



Easy Clean Coating ECC-4000

For Ceramic and Glass Substrates

Introduction 3M™ Easy Clean Coating ECC-4000 is an air-dried, clear, colorless treatment for ceramic sanitary fixtures and glass surfaces that can be used to provide “Easy to Clean” performance. This fluoropolymer will react with the surface to create a low surface energy coating that is not easily wetted with liquids. The treatment is stable and cannot be removed except by harsh cleaners or reagents, such as abrasive cleaners or a very strong base.

ECC-4000 coating is typically applied from a very diluted solution containing about 1.0% by weight of product, resulting in a coating thickness of 20 to 100 nm. ECC-4000 coating can be applied by spray application or dip coating. The treatment provides a hydrophobic surface that allows simple rinsing away of soils and sludge from the surface with no residual surface staining. The treated surface is durable, highly repellent to oils and water and does not change surface appearance.

Application ECC-4000 coating can be applied to ceramic surfaces at room temperature to provide low surface energy benefits.

The treated substrate will have:

- 1. Surface protection** ECC-4000 coating can be used for ceramic materials such as sinks, toilets, tiles (not floor tiles), showers tubs and other sanitary fixtures. It may also be used for indoor glass applications such as shower panels and mirrors.
- 2. Oil- and water-repellency** ECC-4000 coatings can be used to obtain repellency against any liquid having a surface tension greater than about 15 dynes/cm. This includes water, oils, ketones, and aromatic and aliphatic hydrocarbons.
- 3. Easy-to-clean properties** ECC 4000 coating is a built-in manufacturer applied treatment providing an easy to clean surface, resulting in consumer advantages such as:
 - stain resistance
 - easy removal of hard water deposits
 - no need for aggressive cleanersNote: “Easy-to-Clean” does not mean the surface is “self-cleaning.”
- 4. Enhanced lubricity** Soils and liquids tend to “slide off” surfaces treated with ECC-4000 coating, helping to prevent build-up and extend the time between cleanings.

**3M™ Easy Clean
Coating ECC-4000
Typical Physical
Properties**

Not for
specification
purposes

All values
determined at
25°C and 1
atmosphere
unless otherwise
specified

ECC-4000 coating can be described as a fluoropolymer solution.

Properties	ECC-4000 Coating
Appearance	Colorless to slightly yellow liquid
Specific gravity	0.92 kg/l
Flash point	12°C (54°F)
Type	non-ionic
Composition	10% fluoropolymer 60% alkoxysilane 30% ethanol

ECC-4000 coating can be diluted with alcohols, ketones, acetates or other solvents to give slightly hazy mixtures. ECC-4000 can be diluted with hydrofluoroethers (HFE) to give clear solutions. Instructions for proper product application can be found in the Application Guideline.

Typical Performance Data on Ceramic Materials	ECC-4000 Coating
Initial contact angles (water/hexadecane)	95°-110°/60°-65°
Contact angles after abrasion 50,000 cycles with WC-eend * cleaner 40 cycles with Cif**	80°-95°/45°-50° 70°-80°/40°-45°
Contact angles after exposure 24 hrs 18% HCl at 20°C	90°-95°/50°-55°

* "WC-eend cleaner" is a trademark of Bolton Group ** "Cif" is a trademark of Lever Fabergé

Typical Performance on Glass	ECC-4000 Coating
Initial contact angles*(water/hexadecane)	100°-120° / 60°-70°
Tilt angle (water)	15°-20°
Contact angles after abrasion 2000 cycles with brush/water 4000 cycles with brush/water	100°-110°/50°-60° 90°-100°/50°-60°
Contact angles after exposure 24 hrs 18% HCl at 20°C	90°-100°/50°-60°

**Storage and
Shelf Life**

It is recommended that ECC-4000 coating be stored in a closed bottle, away from direct sunlight, in a cool, dry place (temperatures between 10-25°C/50°-77°F). Avoid contact with moisture. Shelf life is 1 year from date of 3M manufacture.

