Kansas Pipeline Safety Seminar 2023

RECTIFIER BI-MONTHLY CHECKS
WHAT ARE WE READING?

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Agenda

- Types of rectifiers
- Safety
- Main components of a rectifier
- Readings
- What are we looking for in our readings?
- Adjustments if needed and why
- Questions

Types of rectifiers:

Alternating current (A/C) - Single phase and three phase

Constant voltage – Most Common

potential controlled

Solar – Need battery backup for Nighttime and overcast days

Thermal electric generators (TEG) – Use a fuel supply

Wind – Uses battery backup

Safety:

Before touching or entering the rectifier case

Listen for abnormal humming sounds

Burnt electrical smell

Check for voltages on the case of the rectifier – Should be case grounded

- Use voltmeter set on A/C from the case of the rectifier to the pole ground

- Use an A/C voltage sensing probe

Be aware when opening the case for insects - snakes

What are the main components of a rectifier?

Case

Transformer – Steps down A/C to a usable voltage

Rectifier Bridge (Stack)
Converts A/C to DC

- Selenium
- silicon diodes

DC OUTPUT CABLE CONNECTIONS

Negative lead from the rectifier goes to the structure (pipeline – tank bottom)

Positive lead from the rectifier is connected to the Anode(S) AND ONLY TO THE ANODES

If not configured in this manner, you are creating a hazard to your system. You will have rapid corrosion consuming your pipeline or tank bottom creating a leak while protecting your anodes….

If you do not know your cable configuration, take a pipe to soil on them - the pipeline lead will be more negative and the anode lead will be less negative if not positive in polarity…

Another method is to locate the leads the negative should take you to the structure (pipe or tank) while the positive should stop at the ground bed or the end of the last anode.

Kansas Regulations

§192.465 External corrosion control: Monitoring. [K.A.R. 82-11-4(15), (16), (17) (18)]

NOTE: ~~STRIKEOUT~~ and **BOLD** text are changes to K.A.R.'S

~~(a) Each pipeline that is under cathodic protection must be tested at least once each calendar year, but with intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of §192.463. However, if tests at those intervals are impractical for separately protected short sections of mains or transmission line, not in excess of 100 feet (30 meters), or separately protected service line, these pipelines may be surveyed on a sampling basis. At least 10 percent of these protected structures, distributed over the entire system must be surveyed each calendar year, with a different 10 percent checked each subsequent year, so that the entire system is tested in each 10 year period.~~

(a) Each pipeline that is under cathodic protection shall be tested at least once each calendar year, but in intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of 49 C.F.R. 192.463. If tests at those intervals are impractical for separately protected short sections of mains or transmission lines not in excess of 100 feet, or separately protected service lines, these pipelines may be surveyed on a sampling basis. At least one-third of the separately protected short sections, distributed over the entire system, shall be surveyed each calendar year, with a different one-third checked each subsequent year, so that the entire system is tested in each three-year period.

(b) Cathodic protection rectifiers and impressed current power sources must be periodically inspected as follows:

(1) Each cathodic protection rectifier or impressed current power source must be inspected six times each calendar year, but with intervals not exceeding 2 ½ months between inspections, to ensure adequate amperage and voltage levels needed to provide cathodic protection are maintained. This may be done either through remote measurement or through an onsite inspection of the rectifier.

(2) After January 1, 2022, each remotely inspected rectifier must be physically inspected for continued safe and reliable operation at least once each calendar year, but with intervals not exceeding 15 months.

Reading a rectifier

DC volts – Set voltmeter on Volts DC place the positive lead on the positive output of the rectifier and the negative lead on the negative lead of the rectifier and record reading in survey book

