

Air Intake Prefilter Application at GT 13E2 PT. PJB UP Muara Tawar to Increase Plant Reliability, Availability, and Maintenance Time Interval

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Abstract: The role of air intake filter in gas turbine is very important to produce clean air into combustion chamber. Combustion can perform perfectly in proportional ratio of fuel and oxygen. Filter air intake of gas turbine GT 13E2 use cylindrical cartridge filter type and it is installed vertically. Air intake filter performance reduce rapidly if operated in dirty ambient air. This condition require filter replacement to maintain air mass flowrate that required in combustion. However, displacement cannot be performed while plant under operation. Therefore, the effort to increase life time of filter is necessary. Existing air intake filter in block 1 utilize 900 pieces of Donaldson brand. The specification of filter are 16 inches outside diameter. 34.5 inches height. Cellulose base with porosity 52 μ . To reduce amount of attached particle in filter surface, installation weather louver is required. In order to increase plant reliability, availability and maintenance time interval of gas turbine, installation of prefilter and weather louver at intake of compressor have been performed. This effort provide increasing plant reliability, availability and maintenance time interval. Finally, the benefit of this effort increase productivity of electricity and company profit.

Keywords: air, filter, prefilter, reliability, turbine

I. Introduction

Combined cycle power plant (CCPP) in Muara Tawar is industrial power plant using gas turbine. There are several components in gas turbine systems. One of the important component is combustion chamber. Combustion can perform perfectly in proportional ratio of fuel and oxygen. Clean air is required as oxygen carrier medium. Hence, air filtering is important [1]. There are several filter types that used to filter combustion air in gas turbine [2]. Filter air intake of gas turbine GT 13E2 use cylindrical cartridge filter type and it is installed vertically. Material of cartridge filter is consist of combination of polyester fiber and cellulose that have a capability retain particle with diameter more than 1 micron [3].



Figure 1. Filter Air Intake GT 13E2

In actual, air intake filter performance reduce rapidly if operated in dirty ambient air. This condition require filter replacement to maintain air mass flowrate that required in combustion. However, displacement cannot be performed while plant under operation [4]. Therefore, the effort to increase life time of filter is necessary. One of the effort to overcome this problem is utilization of prefilter at the outside of existing filter. The other bennefit of this prefilter is easy to replace without disturbing operation of gas turbine.

II. Theory

Combustion air should be contaminant free to avoid slagging and fouling in filter and combustion chamber [5]. Components at air intake equipment consist of *intake housing, droplet separator, cartridge filter* dan *silencer* as shown in Fig.2.

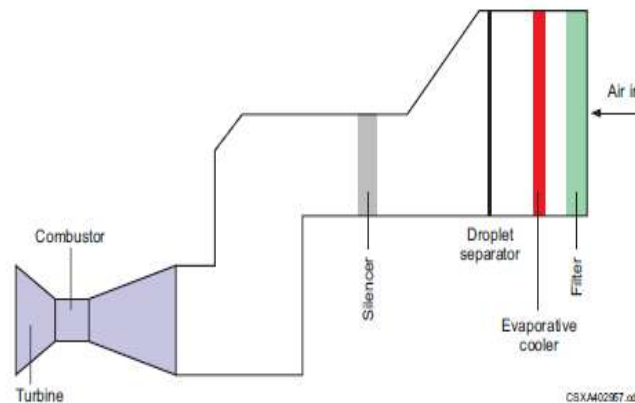


Figure 2. Air Intake Scheme

Gas turbine operating condition require huge of air to perform gas combustion. For example 22 MW turbine requires inlet air 118,214 scfm. Howefer, in 1 ppm particle in ambient air is equal to 5,8 Kg particle/day for gas turbine combustion air flowrate about 240747.8 Kg/hour. Filtration is utilize to protect gas turbine from unwanted air contaminant. Although the utilization of air filter increase pressure drop and temperature, howefer the implementation of air filter has more benefit for overall systems [6]. Any air contaminant have possibility to reduce reliability, availability, and maintanant time interval [7]. The main purpose of inlet filtration is produce clean air to obtain proper operating condition and maintain turbine efficiency.

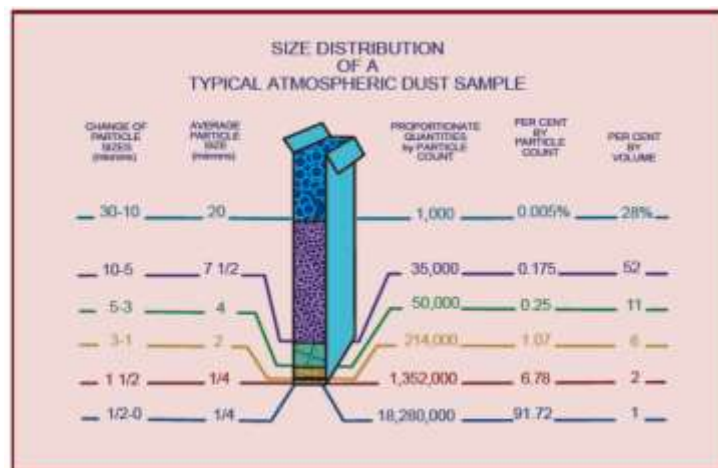


Figure 3. Size Distribution

III. Method

3.1 Problem Identification

Existing air intake filter in block 1 utilize 900 pieces of Donaldson brand. the specification of filter are 16 inches outside diameter. 34.5 inches height. cellulose base with pourusity 52μ. The detail specification is shown in Fig.4.