**Product Safety
and Handling**

Before using this product, please read the Material Safety Data Sheet (available through your local 3M representative) and the precautionary information and directions for use on product packaging. Follow all applicable precautions and directions for use.

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Easy Clean Coating

Application Equipment

We suggest using the following spray equipment:

- Walther Pilot hand-held spray gun or equivalent
Type: Pilot MAXI HD, 1.5mm standard nozzle,
gravity feed cup
Alt nr: V 1161103153
- All materials of construction should resist acid-type liquids

Workplace Safety Recommendations

3M™ ECC Coatings should be applied in solvent spray cabins or in closed cabins with adequate ventilation.

Workers who may be exposed to the coatings and solvents during application should wear protective clothing, gloves and respiratory masks. For additional information, see the precautions and directions for use on the product packaging and the appropriate product Material Safety Data Sheet.

“Easy-to -Clean” Perception

The consumer’s perception of a surface being easy to clean will be strongest when the toilet or other sanitary fixture is treated inside (including the rim) and outside. This prevents hard water stains and other stains on inner and outer surfaces.

For glass shower doors, it is also important to treat the inside and outside. This is because ECC coatings protect not only against hard water deposits and soap scum, but also against oil-based stains and fingerprints.

Appearance of Tiles, Sanitary Ware and Glass

To ensure the best possible appearance of the treated substrate, it is important not to exceed the recommended add-on level of ECC coating. Excess coating, which will result in dull surfaces, can be removed within 30 minutes after coating with water or ethanol.

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Easy Clean Coating ECC-4000

For Ceramic and Glass Substrates

Substrate Preparation

Before treatment, the part should be cleaned (using aqueous detergents, acetone or ethanol) in order to remove dust and other contamination. This cleaning step is not necessary for freshly prepared parts.

The temperature of the ceramic substrate should preferably be 15–30°C (60–85°F).

Coating Solution Preparation

In a glass, stainless steel or plastic vessel, combine:

- 980 g ethanol (less than 0.1% water; can be denatured with alcohols, ethers and ketones)
- Add 10 g of ECC 4000, mix well
- Add 10 g of 37% HCl (12% normal) by weight
- Mix well to obtain a slightly hazy solution.

Avoid contamination of any unused portion of ECC-4000 coating with water or HCl; if contaminated, the product will become useless. Use separate sampling utensils (e.g., syringes, pipettes, etc.) for each fluid.

This solution is only stable for a limited period of time (4–6 hours); therefore, it is recommended that you prepare only the amount of solution that can be used during that time.

Application

- Spray the part uniformly with an air atomised micro droplet spray of the prepared solution at a pressure of about 2 bar (29 psi). Distance from spray pistol to substrate is approximately 10–20 cm (4–8").
- The consumption of solution should be approximately 30–40 g/m² (0.1–0.13 oz/ft²) for machine application and about 40–60 g/m² (0.13–0.2 oz/ft²) for manual application.
- Dry at room temperature for 10–30 minutes before handling or packaging.
- Check the aesthetics of the treated part. If excess coating is present, wipe it off with ethanol after about 10–30 minutes.

Although good performance is usually achieved after a few minutes, it may take up to 48 hours before final performance is achieved.

Note: The perception that the treated surface is “Easy-to-Clean” will be strongest when all exposed surfaces are treated both outside and inside.

For additional
information, contact
your 3M technical
service representative.

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Easy Clean Coatings

Measurement of static contact angle

Purpose

The contact angle is a measurement for the wetting or dewetting properties of a surface. Measurement of the contact angle therefore gives information on the hydro- and oleophobicity of a surface. High contact angles are typical for repellent substrates; low contact angles ($<20^\circ$) are typical for completely wettable surfaces. The specific contact angle on a substrate depends on the liquid used and the temperature. Fluorochemical coatings typically give contact angles with water of higher than 90° and with hexadecane higher than 50° .

Limitation

Contact angles below 20° are very difficult to measure; statistical error on measurements is about 5° .

