

เอกสารแนบที่ 1-11

เอกสารการตรวจสอบสภาพท่อ

ที่ นวร-บร. 129/2565	เขียน ผศผ.
จาก นวร-บร.	
เรื่อง ผลการตรวจสอบข้อส่งน้ำมันเตา	
วันที่ 17 มิถุนายน 2565	

3. มีการทำ Fuel Oil Pipe Line Leak Test เมื่อวันที่ 12 เมษายน 2565 โดยวิธีปิดวาล์วหัว-ท้ายของท่อส่งน้ำมันเตา
เติมน้ำมันเตาเข้าไปในท่อเพื่อเพิ่มแรงดันที่ 3.4 Bar และ อีก 1 ท่อเพื่อปิดวาล์วประมาณ 4 Bar หลังจากการเพิ่มแรงดันและบันทึกทั้งการ
การลดลงของแรงดันในท่อ ผลการทดสอบพบว่าระดับแรงดันของท่อภายในท่ออยู่ลดลงอย่างช้าๆเนื่องจากมีการรั่วซึมขนาดเล็ก
และอุปกรณ์ที่อยู่ในระบบท่อซึ่งไม่สามารถระบุ เพื่อหาสาเหตุของน้ำมันออกจากการทำงานของท่อ จากการพิจารณาเวลาการลดลงของ
แรงดันในท่อ และระยะเวลาในการซ่อมแซม โดยเพิ่มแรงดันภายในท่อจากแรงดัน 3.4 Bar ให้ได้ระดับ 4 Bar ใช้เวลาในการเดินท่อ 2-
3 นาที สรุปว่าท่อส่งน้ำมันในกรณี ขยะของเสียยังคงใช้งานได้ Fuel Oil Leak Test 12 April 2022

(นายอนุชิต เลื่องลือวุฒิ)

หน่วยวิศวกรรมและบำรุงรักษาโรงไฟฟ้าพลังความร้อน (นวร-บร.)
โทร.2400, 2409 โทรสาร.2404

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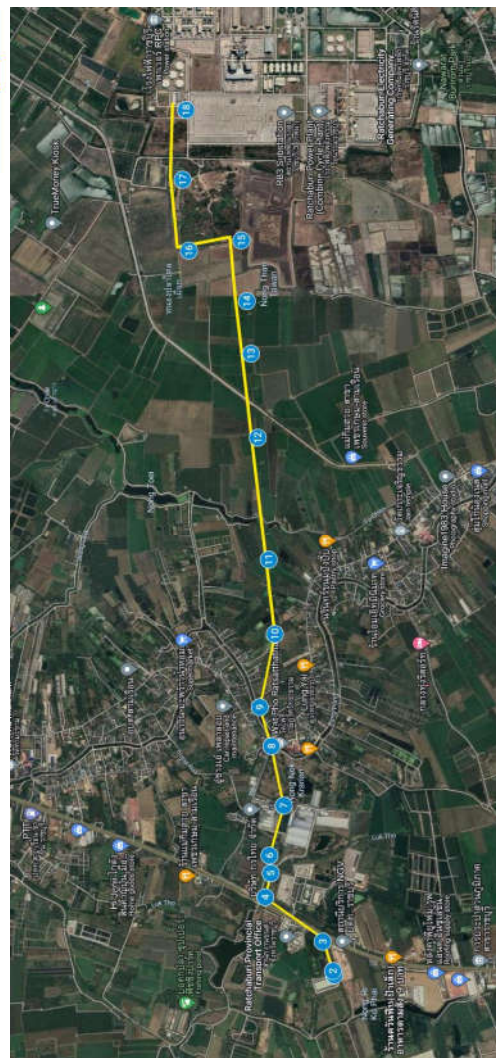
งานสำรวจแนวท่อส่งน้ำมันเตา
โรงไฟฟ้าพลังความร้อนบุรีรัมย์

หน่วยวิศวกรรมและบำรุงรักษาไฟฟ้าพลังงานร้อน

29 มิถุนายน 2564



แผนที่แนวท่อส่งน้ำมันเตา



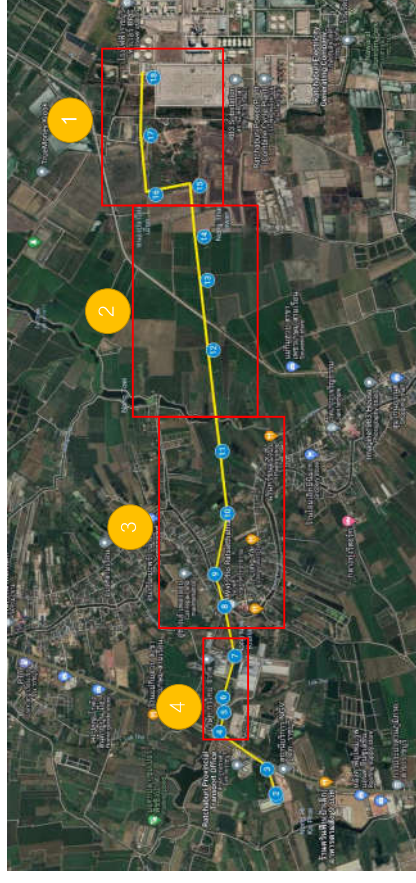
โทร.2400, 2409 โทรสาร.2404

ผลการสำรวจ : จุดที่ 1



แผนที่แนวท่อส่งน้ำมันเตา

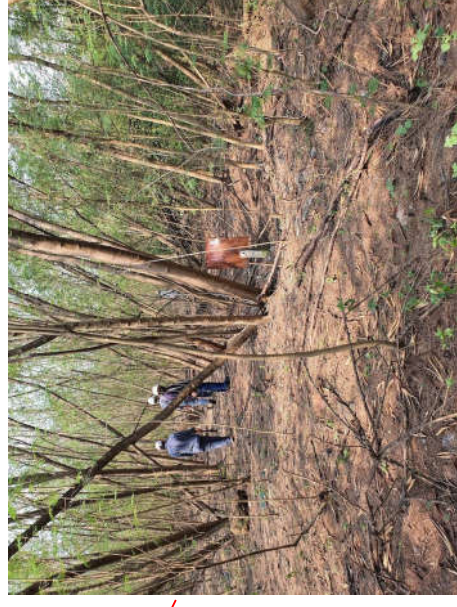
วันที่สำรวจ : 11 มี.ค. 65



ผลการสำรวจ : จุดที่ 1



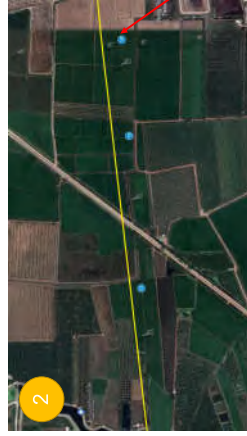
ผลการสำรวจ : จุดที่ 1



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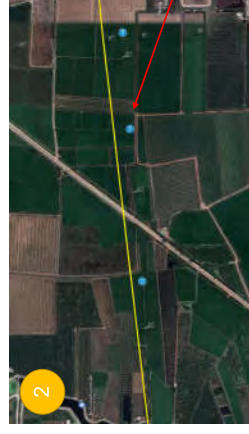
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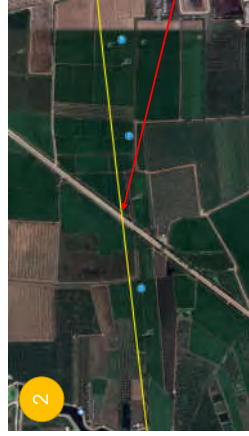
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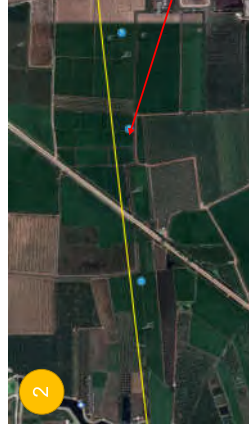
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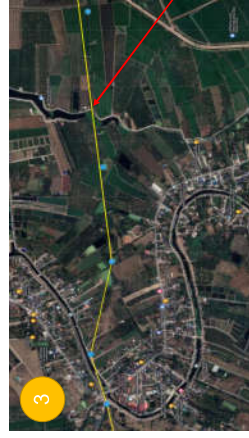
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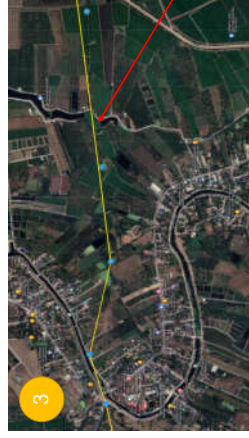
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ผลการสำรวจ : จุดที่ 2



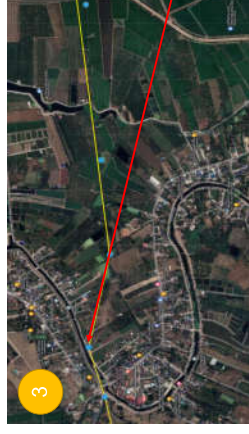
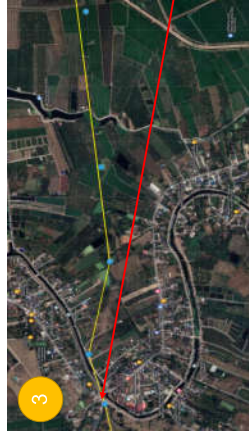
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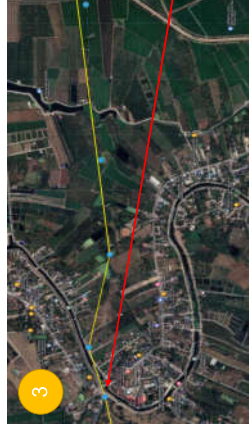
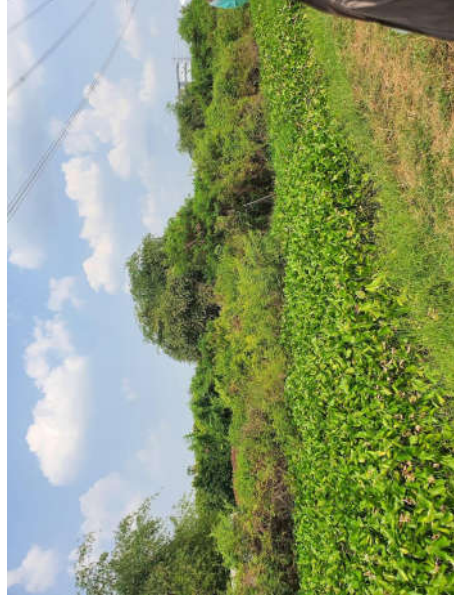
ผลการสำรวจ : จุดที่ 2



ผลการสำรวจ : จุดที่ 3



ผลการสำรวจ : จุดที่ 3





CONTENT

1. Introduction
2. DCVG (Direct Current Voltage Gradient) Coating Survey
3. Conclusion
4. Appendix

Cathodic Protection for Test Inspection

Ratchaburi Power Plant, Fuel Oil Pipeline DCVG Test Inspection Project.

submitted to
Electricity Generating Authority of Thailand.
April 18, 2022

prepared by
CPE Engineering and Service Co., Ltd.

Doc. No. : CPED-2022/018

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1. INTRODUCTION

Introduction

This document is specifically written for **Ratchaburi Power Plant, Fuel Oil Pipeline DCVG Test Inspection Project** in checking

- DCVG Coating Survey



CONTENT

- 2.1. DCVG Coating Survey Criteria
- 2.2. DCVG Coating Survey Test Procedure
- 2.3. Data Record Sheet

2. DCVG (DIRECT CURRENT VOLTAGE GRADIENT) COATING SURVEY

2.1. DCVG Coating Survey Criteria

The Criteria of Defect Severity is according to NACE SP0502-2007 Section A6.4.1

A6.4.1 Once a holiday is located, its size or severity is estimated by measuring the potential lost from the holiday epicenter to remote earth. This potential difference is expressed as a fraction of the total potential shift on the pipeline (the difference between the "on" and "off" potential, also known as the IR drop), resulting in a value termed the % IR.
DCVG survey readings are sometimes broken into four groups based on approximate size, for example, as follows :

A6.4.1.1 **Category 1:** 1 to 15% IR -- Holidays in this category are often considered of low importance, and repair is not required. A properly maintained CP system generally provides effective long-term protection to these areas of exposed steel.

A6.4.1.2 **Category 2:** 16 to 35% IR -- Holidays in this category may be recommended for repair, based on proximity to groundbeds other structures of importance. The holidays are generally considered of no serious threat and are likely to be adequately protected by a properly maintained CP system. This type of holiday may be slated for additional monitoring--fluctuations in the levels of protection could alter this status as the coating further degrades.

A6.4.1.3 **Category 3:** 36 to 60% IR -- Holidays in this category are generally considered worthy of repair. The amount of exposed steel in such a holiday indicates it may be a major consumer of protective CP current and that serious coating damage may be present. These holidays would normally be recommended for programmed repair, based on proximity to groundbeds or other structures of importance. They may be considered a threat to the overall integrity of the pipeline. As in **Category 2** holidays, this type of holiday may be slated for monitoring because fluctuations in the levels of CP could alter the status as the coating further degrades.

A6.4.1.4 **Category 4:** 61 to 100% IR -- Holidays in this category are generally recommended for immediate repair. The amount of exposed steel indicates that the holiday is a major consumer of protective CP current and that massive coating damage may be present. **Category 4** holidays typically indicate the potential for very serious problems with the coating and are often considered likely to pose a threat to the overall integrity of the pipeline.

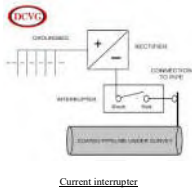
2.2. DCVG Coating Survey Test Procedure

Test Equipment

- 1) DCVG equipment completed set
- 2) Digital multimeter
- 3) Cu/CuSO₄ reference electrode
- 4) Temporary transformer rectifier
- 5) Temporary groundbed
- 6) Current interrupter
- 7) Hand tools

Test Procedure

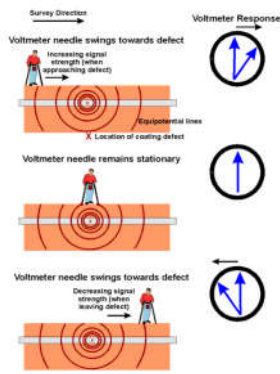
- 1). Install the temporary CP system.
- 2). Insert the interrupter between the (-) terminal of the temporary transformer rectifier and the negative cable. The interrupter should be set at a cycle "On" 0.45 sec, "Off" 0.8 sec.
- 3). Turn on the temporary transformer rectifier and the interrupter.
- 4). Turn on the DCVG equipment and measure the pulse signal strength by taking the one of probe from the DCVG equipment contact to the pipe cable from the CP test post and the another probe from the DCVG equipment place on the grade above the underground pipeline to be tested.
- 5). Adjust the temporary transformer rectifier until the measurement of the DCVG pulse signal strength is more than 500 mV.
- 6). When make the DCVG survey, place the both probes from the DCVG equipment on the grade above the underground pipeline to be tested about 1.5-2.0 m probe spacing. The probe direction is placed either parallel or perpendicular with the pipeline direction.
- 7). Move the both probes from the DCVG equipment forward about 1.5-2.0 m distance spacing and place them on the grade above the underground pipeline to be tested about 1.5-2.0 m probe spacing. The probe direction is placed either parallel or perpendicular with the pipeline direction.
- 8). During the DCVG survey, the DCVG pulse signal will be occurred if the both probes from DCVG equipment are placed on the defect gradient area. Mark the defect point at the highest DCVG pulse signal strength.
- 9). At the defect point, determine the severity of the defect in the term of %IR.
- 10). Make such the DCVG survey until finish.



