WELCOME

BEST PRACTICES FOR PATTERN AND FRP COMPOSITE MOULDS DEVELOPMENT

WEBINAR
FRP INSTITUTE
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FROM PATTERN TO MOULD

Patterns Making– Considerations, new materials

Pattern Surfacing – for class A finish.

FRP composite Moulds

Mould Construction – Speciality Tooling Materials

Mould Repairs & Resurfacing

Mould Maintenance

Pattern Making – Key points

Pattern is usually a positive/ male shape.

- Selection of materials for pattern.
- number of moulds to be made from the pattern.
- Surface finish – Glossy / matte / textured,
- Draft angles – for easy de-moulding of parts,
- Moulds for closed moulding processes will need wider flanges.
- Parts having undercuts, return flanges will need split moulds.
- Locating pins on the flange helps in precise alignment of complex moulds.

Pattern – Materials

Wood, MDF / HDF

High Density Urathane or EPS

POP, Clay

Epoxy / Polyester/ VE
Tooling paste

PCC

Consolidation of pattern with Intec's Polyester or VE tooling paste

- Competitive Price
- Extrudable or sprayable options available
- Cures fast, post curing not required.
- Dispensing equipment is inexpensive.
- Fully compatible with polyester/vinyl-ester primer systems
- Faster

Polyester and Vinyl ester tooling pastes from Intec SRL, Italy

Via Edison Nr. 4 - 42049 Calerno, S. Ilario d'Enza (RE) - ITALY - Tel.: +390522909727 - Fax: +390522909747 - www.intecslem.it - info@intecslem.it

Pattern Surfacing

Pattern Surfacing

Customers judge the finished FRP parts by surface quality and expect automotive type finishes in FRP composites.
A quality mould surface begins at the pattern stage.

Pattern Surfacing

Hi-quality pattern surfacing directly influences -

1) Quality of the Mould's cosmetic finish.
2) Release Characteristics of the mould surface.
3) Longer service life of the mould surface.
4) Mould and final part finishing time.

Hi-Gloss, Undulation-free pattern.

Pattern Surfacing Materials

Duratec® : Coatings with Aqua-Buff ® : Fast-cut Compounds & Polish.

- Polyester or Vinyl Ester Chemistry.
- Exceptional air-cure performance.
- All coatings can be applied by sprayer, brush or Roller after catalyzing with 2% MEKP.
- Provides near class-A finish, smooth release surface with very low porosity.
- Excellent Adhesion, High HDT

CONVENTIONAL

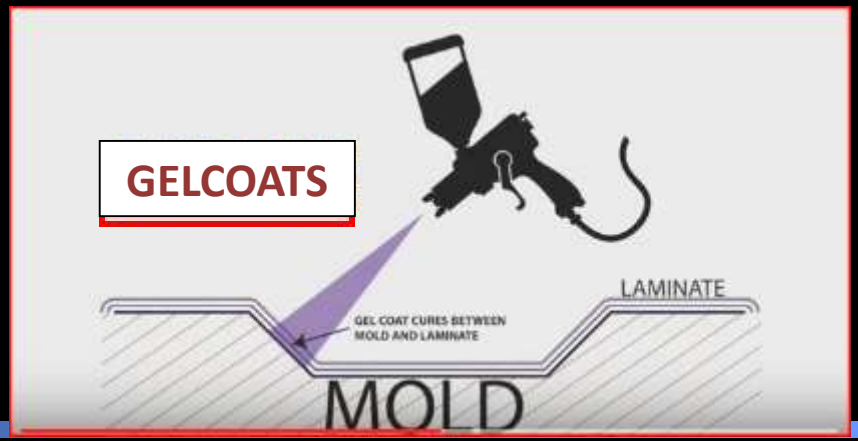
- **Polyurathane coatings**
- **NC paint system**
- **Polyester resins / gelcoats.**

Why Duratec?

HAWKEYE SURFACING SYSTEM Duratec Polyester / Vinyl Ester coatings	Polyurathane coatings / NC paints,
Excellent Thermal resistance. Duratec Polyester & V E coatings have High HDTs.	Lower HDT Values - Inadequate thermal resistance. Lead to post-cure shrink due to exotherm generated from the mold manufacturing process.
Polyester & V E chemistry of the Duratec coatings provide excellent chemical resistance.	Poor chemical resistance - styrene of the gelcoat attacks the coating surface leading to internal tearing of the coatings when the tool is de-molded from the pattern. – Peel off issue.
Gloss retention and complete transfer of surface finish to the mould. Multiple releases.	Gloss reduction & peel off compels to work on the mould surface again. Single release.

