LIA09847

A. SUMMARY

One of the biggest competitors to lead in the [illegible] which has come to prominence as an important material for [illegible] other apparatus for the chemical industry. This article [illegible] because it does an engineering sales job for the whole rubber [illegible]

The way lead is being virtually eliminated in the field of [illegible] pickle tanks in the steel industry (handling incidently, [illegible], usually regarded as the one chemical nearly always handled in lead units when [illegible]) has been [illegible] in Chemical Bulletins Nos. 6 and 7.

In the article pictures of several applications are included with drawings of the type welds to be used in fabricating a steel tank for rubber covering, fillet welds and the proper installation of flanges.

Abstract of the article follows:

B. GENERAL INFORMATION

Rubber is an important material for lining tanks, pipes and other apparatus in the chemical field through its resistance to chemical corrosion and abrasion, its dielectric strength and its noncontaminative qualities. By various compounding procedures rubber's excellent corrosion resistance and other properties can be varied to suit particular requirements. Its performance is unfavorable in the presence of strong oxidizing agents such as nitric and chromic acids, [illegible] hydrocarbons such as benzol and toluol and aliphatic hydrocarbons such as [illegible]

Rubber, like lead, has limited structural strength and is bonded to steel in the fabrication of tanks, pipes, etc. Heat or a combination of [illegible] are [illegible] to vulcanize rubber to steel and this may be done to [illegible] [illegible] as well as [illegible]. Rubber will withstand temperatures up to [illegible] [illegible] to be used up to [illegible]° F. A safe upper limit [illegible] [illegible] of an [illegible] lining of brick is regarded as 180° F.

[illegible]

Size [illegible] the [illegible] of the rubber lining. [illegible] industrial [illegible] by rail to the [illegible] rubber processing [illegible] equipment can be lined in the field by [illegible] are also available for making other than minor repairs which are generally made by the owner.

C. [illegible]

Metal plates and surfaces to be rubber lined should be free from [illegible] or other [illegible], as well as from scratches, protrusions and [illegible]. [illegible] stiffeners and other structural members [illegible] should be on the side of the plate opposite to that upon which the rubber is to be vulcanized. [illegible] plates [illegible] into forms should be flat, [illegible]. Any [illegible] edges must be removed, especially on the [illegible] side of tanks. Machining or chipping at least 1/2 in. from sheared edges of plates is recommended.

Design requirements include accessibility to the interior of closed vessels or large ducts in installations and repairs. An opening of 18 in. inside diameter is a minimum for manholes. Outlets on rubber lined tanks and vessels are designed for flanged pipe and fittings. Screwed flanges must be assembled without oil or lubricant since oil attacks rubber. Care must be taken to remove all oil, grease or other viscous coatings before the rubber is applied.

Tanks with large surfaces need reinforcement to prevent bulging and such reinforcing beams can also be coated with rubber. Plates for tanks, ducts and other parts should be designed for joining to one another and to other structural members by welding, preferably by fillet and butt welds. Welds that are to be covered with rubber must be smooth with no porosity, holes, high spots, lumps or pockets. Peening can be used to eliminate porosity. A fillet radius of at least 1/4 in. is desirable and other detailed information on welding and building up layers of deposited weld materials are given. Spot welding is objectionable as are riveted joints unless these can be countersunk. All sharp corners must be rounded with 1/8 in. as a minimum radius. Cleanliness of steel surfaces is an important factor as they must be free of grease, weld spatter, and all foreign material. Shot blasting immediately prior to rubber lining is a general practice.

Following shot-blasting, steel surfaces to be rubber lined are cemented with two coats of primer and one coat of intermediate cement. The rubber, which is cut to convenient size and shape before hand, is treated with naphtha or other reagent to make it tacky just prior to applying it to the cemented surface. Every square inch of the rubber is carefully rolled down usually by hand to force out entrapped air between the rubber and the metal. After the rubber has been applied to the steel, it is cured in place by exhaust or pressure steam depending upon the curing characteristics of rubber stock. Surfaces not rubber covered are painted with acid resistant paint. Lining thickness of 3/16 in. is standard for tanks and large diameter pipe. Lining thickness of 1/8 in. is standard for small diameter pipe. Thicker linings are used for severe service conditions or to provide additional protection against mechanical abuse.

