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Modification Connection Pipe Desalting Water Pump and Regeneration Pump with Adding Manual Valve

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Abstract

This paper presents the modification connection pipe desalting water pump and regeneration pump by adding manual valve, used in the Labuhan Angin power plant. The Labuhan Angin power plant is a type of coal-fired power station with two 115 MW of power capacity. It generates electricity by using steam to drive a rotating turbine that is coupled to a generator. Seawater that has already been processed in a water treatment plant was used in the process to create the steam. Water from the water treatment plant that has been demineralized needs to be moved to a condensate storage tank and then poured into a boiler. Based on the analysis of the current situation, when two desalting water pumps run simultaneously to supply the condensate could cause the load to drop, especially when the power is fully loaded. Hence, the modification connection pipe desalting water pump and regeneration pump with adding manual valve could be one of the solutions.

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Abstrak

Makalah ini memaparkan modifikasi sambungan pipa pompa air desalinasi dan pompa regenerasi dengan penambahan katup manual yang digunakan pada PLTU Labuhan Angin. PLTU Labuhan Angin merupakan salah satu jenis PLTU berbahan bakar batu bara dengan kapasitas daya 115 MW. PLTU ini menghasilkan listrik dengan memanfaatkan uap untuk menggerakkan turbin berputar yang dikopel dengan generator. Air laut yang telah diolah di instalasi pengolahan air digunakan dalam proses tersebut untuk menghasilkan uap. Air dari instalasi pengolahan air yang telah *didemineralisasi* perlu dipindahkan ke tangki penyimpanan kondensat kemudian dituang ke dalam boiler. Berdasarkan analisis situasi saat ini, apabila dua pompa air desalinasi bekerja secara bersamaan untuk *supply* kondensat dapat menyebabkan beban menjadi turun, terutama pada saat daya terisi penuh. Oleh karena itu, modifikasi sambungan pipa pompa air desalinasi dan pompa regenerasi dengan penambahan katup manual dapat menjadi salah satu solusinya.

1. INTRODUCTION

A power plant's cooling water pumping system is its most crucial component (Asian Tech Limited, 2007). As a result, the power plant needs to be improved. This change will prevent damage to the motorized and desalting water pump, which operates continuously

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and at maximum efficiency. It will also address issues with water filling the condensate storage tank, improving the operational unit and lowering the load power on the power plant unit.

The Labuhan Angin power plant is a type of coal-fired power station with two 115 MW of power capacity. It generates electricity by using steam to drive a rotating turbine which was coupled to a generator. Seawater which has been already processed in a water treatment plant was used in the process to create that steam. The demineralized water from the water treatment plant needs to be moved to a condensate storage tank and then poured into a boiler. Using a desalting water pump, it moves to the condensate storage tank. According to the current standard, the pump stream debit is 50 m3/h and the outlet valve conditions must be between 35% and 40% open. Therefore, two desalting water pumps must run simultaneously to supply the condensate storage tank with the necessary amount of water. This situation is extremely risky since the water supply to the condensate water storage tank will be terminated if one of these pumps could not run. When both units are operating and the power is fully loaded, this condition will cause the load to drop. Hence, the modification connection pipe desalting water pump and regeneration pump with adding manual valve could be one of the solutions. This paper presents the modification connection pipe desalting water pump and regeneration pump with adding manual valve, used in the Labuhan Angin power plant. This modification could be done by adding motor valve to the pipe connection between desalting water pump and regeneration pump, which opening motor valve can be adjusted from water treatment plant control room (PT. PLN Persero, 2007). This modification aims to improve desalting water pump operation.

2. IMPLEMENTATION METHOD

In water filling systems to condensate storage tank, demineralization water was transferred by desalting water pump (Figure 1). Stream debit of desalting water pump is $50m^3/h$ which outlet valve conditions only could open maximum 35% -40%. This procees is to accommodate pump electric current, because if opening valve more than 40%, it can cause electric current increase to 15A. It causes overheating in the motor and the pump could be tripped. Considering this condition, one desalting water pump only can supply $20m^3/h$ of demineralization water. Stream debit of condensate transfer pump is $42m^3/h$. With assumed that condensate transfer pump transferred demineralization water continuously so it will be additional about $42m^3/h$. To fulfill that requirement, it only could be done by proceeding both of desalting water pump at the same time.

Figure 1.
Desalting water pump.

To overcome the problem, the modification connection pipe desalting water pump and regeneration pump with adding manual valve was proposed. This modification could be done by adding motor valve to the pipe connection between desalting water pump and regeneration pump, which opening motor valve can be adjusted from water treatment plant control room (PT. PLN Persero, 2007). This modification aims to improve desalting water pump operation. First, the stream of demineralization water to the condensate storage tank will be irritated if one of the desalting water pumps is damaged or being repaired; second, when both unit power plants are operating at full capacity, the desalting water pump (see Figure 1) is unable to supply the water needed in the condensate water tank. Power plant performance may be affected by these issues, and the ultimate consequence could be a reduction in power plant unit load.

