

STRONGHOLD

GRP ROOFING SYSTEM

The strongest and most durable flat roofing system available.

2 x stronger than any other flat roofing system when reinforced with KEVLAR® technology. Complete with a 25 year manufacturer's guarantee when properly installed to manufacturer's specifications.



600 or 900 (2x450) gram per m² fibreglass reinforcement can also be used for a super strong finish available with a 20 year guarantee. (Terms and conditions apply).

Fire retardant. (BS476 Part 3)

Exceptionally long lifespan

Extremely durable withstanding foot traffic

Easy to use

Available with a mid grey or dark grey topcoat

Any BS colour available as optional extra



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SECTION 1: MATERIALS



The following materials and tools will be required on most roofs:

Decking Boards

Only the following decking boards should be used: In order of preference:-

A) OSB 3 T+G

OSB 3 (orientated strand board) T & G conditioned roof/floor grade decking is recommended. Minimum 18mm, usually 2400mm x 600mm. Allows for an excellent finish, which can be less susceptible to stress fractures, than butt-jointed products.

Suitable for high security applications with a composite Kevlar and 600g/m² glass csm laminate.

Suitable for maintenance foot traffic with 600 g/m² glass csm laminate.

Suitable for balconies with 2 layers of 450 g/m² glass csm laminate.

Should be laid with gap uppermost to help "glue" the boards together. With all board types allow a 20mm expansion gap against any walls.

Guarantee available.

B) WBP PLY

A good quality ply is also acceptable if specified by the architect although they should be considered a second best option. Joints must be reinforced. Suitable for all applications.

Guarantee available when joints are taped and bandaged

C) OSB 3

2400mm x 1200mm butt jointed boards may also be used. Joints must be reinforced.

Suitable for maintenance foot traffic in a roofing application with 600 g/m² glass csm.

No guarantee available with this board type.

Fixings

All nails should be galvanised, 60–70mm long ring shank nails or better/equivalent for fixing the decking sheets to the roof joists. The fixing should be at least 40mm into the joist. For high security applications use minimum 75mm ring shank nails or screws to achieve 55mm joist penetration.

Galvanised 20 mm long, large head clouts should be used for tacking the roofing trims to the deck. The deck sheets may be fixed to the roof joists with galvanised or sheradised screws. Screws or nails MUST be countersunk. Screwing or nail guns may help avoid ceiling damage.

Tape

Packing tape or cello tape are good options to bridge board joints, 50mm.

Resin

STRONGHOLD Base Resin

When estimating quantities allow:-

3.5 Kg/m² for composite Kevlar security layer and 600g/m² glass csm

4.5 Kg/m² for composite Kevlar security layer and 2 layers of 450g/m² glass csm balcony spec.

2.5 Kg/m² for single layer 600g/m² glass csm

3.5 Kg/m² for 2 layers of 450g/m² glass csm balcony spec.

Kevlar Reinforcing

The KEVLAR reinforcing is 200g/m² high strength weave. Kevlar should be stored in a sealed polythene bag. Moisture is not a problem for the Kevlar but will contaminate the finished laminate.

Keep dry.

SECTION 1: MATERIALS



Glass

The glass should be 450 or 600 g/m² Stronghold emulsion bound, csm (chopped strand mat). Stronghold glass is manufactured to BS3496. Old, damp glass should never be used. Glass (the binder) is hygroscopic and will become damp if left exposed to the air. Unused glass should be stored in a sealed polythene bag.

Topcoat

STRONGHOLD Topcoat is specially formulated to harden with the same catalyst as STRONGHOLD Base Resin. The Topcoat is normally pigmented but may be supplied clear (non-pigmented) – in which case it will require the addition of a polyester pigment paste to achieve a finished colour of your choice (see section 1, Top coating).

Application rate of the Topcoat is 0.5 Kg/m²

Catalyst

You will need catalyst or hardener in order to make the Base Resin and Topcoat cure. This is methyl ethyl ketone peroxide liquid. The catalyst must be added to both the STRONGHOLD Resin and the STRONGHOLD Topcoat at the rate of between 1% and 4% by weight, depending on conditions. The resins and catalysts are adjusted to compensate for seasonal temperature differences.

Inexperienced installers should start the roof using small resin batches. Catalyst ratios can then be adjusted accurately. This can save resin loss through too fast a cure or time waiting for too slow a cure. If the roof takes too long to cure it may not be possible to apply the Topcoat on the same day, which may be detrimental to a good Topcoat bond.

- Please note that these materials are hazardous and MUST be handled with care as specified in the manufacturer's data provided.

Mastic (Adhesive Sealant)

Curable polyurethane mastic is required to fix edge trims to fascia carried batten and to join or seal certain roof detail. Polyurethane mastics bond well with polyester. Two recommended grades are Soudaflex and Sikaflex. Silicones and other mastics should not be used.

Tools Required

The following tools will generally be required in order to cut and fit the component parts correctly:

Power saw
Stanley knife
Hammer
10-20 litre buckets
2"- 4" Brushes
Disposable gloves
Heavy grade abrasive paper
Sweeping brush
Hand saw
Hand grinder with stone cutter (tinsnips !)
Mixing tool
Mastic gun
Lambswool rollers (Phenolic core)
Paddle wheel rollers
Catalyst dispenser

A suitable hand cleaner and solvent for brushes and rollers should also be at hand. The best solvent for resin is acetone but REMEMBER this is extremely flammable so NO SMOKING when handling these materials.

It is worth noting that dust masks should be used when handling all glass products. Suitable protective clothing should be worn at all times. An eye bath should be at hand in the event that resin, catalyst or acetone make eye contact. This list should not be considered definitive, and reference made to the safety data sheets incorporated in this manual.

Technical Note

Roofs over approximately 100 m² should incorporate expansion and contraction joints or allow for expansion and contraction by other means. This will reduce stress in the single skin GRP roof avoiding cracks occurring as a result of stress fatigue.

SECTION 1: PREPARATION



A fibreglass roof should always be laid directly onto a new timber decking. Bitumen based substrates such as felt or asphalt will affect the cure of the base resin.

Note the weather prior to removing the old roof. The decking must be dry and the fibreglass must be laid in dry conditions.

If resin comes into contact with water it will never cure properly. Consequently water contaminated resin will have to be removed. This is costly and time consuming.

Remove the old decking, and check joists for rot. Roof joists and timbers must be sound and rot free. Replace as necessary. Install insulation as required. Most flat roofs show some pooling. This is not a problem for GRP but it is better to drain the roof completely. If possible, nail firing pieces to joists prior to deck fitting. A fall of approximately 1 in 40 is ideal, 1 in 80 is sufficient to clear most pooling. If the roof is very flat a planner can be used to recess any draining edges by 2mm to allow "A" trims to be fitted flush with the deck. This will reduce pooling to a minimum, but probably not altogether.

Authors note.

Most flat roofs exhibit pooling which although not a problem can be unsightly. Felt roofs often have gravel spread on them to assist thermal dissipation of excess heat from sun, or is it to hide the puddles? If the roof structure is very flat then the customer should be advised that pooling is likely. If this is going to be a problem then firings to reduce or dressing with stones to hide, should be suggested.

