IJMECIE International Journal of Mechanical, Electrical and Civil Engineering
E-ISSN: 3047-4531
P-ISSN: 3047-4523

Research Article

Differential Pressure Flow Transmitter Type Azbil JTD920S Performance Analysis in Desalination Process at PT Indonesia Power UBP Cilegon

Muhamad Aldi Firdaus [1,*], Diyajeng Luluk Karlina [2], Yudi Nugraha [3]

[1-2] FKIP, Vocational Education in Electrical Engineering, Universitas Sultan Ageng Tirtayasa, Indonesia
[3] PT. Indonesia Power UBP Cilegon, Indonesia
* Corresponding Author: aldiyyyy28@gmail.com

Abstract: The Gas and Steam Power Plant (PLTGU) utilizes exhaust heat from gas turbines to produce steam, which is then used to drive steam turbines. One of the critical processes in this system is seawater desalination, which requires reliable measuring instruments to ensure the continuity and quality of the water supply. The Differential Pressure Flow Transmitter type Azbil JTD920S is used to measure fluid flow rates at four main points: Sea Water Flow (feed), Distillate Water Flow, Condensate Water Flow, and Sea Water to Ejector Condenser Flow. A decline in transmitter performance may occur due to environmental factors, corrosion, and high workload, making periodic preventive maintenance (PM) essential. This study aims to analyze the transmitter's performance by comparing PM data with the manufacturer's maximum specifications using literature studies, direct observation, and interviews. The calculation results show that the highest per-formance levels are found in the Distillate Water Flow (73.53%) and Sea Water to Ejector Condenser Flow (73.87%) lines, while the lowest is in the Condensate Water Flow (49.00%). These findings emphasize the importance of close monitoring of high-performance transmitters to prevent premature failure and maintain the efficiency of the desalination process.

Keywords: Azbil JTD920S; Desalination; DP Flow Transmitter; PLTGU; Preventive Maintenance.

Received: September 27, 2025
Revised: October 13, 2025
Accepted: October 28, 2025
Published: October 31, 2025
Curr. Ver.: October 31, 2025

1. Introduction

The Gas and Steam Power Plant (PLTGU) is a combination of a Gas Power Plant (PLTG) and a Steam Power Plant (PLTU) (Achmad et al., 2022). In this system, exhaust heat from the gas turbine is recovered to produce steam through a component known as the Heat Recovery Steam Generator (HRSG), which is then used as the working fluid in the steam turbine (Setyoko, 2006). One of the essential processes in the PLTGU system is desalination, which is the separation process used to reduce the salt content in seawater so that it can be utilized as feed water or for cooling purposes (Ely, 2019).

In the desalination process, the performance of instrumentation equipment greatly determines the quality and continuity of the water supply. One of the key instruments in-volved is the Differential Pressure Flow Transmitter type AZBIL JTD920S. This device functions to measure the fluid flow rate based on the differential pressure principle and is installed at four strategic points: Sea Water Flow (feed), Distillate Water Flow, Condensate Water Flow, and Sea Water to Ejector Condenser Flow. The accuracy of this measuring device is crucial as it directly affects the efficiency of the desalination process and the con-tinuity of power plant operations.

Over time, the transmitter's performance may decline due to environmental factors, corrosion, and high workload. Therefore, Preventive Maintenance (PM) is carried out pe-riodically. Preventive maintenance refers to scheduled maintenance activities performed to ensure that equipment remains functional and to prevent potential failures before they occur

(Sitinjak & Silalahi, 2023). Its function is to ensure that measurement accuracy remains consistent. However, the effectiveness of preventive maintenance needs to be evaluated by comparing the maintenance data with the manufacturer's maximum specifications.

2. Preliminaries or Related Work or Literature Review

2.1 Transmitter

A transmitter is a device that functions as an extension of a sensor. It converts the process signal received from the detector into an electrical signal, which is then transmitted to receiving devices such as recorders, controllers, or indicators (Mansyur, 2023).

2.2 Differential Pressure Flow Transmitter

A Differential Pressure Transmitter is a type of transmitter that operates by comparing two pressure values received by its sensor (Gunoto, 2021).