D. TYPICAL APPLICATIONS

All sizes, shapes and varieties of storage tanks have been rubber lined. The usual applications are cylindrical closed tanks, horizontal or vertical. The latter may be of the open type. Dished heads may be designed for pressure uses. In large diameter tanks the problem of structural supports presents itself to the rubber people also.

1. [illegible]

Three functions claimed for rubber in plating [illegible]

(1) Rubber provides resistance to corrosion from acid solutions in which most plating is done.

(2) Rubber is a non-conductor, insulates the cathode and prevents current leakage.

(3) "Rubber prevents metallic contamination such as might result from lead linings."

Two characteristics built into the rubber compound for our particular [illegible] tion are:

(1) Elimination of constituents that can be leached out of the rubber by the acid solution and that would poison the bath, contribute an objectionable color to the plate.

(2) The second consideration is to have lining of uniform density and composition to prevent plating through with resultant deposition of metal on the surface of the rubber.

Automatic continuous plating units make use of rubber lined tanks throughout except in the chrome plating tank. The author states, "Rubber is not satisfactory for the chrome tank." In these automatic units a typical cycle consists of an acid pickle, a wash, copper strike, wash, bright nickel plate, wash, chrome plate and wash. The bright nickel plating is a time consuming operation, hence that tank is the biggest tank for which rubber lining is well suited. (Lead lined tanks are used in the chrome plating tank and compete with rubber for lining acid pickle tanks in these units.)

2. Pickling Tanks.

As shown in Chemical Bulletins 4 and 7 rubber linings in acid pickle tanks have to a large extent displaced lead linings in continuous pickler units. Rubber linings 1/4 in. thick protected by inner linings of acid resistant brick are used. Pickling is done at temperatures as high as 230° F. which is severe service. In units of this kind there are four or five rubber lined acid tanks with sectional rubber lined covers. The exhaust system including ducts, dampers, scrubbers, fans and stacks and a waste acid system are also places where the use of rubber is advocated.

The rayon industry uses special rubber lined wash tanks. In the pulp and paper industry chlorination and bleach tanks are used and are oftentimes vertical cylindrical tanks approximately 15 ft. in diameter and 40 ft. high. Zeolite tanks used in industrial water softening are rubber lined where it is essential to prevent iron contamination.

3. Pipe and Fittings.

Rubber lined pipe and fittings are favorable for handling corrosive solutions. For rubber linings, flanged pipe and fittings are used. The maximum length of pipe sections that can be rubber lined is 10 ft. Three types of rubber lined valves in common use are the diaphragm valve, gate valve and special designs of angle valves.

6. [illegible]

[illegible] lined tank cars and trucks are widely used for bulk [illegible] tion of chemicals. [illegible] as [illegible] [illegible] [illegible] to damage [illegible] tank cars, [illegible] of the car to [illegible] [illegible] joints, such as [illegible] tank cars in service. [illegible] [illegible] damage.

8. [illegible]

[illegible] washers or filters which are in common use in the [illegible] industry, [illegible] industry, and the field of [illegible] [illegible] also be rubber covered [illegible] must be [illegible] to [illegible] the rubber. The [illegible] speed [illegible] to about 10,000 ft. per [illegible] and the fans are usually returned to the [illegible] facturer for dynamic balancing. Rubber lined evaporators or crystallizers are a specialty of some companies. Rubber lined centrifugal pumps are in common use but here too, design must allow clearances for rubber subsequent to lining. Rubber lined absorption towers are an example of special process equipment. Agitators of varying sizes may also be rubber covered.

CONCLUSIONS

1. Rubber linings are firmly bonded to the steel tank without requiring straps for support. (This has the effect of homogeneous bonding and prevents sagging which is sometimes a cause of failure in lead strapped installations.)

2. Temperature limits of the usual rubber lining is 180° F. although special compounds can handle certain materials up to 205-210° F. or even higher. Brick inner linings are used to insulate rubber from heat and protect it from abrasion.

3. Rubber is a nonconductor and insulates plating operations, preventing current leakage. (Stray currents are a source of electrical loss in many lead installations.)

4. (Ease of repair is also an advantage of rubber as well as lead. In fact, repair work on rubber installations is possibly less expensive due to the high labor cost of lead burners.)

Note: Parenthetical statements above are our comments and not statements from Mr. O. S. True's article.