Technical note:

As it is possible to apply GRP to a vertical surface, a steep roof pitch poses no problems for the product. Be aware however, that polyester resins are slippery and a steep surface should be worked with caution and suitable equipment. Resin drainage may be a problem for inexperienced users.

SECTION 1: DECKING & JOINT PREPARATION



Fix the new decking boards on the joists by nailing or screwing. Boards should be fitted at 90 deg to the roof joist. Boards will have to be jointed on the joists unless T & G boards are used. OSB 3 boards should be laid with the writing/expansion gap uppermost. With butt jointed boards leave 3mm gaps between the boards to allow for expansion of the sheets. For all board types always stagger the board joints. Never use a board smaller than that which will fix to two joists. This will reduce the stresses in the roof, which are inevitably concentrated along the joints.

Care should be taken to fix boards neatly. It is a good idea to lay down 2 runs before fixing the first run. At the end of the first run use off cut to start the second run (if the off cut is long enough to cover 2 joists. If not then start next run with complete board.)

It is good practise to position next layer before fixing previous layer. Tighter joints will be easier to achieve.

Boards should be 25mm away from walls. Boards should finish flush with fascia tops.

With T + G boards always fit the tongue into the groove not the grove onto the tongue

Fixings should be applied at 300mm centres down the length of each joist covered by the boards. Once the deck is laid and well fixed, the joints between the sheets must be taped with 50mm masking tape. This is vital since it seals the joint and stops resin draining through when the laminate is formed. Taping also forms a mini expansion joint along the edge of the sheets where the stresses accumulate and allows the laminate to release from the deck at that point. If butt jointed boards are to be used a 75mm bandage of g.r.p. should be applied to reinforce the joints prior to laminating the roof area.

If it is not possible to complete the roof at this point either cover with a tarpaulin or "sheath" the roof area with a layer of catalysed resin. This is to stop any moisture uptake by the roof until the laminate is applied. Wet decking or sheathing should be mopped and rag dried before allowing weather to remove any residual moisture prior to laminating.

N.B. Do not start a roof if a long period of rain is forecast.

Never use a naked flame to dry a roof. Timber and resin are flammable

Remember always that the biggest cause of flat roof failure is caused by laying grp onto damp decking. This always leads to failure. Keep this in mind when asked by the builder to lay upon their decking which commonly has been poorly protected between phases. The responsibility lies with the roofer. If in doubt, point this out

SECTION 1: KEVLAR LAYER APPLICATION



Allow 1Kg of Stronghold resin per square metre

The general rules for laminating apply and the section on laminating should be read prior to starting the work.

The Kevlar layer should be installed first on to the clean dry new deck. Do not trim the roof first as with normal glass reinforcement.

First cut Kevlar pieces to size using shears available from your supplier.

The pieces should overlap by 100mm and cover all of the new deck area.

Set aside the KEVLAR pieces in order.

Any butt joints in the deck should be first taped with masking tape and then using a small amount of resin, glass bandage should be applied to seal joints.

The area can then be wetted with resin using the lambs wool rollers at the rate of 0.5Kg/m².

The Kevlar is then rolled into place and more resin applied on top at the same rate of 0.5 Kg/m²

A laminating roller should then be passed at least 3 or 4 times over the wet area to remove any trapped air.

After this layer is cured the grp roof trims should be applied and the chopped strand glass (csm) layer applied last.

Please Note Kevlar resists sanding so it is very important to install Kevlar layer carefully to ensure a flat finish. Rough or bumpy areas will need to be reworked with angle grinders and even this is not a quick process. Make sure deck is flat and has no wood "sticking up" before applying Kevlar layer. Then apply carefully one piece at a time.

Kevlar fights against distortion and hence is difficult to form around complex shapes. For this reason it is best installed against the new flat deck. Any mistakes in the work can be reworked using angle grinders. Wear eye protection.

SECTION 1: TRIMS



Trims are available to suit most applications and configurations

All trims have a matt finish and a gloss finish. **Always bond to the matt side.** It is a good idea to look closely at any trims and become familiar with what the matt or gloss finish looks like. If a bond is ever required to the gloss side then it should be lightly sanded to achieve a matt finish and wiped with acetone to facilitate a good bond.

Gutter or A trims

Where it is required that water drains into a gutter an "A" detail or gutter trim should be used.

This trim needs to be 35 to 50 mm off the fascia when dressed into a standard domestic gutter. To achieve this fix two 19mm battens onto fascia. Battens should be about 10mm lower than roof surface to allow for the radius of the "A" trim.

Parapet or B trims

B trims are fixed in the same manner except only a 19mm off stand is required to allow for the return on the bottom of the trim. Therefore a single 19mm batten fixed to the fascia or board edge is sufficient.

Fixing A or B trims

To fix edge trims A or B first apply small beads of polyurethane mastic at 300mm centres to the batten so that when the trim is offered up to it, it will adhere to the back of the trim. Always rub trims into place to ensure a good bond.

Fix the trim to the roof by nailing the horizontal flange with 20mm Large Head Clout nails. Do not nail through the front of the trim. 15mm clout nails may also be used but can be painful to use!

Where a joint must be made, simply overlap the trim ends by about 100mm and sandwich a bead of polyurethane adhesive in the joint before clipping the two together. Wipe off excess sealant.

Fixing D wall fillet trims

When sealing the roof edge to an abutting wall, a fillet or "D" trim should be used. This should be snugged into the corner formed by the wall and roof deck and fixed to the decking with 20 mm galvanised clout nails. The vertical flange of the trim should not be fixed to the wall as this is a point of movement between the roof and the adjoining wall and any fixing here may stress the roof. The flat roof is also able to vent air behind the "D" trim. Joints can be made simply by overlapping and must be sealed with polyurethane adhesive in the overlap just like the trim joints. It is better to use too much adhesive and have to wipe off the excess, than not enough resulting in a weak joint. Reinforce D trim joints.

Technical Note:

Decking should not be fitted tight against an abutting wall. A gap of 25-50mm is sufficient to allow the roof to vent behind the D trim underneath the lead flashing. This gap also allows for expansion of the roof area in hot periods. This is important.

Fixing expansion or E280 trims

Use expansion trims if the roof is over 50 square metres or for runs longer than 10 metres. A 20mm gap should be left in the decking (or cut out after laying deck) and the trim should be bandaged and then laminated over with the main layer of grp.

Fixing F trim or flat flashing

When sealing to an adjacent pitched roof, the flat flashing Section F should be used.

Note: Always fold back existing felt before fitting. It is advisable to change the first course of felt if a little old or perished as this will always fail before the new grp roof and becomes the reason for costly "call backs" at a later date. At least discuss this option with the customer if appropriate.

Do not nail the flashing to the pitched roof structure. The flashing should be allowed to move when expansion/contraction occurs. Nail the flashing to the new deck with most of it curving up onto the existing roof rafters. Reinforce any joints with bandage and take the main grp layer up the flashing past the point where the bottom of the tiles / slates sit so as to reinforce any possible wearing areas.

After the grp roof is completed and cured, redress the felt and tiles etc over the flashing.

SECTION 1: TRIMS



Tips For Fitting Trims

Pull A and B trims slowly onto the batten until their outside face comes vertical.