Why Duratec?

HAWKEYE SURFACING SYSTEM Duratec Polyester / Vinyl Ester coatings	Polyester gelcoats or resins
Air-cure chemistry : Catalyzed Duratec coatings cures at thin coats. No wax or any other barriers are required.	Gelcoats or polyester resins require barriers otherwise it does not cure completely as thin coat due to air inhibition.
Easier to sand cured hard coatings, provides porosity-free surface.	Tacky surface difficult to sand and contains lot of porosity.



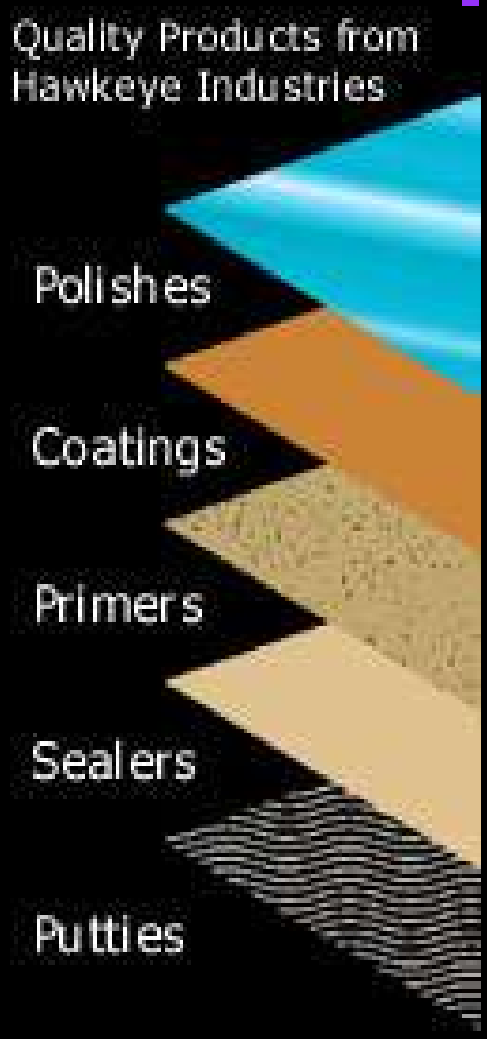
Why Aqua-Buff ?

AQUA-BUFF compounds	Other compounds
Water Based, environment-friendly. Ablating type fillers, break down and disappear while compounding.	Solvent based, pose environment & fire hazards.
Contains Animal Tallow & fillers, brings out the true surface by cutting and increasing the surface tension.	Contains oils or polymers, leaves a film, surface appears shiny due to solvent film.
Economic since one can use only half as much, compared to other compounds.	No dilution, requires more compound.
Gives Swirl-mark -free finish.	May leave Swirl marks

Pattern Surfacing - Materials

Duratec + Aqua-Buff
Specifically Designed
Unique System

- Aqua-Buff 2000
- Aqua-Buff 1000W
- Duratec Polyester Hi-Gloss Coating
- Duratec Polyester Surfacing Primer
- Duratec Polyester Base Primer
- Duratec Vinyl Ester Putty
- Duratec Polyester Sealer



Duratec Vinyl Ester Putty on Sealed Wood (if required) – For excessive fairing.

Spraying Duratec Polyester Base Primer Over Sealed Wood. Spray gun Nozzle dia . Min. 2.5mm