Definition

The contact angle is the angle that the tangent line of the drop makes with the surface.

Principle

Surfaces with very low surface energy (such as those with fluorochemical treatments) have high contact angles.

Apparatus and materials

Static contact angles can be measured with a goniometer, such as an Olympus TGHM. DI water and hexadecane are the liquids typically used. Dynamic (advancing and receding) contact angles can be measured with commercially available equipment.

Test sample

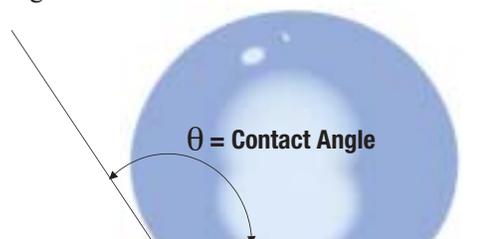
A fluorochemical-treated substrate such as ceramic tile, glass, sanitary ware, porcelain, enamel, etc.

Test procedure

The substrate is mounted horizontally on the goniometer platform; a drop of liquid of about 5 microliters is put on the surface. While looking through the goniometer, a tangent line of the apparatus is moved in such a way that the line matches, as closely as possible, the curvature of the droplet. The tangent line dissects a scale from 0 - 180° . The intersection gives the contact angle in degrees. Dynamic contact angle measuring devices do these operations automatically and provide the data (contact angle, surface energy, etc.) electronically.

Evaluation and rating

Contact angle in degrees is read on the scale.



Abrasion test with water

Purpose	To test the mechanical abrasion resistance of a fluorochemical coating.
Limitation	The equipment used in the abrasion with water test is a linear abrader; curved surfaces cannot be tested using this technique.
Definition	The treated substrate undergoes mechanical abrasion by moving a water-soaked sponge that is mounted on a metal holder. A number of cycles are made during which the sponge moves linearly and horizontally over the surface. Water is automatically added.
Apparatus and materials	Erichsen Washability and Scrubbing Tester Model 494, equipped with a microdose pump and a metal holder; a sponge or a Scotch-Brite™ High Performance Wipe; and tap water. The metal holder weighs 400-450 grams.
Test sample	Fluorochemical-treated ceramic, glass, enamel or tile.
Test procedure	Flat substrate is fixed in a frame of the Erichsen machine; a water-saturated sponge is applied to the substrate and 4,000 cleaning cycles are performed. Water is continuously dripped onto the surface. After 24 hours, the contact angles with DI water and hexadecane are measured.
Evaluation and Rating	Contact angles after the abrasion test are measured.

Abrasion test with cleaner

Purpose	To test the mechanical abrasion resistance of a fluorochemical coating.
Limitation	The equipment used in the abrasion test with cleaner is a linear abrader; curved surfaces cannot be tested using this technique.
Definition	The treated substrate undergoes mechanical abrasion by a moving, detergent-soaked brush or wipe, mounted on a metal holder. A number of cycles are made during which the brush moves linearly and horizontally over the surface.
Apparatus and materials	Erichsen Washability and Scrubbing Tester Model 494, equipped with a microdose pump and a metal holder; a DIN brush or a Scotch-Brite™ High Performance Wipe. An abrasive cleaner (eg. Cif) and a mild detergent (eg. WC-eend) can be used. The metal holder weighs 400-450 grams.
Test sample	Fluorochemical-treated ceramic, glass, enamel or tile.
Test procedure	Flat treated substrate is fixed in a frame of the Erichsen machine; 1) about 5 ml of abrasive cleaner are applied to the substrate and 40 cleaning cycles are completed; the detergent is carefully washed off with water. After 24 hours the contact angles are measured using DI water and hexadecane. 2) about 5 ml of mild detergent are applied to the substrate and 50,000 cycles are completed; every 1,000 cycles, 5 ml additional detergent is re-applied; after the cleaning cycles, the detergent is carefully washed off with water.
Evaluation and Rating	24 hours after the test procedure has been completed, contact angles are measured, using water and hexadecane.

