THE EFFECT OF CUSTOMER WATER METER CALIBRATION IN CONTROLLING LOSS LEVELS NON-PHYSICAL WATER TIRTAULI PDAM TOZAI INDAH LAMA RESIDENTIAL AREA PEMATANGSIANTAR CITY

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Abstract

The water meter is a tool used to calculate the volume of water distributed by PDAM (Regional Water Supply Company) to customers, so that the amount to be paid can be determined. Measuring the level of accuracy of the customer's water meter aims to analyze the level of deviation of water volume measurements by water meters that occur in the field. This study is intended to analyze the effect of water meter calibration on the level of non-physical water loss. The research was conducted on 88 house connections in the Tozai Indah Lama area, Pematangsiantar City by comparing the readings of the customer's water meter with a 20 liter volume vessel. This study covers the relationship between the level of accuracy of the water meter and water loss. From the research results, the level of water loss has decreased from the beginning5.87 %become5.32 %. to the total water loss rate.

Keywords: Effect of water meter calibration to reduce non-physical water loss.

INTRODUCTION

PDAM Tirtauli Pematangsiantar City is a business entity owned by the Pematangsiantar City Region which is engaged in managing and providing clean water needs. Apart from being social in nature, PDAM Tirtauli Kota Pematangsiantar also operates economically, which means it requires costs for its daily operations, which incidentally derives from the proceeds from selling water to consumers. However, loss of water is a classic problem that has no end, both physical and administrative leaks will result in losses for the Company in terms of revenue and will also harm consumers in terms of service, so to avoid these losses,

In order to be able to easily find out the amount of water produced as well as the water sold and the level of non-physical water loss in PDAM Tirtauli, Pematangsiantar City, the Tozai Indah Lama Housing area, Setia Negara Village, Siantar Sitalasari District, Pematangsiantar City requires good handling, including: maintenance, repair and it is no less important to calibrate the water meter in the field using a measuring vessel.

If the calibration has been carried out properly and correctly, the installed water meter can work optimally in accordance with existing standards, which in turn can reduce the Non-Physical Water Loss Rate so that it can increase revenue for PDAM Tirtauli Pemtangsiantar City as the clean water manager and improve the quality of service for

customers as consumers so that the water used is in accordance with the amount recorded in the water meter.

LITERATURE REVIEW

Calculation of Water Needs

The need for clean water in a service area depends on the activities and standard of living of the people in that area. The higher the level of activity and standard of living of a community, the greater the need for water.

Loss of Water

The definition of water loss is: the difference between the volume of water distributed and the recorded volume of water consumed. Water loss can be calculated using a practical formula that can be used:

$$Kehilangan\ air = \frac{\text{jumlah air di Distribusikan} - \text{jumlah air terjual}}{jumlah\ air\ di\ Distribusikan}\ x\ 100\%$$

Sources of Water Loss

Broadly speaking, water loss can be classified into two parts, namely:

A. Lostphysical water

Lostphysical water, namely: Leakage that is real (physical) which causes water to not be distributed (sold) to customers because water comes out of the pipe network for certain reasons.

B. Non-physical loss of water.

Non-physical loss of water, namely loss of water that is not clearly visible as loss of water, is generally of an administrative nature.

Water Loss Indication

There are several ways to indicate the possibility of water loss, including:

A. By comparing the amount of water produced with the recorded water usage (m3), meaning by looking at the water production data (from the engineering section) and comparing it with the recorded water usage data (from the production and financial administration sections), we can find out the possibility of unrecorded water use, if it turns out that the recorded water use is less than the amount of water produced. This way we justcan only determine the amount of water that is not recorded, but does not show all the water lost because what is meant by the amount of water lost is all unpaid water use (including recorded but unpaid water use).
B. By measuring the amount of water flowing at night and then comparing it with water use in one day.

Efforts to Prevent Water Loss

Loss of water will cause losses for drinking water companies as well as for consumers, both in terms of finance and in terms of quantity, quality and continuity of

water. Basically actions taken to prevent water loss are better than taking actions to overcome water loss. Therefore action as early as possible to prevent water loss is something that really needs to be done.

This water loss can occur due to leaks in the Distribution pipeline network and the existence of illegal connections. Sources of losses caused by leaks in the distribution network are usually caused by very high water pressure in the pipes, old pipes and the construction of pipe installation and planting, so that pipes break or pipe joints are released, for this reason prevention can be done by controlling/regulating water pressure on the pipe network. Meanwhile, to prevent unrecorded connections, it is necessary to check the possibility of unrecorded connections.