Pattern Surfacing
Duratec Application

Sanding of Duratec Polyester Base Primer

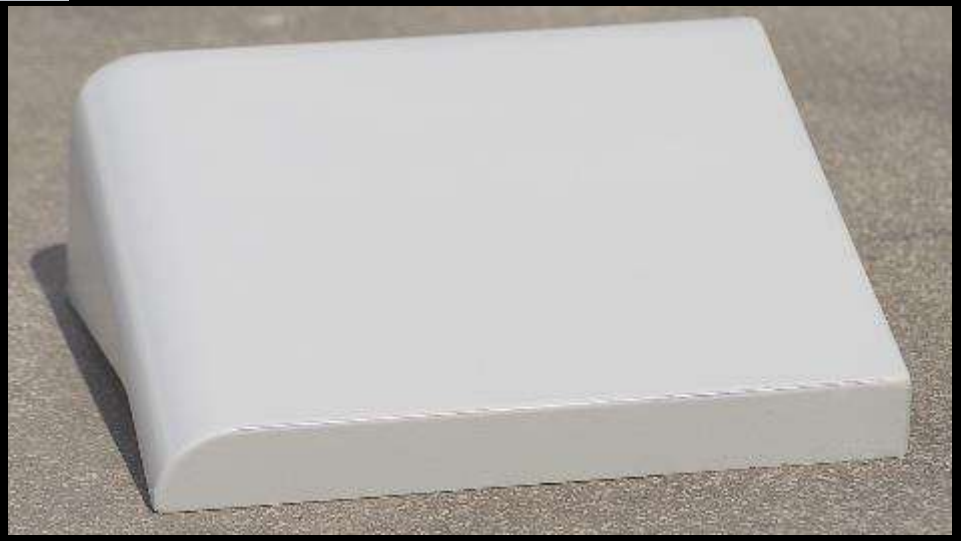
Spraying Duratec Polyester Surfacing Primer

Spray gun Nozzle dia . 2.00 to 2.5mm

Pattern Surfacing : Duratec Application

- Cured Primer coat can be sanded and polished to a surface with 70% gloss.

- or top-coated with hi-gloss topcoat to get 90+ gloss units.



Pattern Surfacing -Duratec Application

- Ultimate glossy & hard surface.
- Exceptionally low porosity.
- Resist fish-eyes & pin-holes.

- Provides a final gloss over 90% after sanding and polishing with Aqua-Buff compounds.

Duratec Polyester Hi-Gloss Coatings

Aqua-Buff ®- Compounding & Polishing

Buffing with

- Aqua-Buff 1000W – Fast-cut compound. + Schlegel pad # 175

Polishing with

- Aqua-Buff 2000 - compound & polish + Schlegel pad # 275.

Pattern ready for mould making

- Glossy patterns retain 98% of their initial gloss after mould making process.
- Mould prep is reduced due to high gloss transfer.

Plug & Pattern Surfacing System

– For Mirror Finish Molds.

Pattern preparation – Release agents

- Seal polished surface first.
- Use wax release rather than semi-permanent release system. Use 7 – 8 coats of wax paste.
- Use of PVA recommended - it provides extra protection by making a physical, sacrificial barrier between Surfaced pattern and the mould.

Pattern Surfacing - PU foam

Compound with Aqua Buff 1000-W and polish with Aqua Buff 2000.

High-density PU foam tooling board with Duratec VE primer and VE topcoat.

Pattern Surfacing - EPS Foam

- 1) Duratec StyroShield Primer (707-019).

Cured StyroShield forms a barrier for use of conventional polyester laminating resins or polyester/ VE tooling paste.

It contains microspheres, providing insulation for polystyrene foam.

FRP COMPOSITE MOULD CONSTRCTION

FRP Composite Moulds

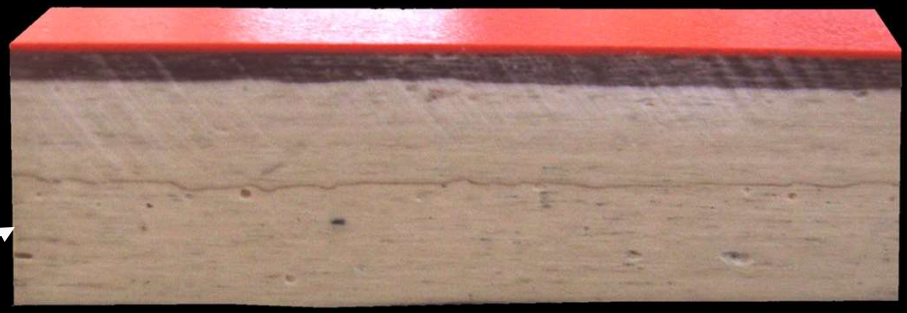
- Inexpensive & light weight
- For Low to moderate volume production.
- For parts cured at ambient temperatures
- CTE of composite tools closely matches to that of moulded part helping the part maintain the dimensional accuracy.
- periodic maintenance required.