Current interrupter



DCVG surveying



DCVG survey detecting the defect

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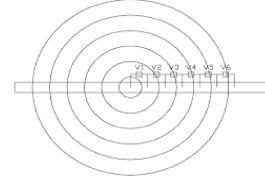
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2.3. Data Record Sheet

2.3.1.	CP DCVG Coating Survey for	Section TS1-TS3	from:	sta. 0+000	to:	sta. 0+260	,	0	Defects
2.3.2.	CP DCVG Coating Survey for	Section TS3-BB1	from:	sta. 0+260	to:	sta. 0+785	,	9	Defects
2.3.3.	CP DCVG Coating Survey for	Section BB1-BB2	from:	sta. 0+785	to:	sta. 0+950	,	5	Defects
2.3.4.	CP DCVG Coating Survey for	Section BB2-TS4	from:	sta. 0+950	to:	sta. 1+070	,	3	Defects
2.3.5.	CP DCVG Coating Survey for	Section TS4-TS5	from:	sta. 1+070	to:	sta. 1+425	,	9	Defects
2.3.6.	CP DCVG Coating Survey for	Section TS5-TS6	from:	sta. 1+425	to:	sta. 1+840	,	2	Defects
2.3.7.	CP DCVG Coating Survey for	Section TS6-TS7	from:	sta. 1+840	to:	sta. 2+120	,	10	Defects
2.3.8.	CP DCVG Coating Survey for	Section TS7-TS8	from:	sta. 2+120	to:	sta. 2+635	,	5	Defects
2.3.9.	CP DCVG Coating Survey for	Section TS8-TS9	from:	sta. 2+635	to:	sta. 3+145	,	2	Defects
2.3.10.	CP DCVG Coating Survey for	Section TS9-TS10	from:	sta. 3+145	to:	sta. 3+980	,	23	Defects
2.3.11.	CP DCVG Coating Survey for	Section TS10-TS11	from:	sta. 3+980	to:	sta. 4+550	,	18	Defects
2.3.12.	CP DCVG Coating Survey for	Section TS11-TS12	from:	sta. 4+550	to:	sta. 4+910	,	12	Defects
2.3.13.	CP DCVG Coating Survey for	Section TS12-BB3	from:	sta. 4+910	to:	sta. 5+325	,	19	Defects
2.3.14.	CP DCVG Coating Survey for	Section BB3-TS13	from:	sta. 5+325	to:	sta. 5+690	,	24	Defects
2.3.15.	CP DCVG Coating Survey for	Section TS13-TS14	from:	sta. 5+690	to:	sta. 6+230	,	29	Defects
2.3.16.	CP DCVG Coating Survey for	Section TS14-TS15	from:	sta. 6+230	to:	sta. 6+715	,	25	Defects
2.3.17.	CP DCVG Defect Conclusion								

%IR Determination

- 1). At the defect point, make sure where the center defect is.
- 2). From the defect center point, take the pipe to remote earth voltage drop of the each probe span until near zero.
- 3). Summarize each probe span voltage drop is over the line to remote earth voltage drop.

Over the line to remote earth voltage drop = $V_1 + V_2 + V_3 + \dots$

- 4). Determine the signal strength at the defect.

$$S_D = S_A - [(S_A - S_B) \times (d_A / (d_A + d_B))]$$

Where:

 S_D = Signal strength at the defect in mV S_A = Signal strength at the test station A before the defect in mV S_B = Signal strength at the test station B after the defect in mV d_A = Distance at the defect from the test station A in m d_B = Distance at the defect to the test station B in m

- 5). Determine %IR at the defect.

$$\%IR = \frac{\text{Over the line to remote earth voltage drop} \times 100\%}{\text{Signal strength at the defect}}$$

- 6). Compare %IR to the DCVG criteria to identify the severity.

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 289

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS1-TS3

from: sta. 0+000 to: sta. 0+260

No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG			Remarks
			North	East	Volt	Amp	Volt	Amp	Tap	
1	TA	TS8	11.60136	99.85152	100 V	30 A	90.36 V	7.09 A	-	sta.2+635

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

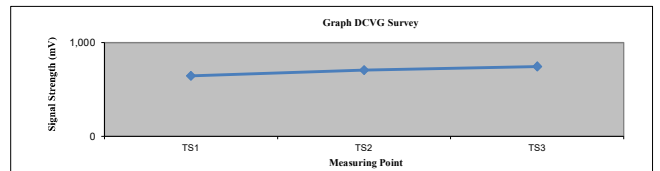
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	PS Potential (V)		Signal Strength (mV)	>800 mV Accept	Remarks
			North	East		TSN	TSR			
1	TP	TS1	11.59821	99.83012	Dry Soil	-1.569	-0.922	647	Yes	
2	TP	TS2	11.59830	99.83044	Dry Soil	-1.568	-0.861	707	Yes	sta.0+035
3	TP	TS3	11.59895	99.83221	Dry Soil	-1.685	-0.939	746	Yes	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion

X	After surveying, we have found " No Defect point "
	After surveying, we have found " Defect points "



CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS1-TS3

from : sta. 0+000 to : sta. 0+260



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS3-BB1

from : sta. 0+260 to : sta. 0+785



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS3-BB1

from : sta. 0+260 to : sta. 0+785

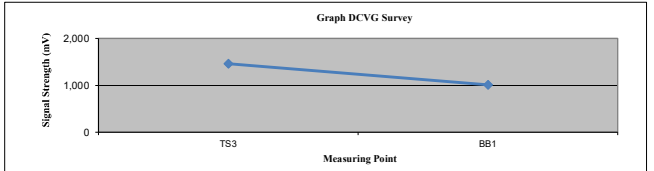
Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG		Remarks
			North	East	Volt	Amp	Volt	Amp	
1	TA	Negative Cable at Loading Station	(13.9885)	(99.8382)	100 V	30 A	34.41 V	20.37 A	-

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

Signal Strength Data										
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	>80 mV Accept	Remarks
			North	East		"ON"	"OFF"			
1	TP	TS3	13.9885	99.8321	Dry Soil	-2.346	-0.883	1,463	Yes	
3	TP	BB1	13.6024	99.8350	Dry Soil	-1.954	-0.941	1,013	Yes	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "
☒ After surveying, we have found " 9 Defect points "



1	Defect about	sta. 0+281	N = (13.9888	E = 99.83240	about	21	m.	after	TS3	sta. 0+260
2	Defect about	sta. 0+385	N = (13.9938	E = 99.83320	about	125	m.	after	TS3	sta. 0+260
3	Defect about	sta. 0+509	N = (13.6007	E = 99.83373	about	249	m.	after	TS3	sta. 0+260
4	Defect about	sta. 0+536	N = (13.6059	E = 99.83385	about	276	m.	after	TS3	sta. 0+260
5	Defect about	sta. 0+612	N = (13.6020	E = 99.83418	about	352	m.	after	TS3	sta. 0+260
6	Defect about	sta. 0+659	N = (13.6056	E = 99.83448	about	399	m.	after	TS3	sta. 0+260
7	Defect about	sta. 0+700	N = (13.6089	E = 99.83457	about	440	m.	after	TS3	sta. 0+260
8	Defect about	sta. 0+736	N = (13.60218	E = 99.83472	about	476	m.	after	TS3	sta. 0+260
9	Defect about	sta. 0+761	N = (13.60234	E = 99.83486	about	501	m.	after	TS3	sta. 0+260

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 0+281

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

from : sta. 0+260 to : sta. 0+785

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 21 m.
Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 504 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	0.260	(13.9885)	(99.8322)	Dry Soil	-2.346	-0.883	1,463	
Defect		0.281	(13.9888)	(99.83240)	Dry Soil			1,445	
TP after Defect	TP	0.785	(13.6024)	(99.8350)	Dry Soil	-1.954	-0.941	1,013	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

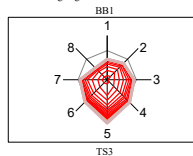
Over the line to remote earth voltage drop = $\frac{186.8}{13}$ mV %IR = $\frac{186.8}{13}$ mV
Severity = $\frac{186.8}{13}$ mV
☐ < 15% Low
☐ 16-35% Medium
☐ 36-60% High
☐ > 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.281) / (0.26 - 0.785)
= 1,445 mV

-Show how to calculate over the line to remote earth voltage drop
= 18+50+20+20+15+10+7+6.8+6+5+4+3+3+2.8+3+2.6+3+3
= 186.8 mV

-Show how to calculate %IR
= 186.8 x 100 / 1445
= 13 %

-Show the contour of the voltgae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 0+385

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 125 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 400 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.385	11.98895	99.83220	Dry Soil		1.356
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

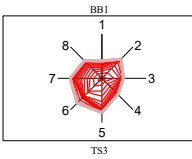
Over the line to remote earth voltage drop = 23.8 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.385) / (0.26 - 0.785)
= 1,356 mV

-Show how to calculate over the line to remote earth voltage drop
= 3.2+4.2+5+1+3.4+0.6+0.2+0.4+0.2+0.2+2+1.8+1
= 23.8 mV

-Show how to calculate %IR
= 23.8 x 100 / 1356
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	21 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 0+536

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 276 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 249 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.536	11.60037	99.83185	Dry Soil		1.226
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

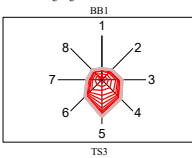
Over the line to remote earth voltage drop = 41.6 mV
%IR = 3Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.536) / (0.26 - 0.785)
= 1,226 mV

-Show how to calculate over the line to remote earth voltage drop
= 4+3.8+4+6+4.8+4.8+8+3+1.6+1.4+1.4+0.8+0.6+0.6
= 41.6 mV

-Show how to calculate %IR
= 41.6 x 100 / 1226
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 0+509

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 249 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 276 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.509	11.60037	99.83373	Dry Soil		1.250
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

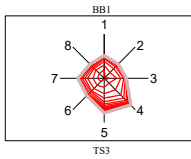
Over the line to remote earth voltage drop = 34.2 mV
%IR = 3Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.509) / (0.26 - 0.785)
= 1,250 mV

-Show how to calculate over the line to remote earth voltage drop
= 1.8+4.4+8.4+6.8+3.8+3+1.8+0.8+0.8+0.8+0.6+0.4+0.4+0.4
= 34.2 mV

-Show how to calculate %IR
= 34.2 x 100 / 1250
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 0+612

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 352 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 173 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.612	11.60120	99.83418	Dry Soil		1.161
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

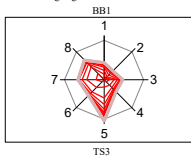
Over the line to remote earth voltage drop = 130.4 mV
%IR = 11Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.612) / (0.26 - 0.785)
= 1,161 mV

-Show how to calculate over the line to remote earth voltage drop
= 3+20+35+20+15+10+5+6.2+4.8+3.6+2.4+1+0.6+0.6
= 130.4 mV

-Show how to calculate %IR
= 130.4 x 100 / 1161
= 11 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 0+659

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 399 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 126 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.659	11.60156	99.83448	Dry Soil		1.121
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

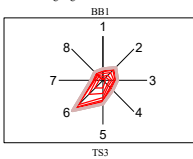
Over the line to remote earth voltage drop = 39.0 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.659) / (0.26 - 0.785)
= 1,121 mV

-Show how to calculate over the line to remote earth voltage drop
= 10+8+13+3.4+1.6+1+0.8+0.6+0.6
= 39.0 mV

-Show how to calculate %IR
= 39 x 100 / 1121
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 0+736

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 476 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 49 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.736	11.60213	99.83472	Dry Soil		1.055
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

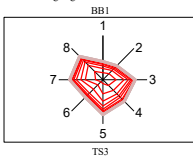
Over the line to remote earth voltage drop = 23.6 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.736) / (0.26 - 0.785)
= 1,055 mV

-Show how to calculate over the line to remote earth voltage drop
= 2.6+7+5+3+2.2+1.2+1+0.6+0.4+0.2+0.2
= 23.6 mV

-Show how to calculate %IR
= 23.6 x 100 / 1055
= 2 %

-Show the contour of the voltagae gradient at the defect



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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 0+700

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 440 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 85 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.700	11.60189	99.83457	Dry Soil		1.086
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

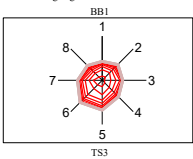
Over the line to remote earth voltage drop = 21.2 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.7) / (0.26 - 0.785)
= 1,086 mV

-Show how to calculate over the line to remote earth voltage drop
= 4.4+3.6+5.6+2.4+1.6+1.2+1+0.6+0.4+0.4
= 21.2 mV

-Show how to calculate %IR
= 21.2 x 100 / 1086
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 0+761

Pipeline Route Fuel Oil Pipeline

Section TS3-BB1

Test Post No. before Defect TS3 sta. 0+260 Distance to Defect 501 m.

Test Post No. after Defect BB1 sta. 0+785 Distance from Defect 24 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.260	11.98895	99.83221	Dry Soil	-2.346	-0.883
Defect		0.761	11.60213	99.83486	Dry Soil		1.034
TP after Defect	TP	0.785	11.60243	99.83501	Dry Soil	-1.954	-0.941

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

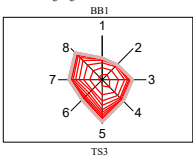
Over the line to remote earth voltage drop = 47.4 mV
%IR = 5Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 1463 - (1463 - 1013) x (0.26 - 0.761) / (0.26 - 0.785)
= 1,034 mV

-Show how to calculate over the line to remote earth voltage drop
= 7+10+7+5+5+3+2.6+2.4+2+1+0.8+0.8+0.4+0.4
= 47.4 mV

-Show how to calculate %IR
= 47.4 x 100 / 1034
= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section BB1-BB2

from : sta. 0+785 to : sta. 0+950

Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG		Remarks
			North	East	Volt	Amp	Volt	Amp	
1	TA	Negative Cable at Loading Station	13.98053	99.82982	100 V	30 A	34.41 V	20.37 A	-

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

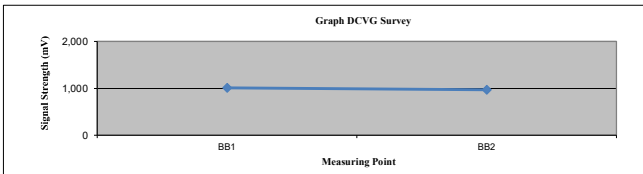
Signal Strength Data									
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Accept
			North	East		"ON"	"OFF"		
1	TP	BB1	13.00243	99.83501	Dry Soil	-1.954	-0.941	1,013	Yes
3	TP	BB2	13.00213	99.83600	Dry Soil	-1.851	-0.878	973	Yes

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "

☒ After surveying, we have found " 5 Defect points "



1	Defect about	sta. 0+785	N = 13.00243	E = 99.83501	about	0	m.	after	BB1	sta. 0+785
2	Defect about	sta. 0+800	N = 13.00240	E = 99.83514	about	15	m.	after	BB1	sta. 0+785
3	Defect about	sta. 0+870	N = 13.00229	E = 99.83577	about	85	m.	after	BB1	sta. 0+785
4	Defect about	sta. 0+880	N = 13.00224	E = 99.83586	about	95	m.	after	BB1	sta. 0+785
5	Defect about	sta. 0+917	N = 13.00214	E = 99.83619	about	132	m.	after	BB1	sta. 0+785

CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section BB1-BB2

from : sta. 0+785 to : sta. 0+950



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	21 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect01 at sta. 0+785

Pipeline Route Fuel Oil Pipeline

Section BB1-BB2

from : sta. 0+785 to : sta. 0+950

Test Post No. before Defect BB1

sta. 0+785

Distance to Defect 0 m.

Test Post No. after Defect BB2

sta. 0+950

Distance from Defect 165 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	0.785	13.00243	99.83501	Dry Soil	-1.954	-0.941	1,013	
Defect		0.785	13.00243	99.83501	Dry Soil			1,013	
TP after Defect	TP	0.950	13.00213	99.83600	Dry Soil	-1.851	-0.878	973	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 26.4 mV

%IR = 3

Severity =

☒ < 15% Low

☐ 16-35% Medium

☐ 36-60% High

☐ > 61% Very high

-Show how to calculate signal strength at the defect

= 1013 - (1013 - 973) x (0.785 - 0.785) / (0.785 - 0.95)

= 1,013 mV

-Show how to calculate over the line to remote earth voltage drop

= 4.6+4+3.2+2.2+1.8+1.8+1.6+1.6+1.4+1+0.8+0.6

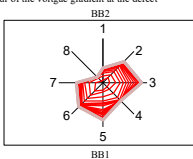
= 26.4 mV

-Show how to calculate %IR

= 26.4 x 100 / 1013

= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	21 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect02 at sta. 0+800

Pipeline Route Fuel Oil Pipeline

Section BB1-BB2

from : sta. 0+785 to : sta. 0+950

Test Post No. before Defect BB1

sta. 0+785

Distance to Defect 15 m.

