylene), PE (polyethylene) or PVC
- Rotary drums made of PP (polypropylene) or PE (polyethylene)
- plastic or rubber-lined tanks
- Plastic-coated hooks and racks

Stainless steel should not be used with Caswell Mega Black.

CLEANING & DEGREASING

Use an alkaline degreaser.

An alkaline degreaser is a water-based, all-round cleaner (high pH) that effectively removes oil, grease, coolants and tensiles, polishing paste and similar contamination. This type of cleaner is recommended as a standard step before metal surface treatments such as black oxidation.

Examples (practically available):St. Marc, Blue Wonder Degreaser, Dasty DegreaserProfessional: Kärcher RM 31, Zep Industrial Purple Degreaser

Use: Light the degreaser as shown on the product label, apply generously, leave on briefly, brush/wipe if necessary, and then rinse thoroughly with clean water.

RUST REMOVAL

Make sure that the object to be treated is completely free of rust, dirt and grease. This is very important to get a good result and not to contaminate the black oxide liquid.

Parts that are rusty can be derusted with:

- Mechanical processing
- Galvanizing Shop Metal Activator (flash rust)
- Hydrochloric acid (HCl)

METAL ACTIVATION

If the desired depth of the black is difficult to obtain, activation of the surface before blackening is required by submerging parts for 1 to 2 minutes, usually in:

- Galvanizing Metal Activator or another etching agent
- 30% hydrochloric acid diluted 1:1 or 1:2 with water – immerse for 30 to 60 seconds
- By sanding or other mechanical processing.

Then rinse very well to prevent acids from getting into the containers of the next steps.

PROTECTING THE CONVERSION COATING

Black oxide conversion coatings are not inherently anti-oxide and will oxidize further if they come into contact with oxygen. The corrosion resistance is obtained by applying a moisture-resistant sealer and is therefore necessary.

INTERIM RINSING

Thorough rinsing between each step of the process is extremely crucial, especially after chemical blackening. If this is not done sufficiently and black oxide liquid

remains on the object, it can lead to rust formation after applying the sealer when it dries. Insufficient rinsing also carries the risk of contaminating the black oxide liquid and sealer from the previous step, making them less effective and causing problems. If acid from the etching process or black oxide liquid gets into the sealer, rust may occur after applying the sealer. The sealer must then be replaced.

We recommend rinsing thoroughly between each step. You can do this by rinsing the object above the liquid used with clean water, for example with a plant sprayer, and then submerging the object in clean water. Repeat this process after each step, using a separate rinsing bucket for each liquid, such as after etching, degreasing and blackening.

Adding a small amount of baking soda to the final rinse water will help ensure that the remaining acids are completely removed and neutralized. Then rinse well with clean water.

PREPARING THE BLACK OXIDE BATH

Before a production tank is filled, you first test with well-prepared, rust-free test pieces. Vary the dilution of the Caswell Mega Black concentrate and the immersion time to determine the correct ratio and times for the desired black depth.

If the bath is too strong (too little diluted), acid and inhibitors inhibit conversion and etch the surface: the layer rises slowly and remains light grey/iridescent. Then dilute (e.g. 1:12) so that this inhibition disappears and you get a uniform, deep black layer within 2–3 minutes.

If the bath is too weak (diluted too much), the ionic strength is too low and the layer precipitates loosely/powdery (smut/rub-off). Make the liquid stronger (e.g. 1:6) for a compact, well-adhering layer.

Starting point:

- 1 part concentrate + 9 parts water (10% v/v).
- Use a test to determine the shortest possible immersion time for the desired color, usually 2–3 minutes, with a maximum of 5 minutes, depending on alloy and surface hardness.
- Dipping for too long does not deepen the black and can give smudge/release (smut/rub-off).
- If smut occurs at less than 5 min, increase to 1:6 (1 part concentrate + 6 parts water) and test again.
- If it takes more than 5 minutes to achieve the desired color, dilute to 1:12 and reassess.
- If the result remains light gray or iridescent, then activation of the surface is required.

NEUTRALIZING ACID

Acid from the etching agent, hydrochloric acid, or the black oxide liquid can cause corrosion if it is not completely washed away. As an additional step before sealing, you can dissolve 1–2 tablespoons of sodium bicarbonate (baking soda) in 2 litres of water and briefly immerse the workpiece in it to neutralise any remaining acid. Rinse the object with clean water and apply the sealer.

CHEMICAL BLACKENING - DIPPING

Parts must be thoroughly cleaned, derusted and/or activated. Parts must be protected from rust during production and internal storage to limit surface preparation.

Depending on shape, weight and production requirements, parts are placed in plastic immersion baskets or hung on plastic-coated racks or hooks. For large numbers of small parts, rotating, perforated plastic drums (1–2 rpm) are recommended. When using baskets or racks, the parts should be moved when inserting into each solution and rinse to remove air bubbles and achieve even contact with the solution throughout.

