world rowing equipment and technology commission

Boat Surface Treatment

Information Note & Review in the Context of

Appendix R2 – Bye-laws to Rule 29

Arnoud Greidanus · Mathias Binder · Adrian Champion · Michael Martinov

June 7th 2026 · Released R1

Why Frictional Drag Matters

70–90%

of total water resistance
is frictional drag

Rowing boats are long and narrow, minimizing pressure and wave drag

Three Types of Water Resistance

1. **Pressure Drag**
   Energy to move water aside. Reduced by streamlined shapes.

2. **Wave Drag**
   Energy for wave formation induced by the hull moving through water.

3. **Frictional Drag**
   Water shearing along the boat surface, generating turbulence near the hull.

The boat surface's interaction with water flow is the dominant performance factor.

Laminar vs Turbulent Flow

Laminar Flow

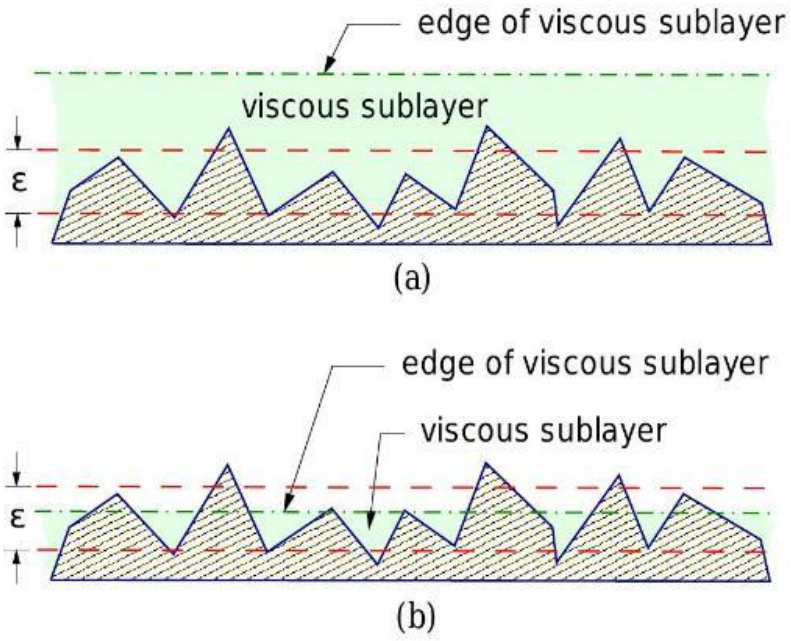
- Smooth, layered streamlines
- Little interaction between layers
- Low Reynolds numbers
- Rare in real-world conditions

Turbulent Flow

- Chaotic vortices and mixing
- Significant layer interaction
- High Reynolds numbers
- More mixing = more friction drag

The boundary layer's viscous sub-layer thickness determines when surface roughness affects drag.

Surface Roughness & Viscous Sublayer



Key Concept

The viscous sublayer is the thin first layer of flow closest to the hull surface. This layer becomes thinner with a higher boat velocity. The ratio of roughness dimesion over the sublayer thickness determines whether the boat is “hydrodynamically smooth.”

10–25 µm

Estimated sublayer thickness for rowing boats

50–100 µm

Human hair thickness (for scale)

(a) Smooth – roughness below sublayer **(b)** Rough – elements protrude through sublayer

Do Commercial Products Reduce Drag?

No scientific evidence

Simple polish/wax products cannot enhance the boat surface relative to turbulent flow or increase boat velocity.

Why don't they work?

- Products may increase water-repellent character up to ~150° contact angle
- Achieved slip length is less than 1 µm
- Effective slip needs 10–100 µm to reduce drag
- Products keep hulls cleaner longer, but washing achieves the same result

What do they actually do?

- Keep the surface cleaner for longer between washes
- Enhance water-repellent character slightly
- Contain nano/micro-particles and volatile solvents
- May pose health and environmental risks

Laboratory Test Results

Independent study commissioned by World Rowing, conducted at Delft University of Technology under controlled laboratory conditions.

Six Products Tested

Coating / drag-reducing products:

- Aquaspeed Nanoprom
- McLube Hullkote

Polishing / maintenance products:

- 3M Perfect-It Gelcoat Medium Cutting Compound
- Polarshine 10 Polishing Compound (Mirka)
- Yachticon Premium Polish Teflon
- Autoglym Super Resin Polish

Note: Some of the tested polishing products are combination products that contain additional substances such as PTFE which remain on the surface and are not permitted under the rules.