Meanwhile, a Differential Pressure Flow Transmitter is an instrument similar to a Differential Pressure Transmitter, but it is referred to as a flow transmitter because its primary function is to measure the seawater flow rate in the desalination system. It is installed at four key points: Sea Water Flow (feed), Distillate Water Flow, Condensate Water Flow, and Sea Water to Ejector Condenser Flow.

Figure 1. Differential pressure flow transmitter type Azbil JTD920S.

The Differential Pressure Flow Transmitter used at the PLTGU UBP Cilegon, branded Azbil JTD920S, serves as the data source for this study. Its specifications are presented in the table below.

Table 1. Flow transmitter JTD902 specifications.

Code	Descriptions	Specifications
Model	Type of tool	YA9000 SuperAce, Electric Standard Differential Pressure Type
JTD902	Measuring Span	0.5 to 100 kPa (50 to 10610 mmH_2O)
-1	0.5 to 100 kPa (50 to 10610 mmH_2O)	4 to 20 mA DC (Analog Standard Communication)
E	Material for Wetted Parts (Meterbody cover / Vent Drain plugs / Center Body)	SCS14A or SUSF316 / SUS316 / SUS316 (Diaphragm: SUS316L)
1	Fill Fluid	General purposes: Silicone Oil
G	Process Connection	Process Connection
2	Bolt / Nut Material	SUS304 (Maximum Working Pressure 10 MPa)
A	Electrical Conduit and Explosion Proof	1/2 NPT, Not Explosion-proof
I	Indicator	Digital Meter With Actual Reading
B	Anticorrosion Treatment	Heavy-duty Anticorrosion Treatment
X	Burnout Feature	None
0	Mounting Bracket	SUS304
-A2	Options 1	External Zero Adjustment

T1	Options 1	Test Report
U2	Options 1	Non-SI Unit Conformance
	Brand	Azbil, Japan

Figure 2. Flow transmitter JTD902 specifications.

2.3 Parts of a Differential Pressure Flow Transmitter

The components of a Differential Pressure Flow Transmitter consist of several main parts, each with distinct functions but interconnected in the process of pressure measurement and signal transmission.

Figure 3. Parts of a Differential Pressure Flow Transmitter.

A Differential Pressure Transmitter consists of four main components that work together to support the pressure measurement process. (1) The electronic section functions to receive, regulate, and monitor the electrical current to ensure system stability. (2) The pressure sensor element detects the pressure difference between the high and low sides as the basis for measurement. (3) The adjustment section is used for calibration, particularly under zero-pressure conditions, to ensure measurement accuracy. (4) The pressure ports serve as inlets for the fluid from the high- and low-pressure sides, generating a pressure difference that is then converted into an electrical signal.

2.4 How Differential Pressure Flow Transmitters Work

A transmitter is a device that functions as an extension of a sensor. It serves to convert the process signal received from the detector into an electrical signal, which is then transmitted to receiving devices such as indicators, controllers, or data recorders. In a differential pressure transmitter, there is a connection between the high-pressure side and the low-pressure side (Ghiffari et al., 2024) as shown in Figure 4 below (Fatimah & Hidayat, 2024; Syahputera & Teknologi Rekayasa Instrumentasi dan Kontrol Jurusan Teknik Elektro Politeknik Negeri Lhokseumawe, 2022).

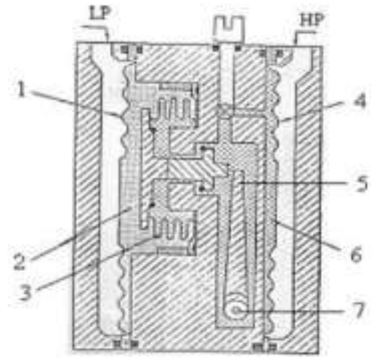

Figure 4. schematic section of the meter body of a transmitter.