If you work with an immersion basket, shake or move the parts several times during immersion to prevent "nesting" of air bubbles and ensure an even finish.

CAUTION: Discoloration and tarnish from a heat treatment must be removed before blackening for the best and most even finish.

The black oxide process consists of five or seven steps, depending on the condition of the iron or steel surface and the need for derusting or activation. In most cases, a simple five-step process will suffice.

1. Clean the object well with, for example, an alkaline detergent, alcohol or acetone. Do not use an oil-based degreaser. The time and temperature required depend on the type of metal, the degree of contamination and the cleaning agent chosen.
2. Rinse the object well in a designated sink for at least 30 seconds.
3. Black the object in the created solution.
4. Rinse the object.
5. Without drying, immerse the object directly in the sealer and let it soak in for 1 to 2 minutes – shake off the excess sealer and let it dry thoroughly.

If it is necessary to etch or remove rust add the following steps:

After step 2 (rinsing):

1. Derusting or etching.
    a. Flash rust: immerse the object in Galvanizing Shop Metal Activator as described in the manual.

   b. Etching: immerse the object in Galvanizing Shop Metal Activator or a mixture of 30% hydrochloric acid diluted 1:1 or 1:2 with water – immerse for 30 to 60 seconds
2. Rinse very well – continue with step 3 in the step-by-step plan above.

A sealer must be applied before the depth of the black can be assessed. The final depth of the black, depending on the surface roughness, will sometimes only be visible after 24 hours when the sealer is fully absorbed into the black oxide coating.

- Caswell Penetrating Sealer
- Caswell Sealer

Possibly another sealer of your choice, such as lacquer, wax or oil.

CAUTION! Insufficient rinsing can leave acid residue, which causes rust during or after sealing (especially on threads). Prepare a separate container with water and baking soda (sodium bicarbonate): after blackening and rinsing, dip the workpiece in it to neutralize the remaining acid, then rinse thoroughly again and seal the object immediately without drying.

CHEMICAL BLACKENING - APPLY BY HAND

Although Caswell Mega Black can be applied by hand at full strength, it is generally convenient to make a solution of 10-33% by volume.

- Use a solution of 1 part Mega Black Oxide to 9 parts water for a slower reaction
- Use a solution of 1 part Mega Black to 2 parts water for a faster response

Tests should be performed on scrap pieces of the same steel with the same finish to develop an optimized process and result.

- Degrease the area to be finished very well with alcohol, acetone or a liquid detergent. Do not use an oil-based degreaser.
- Rinse the object well with running water. If water breaks occur during rinsing, degrease the object again. Water breaks indicate that the object is not clean.
- Remove rust with steel wool or sandpaper.
- Apply prepared solution generously with a cotton swab, sponge or brush with a light rubbing motion. Make sure you get a smooth and even coverage. Continue to rub lightly for 1 to 3 minutes. It also helps to add some of the solution when the reaction has stopped. The depth of the black is controlled by the time the surface is in contact with fresh solution.
- Rinse under running water, with a damp cloth or sponge. Do this several times to remove any remaining black oxide liquid.
- If necessary, add some baking soda to the rinse water to neutralize any remaining acids from the black oxide liquid. Then rinse with clean water.
- Wipe the object dry or dry it with a heat gun. Do not use compressed air to dry as this may stain and release oil or other contaminants.
- Rub with a soft cloth or brush to remove the non-stick layer of depleted chemicals from the surface.

Repeat steps 4, 5, and 6 if a darker finish is desired.

Use a sealer to finish the black oxide coating and protect it from oxidation.

CAUTION! Insufficient rinsing can leave acid residue, which causes rust during or after sealing (especially on threads). Prepare a separate container with water and baking soda (sodium bicarbonate): after blackening and rinsing, dip the workpiece in it to neutralize the remaining acid, then rinse thoroughly again and seal the object immediately without drying.

TECHNICAL CHARACTERISTICS

Property	Specification
Product	Caswell Mega Black
Works on	Iron/steel (cold/hot), construction, alloy, tool steel, cast iron, forging, sintered metal and on a2 tool steel Does not work on stainless steel
Dilute	Standard 1:9; Adjust immersion 1:6–1:12; brush/sponge 1:2–1:9 or undiluted
Surface (coverage)	≈ 10 to 12.5 m² per liter of concentrate
Activate/etch	If necessary with: • Galvanizing Metal Activator • 30% hydrochloric acid diluted 1:1 or 1:2 with water – immerse for 30 to 60 seconds • Mechanical treatment
Sealer	Obligatory; Apply while the surface is still wet
Litigation time	Usually 2–3 min; Max. 5 min
Agitation	Light movement; Circulation/filtration recommended
Temperature	20–32 °C (light heating permitted)
Shelf life	Solution: closed for a few months; Process bath: replenishment/maintenance
Filtration	Mandatory for a clean liquid and longer bath life: use ~50 µm polypropylene filter
Tank/baskets/racks	No stainless steel. PP/PE/PVC; rubber/plastic-lined; plastic-coated hooks
Dry	Be careful with heat gun - do not use compressed air

PROBLEMS AND SOLUTIONS

It is very important that acids from any etching bath, or from the black oxide agent itself, are properly rinsed away. If acids remain, the metal will react to this during sealing or later and brown rust will occur.

