

LEYCO-POX 171S laminates for tank repair - basic procedures

LEYCO-POX 171S Technical Manual

Applications bulletin (restricted)

Glass-fibre reinforced LEYCO-POX 171S resin systems are often time-saving and cost-effective alternatives to patching or re-bottoming with steel plates for the repair of steel storage tanks. These laminates are used extensively in the oil industry, mainly in tanks for crude oil storage and have also been used in renovating old tanks for the subsequent storage of refined oil products, including aviation fuels, where maintenance of product quality and freedom from contamination are naturally very important.

Laminating is particularly effective for the repair of tank bottoms which have suffered from internal corrosion, since the laminate then prevents further corrosion. Laminates have also proved successful in repairing leaks caused by external corrosion, but in this case rather thicker laminates are generally recommended because the corrosion is not arrested by the repair. The technique, though, is essentially a method of repair and in all cases the tanks concerned must be structurally sound.

The LEYCO-POX 171S resin based systems which have been developed for these laminates are easy to apply and are adjustable in reactivity to suit various ambient temperature conditions. When cured, the systems have excellent resistance to crude oils including sour and water-containing crudes; they are also unaffected by the various refined products, nor do they cause any contamination of these products.

Typical procedures employed for the repair of two basic types of tank are described:

- 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 171S 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 are 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, mill-scale, etc. and sufficiently smooth so that there are no air pockets under the laminate.

REPAIR PROCEDURES

A. Welded tanks

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 SA21/2 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.

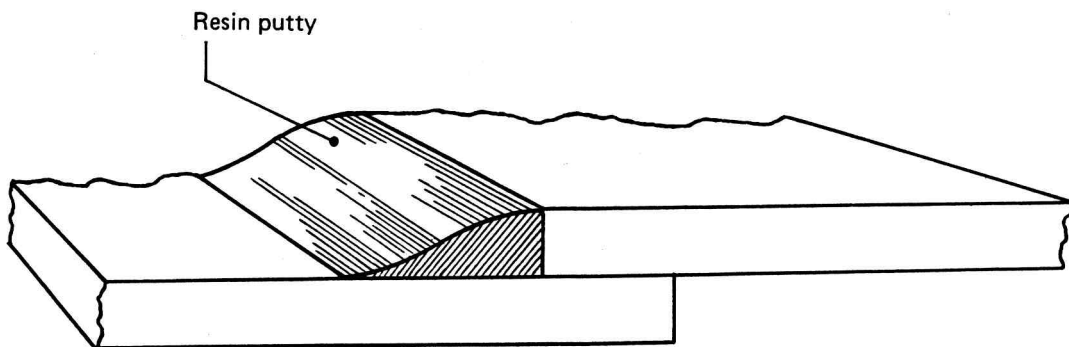
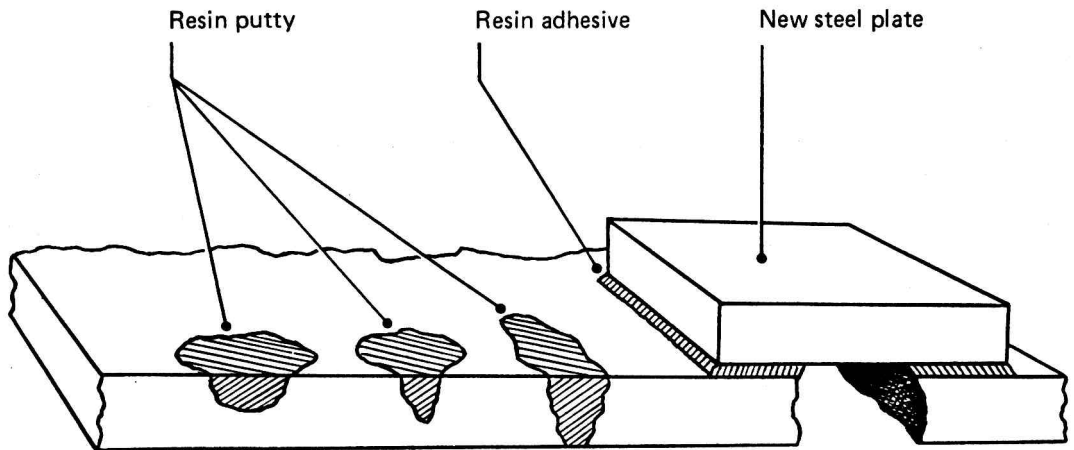
Remove blast-cleaning products and apply a conventional two-pack LEYCO-POX 171S resin/amine adduct or polyamide curing agent primer immediately after grit-blasting. The manufacturer's instructions on mixing, thinning, application rates (and working life of the paint should be strictly followed.

