

## TYPICAL PROCEDURES ARE DESCRIBED FOR THE REPAIR OF TWO BASIC TYPES OF TANK:

- A** Fully welded tanks with either fixed or floating roofs.
- B** Old riveted tanks requiring repair either to the seams or the whole floor area.

Tank roofs can also be repaired with **LEYCO-POX** resin laminates, provided that the roof is structurally sound; procedures are similar to those used for tank floors.

The methods given below are based on experience and good practice; they have been shown, over many years, to work admirably. It must be borne in mind however that, whilst the procedures

are described in some detail, variations in tank construction may necessitate minor modifications to suit local conditions. In this, the advice of an experienced contractor is invaluable.

# Initial preparation



As with all repair techniques, the tank must be gas-free and grease-free; the established safety precautions must be taken with tanks which have contained leaded products. In addition, any loose dirt on the underside of the roof or on the roof trusses should be removed to prevent it falling onto the floor whilst the repair is in progress, which could cause subsequent problems.

Other preliminaries are conventional, all valves and pipes leading to the tank must be positively blanked off. Suitable ventilation facilities and power supplies for grit-blasting equipment and lighting should be installed.

The basic aim of the stages prior to laying the laminate is to ensure that the surface is such that there will be good adhesion between the substrate and the laminate. For this, the surface must be free from contaminants, rust, millscale, etc. and sufficiently smooth so that there are no air pockets under the laminate.



# A

## WELDED TANKS

### Repair procedures

1. Dry grit-blast the tank floor and the tank wall to a height of about 1 metre.

A dull grey metal finish, Swedish Standards Association SIS 05 59 00 grade SA 2<sup>1/2</sup> or Steel Structures Paint Council, USA Standard SP6-63, is suitable.

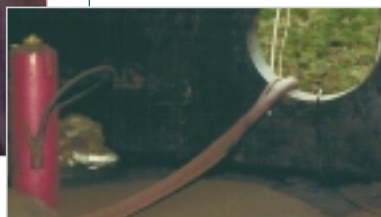
☞ *The height up to which the treatment of the walls is carried depends on the particular use of the tank. In dehydration tanks or others containing water bottoms, it may be necessary to apply the laminate higher up the wall so that the top of the laminate is 40-50 cm above the maximum depth of water likely to be encountered in service.*

Remove blast-cleaning products and apply a conventional two-pack **LEYCO-POX** resin/amine adduct or polyamide curing agent primer immediately after grit-blasting. The manufacturer's instructions on mixing, thinning, application rates and working life of the paint should be followed.

☞ *The use of clean brushes and a vacuum cleaner to remove dust etc. prior to application of the primer is recommended. The freshly grit-blasted surface should be primed as soon as possible, especially in humid conditions, preferably not later than 4 to 6 hours after blasting, to prevent further corrosion. Under no conditions should the grit-blasted surface be left uncoated overnight.*

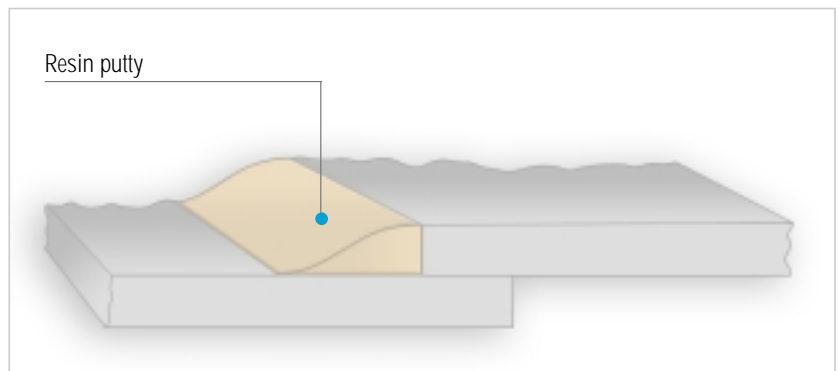
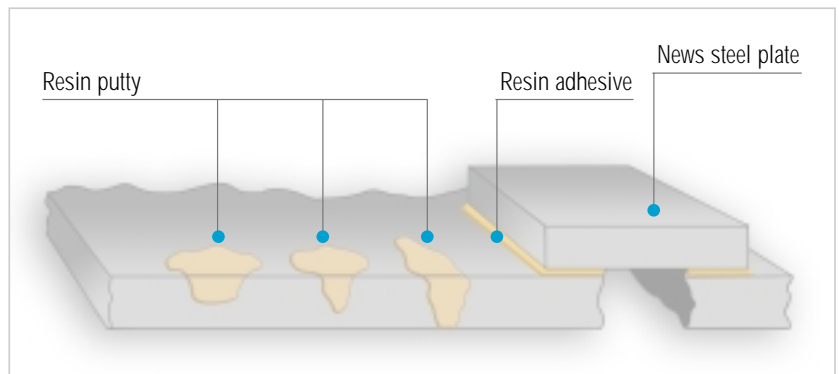
☞ *Metallic pigmented primers, e.g. zinc-rich primers, are not recommended; they are intended for different service conditions overcoated with paint. Under the thicker and more rigid layer of a laminate, their lower cohesive strength will result in lower adhesion of the laminate than when a conventionally pigmented LEYCO-POX resin primer is used.*