Mould Construction – Materials

Tooling Gelcoat

VE Skin coat

Bulk laminate with Tooling resin



Mould Construction – Gelcoat

- **Tooling gelcoats** : Vinyl ester / Isophthalic –
- High resistance to styrene and high temperature.
- Good gloss for longer period.
- High mechanical loading capacity.

Nord VE gelcoats - GC206 & GC207

Gelcoat Thickness – 0.8 to 1mm, 2 coats x 500gms/sq, mtr.

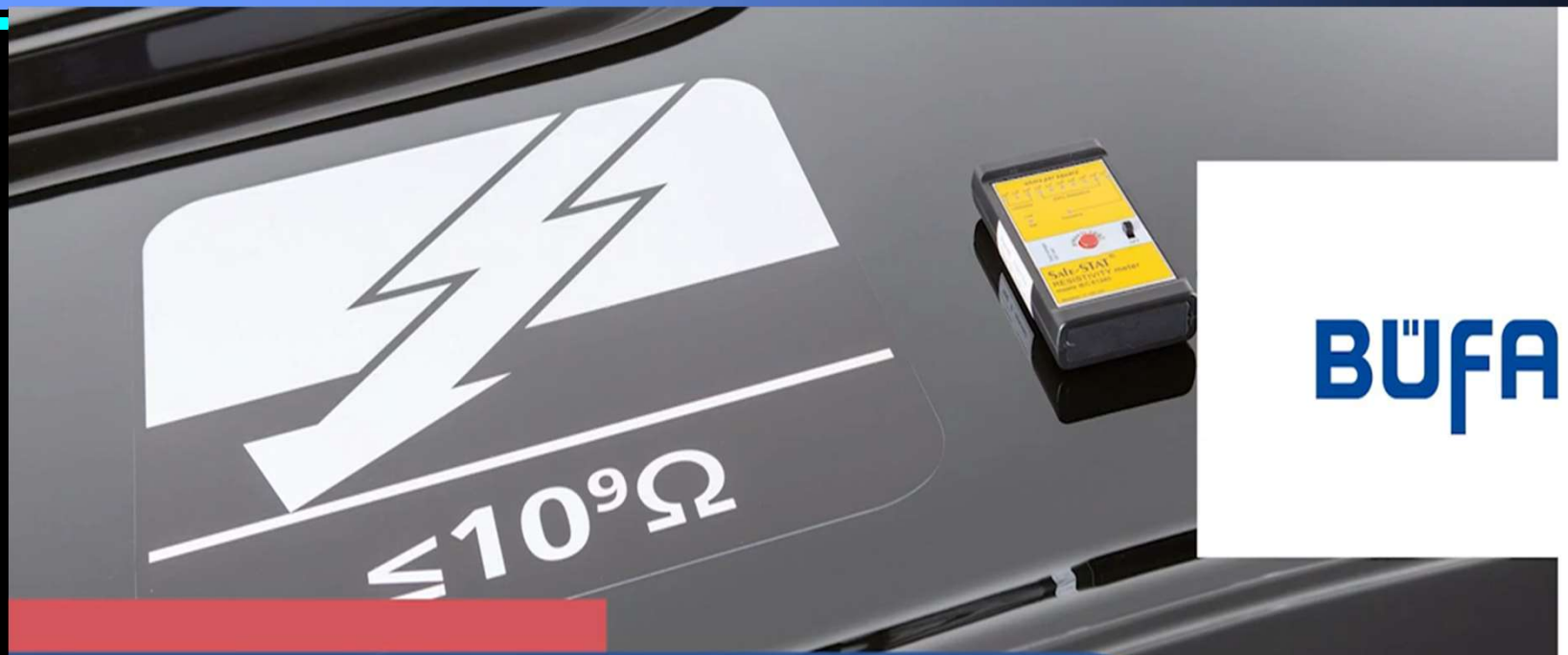
Mould Construction – Conductive Tooling **Gelcoat**

Most Innovative product from BÜFA®

- use single wall carbon nano tubes (SWCNT). Dissipates static electricity efficiently through a single earthing point.

- Easier and faster de-moulding,
- Mould cleaning with less efforts.
- Reduced wastage
- increased component quality.
- Occupational safety

- No More "electrical shocks" during de-moulding



BÜFA

GELCOATS AND RESINS

Smoother, safer, faster

The dissipative BÜFA®-Conductive Tooling Gelcoat

Composites

Mould Construction – Skincoat

- **Skincoat Resin –** VE resin-only after gelcoat is fully cured.

