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ANALYSIS OF VEGAPULS64 LEVEL TRANSMITTER USAGE IN PT ENERGI SEJAHTERA MAS

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Abstract

PT Energi Sejahtera Mas (ESM) is an oleochemical manufacturing company based in Dumai, Riau, Indonesia. PT ESM uses various instruments in their plants to support production processes. While author's internship was underway, 3 level transmitters were replaced with VEGAPULS 64 in tank farms, which were on T-1225, T-1228, and T-1134 tanks.Analysis is performed on these three new level transmitters to see if VEGAPULS 64 is applicable on tank farms. Both new and old transmitters are compared by how much error they made while measuring medium's height in tanks.The result shows that VEGAPULS 64 usage on T-1225 and T-1134 gives a more accurate measurement than the previous level transmitter. But, on the other hand, it causes more error on T-1228. There are some possibilities that might cause this to happen, which are wrong parameter adjustment, the signal's polarization direction, or human error. Changing the parameter is recommended because the value is different with the one it supposed to be.

Keywords: *PT Energi Sejahtera Mas, VEGAPULS 64, Level transmitter, Tank farm.*

Introduction

PT Energi Sejahtera Mas (PT ESM) is an oleochemical manufacturing company based in Dumai, Riau, Indonesia. Their products are mainly divided into three categories, fatty acid, fatty alcohol, and glycerine.PT Energi Sejahtera Mas has numbers of infrastructures for supporting production process. One of those is tank farms, which is basically tanks for storing various chemicals.In addition to infrastructure, PT ESM also uses various instruments to measure certain quantities, such as level transmitter, pressure transmitter, temperature transmitter, etc. Every measurement result is sent to distributed control system (DCS) for monitoring purpose.There are 4 types of level transmitters that are being used by PT ESM during the making of this article, which are ABB K-TEK MT5200, ABB K-TEK MT5000, VEGAPULS 64, and E+H Micropilot FMR60. During author's internship in PT ESM, 3 ABB level transmitters on tank farms were replaced with VEGAPULS 64, which are in T-1225, T-1228, and T-1134 tanks.We want to analyse the performance of VEGAPULS 64 and decide whether it is suitable to replace those three level transmitters mentioned earlier.

1. Literature Review

1.1. VEGAPULS 64

VEGAPULS 64 is a level transmitter produced by VEGA Grieshaber KG. This level transmitter uses a principle called frequency-modulated continuous wave (FMCW) to measure the distance between transmitter and surface of a media.

An electromagnetic wave with continuously changing frequency over time is transmitted vertically down to surface of a media. The reflected signal is received by the level transmitter back. The time needed for transmitted signal to return is the key to determine distance between level transmitter and media surface.

Fig. 1
VEGAPULS 64 Source: www.vega.com

1.2. ABB K-TEK MT5000 and MT5200

ABB K-TEK MT5000 and MT5200 are level transmitters produced by K-TEK, a company that has been acquired by ABB. These level transmitters have three main parts, which are probe, coupler, and housing. A probe is the part that is set to touch a media we want to measure.

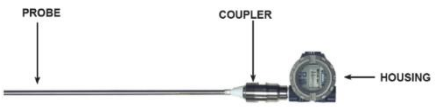

Fig. 2
ABB K-TEK Guided Wave Radar Level Transmitter Source: K-TEK
(a) MT5000 & (b) MT5200

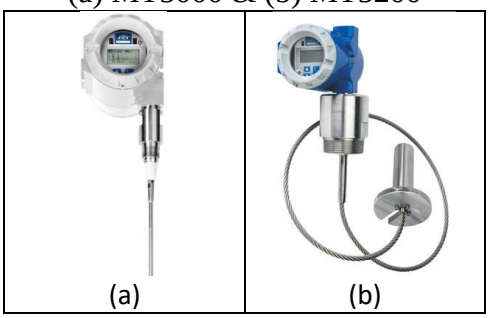

Fig. 3
ABB K-TEK Source: K-TEK

The way they work is by sending an electromagnetic wave along its probe to surface of measured media. Some of the signal is reflected by the media and received by the level transmitter. The distance between level transmitter and the media is determined based on how long the signal travels.

2. Research Method

We analyse the result based on errors made by ABB and VEGAPULS 64 measurement. Two types of graphs are created based on data we get, which are records of error produced by each type of level transmitters and records of error before and after a level transmitter being replaced on tank farms. Analysis on E+H Micropilot FMR60 cannot be done because there is only one of it currently being used on tank farms, which might give an inaccurate result.Every data we need are received from study of literature, company's documentation, and primary data.