Test Post No. after Defect BB2

sta. 0+950

Distance from Defect 150 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	0.785	13.00243	99.83501	Dry Soil	-1.954	-0.941	1,013	
Defect		0.800	13.00230	99.83514	Dry Soil			1,009	
TP after Defect	TP	0.950	13.00213	99.83600	Dry Soil	-1.851	-0.878	973	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 78.8 mV

%IR = 8

Severity =

☒ < 15% Low

☐ 16-35% Medium

☐ 36-60% High

☐ > 61% Very high

-Show how to calculate signal strength at the defect

= 1013 - (1013 - 973) x (0.785 - 0.8) / (0.785 - 0.95)

= 1,009 mV

-Show how to calculate over the line to remote earth voltage drop

= 12+18+15+7+5+5+4+2+2+1.8+1.2+1.4+1.2+0.8+0.8+0.8+0.8+0.8+0.8

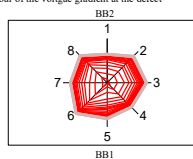
= 78.8 mV

-Show how to calculate %IR

= 78.8 x 100 / 1009

= 8 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	21 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 0+870

Pipeline Route Fuel Oil Pipeline
Section BB1-BB2
Test Post No. before Defect BB1 sta. 0+785 Distance to Defect 85 m.
Test Post No. after Defect BB2 sta. 0+950 Distance from Defect 80 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.785	11.60243	99.83580	Dry Soil	-1.954	-0.941
Defect		0.870	11.60229	99.83577	Dry Soil		992
TP after Defect	TP	0.950	11.60213	99.83650	Dry Soil	-1.851	-0.878

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

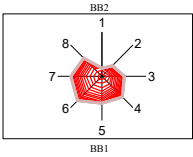
Over the line to remote earth voltage drop = 15.6 mV Severity = x
%IR = 2 16-35% Medium
36-60% High
> 61% Very High

-Show how to calculate signal strength at the defect
= 1013 - (1013 - 973) x (0.785 - 0.87) / (0.785 - 0.95)
= 992 mV

-Show how to calculate over the line to remote earth voltage drop
= 1.2+1.8+2.2+1.6+1.2+1+0.8+0.8+0.8+0.4+0.2+0.2
= 15.6 mV

-Show how to calculate %IR
= 15.6 x 100 / 992
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By CPE S.Tanya Supervisor 22 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 0+917

Pipeline Route Fuel Oil Pipeline
Section BB1-BB2
Test Post No. before Defect BB1 sta. 0+785 Distance to Defect 132 m.
Test Post No. after Defect BB2 sta. 0+950 Distance from Defect 33 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.785	11.60243	99.83580	Dry Soil	-1.954	-0.941
Defect		0.917	11.60234	99.83619	Dry Soil		981
TP after Defect	TP	0.950	11.60213	99.83650	Dry Soil	-1.851	-0.878

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

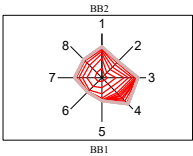
Over the line to remote earth voltage drop = 8.4 mV Severity = x
%IR = 1 16-35% Medium
36-60% High
> 61% Very High

-Show how to calculate signal strength at the defect
= 1013 - (1013 - 973) x (0.785 - 0.917) / (0.785 - 0.95)
= 981 mV

-Show how to calculate over the line to remote earth voltage drop
= 0.8+1.2+1+1+0.8+0.4+0.4+0.4+0.4+0.4+0.6+0.6+0.4
= 8.4 mV

-Show how to calculate %IR
= 8.4 x 100 / 981
= 1 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 0+880

Pipeline Route Fuel Oil Pipeline
Section BB1-BB2
Test Post No. before Defect BB1 sta. 0+785 Distance to Defect 95 m.
Test Post No. after Defect BB2 sta. 0+950 Distance from Defect 70 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	0.785	11.60243	99.83580	Dry Soil	-1.954	-0.941
Defect		0.880	11.60234	99.83586	Dry Soil		990
TP after Defect	TP	0.950	11.60213	99.83650	Dry Soil	-1.851	-0.878

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

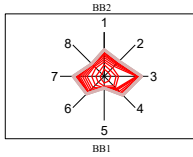
Over the line to remote earth voltage drop = 17.0 mV Severity = x
%IR = 2 16-35% Medium
36-60% High
> 61% Very High

-Show how to calculate signal strength at the defect
= 1013 - (1013 - 973) x (0.785 - 0.88) / (0.785 - 0.95)
= 990 mV

-Show how to calculate over the line to remote earth voltage drop
= 3+2.4+1.2+8+0.6+0.6+0.4+0.4+0.4
= 17.0 mV

-Show how to calculate %IR
= 17 x 100 / 990
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section BB2-TS4 from : sta. 0+950 to : sta. 1+070

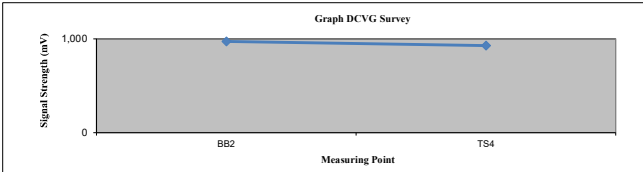
Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG		
			North	East	Volt	Amp	Volt	Amp	Tap
1	TA	Negative Cable at Loading Station	11.59831	99.82992	100 V	30 A	34.41 V	20.37 A	-

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

Signal Strength Data							
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
1	TP	BB2	11.60213	99.83650	Dry Soil	-1.851	-0.878
3	TP	TS4	11.60219	99.83761	Dry Soil	-1.852	-0.924

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion x After surveying, we have found " No Defect point "
X After surveying, we have found " 3 Defect points "



- 1 Defect about sta. 0+985 N = 13.60222 E = 99.83681 about 35 m. after BB2 sta. 0+950
- 2 Defect about sta. 1+025 N = 13.60222 E = 99.83718 about 75 m. after BB2 sta. 0+950
- 3 Defect about sta. 1+059 N = 13.60217 E = 99.83749 about 109 m. after BB2 sta. 0+950

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section BB2-TS4

from : sta. 0+950 to : sta. 1+070



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect02 at sta. 1+025

Pipeline Route Fuel Oil Pipeline

Section BB2-TS4

from : sta. 0+950 to : sta. 1+070

Test Post No. before Defect BB2

sta. 0+950

Distance to Defect 75 m.

Test Post No. after Defect TS4

sta. 1+070

Distance from Defect 45 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	0.950	11.60213 99.83609	Dry Soil	-1.851 -0.878	973	
Defect		1.025	11.60222 99.83718	Dry Soil		945	
TP after Defect	TP	1.070	11.60219 99.83761	Dry Soil	-1.852 -0.924	928	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 23.4 mV
%IR = 2

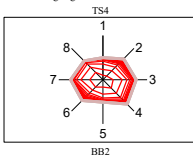
Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 973 - (973 - 928) x (0.95 - 1.025) / (0.95 - 1.07)
= 945 mV

-Show how to calculate over the line to remote earth voltage drop
= 8+5+4+1.4+1.2+0.8+0.6+0.4+0.4+0.4+0.2+0.2+0.2
= 23.4 mV

-Show how to calculate %IR
= 23.4 x 100 / 945
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect01 at sta. 0+985

Pipeline Route Fuel Oil Pipeline

Section BB2-TS4

from : sta. 0+950 to : sta. 1+070

Test Post No. before Defect BB2

sta. 0+950

Distance to Defect 35 m.

Test Post No. after Defect TS4

sta. 1+070

Distance from Defect 85 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	0.950	11.60213 99.83609	Dry Soil	-1.851 -0.878	973	
Defect		0.985	11.60222 99.83681	Dry Soil		960	
TP after Defect	TP	1.070	11.60219 99.83761	Dry Soil	-1.852 -0.924	928	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 315.8 mV
%IR = 33

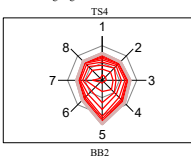
Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 973 - (973 - 928) x (0.95 - 0.985) / (0.95 - 1.07)
= 960 mV

-Show how to calculate over the line to remote earth voltage drop
= 20+60+81+50+50+20+15+6+4.2+4+1.8+1+0.8+0.6+0.6+0.4+0.2+0.2
= 315.8 mV

-Show how to calculate %IR
= 315.8 x 100 / 960
= 33 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect03 at sta. 1+059

Pipeline Route Fuel Oil Pipeline

Section BB2-TS4

from : sta. 0+950 to : sta. 1+070

Test Post No. before Defect BB2

sta. 0+950

Distance to Defect 109 m.

Test Post No. after Defect TS4

sta. 1+070

Distance from Defect 11 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	0.950	11.60213 99.83609	Dry Soil	-1.851 -0.878	973	
Defect		1.059	11.60237 99.83749	Dry Soil		932	
TP after Defect	TP	1.070	11.60219 99.83761	Dry Soil	-1.852 -0.924	928	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 19.2 mV
%IR = 2

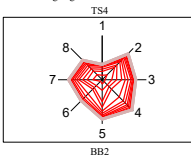
Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 973 - (973 - 928) x (0.95 - 1.059) / (0.95 - 1.07)
= 932 mV

-Show how to calculate over the line to remote earth voltage drop
= 1.4+2+1+1.6+5+2.6+1.2+1.2+0.8+0.8+0.6+0.4+0.2+0.2+0.2
= 19.2 mV

-Show how to calculate %IR
= 19.2 x 100 / 932
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5 from : sta. 1+070 to : sta. 1+425

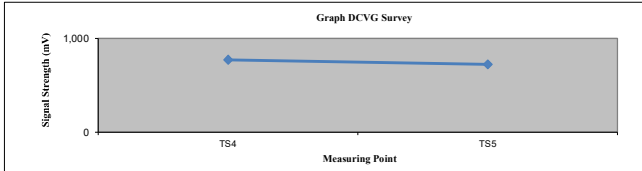
Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG		Remarks
			North	East	Volt	Amp	Volt	Amp	
1	TA	Negative Cable at Loading Station	11.98053	99.83761	100 V	30 A	34.41 V	20.37 A	-

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

Signal Strength Data									
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	-800 mV Accept
			North	East		"ON"	"OFF"		
1	TP	TS4	11.00219	99.83761	Dry Soil	-1.718	-0.944	774	Yes
3	TP	TS5	11.00130	99.84076	Dry Soil	-1.705	-0.981	724	Yes

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "
☒ After surveying, we have found " 9 Defect points "

1	Defect about	sta.	1+101	N =	13.60209	E =	99.83788	about	31	m.	after	TS4	sta.	1+070
2	Defect about	sta.	1+119	N =	13.60205	E =	99.83804	about	49	m.	after	TS4	sta.	1+070
3	Defect about	sta.	1+136	N =	13.60201	E =	99.83819	about	66	m.	after	TS4	sta.	1+070
4	Defect about	sta.	1+148	N =	13.60199	E =	99.83830	about	78	m.	after	TS4	sta.	1+070
5	Defect about	sta.	1+160	N =	13.60195	E =	99.83840	about	90	m.	after	TS4	sta.	1+070
6	Defect about	sta.	1+203	N =	13.60185	E =	99.83879	about	133	m.	after	TS4	sta.	1+070
7	Defect about	sta.	1+213	N =	13.60184	E =	99.83888	about	143	m.	after	TS4	sta.	1+070
8	Defect about	sta.	1+251	N =	13.60176	E =	99.83922	about	181	m.	after	TS4	sta.	1+070
9	Defect about	sta.	1+419	N =	13.60130	E =	99.84070	about	349	m.	after	TS4	sta.	1+070

CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5 from : sta. 1+070 to : sta. 1+425



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	18 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect01 at sta. 1+101

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5 from : sta. 1+070 to : sta. 1+425

Test Post No. before Defect TS4 sta. 1+070 Distance to Defect 31 m.

Test Post No. after Defect TS5 sta. 1+425 Distance from Defect 324 m.

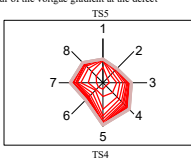
Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	1.070	11.00219	99.83761	Dry Soil	-1.718	-0.944	774	
Defect		1.101	11.00209	99.83788	Dry Soil			770	
TP after Defect	TP	1.425	11.00130	99.84076	Dry Soil	-1.705	-0.981	724	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = mV
%IR = Severity = < 15% Low
 16-35% Medium
 36-60% High
 > 61% Very high-Show how to calculate signal strength at the defect
= 774 - (774 - 724) x (1.07 - 1.101) / (1.07 - 1.425)
= 770 mV-Show how to calculate over the line to remote earth voltage drop
= 10+12+20+10+5+4.8+3+1.2+1
= 67.0 mV-Show how to calculate %IR
= 67 x 100 / 770
= 9 %

-Show the contour of the voltag gradient at the defect



Note/Comment :

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect02 at sta. 1+119

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5 from : sta. 1+070 to : sta. 1+425

Test Post No. before Defect TS4 sta. 1+070 Distance to Defect 49 m.

Test Post No. after Defect TS5 sta. 1+425 Distance from Defect 306 m.

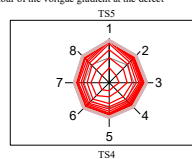
Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	1.070	11.00219	99.83761	Dry Soil	-1.718	-0.944	774	
Defect		1.119	11.00205	99.83804	Dry Soil			767	
TP after Defect	TP	1.425	11.00130	99.84076	Dry Soil	-1.705	-0.981	724	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = mV
%IR = Severity = < 15% Low
 16-35% Medium
 36-60% High
 > 61% Very high-Show how to calculate signal strength at the defect
= 774 - (774 - 724) x (1.07 - 1.119) / (1.07 - 1.425)
= 767 mV-Show how to calculate over the line to remote earth voltage drop
= 75+50+40+30+10+5.6
= 210.6 mV-Show how to calculate %IR
= 210.6 x 100 / 767
= 27 %

-Show the contour of the voltag gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	22 March 2022
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Test By	CPE	S.Tanya	Supervisor	22 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 1+136

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5

Test Post No. before Defect TS4 sta. 1+070 Distance to Defect 66 m.

Test Post No. after Defect TS5 sta. 1+425 Distance from Defect 289 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	1.070	11.60219	99.83761	Dry Soil	-1.718 -0.944	774
Defect		1.136	11.60201	99.83619	Dry Soil	-1.705 -0.981	765
TP after Defect	TP	1.425	11.60130	99.84076	Dry Soil	-1.705 -0.981	724

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 33.2 mV
%IR = 4Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 774 - (774 - 724) \times (1.07 - 1.136) / (1.07 - 1.425)$$
$$= 765 \text{ mV}$$

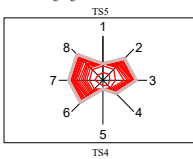
-Show how to calculate over the line to remote earth voltage drop

$$= 6.4 + 7 \times 2.6 + 2 \times 1.6 + 1 \times 1 + 2.4 + 1.6 + 1 \times 1 + 1 + 0.8 + 0.8 + 0.6 + 0.4 + 0.4$$
$$= 33.2 \text{ mV}$$

-Show how to calculate %IR

$$= 33.2 \times 100 / 765$$
$$= 4 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	22 March 2022
T. 0-2924-3024, 0-2924-9553-4 F. 0-2924-1744				www.cpe-eng.co.th / e-mail : cpe@cpe-eng.co.th

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 1+160

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5

Test Post No. before Defect TS4 sta. 1+070 Distance to Defect 90 m.

Test Post No. after Defect TS5 sta. 1+425 Distance from Defect 265 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	1.070	11.60219	99.83761	Dry Soil	-1.718 -0.944	774
Defect		1.160	11.60195	99.83640	Dry Soil	-1.705 -0.981	761
TP after Defect	TP	1.425	11.60130	99.84076	Dry Soil	-1.705 -0.981	724

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 131.0 mV
%IR = 17Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 774 - (774 - 724) \times (1.07 - 1.16) / (1.07 - 1.425)$$
$$= 761 \text{ mV}$$

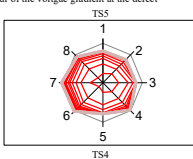
-Show how to calculate over the line to remote earth voltage drop

$$= 40 \times 30 + 15 \times 12 \times 8 + 5 \times 6 + 6.4 + 2.8 + 2 \times 1.6 + 1.4 + 1 + 0.8 + 0.8 + 0.6 + 0.4 + 0.4$$
$$= 131.0 \text{ mV}$$

-Show how to calculate %IR

$$= 131 \times 100 / 761$$
$$= 17 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 1+148

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5

Test Post No. before Defect TS4 sta. 1+070 Distance to Defect 28 m.

Test Post No. after Defect TS5 sta. 1+425 Distance from Defect 277 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	1.070	11.60219	99.83761	Dry Soil	-1.718 -0.944	774
Defect		1.148	11.60199	99.83630	Dry Soil	-1.705 -0.981	763
TP after Defect	TP	1.425	11.60130	99.84076	Dry Soil	-1.705 -0.981	724

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 41.2 mV
%IR = 5Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 774 - (774 - 724) \times (1.07 - 1.148) / (1.07 - 1.425)$$
$$= 763 \text{ mV}$$

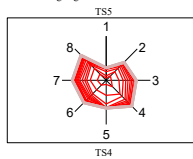
-Show how to calculate over the line to remote earth voltage drop

$$= 10 \times 12 + 3 \times 8 + 4 \times 2 + 1.8 + 1.6 + 0.8 + 0.8 + 0.6 + 0.6$$
$$= 41.2 \text{ mV}$$

-Show how to calculate %IR

$$= 41.2 \times 100 / 763$$
$$= 5 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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T. 0-2924-3024, 0-2924-9553-4 F. 0-2924-1744				www.cpe-eng.co.th / e-mail : cpe@cpe-eng.co.th

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 1+203

Pipeline Route Fuel Oil Pipeline

Section TS4-TS5

Test Post No. before Defect TS4 sta. 1+070 Distance to Defect 133 m.