To strengthen the gelcoat, corrosion resistance

Nord – R842TPA

Thickness – 1 layer x Surface tissue 30 gm/sq. mtr.

- 1 layer x CSM 150 / 225 / 300.

Ensure

- all the air is removed from first layer.
- the reinforcement conforms to

all sharp angles of the mould.

Mould Construction

- **Tooling Resin –**

Vinyl Ester / Isophthalic ZERO SHRINK tooling resins

Nord – RM2550NV Polyester / RM3000 Vinyl Ester

Advantages of Zero shrink tooling system

- *Pre accelerated resin with fillers added*
- *Performs like a normal laminating resin*
- *Rapid cure gives rapid mould making*
- *Complete dimensional stability*
- *Perfect surface replication on the cured laminate*
- *Fibre print through eliminated*
- *Colour shift indicates when the laminate is cured*
- *Normal resin storage life without filler settlement*

Mould with Zero Shrink resin system

Brush / spray application

Colour shift during cure

G : R ratio – 1 : 2

Laminate schedule

- 4 x 450 gms/sq. Mtr. Wet on wet
- core – Balsa / foam
- 4 x 450 gms/sq. Mtr.

Mould Stiffening & Reinforcing

-Stiffening and reinforcing ribs can be added to the back of the mould.

- a simple metal or wooden framework to support the basic mould structure.

-The frame must support the flanges and should be constructed from a minimum of 25 x 25mm, 2.5mm gauge steel box section or 12mm ply.

- Some simple cross bracing can be included to give general stiffness. The framework can include legs to support the mould at a convenient working height.

Mould Releasing from Pattern

According to the size, and application of the mould, demould between 2 and 5 days after laminating, to avoid any marks from the ribs.

If the installation of ribs is not necessary, then release of the mould can then be carried out 24 hours after the peak exotherm of the last layers of **Norester® 2550NV.**

Trim and sand the mould edge back to the pattern edge to expose the entire pattern edge. Using plastic wedges, locate the joint between the pattern and mould face to drive the wedge.

Be careful to force these faces apart with equal pressure around the entire mould flange.

Mold Repairs & Resurfacing

– Old / damaged Moulds can be repaired and re-surfaced more quickly & at less cost than producing an entirely new mould.