3. Results and Discussion

3.1. Strength and Weakness of VEGAPULS 64, ABB K-TEK MT5000, and MT5200

a. VEGAPULS 64

Strength

1) Does not need any contact with measured media.
2) Has false signal suppression feature to ignore any false echoes.
3) May ignore dielectric constant while measuring distance / level.

Weakness

1) Has a beam angle that might create false echoes from any object inside tank except measured media.

b. ABB K-TEK MT5000 and MT5200

Strength

1) Signal is focused on probe and has no beam angle.

Weakness

1) A relatively viscous or paste-like media might stick on probe.
2) When measured media inside of a tank is changed, then dielectric constant setting in level transmitter also needs to be changed.

3.2. Analysis of each level transmitters

Three samples are chosen for each level transmitters to create error graphs. Error graph of VEGAPULS 64 uses data from T-1110, T-1115, and T-1125 tanks. T-1108, T-1151, and T-1221 tanks for ABB K-TEK MT5000. T-1126, T-1204, and T-1205 tanks for ABB K-TEK MT5200

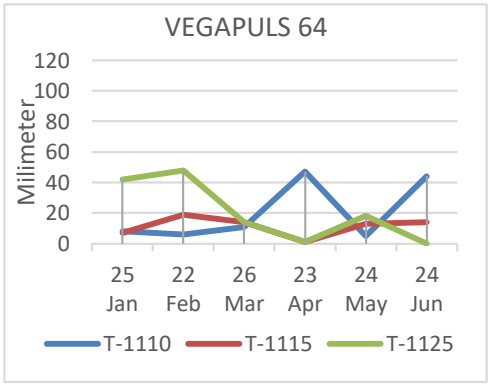

Fig. 4
Error graph from measurement by VEGAPULS 64 (January – June 2021)
Source: Primary Data

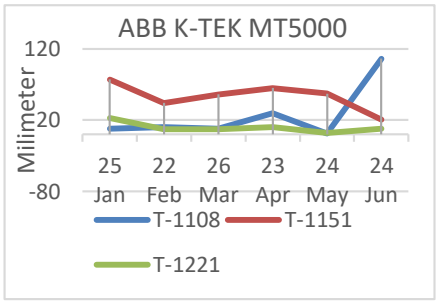

Fig. 5
Error graph from measurement by ABB K-TEK MT5000 (January – June 2021)Source: Primary Data

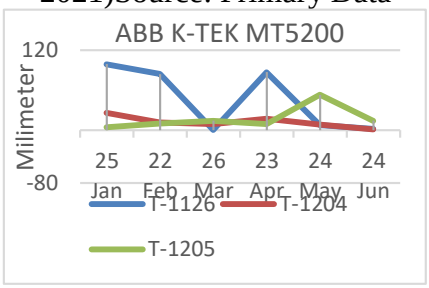

Fig. 6
Error graph from measurement by ABB K-TEK MT5200 (January – June 2021)Source: Primary Data

Condition of each tank is unknown when data is obtained. So there is a probability where a tank is being fed or its content is fed to other tank. Also, a media inside a tank might be replaced at any time and causing some changes in dielectric constant of media inside a tank. This might a cause for errors in ABB K-TEK MT5000 and MT5200.Based on graphs in Fig. 4 to 6, only VEGAPULS 64 has error below 50 mm. It shows that level measurement by VEGAPULS 64 is relatively more stable than both ABB level transmitters.

3.3. Analysis on T-1225 Tank

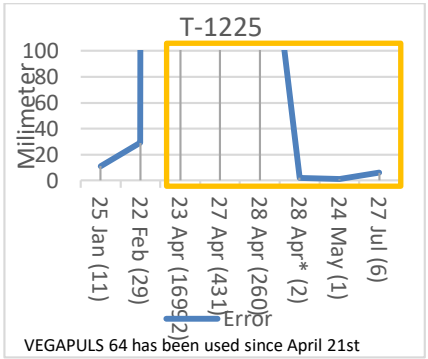

Fig. 7
Error graph from level transmitter's measurement on T-1225
*After troubleshooting
Source: Primary Data

ABB K-TEK MT5000 at T-1225 was changed with VEGAPULS 64 on April 21st, 2021. There was water inside its housing and caused some damage to the old level transmitter. When VEGAPULS 64 was installed, its measurement was relatively very bad, and it needed troubleshooting for a few times. Since April 28th, 2021, the error it caused is almost 0 mm.