Ventilate the tank adequately during the application and drying of the primer to remove solvent vapours.



# Repair procedures

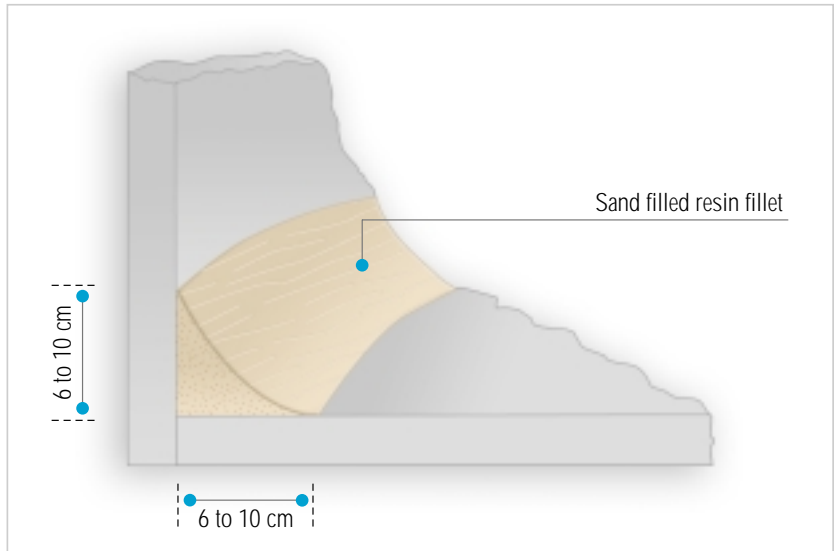
- Any holes greater than about 1 cm diameter in the bottom of the tank should be covered with a grit-blasted and primed steel plate which can be stuck down using the laminating resin system as an adhesive. Holes smaller than 1 cm diameter and any lightly pitted areas should be filled with an **LEYCO-POX** resin based putty.



Fill all overlap welds with the **LEYCO-POX** resin based putty to give a smooth surface on which to apply the laminate without bridging.

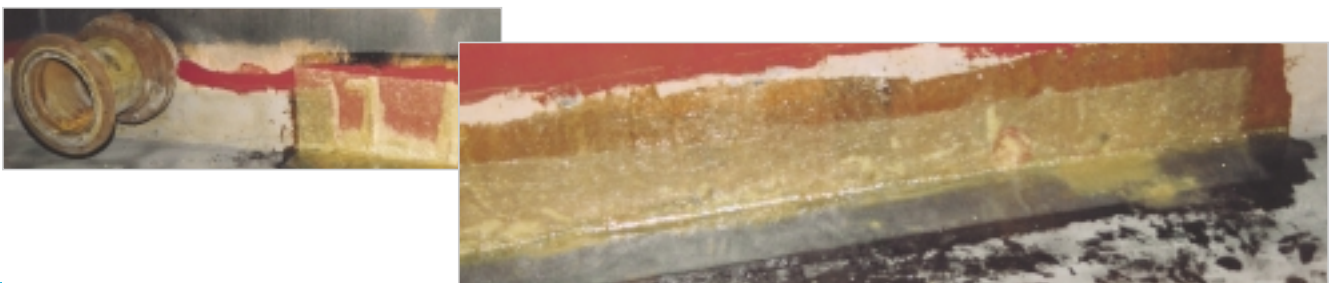
# Repair procedures

Fill the curb angle between floor and plates with a sand-filled **LEYCO-POX** resin filler, again to give a smooth surface on which to apply the laminate without bridging over an air gap.