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 (zinc-rich or lead-rich) 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 171S resin primer is used.

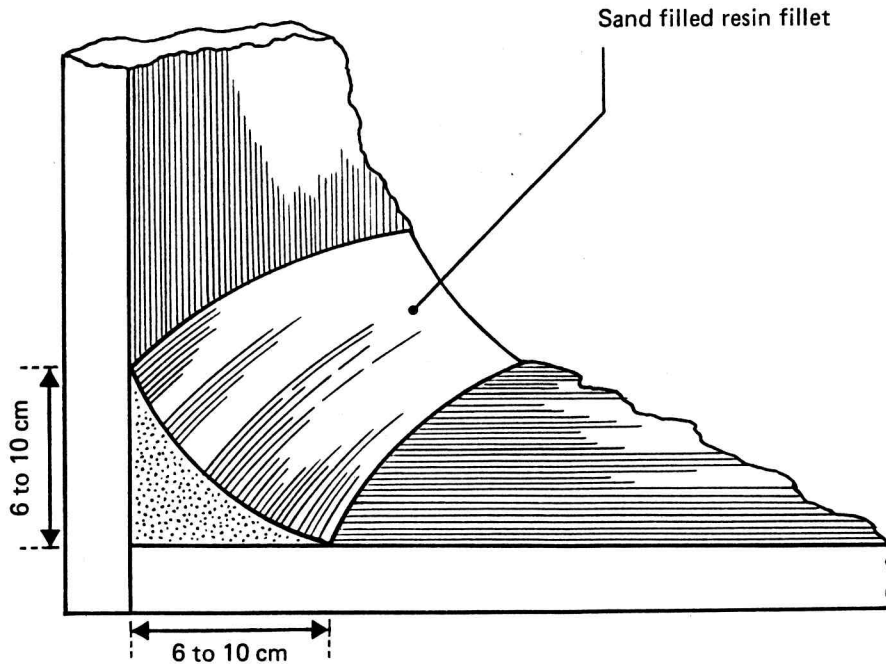
Ventilate the tank adequately during the application and drying of the primer to remove solvent vapours.

2. 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 pitted areas should be filled with an LEYCO-POX 171S resin based putty.



Fill all overlap welds with the LEYCO-POX 171S resin based putty to give a smooth surface on which to apply the laminate without bridging.

Fill the curb angle between floor and plates with a sand-filled LEYCO-POX 171S resin system, 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 fillet could cause cracks to develop in the laminate when the 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.

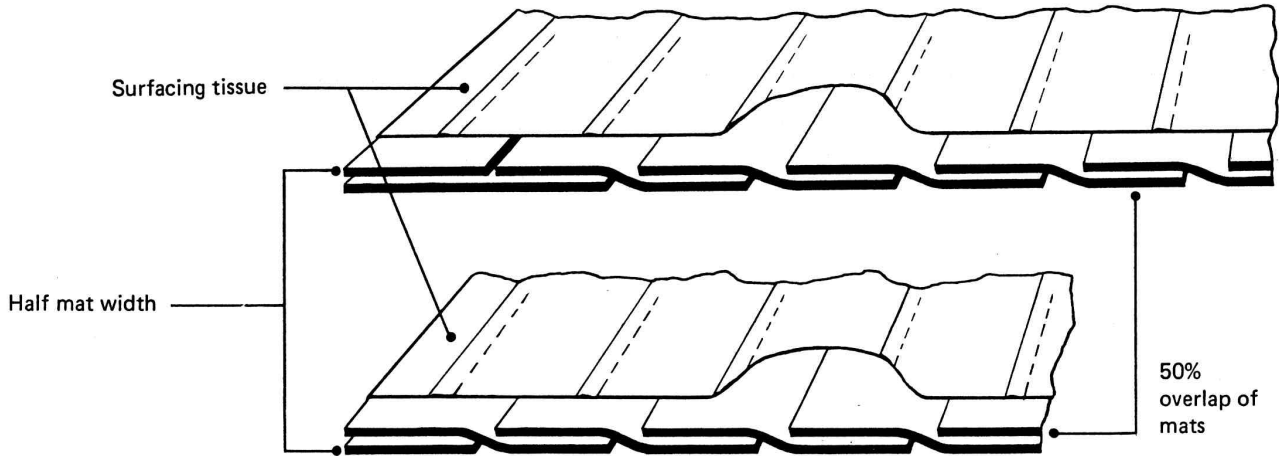
A tack coat of unfilled resin mix can be applied to the areas of plate on which the fillet is to be applied shortly before the sand-filled mix is towed into place. This facilitates application of the filled mix and improves its adhesion. Any other fixed protuberances should be treated similarly.