Nail trims close to inner edge of trim as this makes it easier to cover nails with bandage without getting resin runs on the face of the trim.

Never use silicone to join or fix trims as it will eventually lose its bond. Polyurethane products bond far better to g.r.p. which is why they are specified.

When overlapping A or B trims a bigger overlap (about 4 to 6 inches) helps the "line" of the roof stay truer.

When fitting A trims it is strongly advised to fit the guttering first. It is very difficult to fix later. Use a short off cut of A trim to guide the fitting of the highest and lowest fitting and use a string line to fit the rest of the gutter brackets. Pay attention to falls.

Always use a polyurethane mastic behind A or B type trims. Not doing so will result in the trim warping in hot weather and the "line" of the trim will be difficult to reinstate later. The trim may also pull up when the resin contracts during the curing stage.

It is good practise to nail trims at each end and the in the middle before finally nailing at 150mm centres along entire length.

All roof edges require trims

Corners

Corners may be achieved by mitring on site and laminating over the joint formed with two layers of mat. Preformed corners can also be used.

Once the trims are fitted, the roof is ready to be laminated. The roof at this stage should have trims fitted to each edge so that the area to laminate is edged by the horizontal flanges of the trims around the perimeter.

Note

All trims should be bandaged to the deck using glass bandage prior to further bonding with the main layer.

SECTION 1: LAMINATING



Resin and topcoat like sticking to surfaces. Mask off any areas close to the roof if this is going to be a problem. A car with resin sprayed onto it is going to require a respray. New block paved drives, skylights etc etc are easy to cover but expensive to replace. Consolidating rollers can spray and wind can carry the spray. Be aware.

Never apply to a damp surface. The most common reason for grp roof failure is delaminating.

The most common reason for this is when the roofer applies a grp onto damp decking fitted by others.

The process is:

- 1) The builder fits the decking and covers with a plastic sheet. The plastic sheet is temporarily held down by battens nailed through the sheet.
- 2) The weather gets through the sheet overlaps and nail holes and causes damp areas
- 3) The roofer arrives and is under pressure to complete the roof
- 4) grp is applied to areas that are still damp
- 5) The bond is poor and breaks down and delaminating occurs
- 6) The grp membrane eventually splits and leaks 6) Roof fails and materials or roofer get the blame.

Never forget it is better to change a damp deck than to apply grp to it. Or dry it thoroughly.

Authors note:

We have installed over 5000 grp roofs to date and have never seen a grp roof delaminate when installed on a new, dry, deck. In fact on OSB3 boards the delamination force is about 9000Kg per metre square or about 250Kg for a 6" square area.

Starting.....

Allow 2Kg of resin for every m² of 450g glass. Allow 2.5 Kg for every m² of 600g glass. For second layers 1.5Kg and 2Kg are enough for 450g or 600 g respectively. (See RESIN in MATERIALS section.)

For catalyst allow 1% in hot weather, 2% in mild, 3% in cold and 4% in very cold weather.

This may not seem very scientific but from experience works in reality and will be explained later.

For longer curing times in hot weather less than 1% can be used but be sure to stir in thoroughly.

Resin and topcoat require catalyst to cure. Use graduated black buckets and catalyst dispensers to achieve correct ratios. Always wear eye protection and gloves when handling catalyst, it is harmful.

Resin and topcoat contain additives that settle when stored. Always stir them before decanting.

Forming the glass fibre membrane on the prepared deck is really quite straightforward but requires everything to be prepared before the catalyst is added to the resin.

- 1) Ensure that the deck is clean, dry and free from any surface contamination.
- 2) Cutting the mat to size.

Unroll the mat carefully and cut to size the pieces required to cover the entire area to be worked using a sharp Stanley knife or scissors.

Each piece should overlap the next by about 75mm (never less than 50mm). The pieces should also overlap any edge trims by about 50mm.

Place pieces to one side, in order, so that you know which piece goes where.

Next cut some "patches" of mat approximately 200mm square to reinforce any corners or joins with. About 2 per detail plus a few extra will be sufficient. Also have to hand enough glass bandage to reinforce all edge trims and any butt joints in the decking.

- 3) With the roof trimmed around all edges and the mat now cut to size thoroughly sweep the roof area clean.

SECTION 1: LAMINATING



- 4) Before applying the fibreglass to the roof make sure you have resin, mat, catalyst, application rollers, laminating rollers, buckets, gloves and paint brushes all to hand. Once the resin is "open" it is detrimental to get on and off the roof as this invariably introduces dirt to an already swept area.
- 5) Add catalyst, as specified, to a small amount of resin and mix thoroughly.
- 6) Laminate any corners or joins first. Pour a small amount of resin into a clean plastic bucket or pail (polystyrene containers should never be used as they dissolve on contact with polyester resins.)

Add catalyst as specified and mix thoroughly. Wear eye protection and gloves when handling catalyst.

On a clean area of decking first wet two at a time the mat patches cut earlier and dress over any corner or joint to reinforce. Hang the mat over the corner until level with the bottom trim return, then pull over the corner. Apply the second piece and work the mat to shape by stippling with a 2" brush and or a 3" laminating roller. Repeat until all corners are reinforced. Joints on D or fillet wall trims should also be reinforced. For edge trims such as A or B trims it is sufficient to apply plenty of polyurethane sealant into the joint such that it squeezes out and the excess can be wiped off. For area detail trims like gutters or expansion joints remember that the main laminate should also cover to add strength.

- 7) Now apply bandage to all edge trims approx. 2" on the roof and 2" on the tail of the trim. Mix up enough resin to wet the edge of the trim. Unroll the bandage on to this and apply more resin to the top of the bandage. Be careful to cover the nail heads and not to get resin running down the face of any "A" trims.

This bond is very important and should be consolidated with a laminating roller or the stippling action of a paintbrush.

- 8) Butt jointed boards will now require bandaging over all joints. Use glass bandage and resin to cover all board joints, which should by now already be masked with adhesive tape. Consolidate with a laminating roller. If T + G boards are used some of the joints may not be tight or you may have some butt joints. These should also be taped and bandaged as resin drainage will occur and cause porosity and failure.
- 9) The main area is now ready for laminating. Pour enough resin for one roll into a clean, empty 20 litre bucket (never more than 20 kg at once). Add catalyst as specified and mix thoroughly. Good tip. If you want to cure 7 litres of resin with 2% cat then to work out use the method of resin times cat and add one nought. so 7resin X 2cat = 14.add one nought gives 140. So 7 litres at 2% cat needs 140ml of catalyst. Practise this and it makes life easier on site. Experience tells us that a common fault is to add drops of cat in summer and big splashes in winter. Sooner or later this causes problems with "too slow" or "too fast" mixes. As with all trades, a little bit of practical knowledge can make a lot of difference.
- 10) For 450 gram glass apply the resin to the deck with a lambs wool roller at the rate of 0.5 kg per square metre ensuring that the whole area to be covered on this pass is generally wet with resin. Roll out the glass ensuring that there are no folds or kinks and that the pieces are correctly overlapped.
- 11) Apply more catalysed resin to the glass at 1 kg per square metre. The ideal resin to glass ratio is 3:1. Ensure that the laminate is not porous anywhere.
- 12) If using 600 gram glass allow 2.5Kg of resin per metre of glass.
- 13) Allow 2 or 3 minutes for the glass to soak up resin, to wet out, then go over the whole area with a consolidating roller at least twice. You must get all the air out of the glass so that the glass fibres disappear and the grain of the timber below becomes apparent as the laminate becomes transparent (or the Kevlar layer). Areas appearing white are either too dry, in which case apply more resin, or contain air bubbles and should be worked again with the laminating roller. Pay attention to overlaps and be careful of excess spray from rollers.
- 14) Continue this operation with the next roll of glass, overlapping the first by about 75mm. You will find that you finish the last section of the roof standing on the ladder or scaffold.
- 15) Now you can leave the roof alone and let it cure. This will take between 1 hour and several hours depending on the weather conditions. The colder it is the longer the cure will take.