- ☞ *The fillet should be of approximately the dimensions shown in the sketch. If too large, the filler could cause cracks to develop in the laminate when the shell plates flex as the tank is filled; if too small, the glass will not be able to follow the contour resulting in an air pocket under the laminate.*
- ☞ *A tack coat of unfilled resin mix can be applied to the areas of plate on which the sand-filled filler is to be applied shortly before it is trowelled into place. This facilitates application of the filled mix and improves its adhesion. Any other fixed protuberances should be treated similarly.*

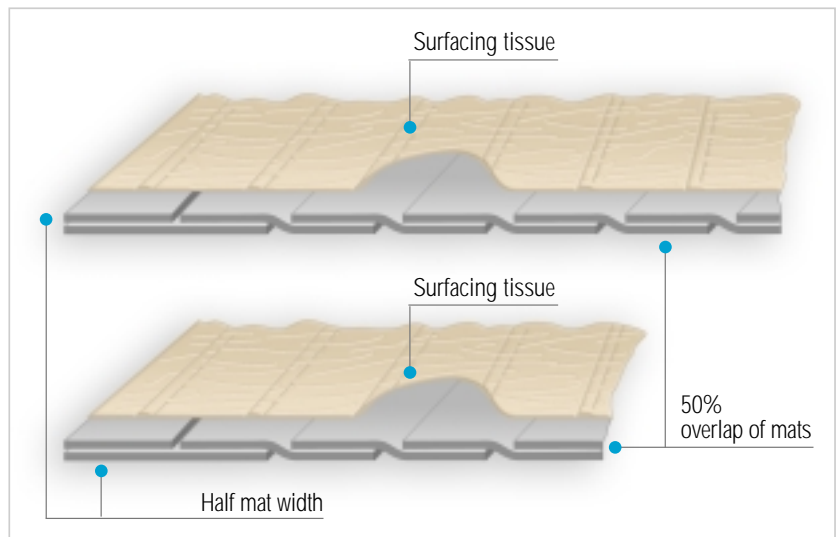
3. Patch any severely pitted areas by applying a laminate consisting of a **LEYCO-POX** resin system reinforced with two layers of chopped strand mat.



4. Apply a laminate over the whole of the tank floor and the cleaned and primed part of the tank wall. This laminate consists of two layers of chopped strand glass mat plus one layer of surfacing tissue with the **LEYCO-POX** resin system developed for tank repair.

☞ Ensure that the primed steel is free of grease and dust before applying the laminate. Abrade the surface of any patches applied as under 3 above. Typically the laminate will consist of two layers of 300 g/m<sup>2</sup> chopped strand mat although circumstances may arise where a thicker mat 450 g/m<sup>2</sup> is considered desirable. A glass surfacing tissue 300 micron is generally used.

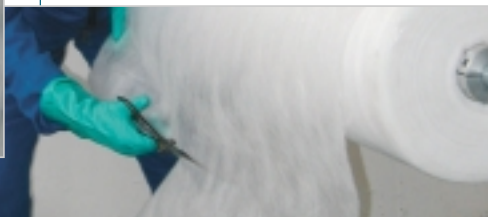
☞ A minimum overlap between adjacent strips of mat of 5 cm is desirable. However to avoid ridges and simplify the laying procedure, it is better to have a 50% overlap as shown in the sketch.



In laying the laminate, apply a layer of resin mix by brush or roller and onto this place one layer of chopped strand mat reinforcement. Compact by rolling with split-washer rollers; this displaces the air in the mat outwards. Apply further resin mix, then the second layer of chopped strand mat and consolidate as before. Repeat for the surfacing tissue.