The Differential Pressure Flow Transmitter consists of several interconnected components that work together to perform accurate pressure measurements. The seal diaphragm (1) acts as a barrier separating the process fluid from the transmitter's internal components, while the silicon fill (2) transmits the pressure from the diaphragm to the sensing element. The bellows (3) respond to pressure changes by expanding or contracting, allowing the system to detect pressure variations. Another seal diaphragm (4) ensures both sides of the transmitter are properly isolated. The torque arm (5) converts the diaphragm's movement into a mechanical signal, which is then transferred through the silicon fill (6) to the torque rod (7). The torque rod transmits this mechanical motion to the sensor, where it is converted into an electrical signal that represents the pressure difference (Mansyur, 2023).

Differential Pressure Flow Transmitter is a device used to measure the flow rate of a fluid based on the principle of detecting the pressure difference (differential pressure) between the high-pressure side and the low-pressure side across a flow restriction element, such as an orifice plate, venturi, or flow nozzle(Dian, 2019).

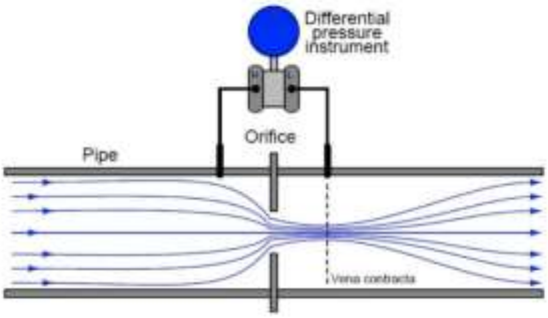

Figure 5. Orifice Flow Meter Working Principle.

The pressure from the fluid, whether in the form of liquid, gas, or steam, is received by the transmitter, and the pressure difference is then converted into an analog signal in the form of an electrical current with a standard range of 4–20 mA (Ghurri & Gunawan Tista, 2016). The current value represents the magnitude of the fluid flow rate. The greater the differential pressure detected, the higher the resulting flow rate. This 4–20 mA current signal is then transmitted to the controller, where it is processed and displayed as a flow rate value in units of tons per hour (t/h).

2.5 Percentage Formula for Calculating Differential Pressure Flow Transmitter Performance

To analyze the performance of an instrument, such as a Differential Pressure Flow Transmitter (DP Flow Transmitter), a comparison is made between the actual measured value (or the output produced) and the maximum or ideal value that the instrument can achieve. This concept is identical to the calculation of Effectiveness (Σ) used in the journal developed by (Yuniarti, 2022).

$$\textbf{Performance percentage} = \frac{\mathbf{Q}_{\text{real}}}{\mathbf{Q}_{\text{max}}} \times \mathbf{100\%} \tag{1}$$

In the performance analysis of the DP Flow Transmitter instrument, the performance percentage is calculated by comparing the actual result with the instrument's maximum specification. Qreal represents the outcome of the Preventive Maintenance process and reflects the actual measured flow rate during testing, expressed in tons per hour (t/h). Meanwhile, Qmax refers to the maximum flow specification of the transmitter, which is the Upper Range Limit (URL) set on the DP Flow Transmitter, also expressed in tons per hour (t/h). By comparing Qreal to Qmax, the instrument's performance percentage can be determined, indicating how closely the instrument operates to its maximum capacity.

3. Proposed Method

3.1 Literature Study

Literature study is a method used to collect various data or references related to the topic discussed in a study (Bakhrudin, 2017). The supporting data used in this study comes from PT. Indonesia Power UBP Cilegon, which is permitted. In the performance analysis of the DP Flow Transmitter, the main data collected using the following techniques:

3.2 Direct Observation (Observation)

Observation is a data collection method conducted through direct monitoring of phenomena or behaviors in the field. This technique allows researchers to observe and record what they see in real situations, without interference or alteration from the researcher(Wani, 2024).

3.3 Interview

An interview is a data collection technique conducted through face-to-face interaction and direct questioning between the data collector or researcher and the respondent or source of information (Dadi Riskiono et al., 2020).

3.4 Literature Study

Literature study is a research method conducted by reviewing, identifying, and analyzing various relevant sources of literature such as books, scientific journals, articles, research reports, and other academic documents. The purpose of the literature study is to gain a comprehensive understanding of a particular topic based on existing theories and previous research findings (Faiz, 2022).