No Drag Reduction Found

None of the six products produced a measurable reduction in drag compared with an untreated smooth reference surface. Products marketed with performance claims showed no advantage.

Polishing Restores Damaged Surfaces

- Scratched surfaces showed up to ~4% more friction
- Polishing products brought damaged surfaces back closer to original condition
- Value lies in maintenance, not in creating extra speed

Polishing as Surface Maintenance

What Polishing Is

- A fine form of sanding that levels microscopic peaks
- "Sandpaper without paper" — abrasive particles in a paste or liquid
- Removes scratches, oxidation marks, and deposits
- Restores the original factory surface quality
- Residue is wiped off completely afterward

What Polishing Is Not

- Not a coating or wax application
- Not applying a foreign substance to remain on the hull
- Not a lubricant or hydrophobic treatment
- Not the addition of a special surface structure
- Not surface enhancement — it’s surface restoration

Polishing is consistent with Appendix R2 when it serves only to restore the original hull surface.

How Other Federations Handle It

World Sailing (ISAF)

Rule 53 – Skin Friction

A boat shall not eject or release a substance, such as a polymer, or have specially textured surfaces that could improve the character of the flow of water inside the boundary layer.

Defined Processes (Equipment Rules 2025–2028):

- Sanding: abrasive removal without shape alteration
- Cleaning: detergents applied then removed
- Polishing: cutting compounds to reduce roughness
- Lubricating: non-permanent friction reducing compound

Int'l Canoe Federation (ICF)

Rule 3.2.6

No foreign substance may be added to boat surfaces giving an unfair advantage. Hull lubricants are not permitted.

Key Implications

- Broad prohibition on any surface additive
- Covers all substances, not just specific products
- Hull lubricants explicitly banned

Both federations prohibit surface substances that alter hydrodynamic properties.

Environmental & Health Considerations

Some boat care products contain substances that pose risks beyond the competition context.

PTFE / PFAS – Environmental Impact

- PTFE (Teflon) belongs to the PFAS group – known as “forever chemicals” because they do not break down in the environment
- Products applied to hulls can release PTFE microplastics directly into waterways during rowing
- PTFE microplastics have been detected in water, sediments, and marine organisms worldwide
- Volatile solvents and nano-particles in some products pose additional risks to aquatic ecosystems
- The European Chemicals Agency (ECHA) is proposing a broad restriction on PFAS under the REACH regulation

Health Risks

- PFAS traces found in human blood and tissue samples; linked to liver damage and cancer risk
- Rowers exposed through skin contact and inhalation when applying products with solvents and nano-particles

Alignment with Appendix R2

- Banning surface additives protects both fair competition and the environment
- Combination products that leave residues introduce persistent substances into waterways
- Rowing’s duty of care extends to protecting the waters we compete on

Appendix R2: What's Allowed (2026)

Permitted

- Mechanical polishing or buffing to restore original hull surface
- Products with purely abrasive function
- Residue must be completely removed after process
- Washing, de-scaling before racing

Not Permitted

- Waxes, sealants, or lubricants left on the hull
- Hydrophobic agents or coatings
- Combination products containing substances intended to remain
- Any foreign substance added to the surface

The guiding principle: polishing is maintenance of the original surface, not the application of a new surface treatment.

Recommendations

Polishing

- Use polishing or buffing only where needed to maintain a smooth surface or to restore it after repairs.
- Keep the amount of polishing paste to a minimum.
- Rinse or wash the boat before first use after polishing so no residue remains on the hull or enters the water during rowing.
- Take special care when polishing outdoors, because dried residue can disperse into the environment if not properly contained.

Wet Sanding

- Wet sanding is not recommended, even if it is not expressly forbidden.
- It has no proven positive performance effect.
- It creates ecological impact through the release of fine particles (microplastic) and sanding residues.
- Every sanding process removes a thin layer of the boat's top coat and reduces the service life of the hull over time.

Section 7 — Practical guidance for polishing and wet sanding under Appendix R2.

Next Steps: Surface Testing

A concept to measure boat surfaces for substances is currently being developed and tested.

1

Proof of Concept

Validate that testing methods already used by another sports federation can also be applied to rowing. First reference measurements are underway.

2

Systematic Testing

If successful, define procedures and conduct a systematic series of tests to establish references and verify results across various products and substances.

3

Rule Proposal

Develop a formal rule proposal and submit a budget request for the required testing equipment.

A list of specific prohibited products and substances will follow.

Any polishing/buffing product containing waxes, PTFE, or similar additives is not allowed.