SECTION 1: LAMINATING



Note:

You will find that the resin thickens up at low temperature and takes longer to wet out the glass. DO NOT be tempted to add more resin because of this. It is necessary to achieve an even and correct glass to resin ratio. Never apply more than 2 layers of mat at one time. Areas requiring more than 2 layers should be done in stages with time allowed for each layer to cure.

Do not use laminating rollers aggressively as they tend to spray resin. Resin is difficult to remove from brickwork, motorcars etc. and should always be applied with care. Never work over 30°C as it is detrimental to the resin cure. Never work below 5°C as resin will not cure no matter how much catalyst is added. Catalyst levels over 4% will not speed up the cure but will make the resin brittle.

Important!!

NEVER put catalysed Resin or Topcoat back into your vehicle. Always ensure that any catalysed containers are kept separate from other materials on site and allowed to cure. **Pour water on any unused resin or topcoat if you have mixed too much and have some left in the bucket.**

Resin, topcoat and catalyst are hazardous. In their solid state they are inert and can therefore be disposed of safely. If stored they should be kept in a cool dark environment safely. Never store or transport resins and catalyst close together. Curing resin produces heat and can therefore be hazardous if inadvertently mixed together. If a container of resin or topcoat starts to smoke due to excessive heat build up then it is advisable to pour some water onto it to ensure that it does not self ignite. This is very rare but it does happen. Be aware.

Tips

When laminating a large area it is possible to put one piece of mat at one end of the roof and then start working at the other end of the roof.

The last piece of mat can then be worked whilst standing on the first piece laid, as it is likely to be fully cured by the time you reach it. This can be safer than working off the ladder or scaffold for the last piece. Inexperienced roofers be careful not to "trap" yourselves on the roof!

If applying another layer of glass or before applying a topcoat it is advisable to flash sand the entire roof area with a 40 / 80 grit paper and wipe with acetone. This will ensure no glass protrusions and facilitate a better bond for the next layer. It only takes a few minutes and eliminates topcoat delaminating or glass strands sticking out. Glass looks like rope when viewed closely and can encourage water ingress if left sticking out of the laminate. Osmosis is the technical term, eventual leaking is the reality.

SECTION 1: TOPCOATING



Applying the last resin coat to the completed roof.

Topcoat requires catalyst to cure. Between 1% and 3% is normally sufficient

Allow 0.5Kg for every m² of roof area.

Pigmented Topcoat

The Topcoat is normally supplied in its pre pigmented form i.e. a mid or dark grey colour. Alternatively, to achieve the colour of your choice with clear topcoat, mix in the pigment at the recommended level of 10% i.e. 2 kg per 20 kg. It is advisable to choose a light colour because this will keep the roof cooler in the summer when in direct sunlight.

Note:

As with all pigmented finishing products it is strongly advised to mix all the topcoat together prior to decanting in useable quantities. Remember that even 2 pails from the same batch may exhibit slight colour variations. The key is to mix everything together to reduce this effect to a minimum. Attempt to be consistent with cat levels and method of application for a more even result.

Ensure that the roof is adequately cured (not too sticky so that it lifts when you stand on it) and sand off any protrusions that are sticking up e.g. glass strands or pieces of debris, and clean with solvent.

A GRP laminate has adequate cure when it is impossible to move the glass fibre strands within the laminate. Do not stand on the laminate until it has reached this stage.

Application

Topcoat should be applied at the rate of 0.5 Kg/m².

- 1) Mix up the entire batch of topcoat to be used to ensure consistent colour over the roof. Pigments can settle during transit. Stir well.
- 2) Now decant a small amount of topcoat and add catalyst. Use this small batch to paint with a brush any corners or roof details which may prove difficult to paint with a roller.
- 3) Now decant a small amount to apply with a roller to the edge trims. Half of the bottom radius can be coated by tilting the roller. If the remaining part of the trim return is requiring topcoat then use a trim off cut to protect the fascia.
- 4) Now decant enough topcoat to cover about 10 metres square of roof area (approx. 5 litre) add catalyst, stir well, and apply with a lambs wool roller.
- 5) It is important to keep this layer even, since the appearance of the roof will depend on how well it has been applied. It should be free from runs, sags, brush marks and roller marks. What you see is what you get. Apply with care.
- 6) Repeat section 4 until the roof area is completed.

The Topcoat should be applied to the whole of the roof laminate including the edge trims. Brush or roller on vigorously, to ensure an even finish and a good bond.

Pour water on any unused resin or topcoat if you have mixed too much and have some left in the bucket.

Always apply the Topcoat within 24 hours of laminating the roof. This will ensure that the Topcoat bonds well to the laminate and the completed roof will gradually continue its cure over the next few weeks, although the roof will normally withstand light foot traffic within 24 hours. If it is not possible to apply the topcoat the same day the roof should be sanded to obtain a key. Then wipe the roof with a solvent prior to applying the topcoat.

SECTION 1: TOPCOATING



The Topcoat is a high performance, fire retardant modified resin and will behave in the same way as the resin i.e.

- **Never use in wet conditions**
- **Never apply below 5°C**
- **Keep the colour light**
- **Keep the application even**
- **Always apply immediately the laminate is cured**
- **Always sand and acetone wash if applied later than 24 hours**

Non Slip Surfaces And Balconies

For balconies or foot traffic areas, 2 layers of glass mat should be applied to the surface. Apply the second layer as the first. It is advisable to cut the mat for the second layer when you cut the first layer. A non-slip surface can be achieved by sprinkling dry slate dust onto the topcoat as it is applied, and then rolling over it until it is covered. 1 Kg of slate dust can comfortably cover 20 square metres.

Tips

- Topcoat, for technical reasons, tends to cure faster than resin. Allow for this when calculating catalyst levels.
- Stir topcoat well prior to adding cat (and after). This will ensure an even colour as pigment can settle with time. For larger areas whole batch should be mixed together first.

Important!!

NEVER put catalysed Resin or Topcoat back into your vehicle. Always ensure that any catalysed containers are kept separate from other materials on site and allowed to cure.

To discard old resin or topcoat it is best to mix with catalyst and left in a safe area to harden. If large volumes get hot then a small amount of water poured onto surface should eliminate the chance of fire.