3.5 Research Flowchart

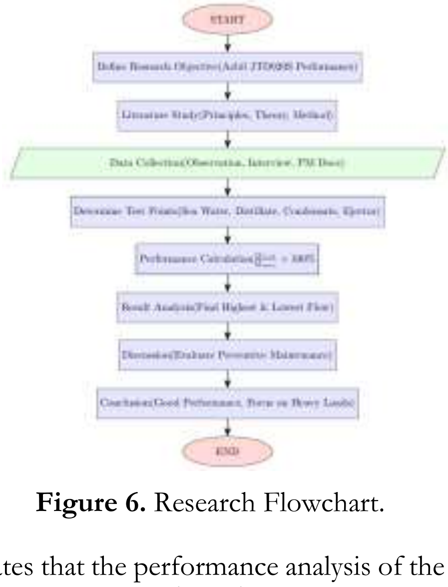

Figure 6. Research Flowchart.

The flowchart illustrates that the performance analysis of the Differential Pressure Flow Transmitter type Azbil JTD920S was conducted through a systematic series of stages, starting from defining objectives, conducting a literature review, collecting data, to analyzing results and drawing conclusions. Each stage focuses on evaluating the transmitter's performance based on actual data compared with the manufacturer's maximum specifications. The results indicate that the instrument remains in good working condition, with performance variations observed across different flow points. In conclusion, scheduled preventive maintenance and continuous monitoring are essential to maintaining the accuracy and efficiency of the desalination system at PLTGU UBP Cilegon.

3.6 Test Point

In this study, there are four test points used on the Differential Pressure Transmitter instrument, namely: (1) Sea Water Flow (feed), (2) Distillate Water Flow, (3) Condensate Water Flow, and (4) Sea Water to Ejector Condenser Flow, as shown in Table 2 below.

Table 2. Preventive maintenance data and maximum specifications for DP Flow Transmitter.

Route	Real-Time PM Results (t/h)	Maximum Specifications (t/h)
Sea Water Flow (feed)	330,2	500
Distillate Water Flow	44,12	60
Condesate Water Flow	4,9	10
Sea Water to Ejector Condesor FLow	110,81	150

The four lines in the table above represent the channels to be analyzed using the percentage formula (1). The results of this percentage calculation aim to determine which point has the highest and lowest performance. Its purpose is to identify the line with the best performance among the four. Once the line with the highest performance is identified, preventive maintenance can be focused on the instrument with the greatest workload, as equipment operating under higher loads tends to experience wear or errors more quickly.

4. Results and Discussion

4.1 Performance Analysis of DP Flow Transmitter Using Percentage Formula

Sea Water Flow (Feed)

Qreal = 330,2

Qmax = 500

$$\text{Persentase} = \frac{\mathbf{330,2}}{\mathbf{500}} \times \mathbf{100\%}$$

= 0,6604 x 100%

= 66,04%

Distilate Water Flow

Qreal = 44,12

Qmax = 60

$$\text{Persentase} = \frac{\mathbf{44,12}}{\mathbf{60}} \times \mathbf{100\%}$$

= 0,7353 x 100%

= 73,53%

Condensate Water Flow

Qreal = 4,9

Qmax = 10

$$\text{Persentase} = \frac{\mathbf{4,9}}{\mathbf{10}} \times \mathbf{100\%}$$

= 0,49 x 100%

= 49,00%

Sea Water to Ejector Condensor Flow

Qreal = 110,81

Qmax = 150

$$\text{Persentase} = \frac{\mathbf{110,81}}{\mathbf{150}} \times \mathbf{100\%}$$

= 0,7387 x 100%

= 73,87%

4.2 Percentage Calculation Results

Table 3. DP Flow Transmitter Performance Percentage.