Test Post No. after Defect TS5 sta. 1+425 Distance from Defect 222 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	1.070	11.60219	99.83761	Dry Soil	-1.718 -0.944	774
Defect		1.203	11.60185	99.83679	Dry Soil	-1.705 -0.981	755
TP after Defect	TP	1.425	11.60130	99.84076	Dry Soil	-1.705 -0.981	724

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 66.8 mV
%IR = 9Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 774 - (774 - 724) \times (1.07 - 1.203) / (1.07 - 1.425)$$
$$= 755 \text{ mV}$$

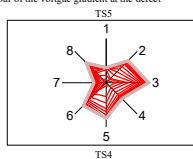
-Show how to calculate over the line to remote earth voltage drop

$$= 16 \times 10 + 9 \times 3 \times 8 + 4 \times 3 + 2 \times 8 + 1 \times 8 + 0.8 + 0.6 + 0.6 + 0.2 + 0.2 + 0.2$$
$$= 66.8 \text{ mV}$$

-Show how to calculate %IR

$$= 66.8 \times 100 / 755$$
$$= 9 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	18 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 189
	: Cu/CuSO ₄ Reference Electrode

Pipeline Route		Fuel Oil Pipeline			
Section	TS4-TS5	from :	sta. 1+070	to :	sta. 1+425
Test Post No. before Defect	TS4	sta. 1+070	Distance to Defect	181	m.
Test Post No. after Defect	TS5	sta. 1+425	Distance from Defect	174	m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	1.070	13.68219	99.83761	Dry Soil	-1.718	-0.944	774	
Defect		1.251	13.68176	99.83922	Dry Soil			749	
TP after Defect	TP	1.425	13.68130	99.84076	Dry Soil	-1.705	-0.981	724	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

33.4

 mV Severity =

x

 < 15% Low

%IR =

4

--

 16-35% Medium

$$= 774 - (774 - 724) \times (1.07 - 1.251) / (1.07 - 1.425)$$

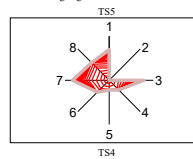
$$= 749 \text{ mV}$$

-Show how to calculate over the line to remote earth voltage drop

$$= 1.8+3+3+3.8+4+2.8+2.2+1.8+1.6+1.4+1+1+1+1+0.8+0.8+0.6+0.4+0.4$$
$$= 33.4 \text{ mV}$$

-Show how to calculate %IR
 $= 33.4 \times 100 / 749$
 $= 4 \%$

- Show the contour of the voltage gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	18 March 2022
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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 289
	: Cu/CuSO ₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS5-TS6 from : sta. 1+425 to : sta. 1+840

Interrupted Transformer Rectifier Data										
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG			Remarks
			North	East	Volt	Amp	Volt	Amp	Tap	
1	TA	Negative Cable at Loading Station	13.59835	89.82992	100 V	30 A	34.41 V	20.37 A	-	

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

Signal Strength Data										
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential(V)		Signal Strength (mV)	>500 mV Accept	Remarks
			North	East		"ON"	"OFF"			
1	TP	TS5	13.60130	89.84076	Dry Soil	-1.705	-0.981	724	Yes	
3	TP	TS6	13.60207	89.84847	Dry Soil	-1.579	-0.943	636	Yes	

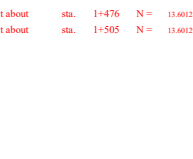
Measuring Point : TP=Test Post, R=Riser

conclusion		After surveying, we have found " No Defect point "
	X	After surveying, we have found " 2 Defect points "

Measuring Point	Signal Strength (m)
TS5	1.5
TS6	1.4

1	Defect about	sta.	1+476	N =	13.60128	E =	99.84123	about	51	m.	after	TS5	sta.	1+425
2	Defect about	sta.	1+505	N =	13.60129	E =	99.84149	about	80	m.	after	TS5	sta.	1+425

1	Defect about	sta.	1+475	N =	13.60129	E =	99.84129	about	51	m.	after	TS5	sta.	1+425
2	Defect about	sta.	1+505	N =	13.60129	E =	99.84149	about	80	m.	after	TS5	sta.	1+425



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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference ElectrodePipeline Route Fuel Oil Pipeline
Section TS5-TS6

from : sta. 1+425 to : sta. 1+840



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	18 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 1+505

Pipeline Route Fuel Oil Pipeline

Section TS5-TS6 from : sta. 1+425 to : sta. 1+840
Test Post No. before Defect TS5 sta. 1+425 Distance to Defect 80 m.
Test Post No. after Defect TS6 sta. 1+840 Distance from Defect 335 m.

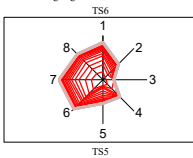
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
			North	East			
TP before Defect	TP	1.425	11.60130	99.84076	Dry Soil	-1.705 -0.981	724
Defect		1.505	11.60129	99.84149	Dry Soil		707
TP after Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.579 -0.943	636

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 49.8 mV
%IR = 7.7
Severity = ☒ < 15% Low
☐ 16-35% Medium
☐ 36-60% High
☐ > 61% Very high-Show how to calculate signal strength at the defect
= 724 - (724 - 636) x (1.425 - 1.505) / (1.425 - 1.84)
= 707 mV-Show how to calculate over the line to remote earth voltage drop
= 13+7+7+4+4+2+6+1.8+1.8+1.6+1.6+1+1+0.8+0.6+0.4+0.4+0.2+0.2
= 49.8 mV-Show how to calculate %IR
= 49.8 x 100 / 707
= 7 %

-Show the contour of the voltag gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	18 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 1+476

Pipeline Route Fuel Oil Pipeline

Section TS5-TS6 from : sta. 1+425 to : sta. 1+840
Test Post No. before Defect TS5 sta. 1+425 Distance to Defect 51 m.
Test Post No. after Defect TS6 sta. 1+840 Distance from Defect 364 m.

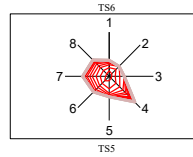
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
			North	East			
TP before Defect	TP	1.425	11.60130	99.84076	Dry Soil	-1.705 -0.981	724
Defect		1.476	11.60129	99.84123	Dry Soil		713
TP after Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.579 -0.943	636

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 8.2 mV
%IR = 1
Severity = ☒ < 15% Low
☐ 16-35% Medium
☐ 36-60% High
☐ > 61% Very high-Show how to calculate signal strength at the defect
= 724 - (724 - 636) x (1.425 - 1.476) / (1.425 - 1.84)
= 713 mV-Show how to calculate over the line to remote earth voltage drop
= 0.6+1.6+1.2+1+0.8+0.6+0.6+0.4+0.4+0.2+0.2+0.2
= 8.2 mV-Show how to calculate %IR
= 8.2 x 100 / 713
= 1 %

-Show the contour of the voltag gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	18 March 2022
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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS6-TS7 from : sta. 1+840 to : sta. 2+120

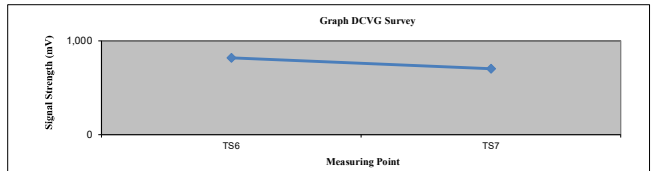
Interrupted Transformer Rectifier Data										
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG			Remarks
			North	East	Volt	Amp	Volt	Amp	Tap	
1	TA	Negative Cable at Loading Station	13.59835	99.82992	100 V	30 A	34.41 V	20.37 A	-	

Installed Type : R=Existing Rectifier, TA=Temporary Anode Grounded at Test Post

Signal Strength Data							
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
			North	East			
1	TP	TS6	11.60207	99.84447	Dry Soil	-1.535 -0.716	819
3	TP	TS7	11.60278	99.84691	Dry Soil	-1.542 -0.837	705

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "
☒ After surveying, we have found " 10 Defect points "

1	Defect about	sta. 1+869	N = 13.60210	E = 99.84473	about 29	m. after	TS6	sta. 1+840
2	Defect about	sta. 1+892	N = 13.60219	E = 99.84493	about 52	m. after	TS6	sta. 1+840
3	Defect about	sta. 1+925	N = 13.60229	E = 99.84522	about 85	m. after	TS6	sta. 1+840
4	Defect about	sta. 1+937	N = 13.60230	E = 99.84533	about 97	m. after	TS6	sta. 1+840
5	Defect about	sta. 1+949	N = 13.60233	E = 99.84544	about 109	m. after	TS6	sta. 1+840
6	Defect about	sta. 1+954	N = 13.60235	E = 99.84548	about 114	m. after	TS6	sta. 1+840
7	Defect about	sta. 1+973	N = 13.60240	E = 99.84565	about 133	m. after	TS6	sta. 1+840
8	Defect about	sta. 1+982	N = 13.60244	E = 99.84572	about 142	m. after	TS6	sta. 1+840
9	Defect about	sta. 2+011	N = 13.60250	E = 99.84598	about 171	m. after	TS6	sta. 1+840
10	Defect about	sta. 2+025	N = 13.60253	E = 99.84611	about 185	m. after	TS6	sta. 1+840

CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS6-TS7

from : sta. 1+840 to : sta. 2+120



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 1+892

Pipeline Route Fuel Oil Pipeline

Section TS6-TS7

from : sta. 1+840 to : sta. 2+120

Test Post No. before Defect TS6

sta. 1+840

Distance to Defect 52 m.

Test Post No. after Defect TS7

sta. 2+120

Distance from Defect 228 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	1.840	11.60207 99.84447	Dry Soil	-1.535 -0.716	819	
Defect		1.892	11.60219 99.84491	Dry Soil		798	
TP after Defect	TP	2.120	11.60278 99.84691	Dry Soil	-1.542 -0.837	705	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 19.0 mV
%IR = 2 %Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 819 - (819 - 705) \times (1.84 - 1.892) / (1.84 - 2.12)$$
$$= 798 \text{ mV}$$

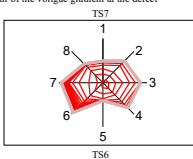
-Show how to calculate over the line to remote earth voltage drop

$$= 1.2 + 4 \times 3 + 2 \times 1.6 + 1 + 0.8 + 0.6 + 0.6 + 0.6 + 0.4 + 0.4 + 0.4 + 0.4$$
$$= 19.0 \text{ mV}$$

-Show how to calculate %IR

$$= 19 \times 100 / 798$$
$$= 2 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	23 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 1+869

Pipeline Route Fuel Oil Pipeline

Section TS6-TS7

from : sta. 1+840 to : sta. 2+120

Test Post No. before Defect TS6

sta. 1+840

Distance to Defect 29 m.

Test Post No. after Defect TS7

sta. 2+120

Distance from Defect 251 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	1.840	11.60207 99.84447	Dry Soil	-1.535 -0.716	819	
Defect		1.869	11.60219 99.84473	Dry Soil		807	
TP after Defect	TP	2.120	11.60278 99.84691	Dry Soil	-1.542 -0.837	705	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 52.0 mV
%IR = 6 %Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 819 - (819 - 705) \times (1.84 - 1.869) / (1.84 - 2.12)$$
$$= 807 \text{ mV}$$

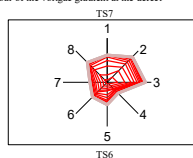
-Show how to calculate over the line to remote earth voltage drop

$$= 14 + 10 + 8 + 4 + 4 + 2 + 6 + 1.8 + 1.6 + 1.2 + 1 + 1 + 0.6 + 0.4 + 0.4 + 0.2 + 0.2 + 0.2$$
$$= 52.0 \text{ mV}$$

-Show how to calculate %IR

$$= 52 \times 100 / 807$$
$$= 6 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	23 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 1+925

Pipeline Route Fuel Oil Pipeline

Section TS6-TS7

from : sta. 1+840 to : sta. 2+120

Test Post No. before Defect TS6

sta. 1+840

Distance to Defect 85 m.

Test Post No. after Defect TS7

sta. 2+120

Distance from Defect 195 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	1.840	11.60207 99.84447	Dry Soil	-1.535 -0.716	819	
Defect		1.925	11.60259 99.84522	Dry Soil		784	
TP after Defect	TP	2.120	11.60278 99.84691	Dry Soil	-1.542 -0.837	705	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 14.4 mV
%IR = 2 %Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 819 - (819 - 705) \times (1.84 - 1.925) / (1.84 - 2.12)$$
$$= 784 \text{ mV}$$

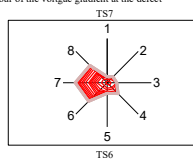
-Show how to calculate over the line to remote earth voltage drop

$$= 0.6 + 2 + 2 + 1 + 0.8 + 0.8 + 0.6 + 1.4 + 1 + 0.8 + 0.8 + 0.6 + 0.4 + 0.4 + 0.2 + 0.2$$
$$= 14.4 \text{ mV}$$

-Show how to calculate %IR

$$= 14.4 \times 100 / 784$$
$$= 2 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 1+937

Pipeline Route Fuel Oil Pipeline
Section TS6-TS7 from : sta. 1+840 to : sta. 2+120
Test Post No. before Defect TS6 sta. 1+840 Distance to Defect 92 m.
Test Post No. after Defect TS7 sta. 2+120 Distance from Defect 183 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.535	-0.716	819	
Defect		1.937	11.60230	99.84533	Dry Soil			780	
TP after Defect	TP	2.120	11.60278	99.84693	Dry Soil	-1.542	-0.837	705	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 17.4 mV Severity = x < 15% Low
%IR = 2 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 819 - (819 - 705) x (1.84 - 1.937) / (1.84 - 2.12)
= 780 mV

-Show how to calculate over the line to remote earth voltage drop
= 1.8+1.6+1.2+1+0.8+0.8+0.6+0.6+0.6+0.6+0.6+1+1+1+0.8+0.8+0.6+0.4
= 17.4 mV

-Show how to calculate %IR
= 17.4 x 100 / 780
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 1+954

Pipeline Route Fuel Oil Pipeline
Section TS6-TS7 from : sta. 1+840 to : sta. 2+120
Test Post No. before Defect TS6 sta. 1+840 Distance to Defect 114 m.
Test Post No. after Defect TS7 sta. 2+120 Distance from Defect 166 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.535	-0.716	819	
Defect		1.954	11.60231	99.84548	Dry Soil			773	
TP after Defect	TP	2.120	11.60278	99.84693	Dry Soil	-1.542	-0.837	705	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 30.2 mV Severity = x < 15% Low
%IR = 3 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 819 - (819 - 705) x (1.84 - 1.954) / (1.84 - 2.12)
= 773 mV

-Show how to calculate over the line to remote earth voltage drop
= 15+5+4+2.2+1.4+0.8+0.4+0.4+0.4+0.2+0.2+0.2
= 30.2 mV

-Show how to calculate %IR
= 30.2 x 100 / 773
= 4 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 1+949

Pipeline Route Fuel Oil Pipeline
Section TS6-TS7 from : sta. 1+840 to : sta. 2+120
Test Post No. before Defect TS6 sta. 1+840 Distance to Defect 109 m.
Test Post No. after Defect TS7 sta. 2+120 Distance from Defect 171 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.535	-0.716	819	
Defect		1.949	11.60231	99.84544	Dry Soil			775	
TP after Defect	TP	2.120	11.60278	99.84693	Dry Soil	-1.542	-0.837	705	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 23.2 mV Severity = x < 15% Low
%IR = 3 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 819 - (819 - 705) x (1.84 - 1.949) / (1.84 - 2.12)
= 775 mV

-Show how to calculate over the line to remote earth voltage drop
= 4.8+4.6+2.8+2+1.6+0.6+0.8+1+1+0.8+0.8+0.6+0.4+0.4+0.4+0.2+0.2+0.2
= 23.2 mV

-Show how to calculate %IR
= 23.2 x 100 / 775
= 3 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 1+973

Pipeline Route Fuel Oil Pipeline
Section TS6-TS7 from : sta. 1+840 to : sta. 2+120
Test Post No. before Defect TS6 sta. 1+840 Distance to Defect 133 m.
Test Post No. after Defect TS7 sta. 2+120 Distance from Defect 147 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.535	-0.716	819	
Defect		1.973	11.60230	99.84560	Dry Soil			765	
TP after Defect	TP	2.120	11.60278	99.84693	Dry Soil	-1.542	-0.837	705	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 26.6 mV Severity = x < 15% Low
%IR = 3 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 819 - (819 - 705) x (1.84 - 1.973) / (1.84 - 2.12)
= 765 mV