10.85 DC Volts

Reading a rectifier

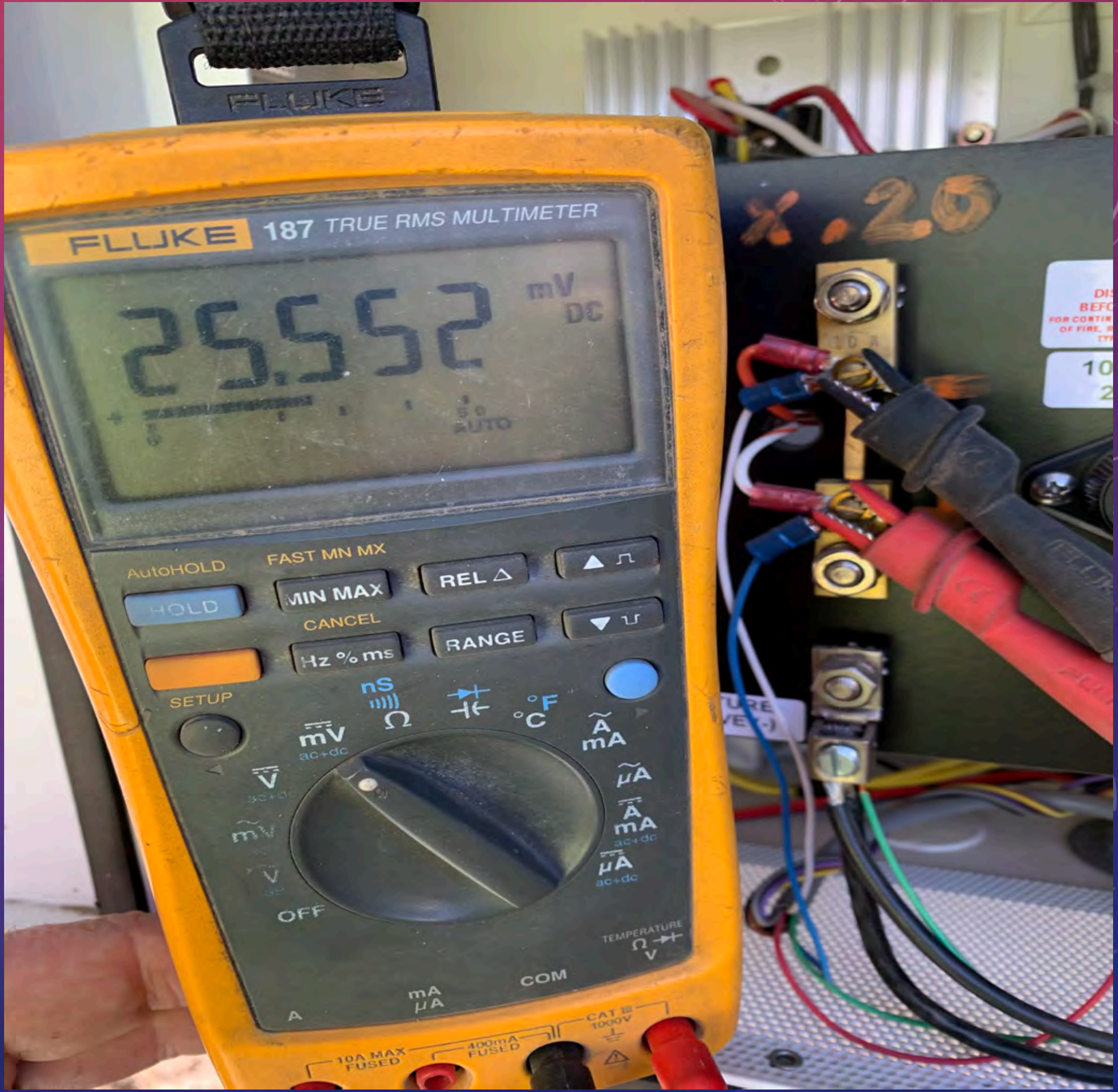
DC Amps

With the voltmeter set on millivolts take a reading across the center most pins on the shunt and remember this reading.

To calculate amperage according to Ohm's law you need to know two of the three factors to calculate the third. In this case we have a millivolt reading and calculating the resistance of the shunt we can calculate the Amperage.

E= IR this shunt is a 50mv 10 A shunt
So, 10/50 = 0.2

25.55 X 0.2 = 5.11DCA



Now that we have a DC Volts reading and a DC Amps reading, we can calculate the resistance of the system.

In this case we had 10.85 DCV and 5.11 DCA

Using Ohms law E=IR 10.85DCV = 5.11DCA R

R= 10.85/5.11

R=2.12 Ohms of resistance

Be advised that this resistance reading is the entire circuit. The wire, the pipeline, the electrolyte and electrical components.

What does this resistance read mean?

As resistance increases the amperage is lowered. The pipeline and circuitry most likely is not changing what does? The Electrolyte with seasonal weather changes or the ground bed is becoming higher resistant or depleting.

If we know the current requirements for this pipeline or tank bottom from previous history or testing, how do we overcome the resistance of the circuit?

Tap up the rectifier to the voltages needed to get the current (amperage) requirements needed. Voltage is like pressure in a water hose the higher the pressure the more water you get out the end.

This also works in reverse, if the resistance of the electrolyte is reduced you may have to lower the input voltages to lower the current output.

How do we know if we have too much current?

Perform an instant off near the rectifier.

If the off reading is lower (less negative) than -1.200mv the settings are OK.

If they are above -1.200MV threshold, the rectifier output needs to be reduced to a level that produces and instant off less than -1.200

If the rectifier has been down or out of service for an extended period, the output may have to be reduced upon startup so that the requirements are not exceeding the threshold limits of the rectifier.

In this case the rectifier output must be reduced to a level that the rectifier is able to remain operating and as the pipeline becomes more polarized the rectifier output can be increased to its normal operating status.

Maintenance Issues

Neglect – dirt – insects - nests

Lightning

Age

Challenging System Short

Cathodic zone in system reading in the -0.300's indicating a potential shorted zone within the system. Sacrificial system (Anodes)

Set up the short locator early in the AM and would short locate for a short period of time then the short locator would drop off and the p/s potentials would revert to near normal

This happened for 3 days in a row indicating that I had an intermittent short.

The shorted condition was narrowed down to only happening in the mornings for a short period of time.

later, the 3rd morning walking the whole zone looking for a dog chain or something that was taking pace on a timely manner that might be obvious.

On the 4th morning within the shorted time frame (narrowing down the scope)using the short locator, I was able to locate the issue causing the shorted zone.

Any Thoughts as to what it might have been?

ANY QUESTIONS?

THANK YOU!