SECTION 1: REPAIRING & JOINTING PROCEDURE



If the roof surface becomes damaged by impact or has to be cut for any reason it can be easily repaired using the following procedure:

- 1) Clean off the damaged area with solvent and abrade the GRP surface with a hand grinder for a distance of 100mm from the damaged area or "patch size". Wash area with acetone
- 2) Cut the 600g glass to the correct (patch) size to cover the affected area and mix sufficient resin with catalyst as previously described.
- 3) Brush resin onto the (patch) area at the rate of 0.5 Kg/m². Place the glass over the area, wet out the glass with resin at the rate of 1 Kg/m². Stipple well with the brush or use a paddle wheel roller for larger areas.
- 4) Ensure that the laminate is air free and completely consolidated and allow to cure.
- 5) Mix the Topcoat with catalyst as previously described and apply with a brush at the rate of 0.5 kilos per square metre. Go outside the patch area but do not go outside the prepared area
- 6) Allow to cure.

This procedure will ensure that the patch or joining piece applied will bond to the original laminate and form a weatherproof patch over the damaged or cut laminate.

SECTION 1: SUMMER & WINTER PRACTISES



Summer

Check weather forecast for suitability.

Do not use grp if temperature is over 35° C.

Apply glass in shorter runs to allow enough time to laminate bonds / edges properly.

Use small batches and low cat levels. Less than 1% cat may be used but extra attention should be given to stirring in thoroughly.

Allow laminate to cure and cool before applying topcoat. Maybe wait until later in the day to achieve this. Topcoat applied to a hot surface can cure very fast indeed. Be aware

Winter

Check weather forecast for suitability. If wet period is forecast it is better to wait than to start work.

Always carry a new polythene (visqueen dpc) sheet. In event of rain then stop work and cover the roof immediately to protect unfinished roof area. Do not continue working until remaining roof area is dried thoroughly. Often this means coming back to job on dry day and allowing boards to dry.

If the decking is wet then sweeping, mopping and dry ragging followed by sunshine are the best methods for drying it.

Remember it is often better to start off the grp process early in the day if you are not sure about timing. So, if not sure ...apply deck.....cover with visqueen.....start grp early on next dry day.

Do not use resin or topcoat if temperature is under 5°C. Remember base resin has a water content and at 0°C or freezing point, the cure stops completely.

Be careful if top coating after 2pm as the sun contributes a lot to the energy required to cure topcoat.

Be aware that shaded areas will cure slower than those in direct sunlight. Uncured topcoat left overnight is to be avoided as dew/rain, leaves and debris etc etc can contaminate or stick to it and leave an unsatisfactory finish.

Resin and topcoat can be kept indoors overnight to ensure that they are not too cold when the time comes to use them.

If it is impossible to sheet over an area then it may be possible to sheath the area with a layer of resin to protect the boards until the laminate can be applied later. This takes a little experience or can in itself cause problems. Inexperienced installers may wish to undertake simpler installations for first few roofs.

Water contamination

If the laminate turns to a milky colour this normally indicates water contamination. The area will have to be removed and once dry and flat a new layer can be applied. Common reasons are rain or an already damp surface.

The other common cause is sweat from the head of the installer. Headbands are the answer providing they don't interfere with your safety hats or your street cred..

SECTION 1: SUMMER & WINTER PRACTISES



General note to the art of cat addition

Catalyst addition charts are generally available and are reasonably accurate when used in a closed (indoors) environment. Outside they are not so useful. Factors that effect catalyst performance are many and varied. To name a few....resin temperature.... deck temperature..... air temperature.....air speed.....shade temperature..... sunlight temperature..... time in bucket.....heating on in house.....sun rising.....sun falling etc etc. This guide goes away from the traditional method of reverting to a chart and asks the installer to think along the lines of if its very hot weather (sun trap, no wind, hot decking etc) then use 1% or less. If its very cold weather (overcast, windy, cold garage roof etc) then maybe 4% is required. Practise makes you better at it. Always remember that the most experienced roofer will sometimes mix a batch that goes too fast in the summer and will sometimes mix a batch that is too slow in the winter. Thinking about each batch is the trick and considering the result is the best way to get better at it. Stronghold resins are designed to give a 20/20/2 cure. This means 20 minutes cure time at 20° C if 2% cat is used. For this to work the resin and the deck need to be at 20° C and ALL the resin leaves the bucket at exactly the same time. Remember that the resin in the bucket rises in temperature due to exothermic reaction but the resin on the deck is spread out so this heat dissipates). In other words even the 20/20/2 spec is not so accurate in the real world, as the resin to leave the bucket last is further advanced in cure as it has been hotter for longer; confused? You're not alone!

With a little experience you will come to trust yourself. If you feel cold then so does the resin and if you feel hot then the same applies. Remember hot 1% or less, warm 2% or less, cold 3%, very cold 4%. Freezing? Go home.

N.B. THIS PROCEDURE DOCUMENT OFFERS GUIDANCE IN ORDER TO ENSURE CORRECT AND PROPER INSTALLATION OF THE STRONGHOLD G.R.P. ROOFING SYSTEM

SECTION 2: STRONGHOLD PRODUCT DATA

BASE RESIN

**Description:**

Unsaturated polyester resin in styrene monomer
Orthophthalic
Medium reactivity
Pre-accelerated
Thixotropic
Unpigmented
Low styrene emission

Specification:

Viscosity rotothinner at 25°C: 3.0 – 3.3 dPaS
Monomer content: 40%
Appearance: clear to blue liquid, accelerants may add pink hue

Application:

Hand laminating with bush or roller

Typical Properties:

20°C, 2% MEKP(1)
Gel time 18min approx
Shelf life 3-6 months

Characteristics:

Good interlaminar adhesion
Good wet out

Use Areas:

Flat roofing: roller brush or spray lamination

Catalyst:

Stronghold MEKP med activity

Flex strength	182 Mpa laminate
Tensile strength	105 Mpa laminate
Tensile modulus	8.9 Gpa laminate
Elongation to break	2.2%
Heat deflection temperature HTD	62% C
Barcol	45-49 laminate

Strength tests carried out to B.S. 4994 C9 lap shear and B.S. 2782 method 341.
Apparent interlaminar shear strength shows no loss in adhesion after four day periods of delayed build up

Handling Precautions And Storage

STRONGHOLD polyester resins contain styrene monomer, an irritant liquid with a flashpoint of 32°C (90°F). As such they are in general subject to the Highly Flammable Liquids and Liquid Petroleum Gases Regulations, 1972. Resin and topcoat are best stored in a cool dry place. Original containers unopened or tightly sealed should be used. Avoid direct sunlight and general light exposure. Shelf life is reduced by heat and or light exposure. Gloves and goggles should be worn to avoid styrene irritation.

SECTION 2: STRONGHOLD PRODUCT DATA

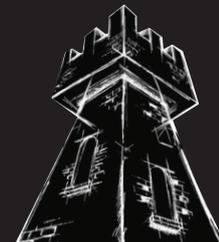
TOPCOAT



Description:	Unsaturated polyester resin in styrene monomer Isophthalic Medium reactivity Clear or pigmented (usually 'cool grey') Light stabilised
Specification:	Viscosity rotothinner at 25°C 180-230 poise Monomer content 32-40% Clear or grey thixotropic liquid
Application:	Roofing topcoat. Roller or brush applied
Typical Properties:	25°C, 1.8% MEKP(1) Gel time 8-12min approx Shelf life 3-6 months
Characteristics:	Good fire resistance in cured state Resilient Good elongation Medium chemical resistance Good heat resistance
Use Areas:	Flat roofing topcoat: Roller or brush applied
Catalyst:	Stronghold MEKP
Handling Precautions And Storage	STRONGHOLD polyester resins contain styrene monomer, an irritant liquid with a flashpoint of 32°C (90°F). As such they are in general subject to the Highly Flammable Liquids and Liquid Petroleum Gases Regulations, 1972. Resin and topcoat are best stored in a cool dry place. Original containers unopened or tightly sealed should be used. Avoid direct sunlight and general light exposure. Shelf life is reduced by heat and or light exposure. Gloves and goggles should be worn to avoid styrene irritation.