3. RESULTS AND DISCUSSION

Based on analysis, two potential solutions are an additional connection line and valve from the regeneration pump to deliver greater flow to the condensate storage tank and an auxiliary pump to supply the required water (see Figure 2 and Figure 3). A regeneration pump is an auxiliary pump. This method (using a regeneration pump to generate additional flow) only requires turning on the pump and opening a valve in the line that links the regeneration pump to the desalting water pump. It is actually quite beneficial to offer solutions when power plants need a lot of water, especially during starting (Higgins *et al*., 2008).

Butterfly valves are the type of valve used in this modification. This decision was made based on the desalting and regeneration pumps' operating conditions, as well as the fact that the pump's working mechanism is flow rather than pressure. One-way flow can be isolated or controlled with a butterfly valve.

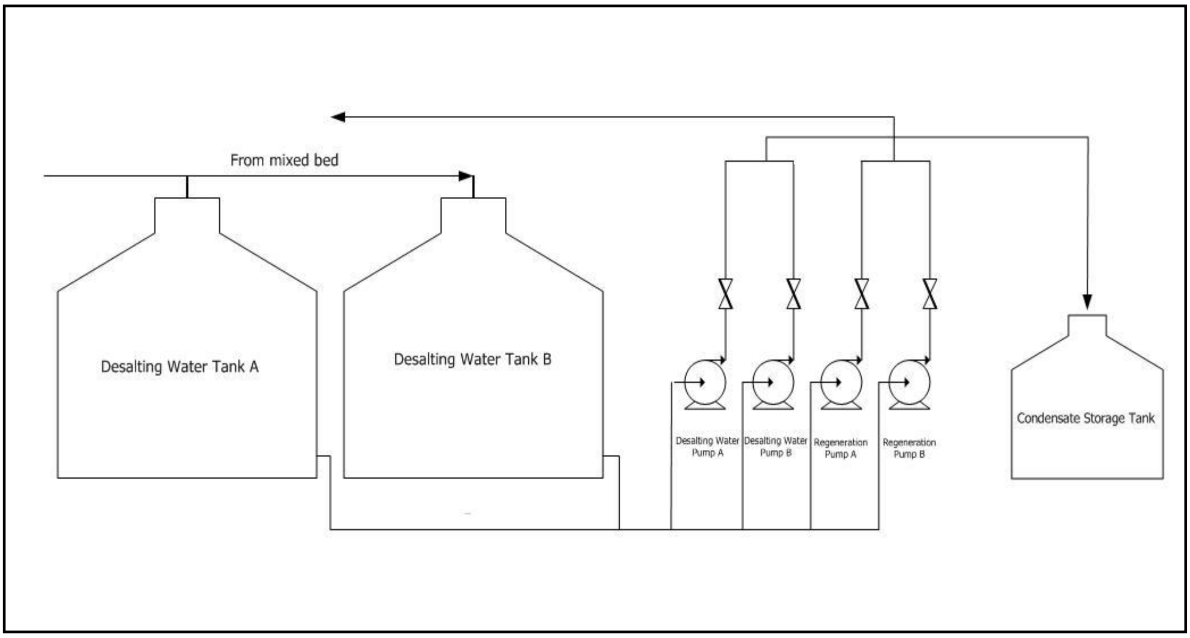

Figure 2.
Line diagram before modification

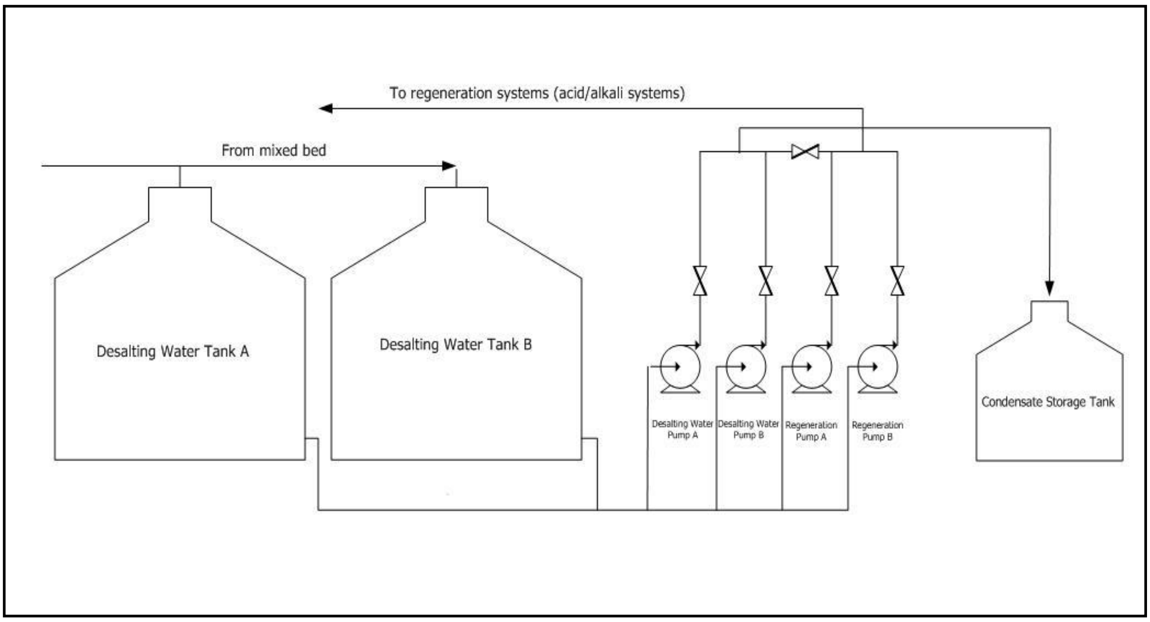

Figure 3.
Line diagram after modification

Figure 4.
Tapping at desalting water pump and regeneration pump after redesign

A regeneration pump can be used to increase flow and address the water filling problem. It is only used when the desalting pump is unable to provide the condensate storage tank with sufficient flow. The condenser (feed water), chemical lab (for water sample), boiler filling (when the unit starts up), and closed cycle cooling water tank all receive water from the condensate storage tank, as is commonly known.As previously explained, the desalting water pump's operating conditions only allow it to transport 20 m^3/h of water out of a maximum capacity of 50 m^3/h. The condensate storage tank level sample in the following table can be used as a reference to calculate the amount of demineralization water utilized.