-Show how to calculate over the line to remote earth voltage drop
= 0.6+1+4+7+6+3+1+2+1.6+0.8+0.4+0.4+0.2+0.2+0.2
= 26.6 mV

-Show how to calculate %IR
= 26.6 x 100 / 765
= 3 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 1+982

Pipeline Route Fuel Oil Pipeline
Section TS6-TS7 from : sta. 1+840 to : sta. 2+120
Test Post No. before Defect TS6 sta. 1+840 Distance to Defect 142 m.
Test Post No. after Defect TS7 sta. 2+120 Distance from Defect 138 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.535	-0.716
Defect		1.982	11.60244	99.84572	Dry Soil		761
TP after Defect	TP	2.120	11.60278	99.84693	Dry Soil	-1.542	-0.837

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 29.8 mV
%IR = 4

Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 819 - (819 - 705) x (1.84 - 1.982) / (1.84 - 2.12)
= 761 mV

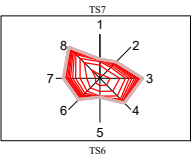
-Show how to calculate over the line to remote earth voltage drop

= 8+7+4+3.8+1.6+1.2+1+0.6+0.6+0.6+0.4+0.4+0.2+0.2
= 29.8 mV

-Show how to calculate %IR

= 29.8 x 100 / 761
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#10 at sta. 2+025

Pipeline Route Fuel Oil Pipeline
Section TS6-TS7 from : sta. 1+840 to : sta. 2+120
Test Post No. before Defect TS6 sta. 1+840 Distance to Defect 185 m.
Test Post No. after Defect TS7 sta. 2+120 Distance from Defect 95 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.535	-0.716
Defect		2.025	11.60251	99.84611	Dry Soil		744
TP after Defect	TP	2.120	11.60278	99.84693	Dry Soil	-1.542	-0.837

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 86.0 mV
%IR = 12

Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 819 - (819 - 705) x (1.84 - 2.025) / (1.84 - 2.12)
= 744 mV

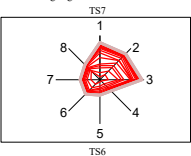
-Show how to calculate over the line to remote earth voltage drop

= 17+20+7+5+13+2+1.2+0.8+2.8+4.2+2.4+1.4+2.2+1.6+1.4+1.2+1+0.8+0.6+0.4
= 86.0 mV

-Show how to calculate %IR

= 86 x 100 / 744
= 12 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 2+011

Pipeline Route Fuel Oil Pipeline
Section TS6-TS7 from : sta. 1+840 to : sta. 2+120
Test Post No. before Defect TS6 sta. 1+840 Distance to Defect 171 m.
Test Post No. after Defect TS7 sta. 2+120 Distance from Defect 109 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	1.840	11.60207	99.84447	Dry Soil	-1.535	-0.716
Defect		2.011	11.60259	99.84598	Dry Soil		749
TP after Defect	TP	2.120	11.60278	99.84693	Dry Soil	-1.542	-0.837

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 29.4 mV
%IR = 4

Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 819 - (819 - 705) x (1.84 - 2.011) / (1.84 - 2.12)
= 749 mV

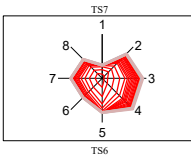
-Show how to calculate over the line to remote earth voltage drop

= 2+3+4.2+4.8+2.6+2.6+1+1+0.8+0.8+1.2+1+0.8+0.8+0.6+0.6+0.4+0.4+0.4+0.4
= 29.4 mV

-Show how to calculate %IR

= 29.4 x 100 / 749
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS7-TS8 from : sta. 2+120 to : sta. 2+635

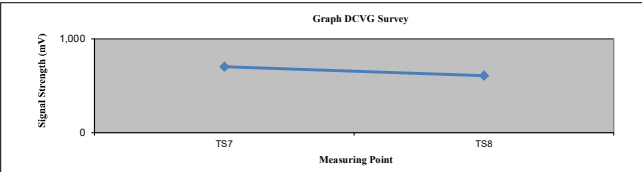
Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG		
			North	East	Volt	Amp	Volt	Amp	Tap
1	TA	Negative Cable at Loading Station	11.98831	99.82992	100 V	30 A	34.41 V	20.37 A	-

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

Signal Strength Data							
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
1	TP	TS7	11.60278	99.84693	Dry Soil	-1.542	-0.837
3	TP	TS8	11.60186	99.85152	Dry Soil	-1.303	-0.693

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "
☒ After surveying, we have found " 5 Defect points "



- 1 Defect about sta. 2+439 N = 13.60192 E = 99.84974 about 319 m. after TS7 sta. 2+120
- 2 Defect about sta. 2+486 N = 13.60182 E = 99.85016 about 366 m. after TS7 sta. 2+120
- 3 Defect about sta. 2+591 N = 13.60181 E = 99.85113 about 471 m. after TS7 sta. 2+120
- 4 Defect about sta. 2+617 N = 13.60186 E = 99.85137 about 497 m. after TS7 sta. 2+120
- 5 Defect about sta. 2+625 N = 13.60184 E = 99.85144 about 505 m. after TS7 sta. 2+120

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS7-TS8

from : sta. 2+120 to : sta. 2+635



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 2+486

Pipeline Route Fuel Oil Pipeline

from : sta. 2+120 to : sta. 2+635

Section TS7-TS8

sta. 2+120

Distance to Defect 266 m.

Test Post No. before Defect TS7

sta. 2+635

Distance from Defect 149 m.

Test Post No. after Defect TS8

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	2.120	11.60278 99.84691	Dry Soil	-1.542 -0.837	705	
Defect		2.486	11.60182 99.85014	Dry Soil		637	
TP after Defect	TP	2.635	11.60186 99.85152	Dry Soil	-1.303 -0.693	610	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 7.0 mV

%IR = 1 %

Severity =
x < 15% Low
16-35% Medium
36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 705 - (705 - 610) \times (2.12 - 2.486) / (2.12 - 2.635)$$
$$= 637 \text{ mV}$$

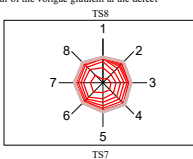
-Show how to calculate over the line to remote earth voltage drop

$$= 2.2 + 1.2 + 1 + 0.8 + 0.6 + 0.2 + 0.2$$
$$= 7.0 \text{ mV}$$

-Show how to calculate %IR

$$= 7 \times 100 / 637$$
$$= 1 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 2+439

Pipeline Route Fuel Oil Pipeline

Section TS7-TS8

from : sta. 2+120 to : sta. 2+635

Test Post No. before Defect TS7

sta. 2+120

Distance to Defect 319 m.

Test Post No. after Defect TS8

sta. 2+635

Distance from Defect 196 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	2.120	11.60278 99.84691	Dry Soil	-1.542 -0.837	705	
Defect		2.439	11.60182 99.84994	Dry Soil		646	
TP after Defect	TP	2.635	11.60186 99.85152	Dry Soil	-1.303 -0.693	610	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 23.8 mV

%IR = 4 %

Severity =
x < 15% Low
16-35% Medium
36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 705 - (705 - 610) \times (2.12 - 2.439) / (2.12 - 2.635)$$
$$= 646 \text{ mV}$$

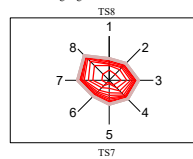
-Show how to calculate over the line to remote earth voltage drop

$$= 6 + 8 + 4 + 2.6 + 1 + 0.8 + 0.4 + 0.2 + 0.2$$
$$= 23.8 \text{ mV}$$

-Show how to calculate %IR

$$= 23.8 \times 100 / 646$$
$$= 4 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	23 March 2022
T. 0-2924-3024, 0-2924-9553-4 F. 0-2924-1744				www.cpe-eng.co.th / e-mail : cpe@cpe-eng.co.th

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 2+591

Pipeline Route Fuel Oil Pipeline

Section TS7-TS8

from : sta. 2+120 to : sta. 2+635

Test Post No. before Defect TS7

sta. 2+120

Distance to Defect 471 m.

Test Post No. after Defect TS8

sta. 2+635

Distance from Defect 44 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	2.120	11.60278 99.84691	Dry Soil	-1.542 -0.837	705	
Defect		2.591	11.60181 99.85113	Dry Soil		618	
TP after Defect	TP	2.635	11.60186 99.85152	Dry Soil	-1.303 -0.693	610	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 97.8 mV

%IR = 16 %

Severity =
x < 15% Low
16-35% Medium
36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 705 - (705 - 610) \times (2.12 - 2.591) / (2.12 - 2.635)$$
$$= 618 \text{ mV}$$

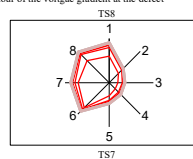
-Show how to calculate over the line to remote earth voltage drop

$$= 70 + 20 + 3.2 + 1.6 + 1 + 0.6 + 0.6 + 0.4$$
$$= 97.8 \text{ mV}$$

-Show how to calculate %IR

$$= 97.8 \times 100 / 618$$
$$= 16 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 189
	: Cu/CuSO ₄ Reference Electrode

Defect No. Defect#05 at sta. 2+625

Pipeline Route Fuel Oil Pipeline

Section	<u>TS7-TS8</u>	from :	sta. <u>2+120</u>	to :	sta. <u>2+635</u>
Test Post No. before Defect	<u>TS7</u>	sta.	<u>2+120</u>	Distance to Defect	<u>505</u> m.
Test Post No. after Defect	<u>TS8</u>	sta.	<u>2+635</u>	Distance from Defect	<u>10</u> m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	Pot Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	2.120	13.68278 99.84693	Dry Soil	-1.542 -0.837	705	
Defect		2.625	13.68184 99.85144	Dry Soil		612	
TP after Defect	TP	2.635	13.68186 99.85152	Dry Soil	-1.303 -0.693	610	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

7.4

 mV Severity =

x

 < 15% Low

%IR =

1

--

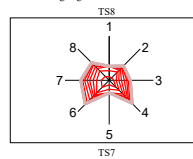
 16-35% Medium

$$= 705 - (705 - 610) \times (2.12 - 2.625) / (2.12 - 2.635)$$
$$= 612 \text{ mV}$$
$$= 2.2 + 1 + 1.2 + 0.8 + 0.6 + 0.4 + 0.4 + 0.2 + 0.2 + 0.2$$

$$= 7.4 \text{ mV}$$

-Show how to calculate %IR
 $= 7.4 \times 100 / 612$
 $= 1 \%$

-Show the contour of the voltage gradient at the defect



Note/Comment :

Test By	CPE	S.Tanva	Supervisor	23 March 2022

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 289
	: Cu/CuSO ₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
 Section TS8-TS9 from : sta. 2+635 to : sta. 3+145



Note/Comment :

Test By	CPE	S. Tanya	Supervisor	23 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 2+640

Pipeline Route Fuel Oil Pipeline

Section TS8-TS9

from : sta. 2+635 to : sta. 3+145

Test Post No. before Defect TS8 sta. 2+635 Distance to Defect 5 m.

Test Post No. after Defect TS9 sta. 3+145 Distance from Defect 505 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	PS Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	2.635	11.60186	99.85152	Dry Soil	-1.303	-0.693	610	
Defect		2.640	11.60195	99.85156	Dry Soil			609	
TP after Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.290	-0.764	526	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 9.8 mV

%IR = 2

Severity =

x	< 15% Low
x	16-35% Medium
x	36-60% High
x	> 61% Very High

-Show how to calculate signal strength at the defect

= 610 - (610 - 526) x (2.635 - 2.64) / (2.635 - 3.145)

= 609 mV

-Show how to calculate over the line to remote earth voltage drop

= 2.2+3+1.2+1+0.6+0.6+0.4+0.4+0.2+0.2

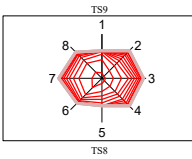
= 9.8 mV

-Show how to calculate %IR

= 9.8 x 100 / 609

= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By CPE S.Tanya Supervisor 23 March 2022

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 289

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

from : sta. 3+145 to : sta. 3+980

Interrupted Transformer Rectifier Data										
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)	Output (dc) while DCVG				Remarks
			North	East		Volt	Amp	Volt	Amp	
1	TA	TS8	13.60186	99.85152	100 V	30 A	70.52 V	23.41 A	-	sta.2+635

Installed Type : R=Existing Rectifier, TA=Temporary Anode Grounded at Test Post

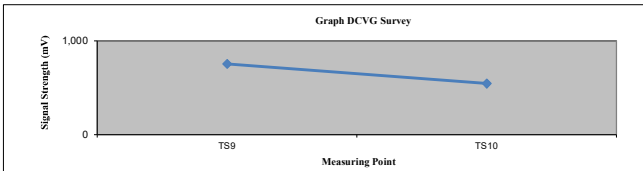
Signal Strength Data									
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	PS Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
1	TP	TS9	11.60224	99.85621	Dry Soil	-1.429	-0.703	756	Yes
3	TP	TS10	11.60299	99.86190	Dry Soil	-1.197	-0.651	546	Yes

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion After surveying, we have found " No Defect point "

X After surveying, we have found " 23 Defect points "



1	Defect about	sta.	3+523	N =	13.60249	E =	99.85970	about	378	m.	after	TS9	sta.	3+145
2	Defect about	sta.	3+555	N =	13.60252	E =	99.85999	about	410	m.	after	TS9	sta.	3+145
3	Defect about	sta.	3+583	N =	13.60259	E =	99.86024	about	438	m.	after	TS9	sta.	3+145
4	Defect about	sta.	3+618	N =	13.60210	E =	99.86057	about	473	m.	after	TS9	sta.	3+145
5	Defect about	sta.	3+683	N =	13.60266	E =	99.86117	about	538	m.	after	TS9	sta.	3+145
6	Defect about	sta.	3+694	N =	13.60263	E =	99.86127	about	549	m.	after	TS9	sta.	3+145
7	Defect about	sta.	3+703	N =	13.60269	E =	99.86134	about	558	m.	after	TS9	sta.	3+145
8	Defect about	sta.	3+727	N =	13.60273	E =	99.86156	about	582	m.	after	TS9	sta.	3+145
9	Defect about	sta.	3+743	N =	13.60263	E =	99.86170	about	598	m.	after	TS9	sta.	3+145
10	Defect about	sta.	3+760	N =	13.60268	E =	99.86186	about	615	m.	after	TS9	sta.	3+145
11	Defect about	sta.	3+783	N =	13.60273	E =	99.86207	about	638	m.	after	TS9	sta.	3+145
12	Defect about	sta.	3+802	N =	13.60275	E =	99.86224	about	657	m.	after	TS9	sta.	3+145
13	Defect about	sta.	3+814	N =	13.60277	E =	99.86235	about	669	m.	after	TS9	sta.	3+145
14	Defect about	sta.	3+826	N =	13.60277	E =	99.86246	about	681	m.	after	TS9	sta.	3+145
15	Defect about	sta.	3+840	N =	13.60277	E =	99.86259	about	695	m.	after	TS9	sta.	3+145
16	Defect about	sta.	3+858	N =	13.60277	E =	99.86276	about	713	m.	after	TS9	sta.	3+145
17	Defect about	sta.	3+863	N =	13.60281	E =	99.86281	about	718	m.	after	TS9	sta.	3+145
18	Defect about	sta.	3+874	N =	13.60279	E =	99.86291	about	729	m.	after	TS9	sta.	3+145
19	Defect about	sta.	3+881	N =	13.60279	E =	99.86298	about	736	m.	after	TS9	sta.	3+145
20	Defect about	sta.	3+911	N =	13.60279	E =	99.86326	about	766	m.	after	TS9	sta.	3+145
21	Defect about	sta.	3+928	N =	13.60280	E =	99.86342	about	783	m.	after	TS9	sta.	3+145
22	Defect about	sta.	3+942	N =	13.60283	E =	99.86355	about	797	m.	after	TS9	sta.	3+145
23	Defect about	sta.	3+971	N =	13.60283	E =	99.86382	about	826	m.	after	TS9	sta.	3+145

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 2+665

Pipeline Route Fuel Oil Pipeline

Section TS8-TS9

from : sta. 2+635 to : sta. 3+145

Test Post No. before Defect TS8 sta. 2+635 Distance to Defect 30 m.