SECTION 2: STRONGHOLD SAFETY DATA

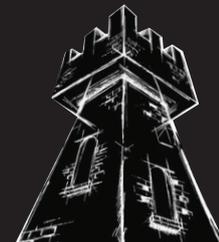
BASE RESIN



1) Emergency Telephone Numbers	31(0)384569289																								
2) Trade Name	STRONGHOLD Base Resin																								
Chemical Name (product type)	Preparation of dissolved polymer(s) containing styrene CAS 100-42-5																								
3) Physical Properties	<table><tr><td>Appearance</td><td>Hazy blue liquid</td></tr><tr><td>Odour</td><td>Characteristic odour of styrene</td></tr><tr><td>State</td><td>Liquid</td></tr><tr><td>a) Boiling point °C</td><td>295°F/145°C</td></tr><tr><td>b) Melting point °C</td><td>May solidify at -31°C</td></tr><tr><td>c) Specific gravity at 23°C</td><td>0.9-1.2 g/cm³</td></tr><tr><td>d) Miscibility in water</td><td>Immiscible in cold water</td></tr><tr><td>e) Flash point (closed cup)</td><td>32°C</td></tr><tr><td>f) Explosion limits in vol% in air</td><td>Lower 1.1%, Upper 8% (Styrene)</td></tr><tr><td>g) Spontaneous combustion temperature</td><td>490°C/914°F in air</td></tr><tr><td>h) Vapour density (air=1)</td><td>Highest 3.6 (styrene)</td></tr><tr><td>i) Vapour pressure</td><td>Highest 0.6 kPa @ 20°C</td></tr></table>	Appearance	Hazy blue liquid	Odour	Characteristic odour of styrene	State	Liquid	a) Boiling point °C	295°F/145°C	b) Melting point °C	May solidify at -31°C	c) Specific gravity at 23°C	0.9-1.2 g/cm ³	d) Miscibility in water	Immiscible in cold water	e) Flash point (closed cup)	32°C	f) Explosion limits in vol% in air	Lower 1.1%, Upper 8% (Styrene)	g) Spontaneous combustion temperature	490°C/914°F in air	h) Vapour density (air=1)	Highest 3.6 (styrene)	i) Vapour pressure	Highest 0.6 kPa @ 20°C
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SECTION 2: STRONGHOLD SAFETY DATA

BASE RESIN



5) First Aid – Emergency Action

- | | |
|-----------------|---|
| a) Inhalation | Remove patient to open air and seek medical assistance immediately. |
| b) Ingestion | Seek medical aid immediately.
Severe irritant.
Drink copious amounts of water. |
| c) Skin Contact | Remove excess, wash with soap and water. |
| d) Eye Contact | Wash with copious amounts of water and/or approved eye lotion.
Seek medical aid if irritation persists |

6) Labelling Information

- | | |
|-------------------------------------|---|
| Contains | Styrene |
| Risk phrases | R10-Flammable
R20 Harmful by inhalation
R36/R38 Irritating to eyes and skin |
| Safety phrases | S23 Do not breath vapour |
| Hazard symbol | X |
| a) IMCO CLASN | 3.3 |
| IMCO PAGE | 3153 |
| SI No./UN No. | 1866 |
| b) UK & EEC legislative requirement | IRRITATING |
| c) EEC No. | 601-026-00-0 |
| Chemical name of Solvent/substance | Styrene |
| % weight | 26 |
| Danger class | Xi (SI 1244) |
| d) Label Reference | 074 |

7) Storage and Handling

- | | |
|---|--|
| a) Environmental health hazards | None known, other than stated in this document. |
| b) Dangerous decomposition products | None known. |
| c) Storage | Store in closed container under dry, cool conditions.
Maximum recommended storage time 3 months. |
| d) Conditions for opened drums (e.g. hygroscopic) | Will react vigorously with oxidising agents. Containers should be re-closed immediately after use and stored under dry, cool conditions. |
| e) Protective clothing recommended | Goggles, gloves and face mask.
NB: A good standard of personal and industrial hygiene should be maintained at all times. |
| f) Ventilation | Efficient ventilation is required in working area. Solvent vapour can form explosive mixture with air. |
| g) Spillages | Should be soaked up with absorbent inert material (e.g. sand or earth) and collected for disposal in closed containers. |
| h) Empty drums | Empty drums may contain residual resin and due care should be taken to avoid inhalation and eye/skin contact. Additionally, there may be solvent vapour build-up. Store away from source of ignition and oxidising agents. |
| i) Waste disposal | Notifiable waste. Dump or burn under controlled conditions.
Contact Local Authority for advice.
Cured resins are inert. |

SECTION 2: STRONGHOLD SAFETY DATA

BASE RESIN



**8) FIRE –
Emergency Action:**

Call Fire Brigade Immediately

Extinguishing Method:

Carbon Dioxide, Dry Chemical or Foam.
DO NOT USE WATER.

(Water may be used as a last resort but only if sprayed in large volumes)

**9) Supplementary
Information:**

Product data sheet

SECTION 2: STRONGHOLD SAFETY DATA

CSM GLASS



1) Company	The Glass Fibre Roofing Co Ltd	
Emergency Telephone Numbers	02920 888020	
2) Trade Name	STRONGHOLD C.S.M.	
Description	Chopped strand mat emulsion bond-chopped and formed to mat.	
3) Physical and Chemical Properties	Appearance	Bound fibre mat
	Colour	Off white
	Odour	Odourless
	Melting point °C	≥ 800
	Bulk density	2.6-2.7 g/cm ³
4) Toxicology Data	E-GLASS FIBRE	TWA (8hr exposure limit): 10mg/m ³ (OES)
	Main hazards	No significant hazard.
	Other hazards	Irritating to eyes Irritating on respiratory system Irritating to skin In combustion emits toxic fumes of carbon dioxide/ carbon monoxide.
5) First Aid Measures		Symptoms and Action
	a) Inhalation	Exposure may cause coughing or wheezing. Remove casualty from exposure ensuring one's own safety whilst doing so. Consult a doctor if necessary.
	b) Ingestion	There may be soreness and redness of the mouth or throat. Seek medical advice.
	c) Skin Contact	There may be mild irritation at the site of contact. Take all contaminated clothing off immediately, unless stuck to the skin. Wash with plenty of soap and water immediately.
	d) Eye Contact	There may be irritation and redness. Rinse immediately with plenty of water, especially under the eyelids, and bathe for 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Always seek medical advice if irritation persists.
6) Labelling information	Hazard symbol	No significant hazard.