3. Patch any severely pitted and holed areas by applying a laminate consisting of a LEYCO-POX 171S resin system reinforced with two layers of chopped strand mat. (See Section 4 below).

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 171S resin system developed for tank repair.

Ensure that the primed steel is grease and dust free before applying the laminate. Abrade the surface of any patches applied as under 3 above.

Typically the laminate would consist of two layers of 300 g/m² (1 oz/ft²) chopped strand mat although circumstances may arise where a thicker mat 450 g/m² (1 1/2 oz/ft²) is considered desirable. A glass surfacing tissue 300 micron (12 thou) is generally used. A minimum overlap between adjacent strips of mat of 5 cm (2 inches) 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/m² 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 (C/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 171S resin/polyamide or amines 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.

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.

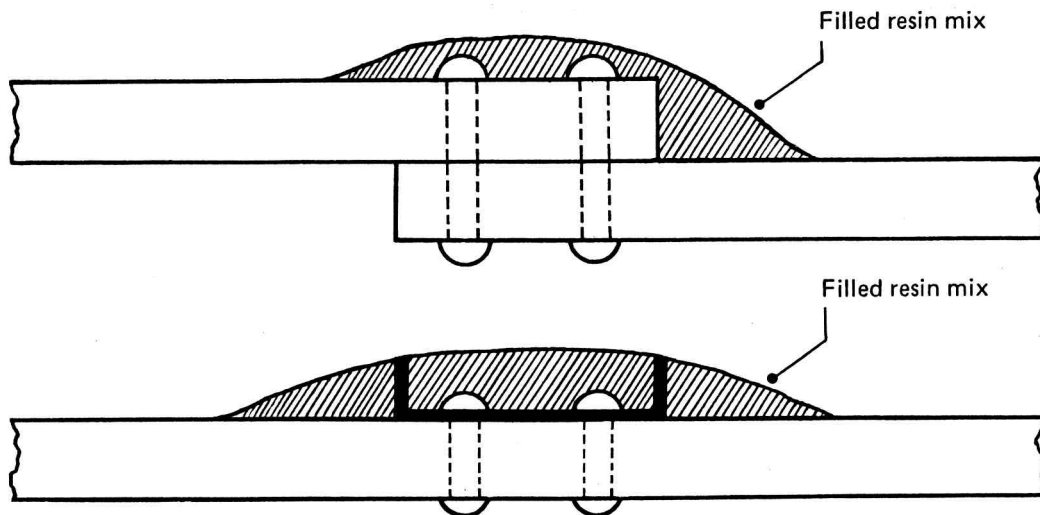
The tank should be structurally sound and there must not be relative movement between plates, that is the plates springing or sliding relative to one another.

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 SA21/2 Swedish Standards Association SIS 05 59 00. Remove all grit and dust by brush and vacuum cleaner.

Apply a conventional two-pack LEYCO-POX 171S resin primer immediately after grit-blasting. As before, a zinc-rich primer is not recommended under a laminate.

2. Apply an LEYCO-POX 171S resin based putty or a sand-filled LEYCO-POX 171S 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.



3. Apply a laminate consisting of the LEYCO-POX 171S 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/m² (1 oz/ft²) 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 layer of reinforcement plus surfacing tissue.

5. A pigmented overseal may be applied if desired (see A. Welded tanks, section 9).

II. Total floor area repair

Essentially the repair procedure in this case is a combination of the procedure for welded tanks (part A) with the preparation of the riveted seams (part B.I, sections 1 and 2).

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 1, ensuring that the area around the rivet heads is thoroughly cleaned.
2. Apply an LEYCO-POX 171S resin based putty or a sand-filled LEYCO-POX 171S resin system over all the rivet heads to LEYCO-POX 171S siltate 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, part A sections 2-10.

HANDLING LEYCO-POX 171S RESIN SYSTEMS

Like all chemicals, LEYCO-POX 171S resins and LEYCO-POX 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 EP 1.6.1 Workshop guide to handling LEYCO-POX 171S resin formulations. A more detailed guide to the handling of these materials is Technical Bulletin EP 1.6.2 Recommendations for handling LEYCO-POX 171S resins curing agents and other auxiliary chemicals used with LEYCO-POX 171S resins.

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