Test Post No. after Defect TS9 sta. 3+145 Distance from Defect 480 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	PS Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	2.635	11.60186	99.85152	Dry Soil	-1.303	-0.693	610	
Defect		2.665	11.60195	99.85179	Dry Soil			605	
TP after Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.290	-0.764	526	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 109.8 mV

%IR = 18

Severity =

x	< 15% Low
x	16-35% Medium
x	36-60% High
x	> 61% Very High

-Show how to calculate signal strength at the defect

= 610 - (610 - 526) x (2.635 - 2.665) / (2.635 - 3.145)

= 605 mV

-Show how to calculate over the line to remote earth voltage drop

= 32+40+20+7+5+2.4+1.2+0.8+0.4+0.2+0.2+0.2+0.2

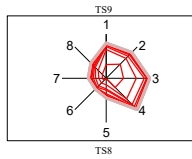
= 109.8 mV

-Show how to calculate %IR

= 109.8 x 100 / 605

= 18 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By CPE S.Tanya Supervisor 23 March 2022

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 289

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

from : sta. 3+145 to : sta. 3+980



Note/Comment :

Test By CPE S.Tanya Supervisor 24 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 3+523

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 378 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 457 m.

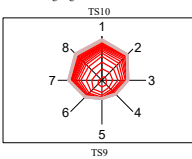
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.523	11.60230	99.85970	Dry Soil		661
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{36.8}{6}$ mVSeverity = $\frac{x}{7}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= $756 - (756 - 546) \times (3.145 - 3.523) / (3.145 - 3.98)$
= 661 mV-Show how to calculate over the line to remote earth voltage drop
= $2.6 + 8 \times 6 + 5 \times 3 + 2 \times 1.4 + 1.2 \times 1 + 0.8 \times 0.4 + 0.2 \times 0.4 + 1 \times 1 + 0.8 \times 0.8 + 0.6 \times 0.4$
= 36.8 mV-Show how to calculate %IR
= $36.8 \times 100 / 661$
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	24 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 3+583

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 438 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 297 m.

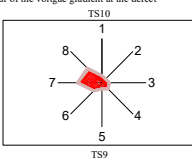
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.583	11.60230	99.86024	Dry Soil		646
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{11.0}{2}$ mVSeverity = $\frac{x}{4}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= $756 - (756 - 546) \times (3.145 - 3.583) / (3.145 - 3.98)$
= 646 mV-Show how to calculate over the line to remote earth voltage drop
= $1 \times 1.4 + 0.8 \times 0.6 + 0.6 \times 0.8 + 1.2 \times 0.8 + 0.6 \times 0.6 + 0.6 \times 0.4 + 0.4 \times 0.2 + 0.2$
= 11.0 mV-Show how to calculate %IR
= $11 \times 100 / 646$
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	24 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 3+555

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 410 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 425 m.

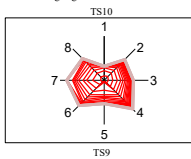
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.555	11.60230	99.85999	Dry Soil		653
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{46.2}{7}$ mVSeverity = $\frac{x}{7}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= $756 - (756 - 546) \times (3.145 - 3.555) / (3.145 - 3.98)$
= 653 mV-Show how to calculate over the line to remote earth voltage drop
= $4 \times 6 + 5 \times 4 + 3.8 \times 3.6 + 3.8 \times 2.4 + 1.8 \times 1.8 + 1.4 \times 1.4 + 1.1 \times 1 + 1 \times 1 + 0.6 \times 0.6 + 0.4$
= 46.2 mV-Show how to calculate %IR
= $46.2 \times 100 / 653$
= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	24 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 3+618

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 473 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 262 m.

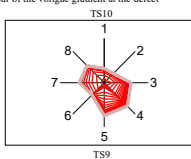
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.618	11.60230	99.86067	Dry Soil		637
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{22.6}{4}$ mVSeverity = $\frac{x}{4}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= $756 - (756 - 546) \times (3.145 - 3.618) / (3.145 - 3.98)$
= 637 mV-Show how to calculate over the line to remote earth voltage drop
= $1 \times 0.8 + 0.4 \times 0.4 + 3.2 \times 2.4 + 2.4 \times 2.4 + 1.6 \times 1.4 + 1 \times 0.8 + 0.8 \times 0.4 + 0.4 \times 0.4 + 0.2 \times 0.2$
= 22.6 mV-Show how to calculate %IR
= $22.6 \times 100 / 637$
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	24 March 2022
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T. 0-2924-3024, 0-2924-9553-4 F. 0-2924-1744

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 3+683

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 538 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 297 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.683	11.60296	99.86117	Dry Soil		621
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

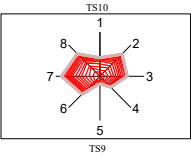
Over the line to remote earth voltage drop = 17.4 mV Severity = x
%IR = 3

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.683) / (3.145 - 3.98)
= 621 mV

-Show how to calculate over the line to remote earth voltage drop
= 0.8+2.4+1.6+1.8+1.6+1.4+1.4+0.8+0.6+0.6+0.6+0.8+0.8+0.4+0.2+0.2
= 17.4 mV

-Show how to calculate %IR
= 17.4 x 100 / 621
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 3+703

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 558 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 277 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.703	11.60297	99.86134	Dry Soil		616
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

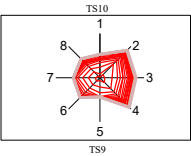
Over the line to remote earth voltage drop = 75.8 mV Severity = x
%IR = 12

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.703) / (3.145 - 3.98)
= 616 mV

-Show how to calculate over the line to remote earth voltage drop
= 12+16+8+5+5+4+3.8+3+2.8+2+2.4+1.8+2.8+1.4+1+1.4+0.8+1+0.8+0.8
= 75.8 mV

-Show how to calculate %IR
= 75.8 x 100 / 616
= 12 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 3+694

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 549 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 286 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.694	11.60291	99.86127	Dry Soil		618
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

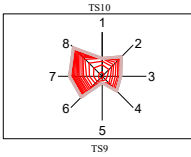
Over the line to remote earth voltage drop = 27.4 mV Severity = x
%IR = 4

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.694) / (3.145 - 3.98)
= 618 mV

-Show how to calculate over the line to remote earth voltage drop
= 2.8+5+4.8+3.8+2+1+1.6+1.4+1+0.8+0.8+0.6+0.6+0.4+0.2
= 27.4 mV

-Show how to calculate %IR
= 27.4 x 100 / 618
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	24 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 3+727

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 582 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 253 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.727	11.60271	99.86156	Dry Soil		610
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

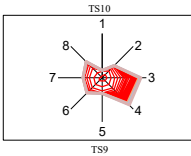
Over the line to remote earth voltage drop = 35.2 mV Severity = x
%IR = 6

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.727) / (3.145 - 3.98)
= 610 mV

-Show how to calculate over the line to remote earth voltage drop
= 4.4+3.8+3+3+2.6+2.2+1.4+1.2+1.4+1.4+1.6+1.4+1+1+0.8+1.4+0.8+1+0.8
= 35.2 mV

-Show how to calculate %IR
= 35.2 x 100 / 610
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 3+743

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 598 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 237 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.743	11.60293	99.86170	Dry Soil		606
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

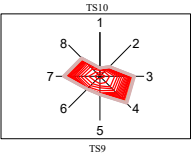
Over the line to remote earth voltage drop = 51.8 mV Severity = x < 15% Low
%IR = 9 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.743) / (3.145 - 3.98)
= 606 mV

-Show how to calculate over the line to remote earth voltage drop
= 4+8+8+4+3.2+2.2+1.8+1.8+1.8+1.8+0.6+1.8+1.4+1.6+1.6+1+1+1
= 51.8 mV

-Show how to calculate %IR
= 51.8 x 100 / 606
= 9 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#11 at sta. 3+783

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 638 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 197 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.783	11.60271	99.86207	Dry Soil		596
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

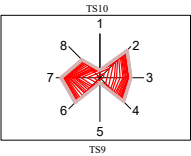
Over the line to remote earth voltage drop = 17.8 mV Severity = x < 15% Low
%IR = 3 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.783) / (3.145 - 3.98)
= 596 mV

-Show how to calculate over the line to remote earth voltage drop
= 2.6+3.2+2.8+2+0.4+0.6+1+1+0.6+0.6+0.4+0.4+0.4+0.4+0.2+0.2+0.2+0.2
= 17.8 mV

-Show how to calculate %IR
= 17.8 x 100 / 596
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#10 at sta. 3+760

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 615 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 220 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.760	11.60290	99.86386	Dry Soil		601
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

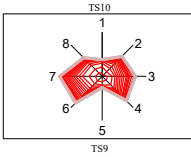
Over the line to remote earth voltage drop = 38.5 mV Severity = x < 15% Low
%IR = 6 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.76) / (3.145 - 3.98)
= 601 mV

-Show how to calculate over the line to remote earth voltage drop
= 6+6+6+3+3+2.1+1.8+1.8+1.6+1.4+1.4+0.8+0.6+0.6+0.4+0.4+0.2
= 38.5 mV

-Show how to calculate %IR
= 38.5 x 100 / 601
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#12 at sta. 3+802

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3+145 to : sta. 3+980
Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 657 m.
Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 178 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.802	11.60270	99.86224	Dry Soil		591
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

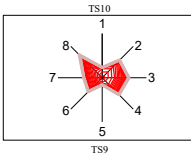
Over the line to remote earth voltage drop = 22.0 mV Severity = x < 15% Low
%IR = 4 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.802) / (3.145 - 3.98)
= 591 mV

-Show how to calculate over the line to remote earth voltage drop
= 1.2+1.4+2+1.8+1.8+1.6+1.6+1+1+0.8+0.8+0.8+0.6+0.6+0.4+0.4
= 22.0 mV

-Show how to calculate %IR
= 22 x 100 / 591
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#13 at sta. 3+814

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 669 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 166 m.

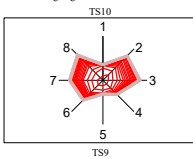
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.814	11.60277	99.86235	Dry Soil		588
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 34.0 mV
%IR = 6Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.814) / (3.145 - 3.98)
= 588 mV-Show how to calculate over the line to remote earth voltage drop
= 5+4+4+3+2.6+1.8+1.6+1.2+1.4+1+1.2+1+1+0.8+0.8+0.6+0.8+0.8+0.8+0.6
= 34.0 mV-Show how to calculate %IR
= 34 x 100 / 588
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#15 at sta. 3+840

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 695 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 140 m.

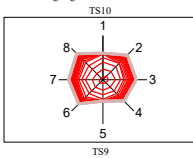
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.840	11.60277	99.86259	Dry Soil		581
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 41.8 mV
%IR = 7Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.84) / (3.145 - 3.98)
= 581 mV-Show how to calculate over the line to remote earth voltage drop
= 2.6+7+7+6+5+2+2.6+0.8+1.6+1+1+1+0.8+0.8+0.6+0.6+0.4+0.4+0.4+0.2
= 41.8 mV-Show how to calculate %IR
= 41.8 x 100 / 581
= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#14 at sta. 3+826

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 681 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 154 m.

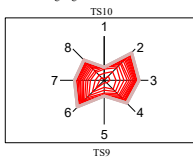
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.826	11.60277	99.86246	Dry Soil		585
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 26.6 mV
%IR = 5Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.826) / (3.145 - 3.98)
= 585 mV-Show how to calculate over the line to remote earth voltage drop
= 4+4+2+3.8+2+1.6+1+2+1+1+1+0.8+0.8+0.6+0.6+0.4+0.4+0.2+0.2+0.2
= 26.6 mV-Show how to calculate %IR
= 26.6 x 100 / 585
= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#16 at sta. 3+858

Pipeline Route Fuel Oil Pipeline

Section TS9-TS10

Test Post No. before Defect TS9 sta. 3+145 Distance to Defect 713 m.

Test Post No. after Defect TS10 sta. 3+980 Distance from Defect 122 m.

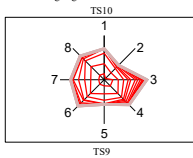
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.858	11.60277	99.86276	Dry Soil		577
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 9.6 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.858) / (3.145 - 3.98)
= 577 mV-Show how to calculate over the line to remote earth voltage drop
= 2+1+2+1.2+1+0.6+1+0.6+0.6+0.4+0.4+0.2+0.2+0.2
= 9.6 mV-Show how to calculate %IR
= 9.6 x 100 / 577
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#17 at sta. 3±863

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3±145 to : sta. 3±980
Test Post No. before Defect TS9 sta. 3±145 Distance to Defect 218 m.
Test Post No. after Defect TS10 sta. 3±980 Distance from Defect 117 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.863	11.60291	99.86281	Dry Soil		575
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

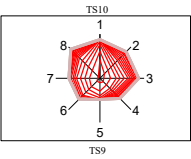
Over the line to remote earth voltage drop = 18.6 mV Severity = x < 15% Low
%IR = 2 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.863) / (3.145 - 3.98)
= 575 mV

-Show how to calculate over the line to remote earth voltage drop
= 1+3.8+2.6+2+1.8+1.8+0.8+0.8+0.6+0.6+0.4+0.4+0.2+0.2
= 18.6 mV

-Show how to calculate %IR
= 18.6 x 100 / 575
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#19 at sta. 3±881

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3±145 to : sta. 3±980
Test Post No. before Defect TS9 sta. 3±145 Distance to Defect 736 m.
Test Post No. after Defect TS10 sta. 3±980 Distance from Defect 99 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.881	11.60279	99.86290	Dry Soil		571
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

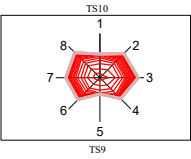
Over the line to remote earth voltage drop = 52.2 mV Severity = x < 15% Low
%IR = 9 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.881) / (3.145 - 3.98)
= 571 mV

-Show how to calculate over the line to remote earth voltage drop
= 12+9+5+5+3+2+1.8+1.8+1.6+1.6+1+1+1.8+0.6+0.6+0.4+0.2+0.2
= 52.2 mV

-Show how to calculate %IR
= 52.2 x 100 / 571
= 9 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#18 at sta. 3±874

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3±145 to : sta. 3±980
Test Post No. before Defect TS9 sta. 3±145 Distance to Defect 229 m.
Test Post No. after Defect TS10 sta. 3±980 Distance from Defect 106 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.874	11.60279	99.86291	Dry Soil		573
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

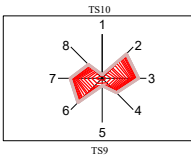
Over the line to remote earth voltage drop = 24.8 mV Severity = x < 15% Low
%IR = 4 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.874) / (3.145 - 3.98)
= 573 mV

-Show how to calculate over the line to remote earth voltage drop
= 2.4+3.8+3+1.8+1.8+1.8+1.8+1+1+0.8+0.8+0.6+0.6+0.4+0.4+0.2+0.2
= 24.8 mV

-Show how to calculate %IR
= 24.8 x 100 / 573
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#20 at sta. 3±911

Pipeline Route Fuel Oil Pipeline
Section TS9-TS10 from : sta. 3±145 to : sta. 3±980
Test Post No. before Defect TS9 sta. 3±145 Distance to Defect 766 m.
Test Post No. after Defect TS10 sta. 3±980 Distance from Defect 69 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.145	11.60224	99.85621	Dry Soil	-1.459 -0.703	756
Defect		3.911	11.60279	99.86328	Dry Soil		563
TP after Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.197 -0.651	546

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

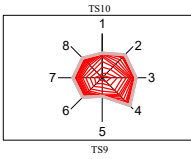
Over the line to remote earth voltage drop = 62.4 mV Severity = x < 15% Low
%IR = 11 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 756 - (756 - 546) x (3.145 - 3.911) / (3.145 - 3.98)
= 563 mV

-Show how to calculate over the line to remote earth voltage drop
= 9+9+10+5+4.4+3+2.8+4.8+4.8+1.6+1.6+1.4+1+1+0.8+0.6+0.6+0.4+0.4+0.2
= 62.4 mV

-Show how to calculate %IR
= 62.4 x 100 / 563
= 11 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT	: DCVG Survey Meter
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Defect No. Defect#22 at sta. 3+942

Pipeline Route		Fuel Oil Pipeline			
Section	TS9-TS10	from :	sta. 3+145	to :	sta. 3+980
Test Post No. before Defect	TS9	sta.	3+145	Distance to Defect	797 m.
Test Post No. after Defect	TS10	sta.	3+980	Distance from Defect	38 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	G/PS (WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	3.145	13.80224	99.85621	Dry Soil	-1.459	-0.703	756	
Defect		3.942	13.06291	99.86355	Dry Soil			556	
TP after Defect	TP	3.980	13.06290	99.86390	Dry Soil	-1.197	-0.651	546	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

34.8

 mV Severity =

x

 < 15% Low
%IR =

6

--

 16-35% Medium

--

 36-60% High

--

 > 61% Very high

-Show how to calculate signal strength at the defect

$$= 756 - (756 - 546) \times (3.145 - 3.942) / (3.145 - 3.98)$$
$$= 556 \text{ mV}$$