SECTION 2: STRONGHOLD SAFETY DATA

CSM GLASS



7) Storage and Handling

a) Storage

Store in a cool ventilated area.

b) Handling

Ensure there is sufficient ventilation of the area. Avoid the formation or spread of dust in the air. Wear dust masks if conditions are dusty. Protective gloves and clothing. Safety glasses with side shields. Ensure eye bath to hand.

Contact the waste disposal services.

Put on protective equipment. Do not breathe vapour.

c) Waste disposal

Keep away from drains, surface water, ground water and soil.

d) Accidental release

Vacuum clean or wet sweep. Transfer to a suitable container for disposal.

8) Fire – Fighting Measures

Extinguishing Method

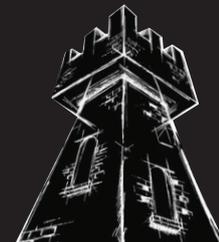
Carbon Dioxide, Dry chemical powder, alcohol or polymer foam or water spray.

Toxic fumes might be formed. Protective clothing and breathing apparatus should be used.

9) Supplementary Information:

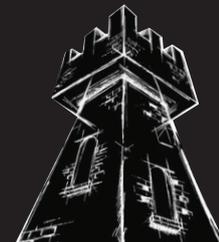
SECTION 2: STRONGHOLD SAFETY DATA

TOPCOAT



1) Emergency Telephone Numbers	31(0)384569289	
2) Trade Name	STRONGHOLD Topcoat	
Chemical Name (product type)	Preparation of dissolved polymer(s) containing styrene CAS 100-42-5	
3) Physical Properties	Appearance Odour State	Viscous liquid clear or pigmented Characteristic odour of styrene Liquid
	a) Boiling point °C b) Melting point °C c) Specific gravity at 23°C d) Miscibility in water e) Flash point (closed cup) f) Explosion limits in vol% in air g) Spontaneous combustion temperature h) Vapour density (air=1) i) Vapour pressure	295°F/145°C May solidify at -31°C 1-1.2 g/cm ³ Immiscible in cold water 32°C Lower 1.1%, Upper 8% (Styrene) 490°C in air Highest 3.6 (styrene) Highest 4.5mmHg @ 20°C
4) Exposure Control/ Personal Protection	a) Threshold limit value (9TLV-8hrs TWA) Source: Threshold limit values and biological exposure indices for 1988/1989 ACGIH(USA). b) Occupational Exposure Limits (OEL) Source: EH 40 Long term exposure limit (8 hr TWA value) Short term exposure limit (10 min TWA value) c) Inhalation d) Ingestion e) Skin contact f) Eye contact	Styrene (CAS 100-42-5) 50ppm Antimony trioxide (CAS 1309-64-4) as Antimony 0.5mg m ⁻³ Styrene (max.exp. limit) 100 ppm Styrene (max.exp. limit) 420 mg m ⁻³ Styrene (max.exp. limit) 250 ppm Styrene (max.exp. limit) 1050 mg m ⁻³ Odour detectable at 25 ppm At 200-400 there is a transient effect on nasal passages. At 400-1000ppm increasing systematic effects such as dizziness, nausea and headaches. At 800ppm and over becomes intolerable to mucous membranes. At 10,00 and over may cause death in less than one hour. Severe irritation and symptoms similar to inhalation. Irritant and defatting. May cause dermatitis and permit bacterial attack. Vapour at 200-400ppm has transient irritating effect on the eyes. Splashes extremely irritant and dangerous.

SECTION 2: STRONGHOLD SAFETY DATA TOPCOAT



5) First Aid – Emergency Action

- | | |
|-----------------|---|
| a) Inhalation | Remove patient to open air and seek medical assistance immediately. |
| b) Ingestion | Seek medical aid immediately.
Severe irritant.
Drink copious amounts of water. |
| c) Skin Contact | Remove excess, wash with soap and water. |
| d) Eye Contact | Wash with copious amounts of water and/or approved eye lotion.
Seek medical aid if irritation persists |

6) Labelling Information

- | | |
|-------------------------------------|---|
| Contains | Styrene |
| Risk phrases | R10-Flammable
R20 Harmful by inhalation
R36/R38 Irritating to eyes and skin |
| Safety phrases | S23 Do not breath vapour |
| Hazard symbol | X |
| a) IMCO CLASN | 3.3 |
| IMCO PAGE | 3379 |
| SI No./UN No. | 1866 |
| b) UK & EEC legislative requirement | IRRITATING |
| c) EEC No. | 601-026-00-0 |
| Chemical name of Solvent/substance | Styrene |
| % weight | 29 |
| Danger class | Xi |
| d) Label Reference | 071 |

7) Storage and Handling

- | | |
|---|--|
| a) Environmental health hazards | None known, other than stated in this document. |
| b) Dangerous decomposition products | None known. |
| c) Storage | Store in closed container under dry, cool conditions.
Maximum recommended storage time 6 months, or recommended in technical data sheet. |
| d) Conditions for opened drums (e.g. hygroscopic) | Will react vigorously with oxidising agents. Containers should be re-closed immediately after use and stored under dry, cool conditions. |
| e) Protective clothing recommended | Goggles, gloves and face mask.
NB: A good standard of personal and industrial hygiene should be maintained at all times. |
| f) Ventilation | Efficient ventilation is required in working area. Solvent vapour can form explosive mixture with air. |
| g) Spillages | Should be soaked up with absorbent inert material (e.g. sand or earth) and collected for disposal in closed containers. |
| h) Empty drums | Empty drums may contain residual resin and due care should be taken to avoid inhalation and eye/skin contact. Additionally, there may be solvent vapour build-up. Store away from source of ignition and oxidising agents. |
| i) Waste disposal | Notifiable waste. Dump or burn under controlled conditions.
Contact Local Authority for advice. |

SECTION 2: STRONGHOLD SAFETY DATA TOPCOAT



- 8) **FIRE –
Emergency Action:** Call Fire Brigade Immediately
Extinguishing Method: Carbon Dioxide, Dry Chemical or Foam.
DO NOT USE WATER.
- 9) **Supplementary
Information:** Technical data sheet

This Health and Safety Product Information Sheet has been approved by:

SECTION 2: STRONGHOLD SAFETY DATA CATALYST



1) Identification Of The Substance And Of The Company

Product Name: Catalyst (Methylethylketoneperoxide)
Supplier: The Glass Fibre Roofing Company Ltd
Units 1 & 2 Poplar Road
Caerphilly
Mid Glamorgan
CF83 1LF
029 20888020
glassfibreroofing.co.uk

2) Composition/Information On Ingredients

Substance/preparation: Liquid mixture.
Chemical Name: Methylethylketoneperoxide
CAS No: 1338-23-4
Concentration: 30% - <35%
EC Number: 215-661-2
Symbol: O,C,Xn
R Phrases: R7, R22, R34

For the full text for all R-phrases, refer to section 16.