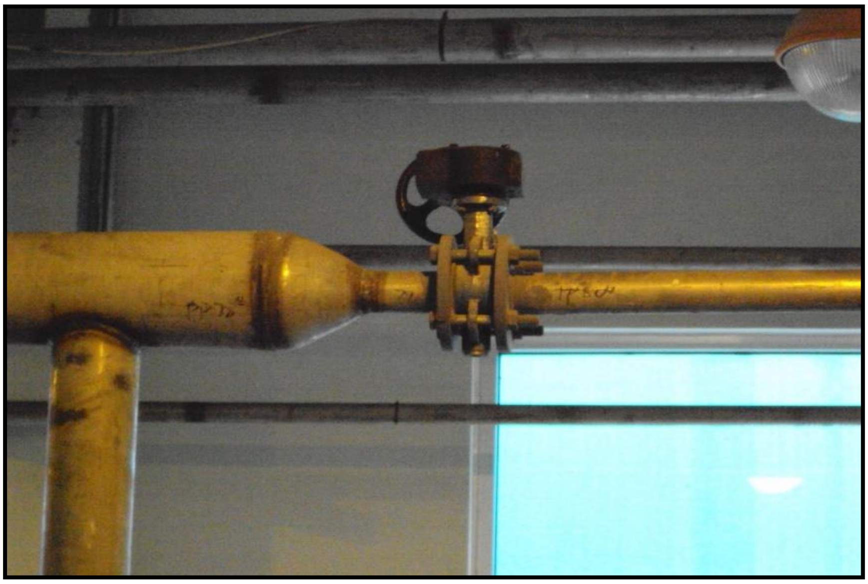

Figure 5.
Butterfly valve (Source: PT. PLN (Persero), 2007)

If power plant is decreasing or even stop because of water problem, from financial side is a very big disadvantages. Labuhan Angin Power Plant has capacity 2 x 115 MW. If sell price of electric is Rp. 860/ KWh, so 115 MW = 115.000 KWh, Rp. 860 x 115.000 = Rp. 98.900.000. In one day = 24 hours, so 24 x Rp.98.900.000 = Rp. 2.373.600.000. If production cost of electric is Rp. 663/ KWh, so 115 MW = 115.000 KWh, Rp. 663 x 115.000 KWh = Rp.76.245.000. In one day = 24 hours, so 24 x Rp. 76.245.000 = Rp. 1.829.880.000.

The financial drawbacks that can be avoided if the power plant is forced to shut down for a day are as follows: the sale price of electricity minus the production cost of electricity is Rp 2.373.600.000 – Rp 1.829.880.000 = Rp 543.720.000.

Table.1
Condensate Storage tank Level

TIME	LEVEL (mm)
02.00	3449
04.00	3287
06.00	3724
08.00	3703
10.00	3600
12.00	2186
14.00	2855
16.00	3524
20.00	3648
22.00	3261
24.00	2892

Figure 6.
Condensate Storage tank

4. CONCLUSIONS

A few conclusions can be drawn from the analysis, observation, and solution. The addition of a manual valve to the pipe connecting the desalting water pump and regeneration pump is crucial for enhancing the desalting water pump's ability to supply demineralization water to the condensate water storage tank. The butterfly valve was selected to be appropriate for the low-pressure pump type. With this additional equipment, Rp 543.720.000 in losses could be avoided if the unit power plant shuts down. In light of this issue, the authors suggested that in order to minimize pump damage, desalting water pump operations should be referred to manual instructions and standard operating procedures. Periodically, the desalting water pump needs to be monitored and controlled.

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