3.4. Analysis on T-1228 Tank

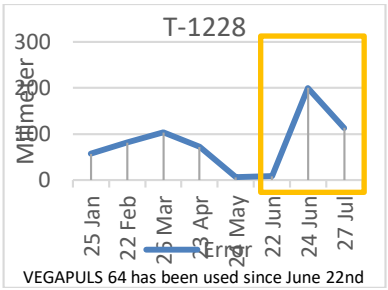

Fig. 8
Error graph from level transmitter's measurement on T-1228
Source: Primary Data

ABB K-TEK level transmitter was replaced with VEGAPULS 64 on June 22nd, 2021. At beginning, its reading was quite accurate, with 8 mm error. But it suddenly spiked since June 24th.There are some factors that can affect measurement by VEGAPULS 64, such as setting, installation, and tank's condition.Distance between VEGAPULS 64 to tank's wall and temperature inside the tank are still in valid range, so these two are not the cause of error.The direction where VEGAPULS 64 face determines its signal polarization direction. But the recommended direction is yet known, which might be the reason for an error in measurement. Further analysis is necessary to determine if VEGAPULS 64 in T-1228 has been installed correctly.Another factor that might cause an error is settings in VEGAPULS 64.

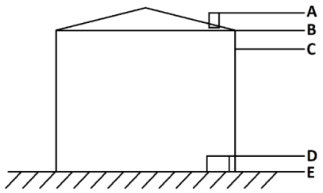

Fig. 9
Illustration of a tank in tank farms Source: Primary Data

These are the details for T-1228 tank in PT ESM:
Measuring hole A-D = 18525 mm
Tank's height B-E = 18322 mm
Media maximum height C-E = 18000 mm
Sounding table D-E = 160 mm
Tank's base E = 0 mm

Point D shows the position of sounding table in a tank. Point D is considered as a point with height of 0 mm or reference point in level measurement. Point C is the upper limit for media storage. Point A is the position for installing level transmitter, hence distance A-D and A-C become the minimum and maximum adjustment in VEGAPULS 64 setting.Maximum height set for media inside the tank is 18000 mm measured from sounding table (point D). This means that distance D-C should be 18000. But calculation based on data above shows that its distance is 17840. So, it is necessary to fix the tank data.Distance of A-D is 18525 mm, so A-C should be 525 mm so D-C could be 18000 mm. Recommended value for minimum and maximum adjustment in VEGAPULS 64's setting are 18525 mm and 525 mm.Data in the field shows that minimum and maximum adjustment used are 18150 mm and 130 mm. Those numbers are different with our recommended value, which might be the reason why the level transmitter causes error.Other than mentioned factors earlier, human error might also be the reason why high error happens on VEGAPULS 64. Mistakes in determining its actual level when doing direct measurement also could happen. To prevent this, the person who does manual sounding should know about tank's data, so it is possible to predict if manual measurement has been done correctly.

3.5. Analysis on T-1134 Tank

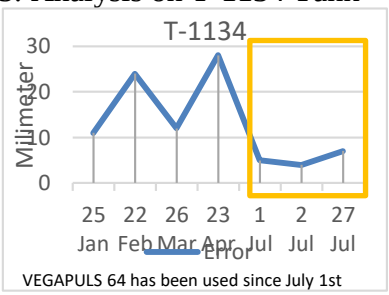

Fig. 10
Error graph from level transmitter's measurement on T-1134Source: Primary Data

A few days before ABB K-TEK MT5200 is replaced with VEGAPULS 64, its reading had a very high error. Troubleshooting had been performed, but there was no sign of good result. The cause for this problem had not been found. That is why the old level transmitter is replaced with VEGAPULS 64.After getting replaced with VEGAPULS 64, error in T-1134 was reduced by a significant amount. This shows that VEGAPULS 64 is suitable for level measurement in T-1134.

4. Conclusion

(1) VEGAPULS 64's performance on T-1225 and T-1134 is good and relatively better than the ABB K-TEK level transmitters.
(2) VEGAPULS 64 level measurement on T-1228 tank is yet considered good because it still has error above 100 mm.
(3) It is recommended to change maximum and minimum adjustment setting on T-1228's VEGAPULS 64 because the value being used at this moment are different with the recommended value.

(4) Further analysis is necessary on how the direction VEGAPULS 64 face affects its level measurement.

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