Introduction to Types of Water Meters

To find out the level of loss caused by the water meter used, it is necessary to know how the condition of the customer's water meter must be selected and in accordance with field conditions, namely pressure, flow and temperature conditions in the installation area. This is done so that the water meter can be used according to its function.

Types of Water Meters According to Construction

By paying attention to the physical water meter, the water meter can be identified according to the existing construction, such as:

A. Pitot tube type.

This kind of measuring device was first invented by Engineer Hendri Pilot at the Academic Royaledes Seine, with this tool it can be proven that there is a proportional relationship between the height of the water column in a pitot tube and the square of the linear velocity of water (fluid). Further refinement was carried out by Ir. Darcy, to stabilize the height of the water column (fluid). Meanwhile, the Bernoulli formula can be calculated on the basis of the height of the water column to determine the speed and volume of water passing through.

B. Turbine/propeller water meter type.

Basically these two water meters are almost the same. The difference is that the Turbine water meter starts to rotate if there is a stream of water moving it, while the propeller, if the corners are moved, the water around it flows. This type of water meter was first discovered by: Mr. Renhard Woltman. Its use is to measure air and liquids. Woltman water meter has a larger capacity with lower pressure loss but less sensitivity.

Classification of Water Meters

Water meters can be classified according to the flow volume contained in the water meter itself so that they can be grouped into:

A. *Displacements*Water meters.

*Displacements*Water metersAlso called Volumetric Water Meter, mainly used for relatively small flows. Usually used in consumers with small to moderate water usage. The working principle of this water meter is to pass water in part after it fills a cross-sectional section of the water meter with a known volume.

B. *Velocity*Water meters.

*Velocity*Water metersor measurement with speed, measuring flow (flow) by passing the water through a cross-section whose area is known. This group of water meters is usually used to measure large volumes of flow.

Characteristics of Water Meters

Each water meter has two characteristics, namely physical characteristics and performance.

A. Physical Characteristics.

Characteristics related to the size and weight of a water meter include nominal, maximum, minimum, transition capacities, as well as the level of accuracy of measurement for a particular flow.

B. *Characteristics*performance.

In discussing the characteristics of the water meter, especially the performance characteristics, there are several discharge quantities (Q) that must be considered in relation to the measuring ability of the water meter. The applicable standard provides the tolerance limit for error, uncertainty and measurement sensitivity required based on the decision of the Directorate of Metrology Number 1025/3344/1983 chapter III article 11 Directorate of Metrology 1983

KWater meter measuring ability.

The measuring capability of each water meter depends on the classification of the type of water meter and the flow volume used where the maximum measuring ability (Qmax) is 3m3/hour and fulfills the maximum allowable error with the sensitivity (starting-flow) according to the class of water meter.

METHOD

Location and Time of Research

A. Location

The location where the research will be carried out is the customer of PDAM Tirtauli, Pematangsiantar CityTozai Indah Lama Residential Area, Naga Huta Village, Sitalasari District, Pematangsiantar City with a total of 198 Home Connection (Installation) customers with Active Customer status.

B. Research time

When the research was carried out in July 2018 for data collection and continued data processing and data analysis from July to August 2018

Method of collecting data

A. *Observation.*

*Observation*are observations made while carrying out research activities carried out, to obtain information about PDAM Tirtauli City of Pematangsiantar data and other field data, which will be used in discussing the problem.

B. Interview.

Interview is an activity to obtain or collect data that is not obtained in the field, because this is for complementary data that can be used as reference material or guidelines without using the basis of a book, by asking directly to the meter recorder or other sources. can be trusted.

C. *Literature Study.*

Literature study is an activity that aims to understand a problem that is the same as a guide/instruction that has been poured into a book, this activity is carried out to compare and also as a reference from the average usage of customers from April to July 2018 which experienced a decrease in usage every month and the level of non-physical water loss that occurs in the research area, thus a study was conducted on the performance of water meters using the "Customer Water Meter Calibration To Control Non-Physical Water Loss Levels" method using a tool: a 20 liter volume vessel.

D. Data source

All activities carried out during the implementation of the research are known in advance regarding the data needed.

E. Data Processing Techniques.

The data processing technique used is data obtained from the results of research activities in the Tozai Indah Lama area, Pematangsiantar City, which is field data that has been absolutely implemented and has been used as a standard or benchmark for the study area for optimal research, then collected and used for Research Report material.