-Show how to calculate over the line to remote earth voltage drop

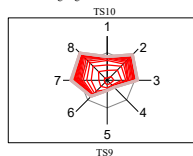
$$= 3+8+7+4+2.6+2.2+2+1.4+0.8+0.8+0.6+0.6+0.4+0.4+0.4+0.2+0.2+0.2$$
$$= 34.8 \quad \text{mV}$$

-Show how to calculate %IR

$$= 34.8 \times 100 / 556$$

$$= 6 \%$$

- Show the contour of the voltage gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	25 March 2022
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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 289
	: Cu/CuSO ₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS10-TS11 from : sta. 3+980 to : sta. 4+550

Interrupted Transformer Rectifier Data										
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG			Remarks
			North	East	Volt	Amp	Volt	Amp	Tap	
1	R	TS15	13.60728	99.88453	50 V	80 A	8.80 V	44.6 A	C2F1	sta.6+715

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

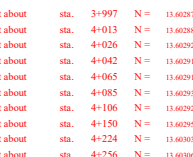
Signal Strength Data										
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	-500 mV Accept	Remarks
			North	East		"ON"	"OFF"			
1	TP	TS10	13.60290	99.86390	Dry Soil	-1.199	-0.686	513	Yes	
3	TP	TS11	13.60331	99.86619	Dry Soil	-1.292	-0.740	552	Yes	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion		After surveying, we have found " No Defect point "
	X	After surveying, we have found " 18 Defect points "

Measuring Point	Signal Strength (mV)
TS10	450
TS11	500

1	Defect about	sta.	4-0193	N = 13.60287	E = 0.98686	about	17	m.	after	TS10	sta.	3-9800
2	Defect about	sta.	4-0197	N = 13.60288	E = 0.98621	about	33	m.	after	TS10	sta.	3-9800
3	Defect about	sta.	4-0426	N = 13.60292	E = 0.98613	about	46	m.	after	TS10	sta.	3-9800
4	Defect about	sta.	4-0402	N = 13.60291	E = 0.98648	about	62	m.	after	TS10	sta.	3-9800
5	Defect about	sta.	4-0465	N = 13.60291	E = 0.98649	about	85	m.	after	TS10	sta.	3-9800
6	Defect about	sta.	4-0885	N = 13.60293	E = 0.98687	about	105	m.	after	TS10	sta.	3-9800
7	Defect about	sta.	4-1106	N = 13.60292	E = 0.98656	about	126	m.	after	TS10	sta.	3-9800
8	Defect about	sta.	4-1150	N = 13.60295	E = 0.98657	about	170	m.	after	TS10	sta.	3-9800
9	Defect about	sta.	4-2224	N = 13.60303	E = 0.98665	about	244	m.	after	TS10	sta.	3-9800
10	Defect about	sta.	4-256	N = 13.60306	E = 0.98665	about	276	m.	after	TS10	sta.	3-9800
11	Defect about	sta.	4-2911	N = 13.60305	E = 0.98677	about	311	m.	after	TS10	sta.	3-9800
12	Defect about	sta.	4-314	N = 13.60304	E = 0.98668	about	334	m.	after	TS10	sta.	3-9800
13	Defect about	sta.	4-362	N = 13.60317	E = 0.98742	about	382	m.	after	TS10	sta.	3-9800
14	Defect about	sta.	4-419	N = 13.60321	E = 0.98789	about	439	m.	after	TS10	sta.	3-9800
15	Defect about	sta.	4-4431	N = 13.60320	E = 0.98806	about	451	m.	after	TS10	sta.	3-9800
16	Defect about	sta.	4-448	N = 13.60319	E = 0.98822	about	468	m.	after	TS10	sta.	3-9800
17	Defect about	sta.	4-548	N = 13.60318	E = 0.98831	about	478	m.	after	TS10	sta.	3-9800
18	Defect about	sta.	4-541	N = 13.60323	E = 0.98807	about	561	m.	after	TS10	sta.	3-9800



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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS10-TS11

from : sta. 3+980 to : sta. 4+550



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect02 at sta. 4+013

Pipeline Route Fuel Oil Pipeline

Section TS10-TS11

from : sta. 3+980 to : sta. 4+550

Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 33 m.

Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 537 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	3.980	11.60290 99.86390	Dry Soil	-1.199 -0.686	513	
Defect		4.013	11.60290 99.86421	Dry Soil		515	
TP after Defect	TP	4.550	11.60331 99.86919	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 32.6 mV
%IR = 6.5Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 513 - (513 - 552) x (3.98 - 4.013) / (3.98 - 4.55)
= 515 mV

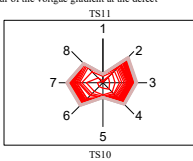
-Show how to calculate over the line to remote earth voltage drop

= 5+10+4+2+1.4+1+1+1+1+0.8+0.8+0.6+0.4+0.4+0.4+0.2+0.2
= 32.6 mV

-Show how to calculate %IR

= 32.6 x 100 / 515
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect01 at sta. 3+997

Pipeline Route Fuel Oil Pipeline

Section TS10-TS11

from : sta. 3+980 to : sta. 4+550

Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 12 m.

Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 553 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	3.980	11.60290 99.86390	Dry Soil	-1.199 -0.686	513	
Defect		3.997	11.60290 99.86406	Dry Soil		514	
TP after Defect	TP	4.550	11.60331 99.86919	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 81.0 mV
%IR = 16Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 513 - (513 - 552) x (3.98 - 3.997) / (3.98 - 4.55)
= 514 mV

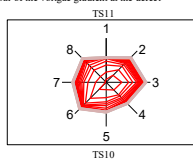
-Show how to calculate over the line to remote earth voltage drop

= 32+14+8+8+3.4+2+1.8+1.2+1.2+1.2+1+1+0.8+0.6+0.4+0.4+0.4+0.4
= 81.0 mV

-Show how to calculate %IR

= 81 x 100 / 514
= 16 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect03 at sta. 4+026

Pipeline Route Fuel Oil Pipeline

Section TS10-TS11

from : sta. 3+980 to : sta. 4+550

Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 46 m.

Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 524 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	3.980	11.60290 99.86390	Dry Soil	-1.199 -0.686	513	
Defect		4.026	11.60292 99.86433	Dry Soil		516	
TP after Defect	TP	4.550	11.60331 99.86919	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 41.8 mV
%IR = 8Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 513 - (513 - 552) x (3.98 - 4.026) / (3.98 - 4.55)
= 516 mV

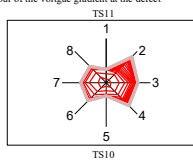
-Show how to calculate over the line to remote earth voltage drop

= 5+8+3+2+1.4+1.4+1.8+2+2+2+2+1.8+1.4+0.6+1+1+1+1+0.8
= 41.8 mV

-Show how to calculate %IR

= 41.8 x 100 / 516
= 8 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
T. 0-2924-3024, 0-2924-9553-4 F. 0-2924-1744				

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 4+042

Pipeline Route Fuel Oil Pipeline
Section TS10-TS11 from : sta. 3+980 to : sta. 4+550
Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 62 m.
Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 508 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	3.980	11.60290 99.86390	Dry Soil	-1.199 -0.686	513	
Defect		4.042	11.60291 99.86348	Dry Soil		517	
TP after Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

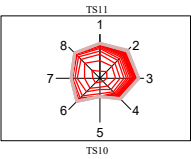
Over the line to remote earth voltage drop = 62.8 mV Severity = x < 15% Low
%IR = 12 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 513 - (513 - 552) x (3.98 - 4.042) / (3.98 - 4.55)
= 517 mV

-Show how to calculate over the line to remote earth voltage drop
= 15+12+7+6+4+3+2.2+1.6+1.8+1.4+1+1+0.8+1+0.6+1+1+0.8+0.8+0.8
= 62.8 mV

-Show how to calculate %IR
= 62.8 x 100 / 517
= 12 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 4+085

Pipeline Route Fuel Oil Pipeline
Section TS10-TS11 from : sta. 3+980 to : sta. 4+550
Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 105 m.
Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 465 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	3.980	11.60290 99.86390	Dry Soil	-1.199 -0.686	513	
Defect		4.085	11.60291 99.86347	Dry Soil		520	
TP after Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

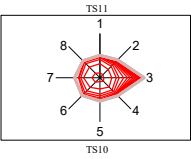
Over the line to remote earth voltage drop = 90.0 mV Severity = x < 15% Low
%IR = 17 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 513 - (513 - 552) x (3.98 - 4.085) / (3.98 - 4.55)
= 520 mV

-Show how to calculate over the line to remote earth voltage drop
= 8+16+9+6+9+8+6+5+5+4+4+3+3
= 90.0 mV

-Show how to calculate %IR
= 90 x 100 / 520
= 17 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 4+065

Pipeline Route Fuel Oil Pipeline
Section TS10-TS11 from : sta. 3+980 to : sta. 4+550
Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 85 m.
Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 485 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	3.980	11.60290 99.86390	Dry Soil	-1.199 -0.686	513	
Defect		4.065	11.60291 99.86349	Dry Soil		519	
TP after Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

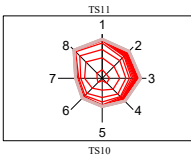
Over the line to remote earth voltage drop = 54.0 mV Severity = x < 15% Low
%IR = 10 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 513 - (513 - 552) x (3.98 - 4.065) / (3.98 - 4.55)
= 519 mV

-Show how to calculate over the line to remote earth voltage drop
= 10+21+12+8+1.6+0.6+0.4+0.4
= 54.0 mV

-Show how to calculate %IR
= 54 x 100 / 519
= 10 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 4+106

Pipeline Route Fuel Oil Pipeline
Section TS10-TS11 from : sta. 3+980 to : sta. 4+550
Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 126 m.
Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 444 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	3.980	11.60290 99.86390	Dry Soil	-1.199 -0.686	513	
Defect		4.106	11.60291 99.86390	Dry Soil		522	
TP after Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

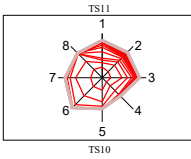
Over the line to remote earth voltage drop = 95.8 mV Severity = x < 15% Low
%IR = 18 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 513 - (513 - 552) x (3.98 - 4.106) / (3.98 - 4.55)
= 522 mV

-Show how to calculate over the line to remote earth voltage drop
= 28+30+28+8+1.8
= 95.8 mV

-Show how to calculate %IR
= 95.8 x 100 / 522
= 18 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 189
	: Cu/CuSO ₄ Reference Electrode

Defect No. Defect#09 at sta. 4+224

Pipeline Route		Fuel Oil Pipeline			
Section	TS10-TS11	from :	sta. 3+980	to :	sta. 4+550
Test Post No. before Defect	TS10	sta. 3+980	Distance to Defect	244	m.
Test Post No. after Defect	TS11	sta. 4+550	Distance from Defect	326	m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	3.980	13.60290	99.86396	Dry Soil	-1.199	-0.686	513	
Defect		4.224	13.60303	99.86615	Dry Soil			530	
TP after Defect	TP	4.550	13.60331	99.86918	Dry Soil	-1.292	-0.740	552	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

30.6
6

 mV Severity =

x

%IR =

< 15% Low
16-35% Medium
36-60% High
> 61% Very high

$$= 513 - (513 - 552) \times (3.98 - 4.224) / (3.98 - 4.55)$$

$$= 530 \text{ mV}$$
$$= 9 + 8 + 4 + 2 + 2 + 1 + 0.8 + 0.4 + 0.6 + 0.6 + 0.8 + 0.4 + 0.4 + 0.2 + 0.2 + 0.2$$

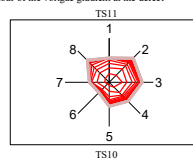
$$= 30.6 \text{ mV}$$

-Show how to calculate %IR

$$= 30.6 \times 100 / 530$$

$$= 6 \%$$

-Show the contour of the voltage gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 189
	: Cu/CuSO ₄ Reference Electrode

Defect No. Defect#11 at sta. 4+291

Pipeline Route		Fuel Oil Pipeline			
Section	TS10-TS11	from :	sta. 3+980	to :	sta. 4+550
Test Post No. before Defect	TS10	sta. 3+980	Distance to Defect	311	m.
Test Post No. after Defect	TS11	sta. 4+550	Distance from Defect	259	m.

Defect Signal Strength Data								
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	Potential (V)	Signal Strength (mV)	Remarks
			North	East		"ON" / "OFF"		
TP before Defect	TP	3.980	13.60290	99.86390	Dry Soil	-1.199 -0.686	513	
Defect		4.291	13.60305	99.86677	Dry Soil		534	
TP after Defect	TP	4.550	13.60331	99.86918	Dry Soil	-1.292 -0.740	552	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

15.6
3

 mV Severity =

x

%IR =

< 15% Low
16-35% Medium
36-60% High
> 61% Very high

$$= 513 - (513 - 552) \times (3.98 - 4.291) / (3.98 - 4.55)$$
$$= 534 \text{ mV}$$

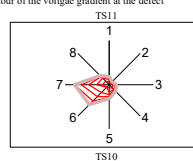
-Show how to calculate over the line to remote earth voltage drop
 $= 3 + 2.6 + 3.6 + 3.4 + 3$
 $= 15.6 \text{ mV}$

-Show how to calculate %IR

$$= 15.6 \times 100 / 534$$

$$= 3 \%$$

- Show the contour of the voltage gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter

: Cu/CuSO₄ Reference ElectrodeDefect No. Defect#13 at sta. 4+362

Pipeline Route		Fuel Oil Pipeline			
Section	TS10-TS11	from:	sta. 3+980	to:	sta. 4+550
Test Post No. before Defect	TS10	sta.	3+980	Distance to Defect	382 m.
Test Post No. after Defect	TS11	sta.	4+550	Distance from Defect	188 m.

Defect Signal Strength Data								
Location	Measuring Point	Sta.	G/PS(WGS84) North	Ground Type	P/S Potential (V) Type	Signal Strength (mV)	Remarks	
TP before Defect	TP	3.980	13.60289	99.86390	Dry Soil	-1.199	-0.686	513
Defect		4.362	13.60319	99.86342	Dry Soil			539
TP after Defect	TP	4.550	13.60331	99.86018	Dry Soil	-1.292	-0.740	552

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =	182.0	mV	Severity =	< 15% Low
%IR =	34			x 16-35% Medium
				36-60% High
				> 61% Very high

-Show how to calculate signal strength at the defect

$$= 513 - (513 - 552) \times (3.98 - 4.362) / (3.98 - 4.55)$$
$$= 539 \text{ mV}$$

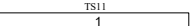
-Show how to calculate over the line to remote earth voltage drop

$$= 40+40+40+30+10+7+5+4+3+2+1$$
$$= 182.0 \quad \text{mV}$$

-Show how to calculate %IR

$$= 182 \times 100 / 539$$
$$= 34 \%$$

• Show the contour of the voltgae gradient at the defect



A contour plot showing the voltage gradient at the defect. The plot is circular with eight radial lines labeled 1 through 8. The lines are numbered clockwise starting from the top (12 o'clock position). The plot shows a red shaded region representing the voltage gradient, which is concentrated in the upper-left quadrant (between lines 1 and 3) and extends towards the center. The plot is labeled 'TS11' at the top and 'TS10' at the bottom.

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter

: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#15 at sta. 4+431

Pipeline Route	<u>Fuel Oil Pipeline</u>			
Section	<u>TS10-TS11</u>	from :	sta. <u>3+980</u>	to : sta. <u>4+550</u>
Test Post No. before Defect	<u>TS10</u>	sta.	<u>3+980</u>	Distance to Defect <u>451</u> m.
Test Post No. after Defect	<u>TS11</u>	sta.	<u>4+550</u>	Distance from Defect <u>119</u> m.

Defect Signal Strength Data								
Location	Measuring Point	Sta.	G/PS (WGS84)		Ground Type	P/S Potential (V)	Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"	
TP before Defect	TP	3.980	13.60290	99.86390	Dry Soil	-1.199	-0.686	513
Defect		4.431	13.60320	99.86806	Dry Soil			544
TP after Defect	TP	4.550	13.60331	99.86818	Dry Soil	-1.292	-0.740	552

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

29.0
5

 mV Severity =

x

%IR =

< 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 513 - (513 - 552) \times (3.98 - 4.431) / (3.98 - 4.55)$$
$$= 544 \text{ mV}$$

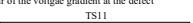
-Show how to calculate over the line to remote earth voltage drop

$$= 5+7+6+7+4$$
$$= 29.0 \quad \text{mV}$$

-Show how to calculate %IR

$$= 29 \times 100 / 544$$
$$= 5 \%$$

-Show the contour of the voltgae gradient at the defect



The contour plot shows the voltage gradient at the defect. The plot is enclosed in a rectangular frame. The top edge is labeled 'TS11' and the bottom edge is labeled 'TS10'. The plot features a central region with a complex, irregular shape, possibly representing the defect. This central region is surrounded by a series of concentric, roughly circular contour lines. The contours are labeled with numbers 1 through 8, indicating different levels of the voltage gradient. The contours are more densely packed in some areas, suggesting a steeper gradient, and more spread out in others, suggesting a shallower gradient. The overall shape of the contours is somewhat elongated horizontally.

