# Modification of Shell And Tube Heat Exchanger To Improve its Efficiency

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***Abstract-*** *The conventional shell and tube heat exchanger fluid contact with tubes flowing up and down in shell there for scale deposit inside the tube so to evaluate this problem the auto tube cleaning system is installed on heat exchangers and keeps the tube cleaning without time consuming intervention .Specialized cleaning sponge are injected at set intervals into the cooling water floe the rough sponge rubber the tubes clean and are the trapped at the outlet of the heat exchanger where the are prepare for the next cleaning cycle.*

***Keywords***- shell and tube heat exchanger, Sponge ball, Ball injector, Ball collector,

## I. INTRODUCTION

Condenser tube cleaning system is a device use to srube the inner wall of heat transfer tube of the central air conditioner by physical method. When the central air conditioner is in refrigeration process temperature of the refrigerant rises , so it must be lower. Cooling water system is the pipe line system use for cooling down the refrigerant and the condenser is the heat exchange device for cooling refrigerant. Cooling water flow in to the condenser through the inert wall of heat transfer tube and then flows out. The cooling refrigerant flow through the outer wall of the heat transfer tubes band the condenser and the thus cool down the refrigerant. The cooling water flows in to the condenser at a low temperature and flows out at a high temperature after absorbing heat. Aft6er operating for a long time, the heat transfer tube may have incrustation , fouling and strain sediment on inner wall which may affect the heat transfer efficiency.

Small temperature drop of the refrigerant effect , increase the load on the host of the central air conditioner and reduce the life of it, so inner wall of condenser heat transfer tube must be regularly cleaned to extend.

## II. PROBLEM SPECIFICATION

We are surveying chillers system and we conduct all part and working principals. And we are observing during maintenance time. The Conventional shell and tube heat exchanger fluid contact with tubs flowing up and down in shell therefore scales deposited inside the tube.

## III. PRIOR RESERCH

### 3.1 HOW TO CHOOSE

The design and selection of condenser tube cleaning system is determined by the refrigerating capacity of the chillers and the outlet pipe diameter of the cooling water. The size of balls shall be decided by the inner diameter of condenser heat transfer tubes of cold water host.

In order to prevent welding slags,welding rods, metal debris, sand and organic fabrics in the installation process, and the filling of cooling tower, corrosion in the cooling tubes and other foreign materials in the operation process from entering the condenser and evaporator, a less than 1.5mm precision of filter shall be installed in front of water inlet of chiller condenser (evaporator) and the effective filtering area of filter screen shall be 3 times larger than section area of the connecting pipe ,to ensure proper water resistance of the filter.

### 3.2 MAIN COMPONENTS

**Ball injector**: The container used for storage, injecting and collecting balls. The installation position of the ball injector and the inlet and outlet connecting pipes shall ensure that the balls are even without blockage.

**Ball collector**: When the balls leave the condenser, they'll be caught by the ball collector. The chamber material is carbon steel or stainless steel, the max working pressure is 10-25 bar, the effective open area is greater than 3 times of that of the connecting pipe and the hydraulic resistance loss is less than 5 Kpa.The ball collecting screen shall be designed with good hydraulic characteristics to prevent the screen from vibrating under the impact of water flow. The design of the ball collecting screen shall ensure no blocking or slipping of ball.

FIG 1.Ball collector

**Sponge balls**: Used for cleaning inner wall of the condenser heat transfer tubes. The balls shall have uniform density and good recoverability. When the balls work at a water temperature of 5-36 ℃,the diameter of wet balls shall not be larger than 0.5 mm of dry balls. During the operation, the diameter of the balls shall be 1-2 mm larger than the inner diameter of the heat transfer tubes.

FIG 2.Sponge balls

### 3.3 SELECTION OF MATERIAL

**Table 1: Selection of material**

| NO. | Part Name | Material |
|---|---|---|
| 1 | CONDENSER TUBE | COOPER-NICKEL ALLOYS |
| 2 | SPONGE BALLS | NATURALRUBBER |
| 3 | PIPE | M.S. |
| 4 | FLOW CONTROL VALVE | Standard |
| 5 | BALL STRINER | Standard |
| 6 | BALL COLLECTOR | Standard |
| 7 | PUMP | Standard |