RESULTS AND DISCUSSION

A. Results

1. Water Meter Analysis in the Field Before Accuracy Testing and After Accuracy Testing in the Field.

To determine the accuracy of the water meter operated at the customer, a water meter accuracy test was carried out using a 20 liter volume vessel. Calculations are made to find out how accurate the customer's water meter is based on a survey conducted in the field in July - August 2018. The accuracy test is carried out by pouring water into a 20-liter glass vessel and comparing the difference between the final meter stand and the customer's initial stand meter. The tests carried out were

3 (three) times the tests were carried out directly at one of the Customer's existing faucets, the length of time for each test per unit was 15 minutes.
Example of metering water in the field:
Name/Address : RONI Br. LUBIS / JLN. TO A BEAUTIFUL VILLAGE.
Channel number : 11.01.170.050
No mether : 112996

Testing I

Initial stand : 271.9
final stand : 290,5
vessel volume : 20 liters
Entered in the formula :

$$\text{x100\%Selisih} = \frac{(\text{stand akhir} - \text{stand awal}) - \text{Volume bejana}}{\text{Volume bejana}}$$

$$\text{Selisih} = \frac{(290{,}5-271{,}9)-20}{20}\text{x100\%}$$

$$\text{difference} = \frac{(290{,}5-271{,}9)-20}{20}\text{x100\%}$$

$$= \text{x } 100\% \frac{(18{,}6)-20}{20}$$

= -7%

Testing II

Initial stand : 290,5
final stand : 309.5
Vessel volume: 20 liters

$$\text{Selisih} = \frac{(\text{stand akhir} - \text{stand awal}) - \text{Volume bejana}}{\text{Volume bejana}}\text{x100\%}$$

$$\text{Selisih} = \frac{(309{,}5-290{,}5)-20}{20}\text{x100\%}$$

$$= \frac{(19)-20}{20}\text{x100\%}$$

= -5%

Testing III

Initial stand : 309.5
final stand : 327,2
Vessel volume: 20 liters

$$\text{Selisih} = \frac{(\text{stand akhir} - \text{stand awal}) - \text{Volume bejana}}{\text{Volume bejana}}\text{x100\%}$$

$$\text{Difference} = \frac{(327{,}2-309{,}5)-20}{20}\text{x100\%}$$

$$= \frac{(17{,}7)-20}{20}\text{x100\%}$$

= -11.5%

From the results of the tests carried out so that the average can be:

Difference $= \frac{(-7)+(-5)+(-11,5)}{3}$

= -7.8%

With an average yield of -7.8%, it is known that the water meter tested is not suitable for use because according to the law of the Directorate of Metrology, the allowable difference is -5% to +5% which is still considered normal.

2. Water Loss Before And After Water Meter Calibration

Calculations are made at the level of water loss before and after replacing the water meter at both the customer and main water meter levels. The water loss rate before and after the Water Meter Calibration is as follows:

Table.5.5. Water Loss Rate Before and After Water Meter Calibration

No	Month	Number of Customers (HOUSE CONNECTIONS)	Distribution	Water sold	Loss of water	
			(m^3)	(m^3)	(m3)	(%)
1	December	198	4,352	4,292	60	1.37
2	January	198	3,670	3,602	68	1.85
3	February	198	3,730	3,606	124	3,32
4	March	198	4,245	4.103	142	3,34
5	April	198	3,934	3,879	55	1.39
6	May	198	4,982	3,792	190	4.77
7	June	198	4,437	4,281	156	3.35
8	July	198	4,356	4,174	182	4,17
9	August	198	4,572	4,511	61	1.33
Amount			38,278	36,240	1038	
Average			4,253.11	4026.66	226,44	5,32