3) Hazards Identification

Symbols(s)



C Corrosive

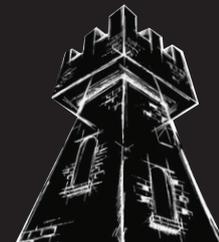


O Oxidizing

R Phrase(s)

R7 May cause fire
R22 Harmful if swallowed
R34 Causes burns

SECTION 2: STRONGHOLD SAFETY DATA CATALYST



4) First Aid Measures

General information:	Take of all contaminated clothing immediately. Remove affected person from source of contamination. Get medical attention immediately. Bring these instructions. Place unconscious person on the side in the recovery position and ensure breathing can take place.
Inhalation:	Move injured person to fresh air immediately. Call a physician immediately.
Ingestion:	Immediately rinse mouth and drink plenty of water. Keep person under observation. Do not induce vomiting. If person is unconscious and vomiting occurs, place in the recovery position. Seek medical advice immediately.
Skin contact:	Remove contaminated clothing immediately and wash with soap and water. Consult a physician for specific advice. Burns: Flush with water immediately. While flushing, remove clothes that do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital.
Eye contact:	Immediately flush with plenty of water for up to 15minutes. Remove any contact lenses and open eyes wide apart. Seek medical advice.

5) Fire Fighting Measures

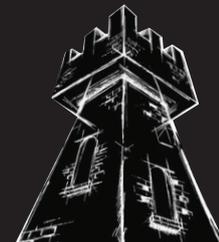
Suitable extinguishing media:	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Extinguishing media which must not be used:	High volume water jet.
Specific hazards:	Cool closed containers exposed to fire with water spray. Do not allow run-off from fire fighting to enter drains or water courses.
Special protective equipment for fire-fighters:	Use personal protective equipment

6) Accidental Release Measures

Personal precautions:	Wear protective clothing as described in section 8 of this safety data sheet. In case of spills, beware of slippery floors and surfaces.
Environmental precautions:	The product should not be dumped in nature but collected and delivered according to agreement with the local authorities.
Spill clean up methods:	For waste disposal, see section 13. When dealing with a spillage, please consult the section relating to suitable protective measures. Absorb spillage with non-combustible, absorbent material (eg sand, earth, diatomaceous earth, vermiculite). Remove mechanically and with care (eg with clean polyethylene plastic shovel). Ventilate well.
Additional advice:	Never add other substances or waste material to product residue. Move product residue to a safe place and dispose of properly.

SECTION 2: STRONGHOLD SAFETY DATA

CATALYST



7) Handling And Storage

Requirements for storage areas and containers:	Electrical installations / working materials must comply with technological safety standards. Containers which are opened must be carefully resealed and kept upright to prevent leakage. No smoking.
Storage precautions:	Store apart from other dangerous and incompatible substances. Avoid impurities (eg rust, dust, ash), risk of corrosion.
Storage temperature:	<30 deg C
Remarks:	Liquid up to -25 deg C.

8) Exposure Controls/ Personal Protection

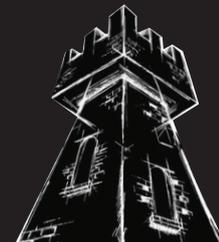
Occupational exposure limits:

Component	Control parameters
Methylethylketoneperoxide	STEL (1998): 0.2ppm (1.5mg/m3)
Engineering measures:	Provide adequate ventilation, including appropriate local extraction, to ensure that the defined workplace exposure limit is not exceeded.
Respiratory Equipment:	Short duration filter unit: Filter A
Hand protection:	Skin should be washed after contact. Suitable protective gloves must be worn. Chemical resistant. (Butyl rubber, 0.5mm thick, breakthrough time >=8hour)
Eye protection:	Wear tight fitting goggles or face shield.
Skin and body protection:	Protective suit.
Hygiene measures:	Wash contaminated clothing before use. Wash at the end of each work shift and before eating, smoking and using the toilet.

9) Physical And Chemical Properties

Appearance	Form Colour	Viscous liquid Colourless
Safety data	PH: Miscibility in water: Boiling point/range: Flash point: Lower explosion limit: Upper explosion limit: Density: Solubility in other solvents: Viscosity, dynamic: Refraction index:	Not applicable. immiscible. Not applicable, decomposition. 59 deg C Method: ISO 3679, Seta-Flash. Not applicable. Not applicable. 1.06g/cm3 at 20 deg C. Medium: Phthalates. Mixable. 23mPa.s at 20 deg C. 1,458 at 20 deg C.

SECTION 2: STRONGHOLD SAFETY DATA CATALYST



10) Stability And Reactivity

Conditions to avoid:	Keep away from heat and sources of ignition.
Materials to avoid:	Accelerators, strong acids and bases, heavy metal salts, reduction mediums. Avoid impurities (eg rust, dust, ash), risk of corrosion.
Hazardous decomposition:	Irritant, caustic, flammable, noxious / toxic gases and vapours can develop in the case of fire and decomposition.
Hazardous reactions:	Vapours may form explosive mixture with air. Stable under recommended storage conditions.

11) Toxicological Information

Acute oral toxicity:	LD50 rat Dose: 1.17 mg/kg Test substance: methylethylketoneperoxide (40% in dimethylphthalate)
Acute inhalation toxicity:	LC50 rat Exposure time 4 h Test substance: methylethylketoneperoxide (40% in dimethylphthalate) Aerosol Nominal concentration
Acute dermal toxicity:	LD50 rat Dose: 1.8 – 3.6 mg/kg Test substance: methylethylketoneperoxide (60% in dimethylphthalate / diacetone alcohol) Did not cause sensitisation on laboratory animals.
AMES – Test:	rat Result: Not mutagenic in AMES Test.

12) Ecological Information

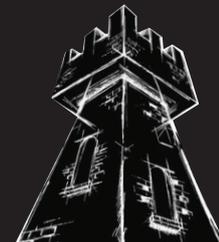
Elimination information (persistence and biodegradability)

Biodegradability:	Result: Steadily biodegradable. Test substance: methylethylketoneperoxide Method: Closed bottle test.
Ecotoxicity effects	
Toxicity to fish:	LC50 Dose: 44.2 mg/l Exposure time: 96 h Test substance: methylethylketoneperoxide (33% in dimethylphthalate)
Water contaminating class:	WGK 2, water endangering

13) Disposal Considerations

Advice on disposal and packaging:	Dispose of in conjunction with appropriate waste disposal authorities and in accordance with disposal regulations.
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SECTION 2: STRONGHOLD SAFETY DATA CATALYST



14) Transport Information

Land transport

ADR / GGVS:

Class: 5.2
Packaging group: II
Classification code: P1
Risk No: 539
UN No: 3105
Description of the goods: ORGANIC PEROXIDE
TYPE D, LIQUID
(methylethylketoneperoxide)

RID / GGVE

Class: 5.2
Packaging group: II
Classification code: P1
Risk No: 539
UN No: 3105
Description of the goods: ORGANIC PEROXIDE
TYPE D, LIQUID
(methylethylketoneperoxide)

Sea transport

Class: 5.2
Packaging group:
Classification code:
Risk No:
UN No: 3105
EmS: F-J S-R
Marine pollutant: No
Proper technical name: ORGANIC PEROXIDE TYPE D,
LIQUID (methylethylketoneperoxide)

Air transport

ICAO / IATA

Class: 5.2
Packaging group:
Classification code:
Risk No:
UN No: 3105
Proper technical name: ORGANIC PEROXIDE TYPE D,
LIQUID (methylethylketoneperoxide)