☞ Typically the weight of resin mix required per unit area in a hand lay-up laminate is roughly three times the total weight of reinforcement per unit area plus about 300 g/m<sup>2</sup> for the surfacing tissue.

5. The laminate applied to the plates may either be applied before or after the main laminate on the tank floor. The technique used is the same as for the floor laminate but the resin may be suitably modified to reduce resin drainage on the vertical surfaces. For convenience the mat is generally applied vertically rather than horizontally.
6. In floating roof tanks where legs are attached to the underside of the roof, the legs should be jacked up and the laminate applied underneath them in the usual way. While the resin system is still wet, a shot blasted and primed steel plate about 45 cm (18 inches) square by about 12 mm (1/2 inch) thick should be placed on the laminate under the leg, then the leg is lowered.
  - ☞ *When the resin system cures, the steel plates are firmly bonded to the laminate and prevent the legs cutting into the laminate each time the tank is emptied.*
7. Once the laminate is hard enough to walk on (about 24 hours), check for porosities using a spark tester (holiday detector) or similar equipment.
  - ☞ *With high voltage spark testing equipment, a voltage in the region 10 - 12 KV is recommended. If a higher voltage is used there is a danger of creating holes in the laminate.*
8. If porous areas are found, roughen the surface of the cured laminate over an appropriate area and remove all dust. Apply a further laminate consisting of one or two layers of chopped strand mat and surface tissue as under 4 above.
9. Where a pigmented overseal is required, this should be applied after the laminate has been checked for pinholes and, if necessary, made good. The overseal should either be based on the laminating system or may be a pigmented two-pack **LEYCO-POX** resin/polyamide or amine adduct cured system of suitable quality.
  - ☞ *If the repaired tank is to be used for fuels, the overseal must of course have approval for this service.*
10. Allow a minimum cure time of one week before putting the tank into service.



# Repair procedures

## B

### RIVETED TANKS

In riveted tanks where leakage is only occurring along the seams and through loose rivets, only a seam repair is necessary. If, however, the floor plates are holed and pitted the complete tank bottom should be repaired.

The tank should be structurally sound and there must not be relative movement between plates, that is the plates springing or sliding relative to one another.

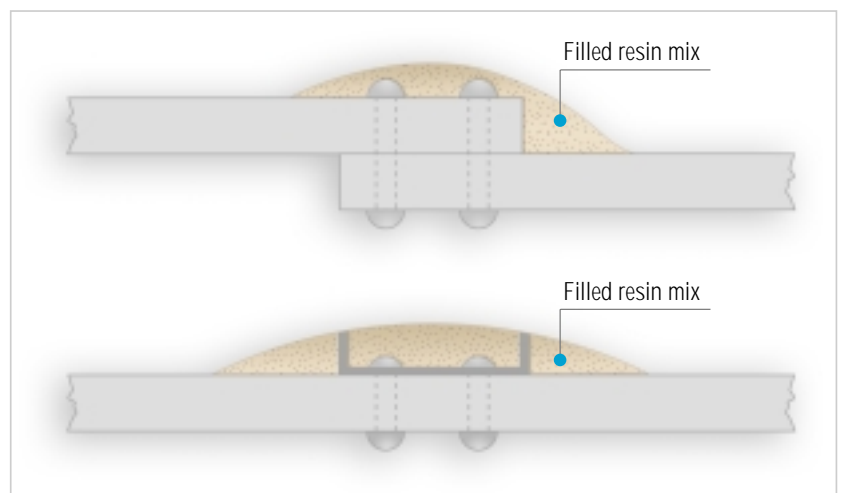
#### I SEAM REPAIRS ONLY

1. Grit-blast the rows of rivet heads and about 30 cm (12 inches) on either side to a dull grey finish grade SA 2<sup>1/2</sup> Swedish Standards Association SIS 05 59 00.

Remove all grit and dust by brush and vacuum cleaner.

Apply a conventional two-pack **LEYCO-POX** resin primer immediately after grit-blasting. As before, a zinc-rich primer is not recommended under a laminate.

2. Apply a **LEYCO-POX** resin based putty or a sand-filled **LEYCO-POX** resin system over all the rivet heads, as shown in the sketch, to give a smooth surface on which to apply the laminate. A tack coat of unfilled resin mix may be first applied to improve adhesion and facilitate application of the filled mix.