Baking soda can be added to the final rinsing water, after the black oxide process and before the sealer, to neutralize residual acids. Then rinse the object well.

It is also important to make sure that, during sealing, the chosen sealer expels all the water and no moisture remains on the black oxide coating. Immerse the object in the sealer several times to expel the water.

Problem	Cause	Solution
Spotty / non-uniform finish	Insufficient cleaning	Black oxide layer removal; thorough cleaning/degreasing; possibly. light sanding/polishing; blacks again.
Spotty / non-uniform	Insufficient rinsing	Better rinsing; Pay attention to water breaks during rinsing.
Bluish glow / gray finish	Insufficient activation	Longer/stronger activation (acid bath/activator); then blacks again.
Finish too light / grey (iridescent)	Solution too strong (too little diluted) inhibits conversion; bath (partially) exhausted; Hard/Alloy Steel	Dilute (e.g. 1:12) and test; replenish/refresh the bath; activate stronger/longer if necessary.
Coating rubs off (smut/rub-off)	Solution too weak (too much diluted); too long treatment; pollution	Strengthen (e.g. 1:6); shorten immersion time; Filter/refresh bath.
Dark streaks/markings	Incomplete immersion; Bubbles; Bad suspension	Fully submerge; light agitation; breaking air bubbles; Adjust basket/rack position.
Rust after blackening	Acid residues; sealer does not expel water; Hard water	Additional coils; short neutralize-dip in water with sodium bicarbonate; rinsing with demi/DI; Seal immediately and sufficiently (multiple dips possible).

Problem	Cause	Solution
Rapid discoloration after sealing	Parts dry between steps; insufficient rinsing	Keep parts wet up to and including sealing; very good rinsing; Keeping process flow tight.
Residual oil / shine spots after sealer	Too much sealer; Insufficient shaking off	Less sealer; shaking off/blowing off the part; remove excess.
White spots / limescale traces	Hard water/minerals in rinse water	Rinse with demi/distilled water; ensure that water is completely expelled by the sealer.
Reaction stops early	Bath exhausted/contaminated	Replenishing or refreshing the bath; filter.
Poor adhesion	Insufficient activation; passive surface; Residual pollution/oil	Longer/stronger activation; better degreasing/cleaning; Redo the process.
Corrosion stains during process	Drying between blacks and sealing; Sealer too late/too thin	Keep parts wet; direct sealing; Sufficient sealer (repeat if necessary).
Spotty/non-uniform black	Insufficient cleaning or rinsing; Water Fractures	Delete layer and start over; thorough cleaning and rinsing; Watch for water breaks.
Excessive abrasion	Improper blackening (too strong/too long); insufficient pre-treatment	Correcting concentration/time; improve cleaning/activation.

WARNING!

The Black oxide solutions are slightly acidic. Avoid contact with eyes, skin and clothing. Wear eye protection (goggles, goggles, or face shield), protective rubber gloves, and aprons when preparing solutions and while working with the solutions. Do not mix the Black oxide concentrate or solutions with cyanide or alkaline materials, or other chemicals. The Black oxide solutions are toxic when used internally.

Do not work with the Black oxide solutions or other products without first reading and understanding the SAFETY INFORMATION.

The safety data sheet can be found on the product page or can be requested from Verzinkshop.nl by e-mail: info@verzinkshop.nl

Do you have any questions? Contact us via:

Mail: info@verzinkshop.nl

Whatsapp or call: +31 6 28090022

WWW.VERZINKSHOP.NL

SAFETY

ALWAYS wear a dust mask, respirator, gloves, and apron when necessary.

ALWAYS treat any chemical as if it could kill you.

ALWAYS label buckets and storage containers with a permanent marker so that you and others know what's inside.

NEVER pour water into acid; it can heat up and explode. ALWAYS pour acid into water.

NEVER leave electroplating pools or other systems that use power unattended. These products may cause a short circuit and cause a fire.

NEVER come into direct contact with chemicals. They can cause serious burns or other damage and are very dangerous substances if not treated with respect.

NEVER THINK you can get away without taking safety precautions! That is not possible!

NEVER leave the lids off the tanks when not in use. They WILL fall over!

Always work safely and ensure good protection and ventilation.

The safety data sheet can be found on the product page or can be requested from Verzinkshop.nl by e-mail: info@verzinkshop.nl

DISCLAIMER

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