- Aqua-Buff 2000
- Aqua-Buff 1000W

- Duratec Polyester Hi-Gloss Coating

- Duratec Polyester Surfacing Primer

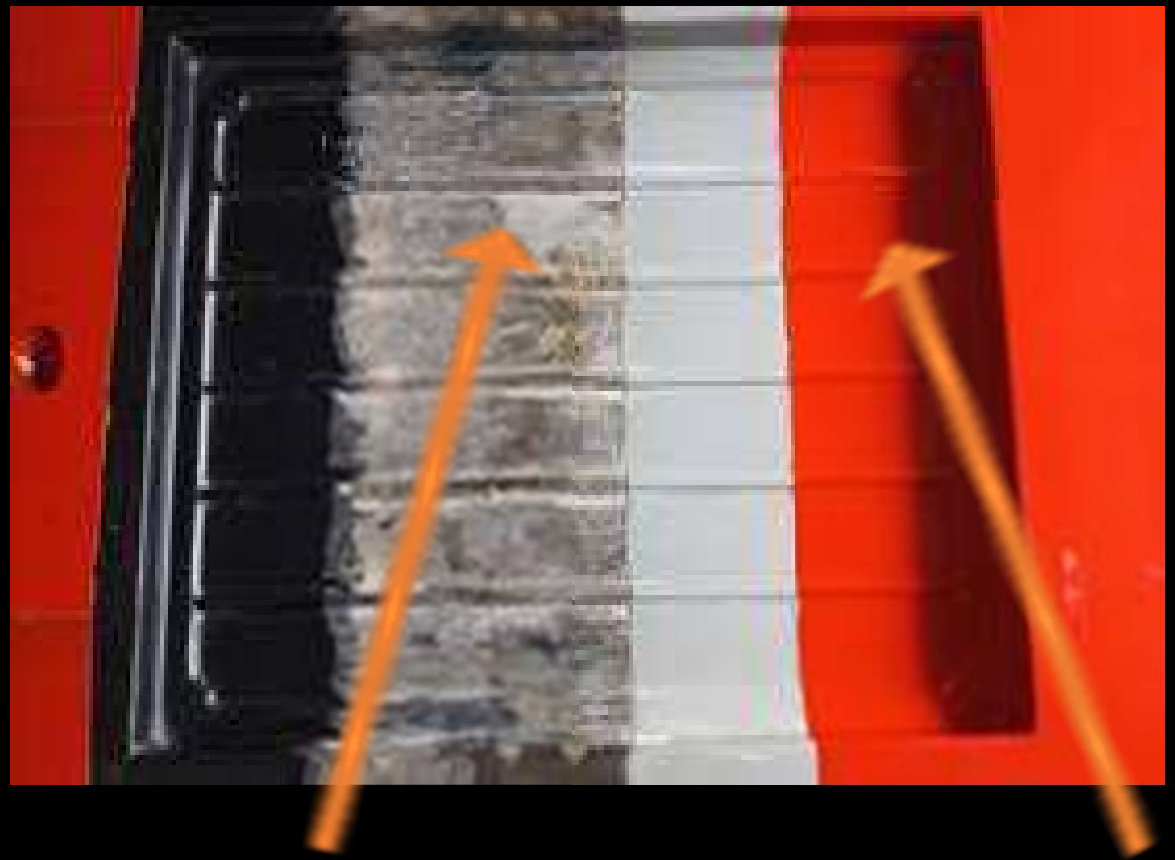
- Duratec Vinyl Ester Putty

Mould Repairs

- Chips, star-cracks and deep scratches on otherwise sound molds can be skillfully repaired with Duratec VE Mold Repair Putty.
- Can be sanded and polished to a gloss equal to tooling gelcoat.
- Cures at thin edge. Does not shrink away from the edge.
- Re-coating not required.

Mould Repairs with Duratec VE Mold Repair Putty.

Mould Repairs & Re-surfacing.



Gelcoat sanded off and Star cracks & scratches repaired with VE Mold Repair Putty .

- And then resurfaced with VE surface primer and VE high gloss orange

Mould Resurfacing : Mould prep

- Chemically strip the release agent off the mold & buff the surface with AB1000W.
- Sand the stripped mold with a coarse grit to create mechanical bond.
- Wipe down with cloth and acetone.
- Use Duratec Mold Repair Putty to Repair cracks, holes and chipped surfaces

Mould Resurfacing : Surface Priming

- Polyester surface primer for open moulds.
- Vinyl Ester surface primer for Closed moulds.(Infusion, RTM, LRTM)

- Surface Primer covers sub-surface porosity and remaining contaminants.

Mould Resurfacing : Topcoating

- Polyester or Vinyl ester topcoats provide exceptionally low porosity, Smooth, hi-gloss, hard surface.

- To be sanded progressively with 320,400,600,800 & 1000 grit sandpapers before buffing and polishing.

Mould Resurfacing : Buffing & polishing

- Fast-cut buffing with Aqua-Buff 1000W followed by polishing with Aqua-Buff 2000 restore original mould conditions.

Mould Repairs & Re-surfacing

FRP Mould Maintenance

Factors affecting Mould surface finish :
Release system - Wax + PVA, wax build-up. Selecting a quality SPR system helps gloss retention.

Heat generated during the cure.

Styrene build-up.

Inappropriate tools to release the parts.

Inappropriate tooling materials,
Tooling gelcoats.

FRP Mould Maintenance

- Ensure proper demoulding procedure.
- Periodic buffing and polishing of mould surface.
- Periodic checking of release property of the mould.
- No solvents like acetone to clean the moulds.
- Proper Scraping resin build-up from the edges and flanges. Use compressed air to blow debris off the mold surface.
- Covering the moulds during storage.
- Keeping record of mould usage.

FRP Mould Maintenance

- Periodic inspection of mould surface – after every 20 to 25 de-mouldings.
- Surface dullness, scratches :– Clean & re-polish the mould.

Aqua-Buff 1000-W	Buffing compound for Polyester moulds.
Aqua-Buff 1000-F	**Fast-cut, aggressive buffing compound for epoxy and metal (Aluminum) moulds.**
Aqua-Buff 2000	**Post compounding Polish for cleaning & removing compounding marks on composite moulds and parts.**
Aqua-Buff One-Step	**One step compound and polish for use on light coloured gelcoated composite parts.**

ECS

Composite Designs & Technology
Structural Design and Analysis

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Thank you