Route	Performance percentage(%)
Sea Water Flow (feed)	66,04%
Distillate Water Flow	73,53%
Condesate Water Flow	4,9,00%
Sea Water to Ejector Condesor FLow	73,87%

From the table above, we can see that the highest performance is in the Distillate Water Flow and Sea Water to Ejector Condenser Flow lines, which can be seen more clearly in the bar chart below:

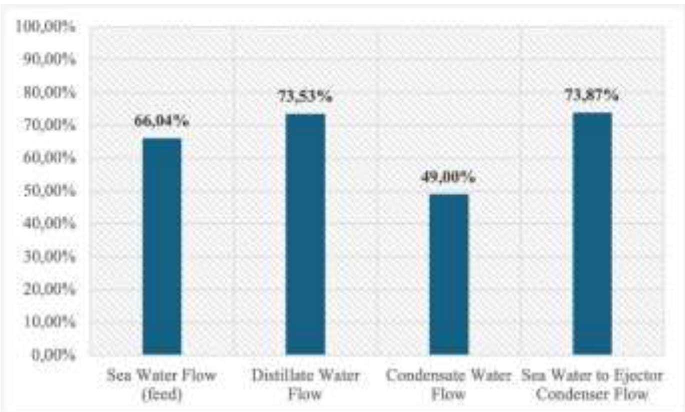

Figure 7. Bar Chart of DP Flow Transmitter Performance Results.

From the above data, it was found that the highest performance analysis on the Differential Pressure Flow Transmitter Instrument in the desalination section of the UBP Cilegon PLTGU was on the Distillate Water Flow and Sea Water to Ejector Condenser Flow lines. This result shows that instruments with the highest performance need to be monitored more closely, because instruments with high workloads generally experience damage or errors more quickly. These results show that all flow transmitters are still functioning properly, despite variations in performance between flow points.

5. Conclusion

Based on the results of the analysis, it can be concluded that the Azbil JTD920S Differential Pressure Flow Transmitter plays a very important role in supporting the desalination process at PT Indonesia Power UBP Cilegon's PLTGU. The accuracy of fluid flow rate measurements on this device has a direct effect on system efficiency and the continuity of cooling water and feed water supply to the power plant. The test results show that the transmitter's performance at each measurement point varies, with the highest performance values found in the Sea Water to Ejector Condenser Flow line at 73.87% and Distillate Water Flow at 73.53%, while the lowest value is found in Condensate Water Flow at 49.00%. This difference in performance indicates the need for more attention to transmitters at points with high workloads because they have the potential to experience damage more quickly. Preventive maintenance carried out routinely has been proven to maintain the accuracy and stability of transmitter performance, but periodic evaluations are still needed to identify critical points and ensure the reliability of the measurement system in the long term. Overall, the performance of the Azbil JTD920S transmitter is still in the good category, but optimization of the maintenance program needs to be continued so that the desalination process can run efficiently and sustainably.

References

Achmad, Sugeng, Riza, Erwin, & Risa. (2022). Penerapan metode HIRADC sebagai upaya pencegahan risiko kecelakaan kerja pada divisi operasi pembangkit listrik tenaga gas uap. *Jurnal Bisnis & Manajemen, 20*(2), 41–64.

Anandea Ragetisvara, A. (2021). Studi kemampuan desalinasi air laut menggunakan sistem Sea Water Reverse Osmosis (SWRO) pada kapal pesiar. *Jurnal Teknik ITS, 10*(2), 2337–3539. https://doi.org/10.12962/j23373539.v10i2.63933

Bakhrudin. (2017). *Seni memahami penelitian kualitatif dalam bimbingan dan konseling*.

Dadi Riskiono, S., Hamidy, F., & Ulfia, T. (2020). Sistem informasi manajemen dana donatur berbasis web pada panti asuhan yatim madani. *Journal of Social and Technology for Community Service (JSTCS), 1*(1). https://doi.org/10.33365/jta.v1i1.670

Dian. (2019). Pengujian orifice plate meter sebagai alat ukur debit air dengan kapasitas 8 LPM pada pipa PVC ½ inch dan ¾ inch (rasio = 0,19).

Ely. (2019). Kualitas air hasil desalinasi menggunakan sistem destilasi sederhana.