# Repair procedures

3. Apply a laminate consisting of the **LEYCO-POX** resin laminating repair system with either two layers of chopped strand mat plus surfacing tissue or two layers of woven glass tape plus surface tissue, over the whole of the smooth filled surface and extending about 10 cm (4 inches) on either side.

On vertical surfaces, a modified resin mix containing a suitable thixotroping agent may be necessary to prevent resin drainage.

☞ Typically two layers of 300 g/m<sup>2</sup> (1 oz /ft<sup>2</sup>) chopped strand mat plus a 300 micron (12 thou) surfacing tissue are used. The laminating resin mix is applied by brush or roller to the part to be repaired.

☞ The first layer of glass reinforcement is laid on this and consolidated with a split-washer roller. Further resin mix is applied, followed by the second layer of glass, which is again rolled with a split-washer roller. Repeat for the surfacing tissue. The whole laminate is then fully consolidated by rolling to displace all the air outwards. Providing sufficient resin system has been applied the laminate should have a resin rich surface.

4. Check for porosities in the laminate using a spark tester or similar equipment, after the resin has cured for 24 hours. Repair any porous areas by roughening the cured laminate, removing all dust and applying a further one or two layers of reinforcement plus surfacing tissue.
5. A pigmented overseal may be applied if desired. (see *Welded tanks*, page 12).

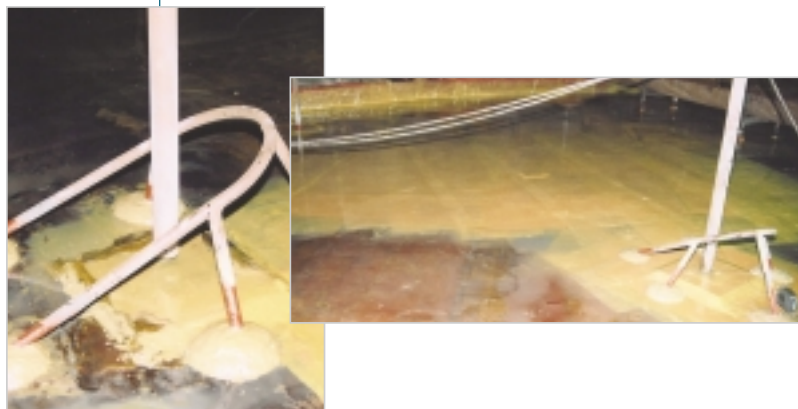




## II TOTAL FLOOR AREA REPAIR

Essentially the repair procedure in this case is a combination of the procedure for welded tanks with the preparation of the riveted seams.

1. Grit-blast the floor of the tank and about 1 metre up the tank wall to a dull grey finish and prime as described under *Welded Tanks* section, ensuring that the area around the rivet heads is thoroughly cleaned.
2. Apply a **LEYCO-POX** resin based putty or a sand-filled **LEYCO-POX** resin system over all the rivet heads to give a smooth surface on which to apply the laminate. A preliminary tack coat of unfilled resin mix may be desirable to improve adhesion of the filled mix and facilitate application.
  - ☞ Unless filler is applied around rivet heads, great difficulty will be experienced in applying a bubble free laminate with no hollow patches. Hollow areas under the laminate are a potential source of failure.
3. Continue as under *Welded Tanks, sections 2-10*.



## Handling LEYCO-POX Resin Systems

Like all chemicals, **LEYCO-POX** resins and **LEYCO-POX 171** curing agents must be handled sensibly and with a certain amount of care.

A practical summary of the simple precautions which should be taken is given in *Technical Bulletin*

A more detailed guide to the handling of these materials is *Technical Bulletin LP 2 Recommendations for handling LEYCO-POX resins curing agents and other auxiliary chemicals used with LEYCO-POX resins.*

There are specific hazards associated with the use of **LEYCO-POX 171 S**. Separate health and safety protocols are available and recommendations contained in these documents followed closely.

The hazards of **LEYCO-POX 171 S** system are such that LEYCO CHEMISCHE LEYDE will only supply these materials if we are satisfied that the user has sufficient knowledge, expertise and equipment to handle and apply them safely.