Exposure to HCl

Purpose	To test the chemical resistance of a treatment.
Limitation	The substrates must be stable to strong acids. The chemicals must be used in a liquid, diluted form.
Definition	A treatment is stable to chemicals if it keeps its repellent characteristics for a specific amount of time when exposed to chemicals of a certain nature and concentration.
Principle	Treated substrate is brought in contact with HCl at room temperature.
Apparatus and materials	Metal cylinders 85 mm in diameter and 10 mm high; structural adhesive 3M™ Scotchweld™ Epoxy Adhesive DP-110; glass petri dishes; aqueous solution of 18% HCl.
Test sample	Treated ceramics, glass, enamel and tiles.
Test procedure	A cylinder made out of stainless steel pipe with an inner diameter of 85 mm and a length of 10 mm is glued to the treated substrate with structural adhesive and allowed to cure for 1 hour. The substrate is then placed horizontally. 10 ml of 18% HCl is then poured in the ring. The ring is covered on top by the petri dish to avoid evaporation. After 24 hours the test liquid, metal ring and adhesive are removed. The treated substrate is thoroughly rinsed with water and allowed to dry at room temperature for 24 hours.
Evaluation and Rating	24 hours after the test has been completed, contact angles are measured, using DI water and hexadecane.

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Easy Clean Coating ECC-1000 ECC-4000

Ceramic Sanitary Ware

Test	3M Test Method	Contact Angle (water/hexadecane) Minimum Specs
Initial Contact Angles	Measurement of Static Contact Angle	>90°/>55°
Contact angles after abrasion with Erichsen cleaning device-DIN 53788 50.000 cycles WC-eend (Johnson)	Abrasion Test w/Cleaner	>85°/>45°
40 cycles CIF (Lever)	Abrasion Test w/Cleaner	>70°/>40°
Chemical Resistance 24 hrs 18% HCl at 20°C	Exposure to HCl	>90°/>50°

Glass for Shower Cabins

Test	3M Test Method	Contact Angle (water/hexadecane) Minimum Specs
Initial Contact Angles	Measurement of Static Contact Angle	>90°/>55°
Contact angles after abrasion with Erichsen cleaning device-DIN 53788 4.000 cycles water-sponge	Abrasion Test w/Water	>85°/>45°
Chemical Resistance 24 hrs 18% HCl at 20°C	Exposure to HCl	>85°/>50°

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Easy Clean Coatings

**QUALITY
MONITORING
REQUIREMENTS**

Use of the Scotchgard™ brand

The Scotchgard brand can only be used by businesses that have a current Trademark License for the Scotchgard brand on file with 3M. Use of the Scotchgard brand also requires that treated substrates meet the Qualification and Performance Specifications for their specified use.

Performance testing and quality monitoring to ensure that the brand specifications are met are primarily the responsibility of the licensee. The Trademark License provides for corroborative testing by 3M or its authorized representatives. This testing is meant only to supplement the performance testing of the licensee; it is not a substitute for such testing.

Quality assurance testing procedures

Production samples of substrates treated with a 3M™ Easy Clean Coating material must be tested in accordance with prescribed 3M test methods and frequency to ensure continual quality of the treated finish.

A profile of the typical end-users of the substrates will determine which performance tests are required. These tests include: oil and water repellency, chemical resistance and abrasion resistance. Refer to the “Qualification and Performance Specification” and “Test Methods” documents for the appropriate tests and test results required to pass a particular performance specification.

It is required that accurate records for each production lot of substrates and each test value be kept as a record for both future application formulations and problem solving.

Sample submission procedure

- 1) Not less than every thirty (30) days, representative samples and test results of treated materials must be sent to 3M or its authorized representative who will do the corroborative performance monitoring testing.
- 2) Results of the Performance Monitoring testing will be summarized monthly and a copy will be sent by 3M to the manufacturer submitting the samples. If performance monitoring is done by a 3M authorized representative, a copy will also be sent to 3M.

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