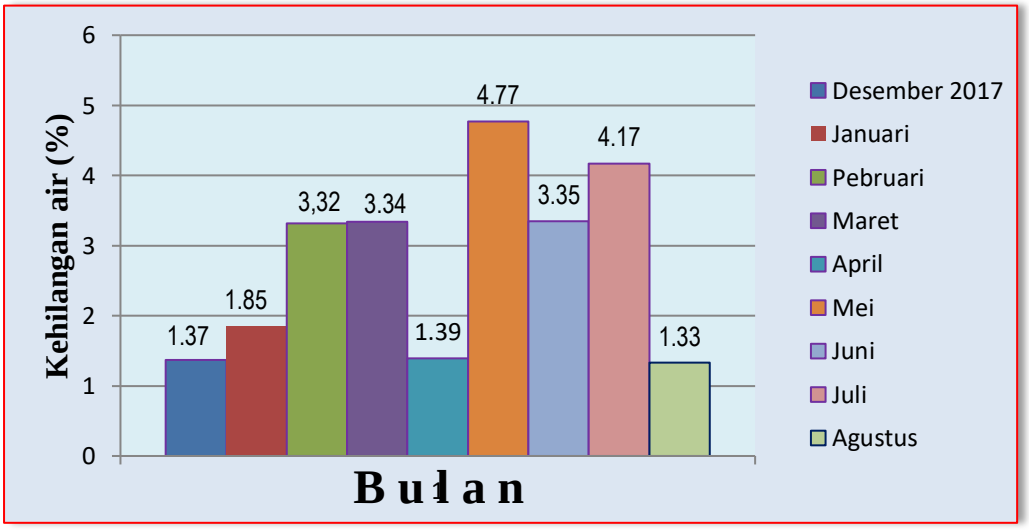

Fig.5.2. Water loss graph

B. Discussion

1. **Quality and Condition of Customer's Water Meter Tested for Accuracy in the Field.**

   The quality and condition of the water meters used in Tirtauli, Pematangsiantar City at this time, based on the accuracy tests carried out, found that 88 units of water meters that were not suitable for use had been replaced with new water meters or in accordance with the 1983 Directorate of Metrology standards of 50 units.

2. **Comparison of the Level of Water Loss Before and After Replacement of the Water Meter**

   Before replacing the water meter by PDAM Tirtauli Pematngsiantar City in the study area, from December 2017 to July 2018, the average water loss rate5.87%, whereas after replacing the water meter and from December 2017 to August 2018, the water loss rate decreased to5,32%, this shows in the feasibility study of replacing the water meter which is carried out after the calibration of the water meter can reduce the level of water loss and increase the income of PDAM Tirtaili City, Pematangsiantar City.

3. **The Effect of Water Meter Calibration to Reduce Non-Physical Water Loss Levels.**

   Accuracy of Water Meter To find out how the percentage deviation of the water meter with the allowable tolerance limit is to calculate the average percentage deviation from the research data at each study location. The accuracy value of the water meter for each discharge is shown inTable 5.3for each Unit. The result of this accuracy test is that water meters aged 1, 2, 3, and 6 years in the study area do not meet the SNI criteria because they have a measurement deviation of more than 5%. Water meters that contribute the most water loss are water meters aged 3 years and 6 years,

4. **Income Level Analysis after Customer's Water Meter Replacement.**

   By calibrating and replacing the water meter, it can increase the income of PDAM Tirtauli Pematangsintar City, this can be proven by:

   A. Sales prior to water meter accuracy and replacement:

      From December 2017 to July 2018, the average water sold was**31,729 m3,**and the rate of water loss is5.87% or 977 m3

   B. Sales after water meter accuracy and replacement:

      In 2018 for 8 (eight) months, the average water sold was**36,240 m3**and the rate of water loss is5.32% or 1,038 m3.

CLOSING

Conclusion

A. After testing the accuracy and replacing the customer's water meters in the field as many as 50 units, the level of water loss has decreased from before5.87 %become5.32 %.
B. Calibration and replacement of water meters can still increase the revenue of PDAM Tirtauli, Pematangsiantar City:
    1. Prior to the calibration and replacement of the water meter in July 2018, water was distributed**4,356 m3**whereaswater sold for**4,174 m3,**and water loss rate of 4.17% or equal to**182**m3
    2. After calibrating and replacing the water meter in August 2018, the water was distributed**4,572 m3**whereaswater sold for**4,511**m3 , and the rate of water loss is 1.33% or 61 m3.
C. The test equipment used in the field uses a vessel with a volume of 20 liters.
D. The research results show that water meters aged 3 and 6 years in the study area have deviations of more than -5% to +5%.

Suggestion

A. It is expected that every water meter that is over 5 years old needs to replace the water meter or replace it periodically.
B. If there is still usage below the average of 18 m3 per month, it is necessary to conduct a survey of the number of occupants at least once every 6 months.
C. Before replacing the water meter should be tested first in the field.
D. It is recommended that the water meter used by the customer must really pass the accuracy test, both in the field and in the water meter workshop.

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