Directions for the Operation and Supervision of Alkazid-plants

Directions for the treatment of aluminum parts of Alkazid plants which are not operating

Point-like corrosion of aluminum parts was occasionally observed when an alkazid plant was not operated. Introduced air seemed to favor the corrosion. It may be expected that from such preliminary points of corrosion, the corrosion proceeds to other parts of the plant as soon as the plant is operated.

In order to prevent such corrosions the following suggestions are made:

If an alkazid-stripping-system must be put out of operation for a long period of time and if simultaneously an inspection must be made where an access of air can easily occur the following precautions should be taken.

1) After removal of the alkazid-solution the plant should be thoroughly flushed with pure steam condensate.

2) The aluminum apparatus should be completely dried by warm air in order to remove all film of moisture from the aluminum parts. Care should be taken that no condensation of water vaper results at the surface of the apparatus due to changing temperatures and moisture contents of the air.

The drying of the apparatus can be performed in the following manner: The elbow piece which connects the bottom of the stripper with that of the boiler is removed. A safety pipe at the lid of the boiler is opened. The heating system is slowly heated by steam thus drying the solution side of the system itself and generating warm air which during its passage through the stripper will dry the aluminum parts. Should the sump of the stripper be also made of aluminum, warm air should be blown in using a pipe. The warm air can be easily produced using a heat exchanger or cooler. The aluminum heat exchanger must also be dried by means of warm air.

It was also observed that the outer surface of the apparatus was partly destroyed if water condensation takes place under the insulation which protects the apparatus. By a slow heating of the apparatus such condensation can be prevented. Another good protection of the surface of aluminum apparatus is the application of a protective coat painting.

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Directions for the removal of corrosion damages of aluminum parts of Alkazid-plants

Should heavy corrosion damages have occurred, the affected parts should be either replaced or repaired by welding. But in many cases, besides heavy corrosions, smaller corrosions scars can be observed which allow a further operation of the plant. In order to provide a protective layer which is resistant against the Alkazid solution the following procedure should be applied:

If easily accessible parts must be protected:
1. The surface must be dried.
2. The corrosion products must be entirely removed by steel-brushes. Provisions must be taken against the entering of small steel particles into the aluminum surface. The cleaned surface must be as smooth as possible and free from scratches.

If difficultly accessible parts must be protected as for instance the pipe bundles of heat exchangers:
1. The apparatus must be flushed with pure condensate.
2. A blanching liquid consisting of nitric acid with an addition of chromium should be allowed to act for approximately 12 hours. (composition of the blanching liquid: 178 ccm. nitric acid, spec. grav. 1.39 and 40 gm. potassium dichromate and distilled water diluted to 1 liter).
3. Thoroughly flushing with pure condensate.
4. Keeping dry the apparatus if it is not operated for a longer period of time.

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Reaction of FeS with Air

In connection with hydrogen sulfide plants it should be always remembered that FeS reacts with small volumes of oxygen under formation of iron oxide and sulfur. If the FeS is dry the reaction takes place with a very high velocity and sometimes with such a development of heat that the mass will glow and the sulfur will be burned. Since in the plants thin films of FeS are formed on the surface of the iron parts and since FeS-sludge which is floating in the alkazid solution may form deposits, that fact should be always born in mind.

The access of air is of the following consequences for a plant which has extracted H_2S from gases: The FeS-sludge or the thin FeS-film is transformed into S and iron oxide under the influence of oxygen whereby the volume is changed. A sponge like of iron oxide is therefore formed. As soon as the plant is again put in operation the iron oxide is transformed into FeS which, since it does not stick to the surface of the iron, is carried away from the recirculating liquid. Another FeS-film is formed on the surface of the iron. The process causes a slight diminishing of the thickness of the iron walls. The opening of the apparatus which is mostly connected with an access of air should be only made if it is very urgent. Air filled and moist apparatus have the tendency to rust.

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I. Principles of the Alkazid-Process

The Alkazid process is a wet process which is able to extract H_2S or CO_2 or H_2S and CO_2 respectively, from gases by means of salt-solutions (the so-called Alkazid solutions). The solutions will absorb H_2S and/or CO_2 when they are cold whereafter the gases are liberated by heating the enriched solutions. The commercial procedure of the process is carried out in such a manner that the Alkazid-solution solution is recirculated between a scrubber and a stripper. The cycle

consists of the following steps:
The refreshed solution enters at the top of the scrubber through which it passes in a counter current flow to the gas absorbing H_2S and/or CO_2. The saturated liquid is pumped through a heat exchanger to the stripper. During its passage through the heat exchanger the saturated liquid is preheated by the stripped warm solution coming from the stripper which is effectively cooled.

The saturated preheated solution passes through the stripper from the top to the bottom whereby it is more and more preheated. Finally it is boiled in a boiler which is situated at the bottom of the stripper stripper. Under the influence of the elevated temperature and the water vapors ascending from the bottom to the top the gases previously absorbed in the washer are stripped from the solution and escape, diluted with water vapors from the upper part of the column. The stripped, refreshed solution is led to a second pump which circulates the solution through the heat exchanger and a cooler to the scrubber whereafter the circle continues again. Should the liberated gases be utilized, which is mostly done with the recovered H_2S-gases, the stripped gases are cooled to normal temperatures resulting in condensation of water vapor.

II. Directions for Alkazid-plants

A. Transport and storage of Alkazid-solutions.
The Alkazid-solution must be treated like a concentrated, aqueous salt-solution, which:
1. may form crystal deposits at very low temperatures and
2 may deliver small gas volumes at very high temperatures or during storage over a longer period of time.

B. Operation
Difficulties are prevented and a smooth operation is secured if in the commercial operation of the Alkazid process the following views are taken into consideration. The following three items are very important if aluminum-containing plants are operated:
1. The specific gravity of the solution is not allowed to be lower than 1.16 for "Dik"-solution) at temp. of 20°C. and referring 1.17 " "M"-solution) to a stripped solution.

If the solutions have a lower spec. gravity occasional corrosions of the aluminum parts may take place. For that reason a local dilution of the liquid must be carefully prevented. Should nevertheless a corrosivity of the solution against aluminum occur, an addition of waterglass will easily stop the corrosion. The maximum quantity of waterglass which is added should not exceed a batch of 300 gm. sodium silicate per cu. m. solution (calculated on solid, water-free salt). The commercial solution is diluted with 10 volumes of steam condensate and the diluted mixture is slowly admixed to the recirculating liquid. Should the plant consist entirely of iron such a concentration of the solution can be employed as it is the most favorable for the extraction. But also in such cases the before mentioned spec. grav. of the solution will result.

2. Should aluminum parts be present in the plant, the apparatus should be thoroughly flushed with a diluted waterglass solution before the alkazid solution is fed in. The concentration of the waterglass solution should be 0.1%. The temperature of the solution may be as high as 60°C

3. It is well known that aluminum is extremely susceptible to the action of mercury salts which cause a complete destruction of of the aluminum. Therefore no thermometer, steam-meters, flow-meters etc. which contain mercury should be employed in the plant. Provisions must be made that the steam which is used for heating purposes does not contain any traces of mercury.
4. Air is by no means allowed to come in contact with the warm alkazid solution and an introduction of air into the cold solution should be also carefully prevented.
5. Sometimes the gases to be extracted contain small amounts of dust which causes a slight formation of sludge in the alkazid-solution. The sludge can be removed continously or intermittently by a filter which is arranged in the main or a side-flow of the re-circulating Alkazid-solution. Besides the mentioned directions further detailed information is available which will be submitted by request.