Faiz, A., & K. I. (2022). Urgensi pendidikan nilai di era globalisasi. *Jurnal Basicedu, 6*(3), 3222–3229. https://doi.org/10.31004/basicedu.v6i3.2581

Fatimah, L. A., & Hidayat, R. (2024). Analisis hasil studi kasus kalibrasi pressure transmitter dengan metode zero calibration. *Electron: Jurnal Ilmiah Teknik Elektro, 5*. https://doi.org/10.33019/electron.v5i1.109

Ghiffari, Johan, & Kahfi. (2024). Penggantian regulator pada radio transmitter Very High Frequency 125.1 Hz approach west. *Journal of Engineering and Transportation, 1*(4).

Ghurri, A., & Gunawan Tista. (2016). Pengujian orifice flow meter dengan kapasitas aliran rendah. *Jurnal Mechanical, 7*(2). https://doi.org/10.23960/mech.v7.i2.201610

Gilbert, D., Pardede, H., Maharani, A., Laju, P., Menggunakan, F., & Maharani Purba, A. (2021). Analisa pengukuran laju fluida menggunakan flow meter vortex dan differential pressure. *Jurnal Teknik Elektro, 3*(1). https://doi.org/10.51510/trekritel.v1i1.419

Gunoto. (2021). Analisa proses kalibrasi transmitter ketinggian air WTP pada pembangkit listrik di PT. Mitra Energi Batam. *Sigma Teknika, 4*(2), 187–198. https://doi.org/10.33373/sigmateknika.v4i2.3265

I Gede Yogi Dewantara. (2018). Desalinasi air laut berbasis energi surya sebagai alternatif penyediaan air bersih. *Jurnal Teknik Mesin (JTM)*. https://doi.org/10.22441/jtm.v7i1.2124

Kurniawan Putra, A., Pariaman, H., & PT Pembangkitan Jawa-Bali. (2020). Analisis energi dan eksergi pembangkit listrik tenaga gas-uap blok 1 unit pembangkitan Gresik. *Jurnal Power Plant, 8*(1). https://doi.org/10.33322/powerplant.v8i1.1048

Mansyur. (2023). Sistem level kontrol menggunakan differential pressure transmitter untuk tangki timbun CPO. *IRA Jurnal Teknik Mesin Dan Aplikasinya, 1*(3), 10–19. https://doi.org/10.56862/irajtma.v1i3.25

Pratama, A., & Rahmadewi, R. (2024). Sistem kontrol level transmitter pada tangki FA-920 di PT. Sintas Kurama Perdana. *Aisyah Journal of Informatics and Electrical Engineering*. https://doi.org/10.30604/jti.v6i1.175

Setyoko, B. (2006). Analisa efisiensi performa HRSG pada PLTGU. *Traksi, 4*(2).

Sitinjak, F. R., & Silalahi, F. T. R. (2023). Analisis strategi pemeliharaan preventive maintenance excavator menggunakan pendekatan AHP dan analisis sensitivitas. *Journal of Integrated System, 6*(2), 226–242. https://doi.org/10.28932/jis.v6i2.7633

Syahputera, A. (2022). Analisa kalibrasi level transmitter dengan metode uji lineritas arus pada plant kontrol level. *Jurnal Tektron, 6*(1).

Wahyu Irawan, O., Susdiawan Pratama, L., & Insani, C. (2021). Analisis termodinamika siklus pembangkit listrik tenaga uap kapasitas 1500 kW. *Jurnal Teknik Mesin-ITI, 5*(3). https://doi.org/10.31543/jtm.v5i3.579

Wani, A. S., Y. F. A., R. S., S. S., & S. D. Y. (2024). Penggunaan teknik observasi fisik dan observasi intelektual untuk memahami karakteristik siswa di sekolah menengah pertama. *Jurnal Pendidikan Tambusai, 8*(1), 3737–3743.

Yuniarti, R., A. F., L. Y. L., A. L., T. M. A., S. S., & S. S. (2022). Pengaruh temperatur dan arah aliran terhadap efektivitas penukar panas NTU pada alat penukar panas tipe plate and frame. https://doi.org/10.36055/jip.v11i1.13989