### 3.4 WORKING

To start with the water pump of the condenser tube cleaning system and pump the balls from the ball injector to the water inlet of the condenser with water. The balls enter the end cover of the condenser along with the circulating cooling water and get into the copper tube of the condenser randomly. Driven by the circulating cooling water, the balls move inside the copper tube to scrub the inner wall of the tube. After leaving the tube, the balls get out of the end cover of the condenser with the circulating cooling water and enters the ball collector installed on the outlet pipeline of the condenser. Ball trap in the ball collector then traps the balls, with the water flowing away through the screen. Then the balls return to the ball injector, which means a whole cleaning process is finished. The cleaning frequency and times can be set via microcomputer control program, to realize automatic on-line cleaning.The Tube Cleaning System is installed on heat exchangers and keeps the tubes clean without time-consuming intervention. Specialized cleaning balls are injected at set intervals into the cooling water flow. The balls rub the tubes clean and are then trapped at the outlet of the heat exchanger, where they are prepared for the next cleaning cycle.Typical installations, such as central chilled water plants in hospitals or universities, require less than 20 man-hours and only 8 hours of process shutdown. Ball traps are available in a variety of shapes and flow configurations to integrate easily with existing pipe runs and available space for installation.

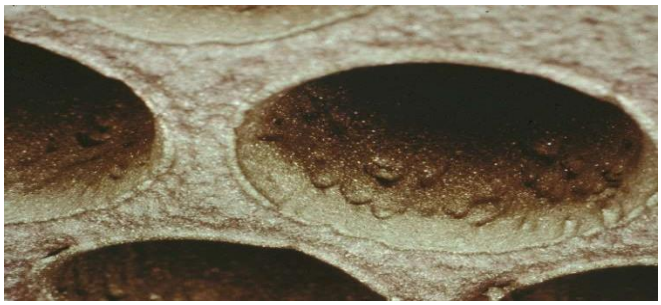

FIG 3. Condenser tube

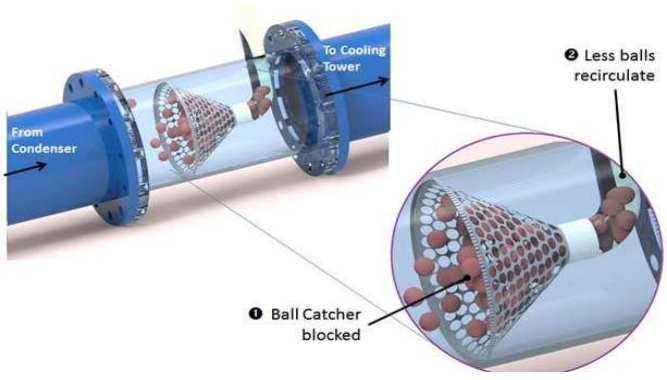


FIG 4.Ball strainer

## IV. DESIGN AND CALCULATION

There is a central air-conditioner with 3 chillers, each of which has a compressor power of 429KW and operates throughout the years. In summer, all three chillers will be under operation, with a total compressor power of 1287 KW and an operation time of 4 months. In other seasons, two chillers will be under operation, with a total compressor power of 858 KW and an operation time of 6 months. Since water quality varies in different regions, the energy saving effect is various between 15%-35%.Assume the energy saving rate is 0%,the average load is 80%,the chillers operates for 24 hours per day and 30 days per month and the electric charge is RMB 1.0 per kw/h,

Then: The electric charge saved per month in summer is:

1287 kW×80%×1 h×1.0 RMB/ kw/h×20%×24 h×30 days= RMB 148262.4.

And the electric charge saved per month in other seasons is:
858 kW×80%×1 h×1.0 RMB/ kw/h×20%×24 h×30 days= RMB 98841.6.

The electric charge saved in the whole year is:

RMB 148262.4×4 months +RMB 98841.6×6 months = RMB 1186099.2

In addition, the total economic benefit reaches as much as 1.2 million Yuan per year, including the expenses on chemical cleaning, labor and equipment maintenance, and calculated at an available machine year of 10 months per year. As it turns out, the user can recover the investment cost of the equipment in a short time

## V. CONCLUSION AND FUTURE SCOPE

### 5.1 CONCLUSION

The project presented has involved the development and implementation of automatic transmissions . The motivation of this work is to implement this idea in with a suitable control. The automatic can be also used in versions by altering few changes in the program.

### 5.2 FUTURE SCOPE

An automated sensor to be attached No need to change pressure by button

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