NO	SPESIFIKASI DASAR	MATERIAL	DIMENSI	REMARK
1	1. Tipe	1. Filter media	1. Filter media	1. Filter media
2	2. Efisiensi	2. Efisiensi	2. Efisiensi	2. Efisiensi
3	3. Dimensi	3. Dimensi	3. Dimensi	3. Dimensi
4	4. Spesifikasi lainnya	4. Spesifikasi lainnya	4. Spesifikasi lainnya	4. Spesifikasi lainnya

Figure 4. Filter Air Intake Specification



Figure 5. Filter Air Intake Donaldson

CCPP Muara Tawar environment located near beach that the air can be contaminated with small and medium particle such as dust, leaves and plastic. All contaminant with diameter more than 52μ will attach at filter surface and block the air into gas turbine. Level of filter plugging can be indicated from differential pressure between intake outlate filter. Fig 6. is shown differential pressure indicator.



Figure 6. Dp Air Intake GT 1.2 Indicator

Operating data was taken from date 1st march 2012 until 3rd march 2012. At 1st march 2012. 900 pieces of filter were replaced with new cartridge and assume the filter under clean condition. Fig. 7. shows the increasing pressure drop over the time versus electricity generation.

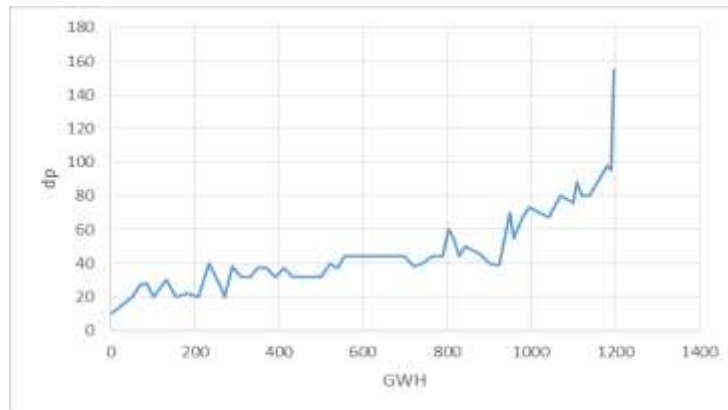


Figure 7. Dp Air Intake GT 1.2 Vs Production

3.2 Improvement

To reduce amount of attached particle in filter surface, installation weather louver is required.



Figure 8. Weather Louver

To reduce small contaminant particle at surface filter, the utilization of prefilter with porosity $>50\mu$. Type of prefilter that used in air intake is GT 13E2 GT 12 is filter wraps G4 that can filtering $>10\mu$.



Figure 9. Prefilter Specification

Prefilter installation can be done in plant under operation without disturbing overall power plant operation.



Figure 10. Prefilter in Filter Air Intake

IV. Discussion

In order to increase plant reliability, availability and maintenance time interval of gas turbine, installation of prefilter and wheather louver at intake of compressor have been performed. Comparison before and after wheather louver installation can be seen in Fig.11. which is the pressure drop reduce significantly.

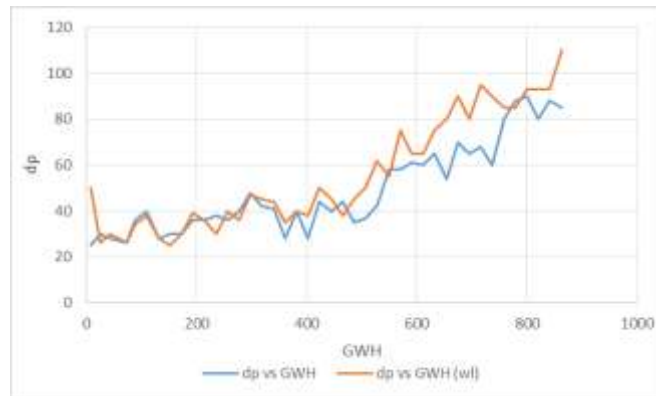


Figure 11. Dp Vs Gwh Before and After Used of Weather Louver

Figure 3.7 shows the pressure drop increment before and after prefilter installation.

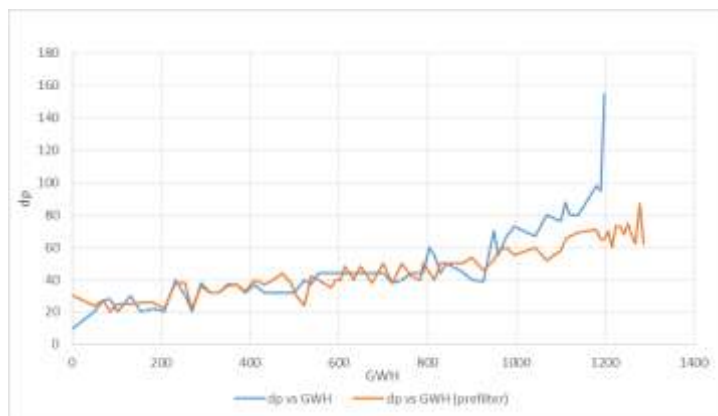


Figure 11. Dp Vs Gwh Before and After Used of Prefilter

V. Conclusion

The installation of weather louver and prefilter have been performed and the pressure drop reduce significantly. This effort provide increasing plant reliability, availability and maintenance time interval. Finally, the benefit of this effort increase productivity of electricity and company profit.

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Reference

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