Note/Comment :

Test By:	CBE	S. Tonno	Supervisor:	30/3/2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#16 at sta. 4+448

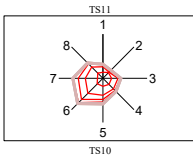
Pipeline Route Fuel Oil Pipeline
Section TS10-TS11 from : sta. 3+980 to : sta. 4+550
Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 468 m.
Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 102 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.199 -0.686	513
Defect		4.448	11.60319	99.86022	Dry Soil		545
TP after Defect	TP	4.550	11.60331	99.86918	Dry Soil	-1.292 -0.740	552

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 40.2 mV
%IR = 7Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 513 - (513 - 552) x (3.98 - 4.448) / (3.98 - 4.55)
= 545 mV-Show how to calculate over the line to remote earth voltage drop
= 9+15+10+5+1.2
= 40.2 mV-Show how to calculate %IR
= 40.2 x 100 / 545
= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30/3/2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#18 at sta. 4+541

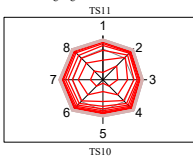
Pipeline Route Fuel Oil Pipeline
Section TS10-TS11 from : sta. 3+980 to : sta. 4+550
Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 561 m.
Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 9 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.199 -0.686	513
Defect		4.541	11.60322	99.86097	Dry Soil		551
TP after Defect	TP	4.550	11.60331	99.86918	Dry Soil	-1.292 -0.740	552

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 175.2 mV
%IR = 32Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 513 - (513 - 552) x (3.98 - 4.541) / (3.98 - 4.55)
= 551 mV-Show how to calculate over the line to remote earth voltage drop
= 36+50+36+14+10+8+5+4+3+1.8+1.4+1+1+0.8+0.8+0.6+0.4+0.4+0.4
= 175.2 mV-Show how to calculate %IR
= 175.2 x 100 / 551
= 32 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30/3/2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#17 at sta. 4+458

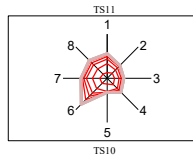
Pipeline Route Fuel Oil Pipeline
Section TS10-TS11 from : sta. 3+980 to : sta. 4+550
Test Post No. before Defect TS10 sta. 3+980 Distance to Defect 478 m.
Test Post No. after Defect TS11 sta. 4+550 Distance from Defect 92 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	3.980	11.60290	99.86390	Dry Soil	-1.199 -0.686	513
Defect		4.458	11.60319	99.86031	Dry Soil		546
TP after Defect	TP	4.550	11.60331	99.86918	Dry Soil	-1.292 -0.740	552

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 24.8 mV
%IR = 5Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 513 - (513 - 552) x (3.98 - 4.458) / (3.98 - 4.55)
= 546 mV-Show how to calculate over the line to remote earth voltage drop
= 5+5+4+3+3.6+3.2+1
= 24.8 mV-Show how to calculate %IR
= 24.8 x 100 / 546
= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30/3/2022
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CATHODIC PROTECTION DCVG COATING SURVEY

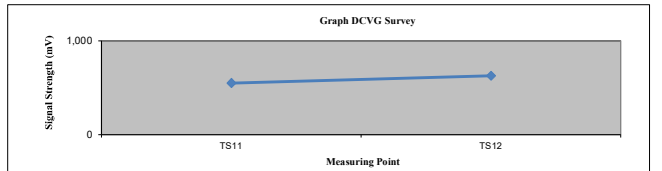
TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference ElectrodePipeline Route Fuel Oil Pipeline
Section TS11-TS12 from : sta. 4+550 to : sta. 4+910

Interrupted Transformer Rectifier Data										
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG			Remarks
			North	East	Volt	Amp	Volt	Amp	Tap	
1	R	TS15	13.60728	99.88453	50 V	80 A	8.80 V	44.6 A	C2F1	sta.6+715

Installed Type : R=Existing Rectifier, TA=Temporary Anode Grounded at Test Post

Signal Strength Data							
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
1	TP	TS11	11.60331	99.86918	Dry Soil	-1.292 -0.740	552
3	TP	TS12	11.60358	99.87251	Dry Soil	-1.335 -0.705	630

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion
x After surveying, we have found " No Defect point "
X After surveying, we have found " 12 Defect points "

1	Defect about	sta. 4+598	N = 13.60332	E = 99.86962	about 48	m. after	TS11	sta. 4+550
2	Defect about	sta. 4+642	N = 13.60336	E = 99.87003	about 92	m. after	TS11	sta. 4+550
3	Defect about	sta. 4+670	N = 13.60335	E = 99.87029	about 120	m. after	TS11	sta. 4+550
4	Defect about	sta. 4+694	N = 13.60387	E = 99.87051	about 144	m. after	TS11	sta. 4+550
5	Defect about	sta. 4+723	N = 13.60341	E = 99.87077	about 173	m. after	TS11	sta. 4+550
6	Defect about	sta. 4+738	N = 13.60342	E = 99.87091	about 188	m. after	TS11	sta. 4+550
7	Defect about	sta. 4+795	N = 13.60348	E = 99.87143	about 245	m. after	TS11	sta. 4+550
8	Defect about	sta. 4+809	N = 13.60350	E = 99.87156	about 259	m. after	TS11	sta. 4+550
9	Defect about	sta. 4+855	N = 13.60353	E = 99.87199	about 305	m. after	TS11	sta. 4+550
10	Defect about	sta. 4+872	N = 13.60351	E = 99.87214	about 322	m. after	TS11	sta. 4+550
11	Defect about	sta. 4+891	N = 13.60358	E = 99.87231	about 341	m. after	TS11	sta. 4+550
12	Defect about	sta. 4+902	N = 13.60350	E = 99.87242	about 352	m. after	TS11	sta. 4+550

CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

from : sta. 4+550 to : sta. 4+910



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 4+642

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

from : sta. 4+550 to : sta. 4+910

Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 92 m.

Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 268 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	4.550	(11.6031) (99.86918)	Dry Soil	-1.292 -0.740	552	
Defect		4.642	(11.6033) (99.8706)	Dry Soil		572	
TP after Defect	TP	4.910	(11.6033) (99.8725)	Dry Soil	-1.335 -0.705	630	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 48.6 mV
%IR = 5Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.642) / (4.55 - 4.91)$$
$$= 572 \text{ mV}$$

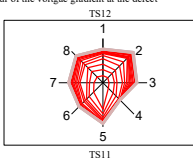
-Show how to calculate over the line to remote earth voltage drop

$$= 8+7+5+7+6+6+0.8+0.6+0.6$$
$$= 48.6 \text{ mV}$$

-Show how to calculate %IR

$$= 48.6 \times 100 / 572$$
$$= 8 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 4+598

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

from : sta. 4+550 to : sta. 4+910

Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 48 m.

Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 312 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	4.550	(11.6031) (99.86918)	Dry Soil	-1.292 -0.740	552	
Defect		4.598	(11.6032) (99.86962)	Dry Soil		562	
TP after Defect	TP	4.910	(11.6033) (99.8725)	Dry Soil	-1.335 -0.705	630	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 7.6 mV
%IR = 1Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.598) / (4.55 - 4.91)$$
$$= 562 \text{ mV}$$

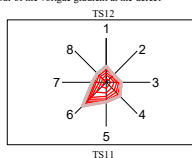
-Show how to calculate over the line to remote earth voltage drop

$$= 1.4+1.8+1.6+0.6+0.6+0.4+0.4+0.2$$
$$= 7.6 \text{ mV}$$

-Show how to calculate %IR

$$= 7.6 \times 100 / 562$$
$$= 1 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 4+670

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

from : sta. 4+550 to : sta. 4+910

Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 120 m.

Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 240 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	4.550	(11.6031) (99.86918)	Dry Soil	-1.292 -0.740	552	
Defect		4.670	(11.6033) (99.87029)	Dry Soil		578	
TP after Defect	TP	4.910	(11.6033) (99.8725)	Dry Soil	-1.335 -0.705	630	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 31.2 mV
%IR = 5Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.67) / (4.55 - 4.91)$$
$$= 578 \text{ mV}$$

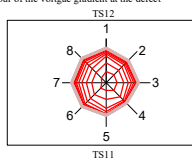
-Show how to calculate over the line to remote earth voltage drop

$$= 4+9+5+4+3+2+1+0.8+0.8+0.6+0.4+0.2+0.2+0.2$$
$$= 31.2 \text{ mV}$$

-Show how to calculate %IR

$$= 31.2 \times 100 / 578$$
$$= 5 \%$$

-Show the contour of the voltagae gradient at the defect



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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 4+694

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 144 m.

Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 216 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.550	11.6031	99.86918	Dry Soil	-1.292 -0.740	552
Defect		4.694	11.6037	99.87051	Dry Soil	-1.335 -0.705	583
TP after Defect	TP	4.910	11.6036	99.87251	Dry Soil	-1.335 -0.705	630

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 118.8 mV
%IR = 20Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.694) / (4.55 - 4.91)$$
$$= 583 \text{ mV}$$

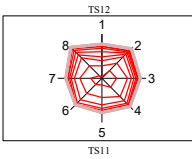
-Show how to calculate over the line to remote earth voltage drop

$$= 4 + 9 \times 5 + 4 \times 3 + 2 + 1 + 0.8 + 0.8 + 0.6 + 0.4 + 0.2 + 0.2$$
$$= 118.8 \text{ mV}$$

-Show how to calculate %IR

$$= 118.8 \times 100 / 583$$
$$= 20 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	28 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 4+738

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 188 m.

Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 172 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.550	11.6031	99.86918	Dry Soil	-1.292 -0.740	552
Defect		4.738	11.6032	99.87141	Dry Soil	-1.335 -0.705	593
TP after Defect	TP	4.910	11.6036	99.87251	Dry Soil	-1.335 -0.705	630

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 26.6 mV
%IR = 2Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.738) / (4.55 - 4.91)$$
$$= 593 \text{ mV}$$

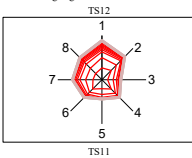
-Show how to calculate over the line to remote earth voltage drop

$$= 8 + 7 + 4 + 1 + 1 + 1 + 0.8 + 0.8 + 0.6 + 0.4 + 0.2 + 0.2$$
$$= 26.6 \text{ mV}$$

-Show how to calculate %IR

$$= 26.6 \times 100 / 593$$
$$= 4 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	29 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 4+723

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 173 m.

Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 187 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.550	11.6031	99.86918	Dry Soil	-1.292 -0.740	552
Defect		4.723	11.6034	99.87077	Dry Soil	-1.335 -0.705	589
TP after Defect	TP	4.910	11.6036	99.87251	Dry Soil	-1.335 -0.705	630

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 50.6 mV
%IR = 9Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.723) / (4.55 - 4.91)$$
$$= 589 \text{ mV}$$

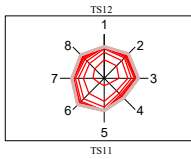
-Show how to calculate over the line to remote earth voltage drop

$$= 9 + 20 + 10 + 5 + 2.4 + 1 + 0.6 + 0.6 + 0.4 + 0.2 + 0.2$$
$$= 50.6 \text{ mV}$$

-Show how to calculate %IR

$$= 50.6 \times 100 / 589$$
$$= 9 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	29 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 4+795

Pipeline Route Fuel Oil Pipeline

Section TS11-TS12

Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 245 m.

Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 115 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.550	11.6031	99.86918	Dry Soil	-1.292 -0.740	552
Defect		4.795	11.6030	99.87141	Dry Soil	-1.335 -0.705	605
TP after Defect	TP	4.910	11.6036	99.87251	Dry Soil	-1.335 -0.705	630

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 18.8 mV
%IR = 3Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.795) / (4.55 - 4.91)$$
$$= 605 \text{ mV}$$

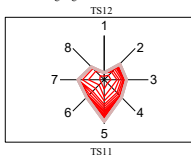
-Show how to calculate over the line to remote earth voltage drop

$$= 4.2 + 3.4 + 2 + 1.6 + 1 + 1 + 0.8 + 0.8 + 0.8 + 0.6 + 0.6 + 0.4$$
$$= 18.8 \text{ mV}$$

-Show how to calculate %IR

$$= 18.8 \times 100 / 605$$
$$= 3 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	29 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 4+809

Pipeline Route Fuel Oil Pipeline
Section TS11-TS12 from : sta. 4+550 to : sta. 4+910
Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 259 m.
Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 101 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	
Defect		4.809	11.60336 99.87156	Dry Soil	-1.335 -0.705	608	
TP after Defect	TP	4.910	11.60336 99.87251	Dry Soil	-1.335 -0.705	630	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

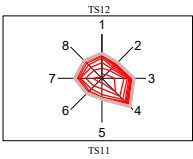
Over the line to remote earth voltage drop = 63.0 mV Severity = x < 15% Low
%IR = 10 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 552 - (552 - 630) x (4.55 - 4.809) / (4.55 - 4.91)
= 608 mV

-Show how to calculate over the line to remote earth voltage drop
= 30+10+7+5+2+2+1.8+1.8+1+0.8+0.6+0.4+0.4+0.2
= 63.0 mV

-Show how to calculate %IR
= 63 x 100 / 608
= 10 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#10 at sta. 4+872

Pipeline Route Fuel Oil Pipeline
Section TS11-TS12 from : sta. 4+550 to : sta. 4+910
Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 322 m.
Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 38 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	
Defect		4.872	11.60331 99.87214	Dry Soil	-1.335 -0.705	622	
TP after Defect	TP	4.910	11.60336 99.87251	Dry Soil	-1.335 -0.705	630	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

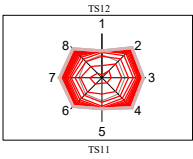
Over the line to remote earth voltage drop = 231.6 mV Severity = x < 15% Low
%IR = 37 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 552 - (552 - 630) x (4.55 - 4.872) / (4.55 - 4.91)
= 622 mV

-Show how to calculate over the line to remote earth voltage drop
= 40+66+34+18+14+10+8+7+6+4+4+3+3+4+3+2+4+1.8+1.8+2+2+1.2
= 231.6 mV

-Show how to calculate %IR
= 231.6 x 100 / 622
= 37 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 4+855

Pipeline Route Fuel Oil Pipeline
Section TS11-TS12 from : sta. 4+550 to : sta. 4+910
Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 305 m.
Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 55 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	
Defect		4.855	11.60331 99.87089	Dry Soil	-1.335 -0.705	618	
TP after Defect	TP	4.910	11.60336 99.87251	Dry Soil	-1.335 -0.705	630	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

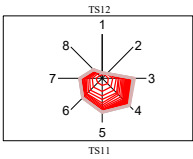
Over the line to remote earth voltage drop = 43.6 mV Severity = x < 15% Low
%IR = 7 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 552 - (552 - 630) x (4.55 - 4.855) / (4.55 - 4.91)
= 618 mV

-Show how to calculate over the line to remote earth voltage drop
= 9+5+5+4+1.6+2+3+2.4+2+0.8+1+1+1+0.8+1+1.4+1.2+0.8+0.6
= 43.6 mV

-Show how to calculate %IR
= 43.6 x 100 / 618
= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#11 at sta. 4+891

Pipeline Route Fuel Oil Pipeline
Section TS11-TS12 from : sta. 4+550 to : sta. 4+910
Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 341 m.
Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 19 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	4.550	11.60331 99.86918	Dry Soil	-1.292 -0.740	552	
Defect		4.891	11.60336 99.87251	Dry Soil	-1.335 -0.705	626	
TP after Defect	TP	4.910	11.60336 99.87251	Dry Soil	-1.335 -0.705	630	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

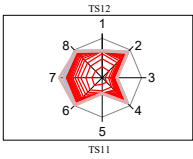
Over the line to remote earth voltage drop = 135.8 mV Severity = x < 15% Low
%IR = 22 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 552 - (552 - 630) x (4.55 - 4.891) / (4.55 - 4.91)
= 626 mV

-Show how to calculate over the line to remote earth voltage drop
= 32+20+16+10+8+7+4+3+3+2.8+2.4+2.4+1.8+1.8+1.6+1.8+1.4+1.4+1.4+1.4
= 135.8 mV

-Show how to calculate %IR
= 135.8 x 100 / 626
= 22 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#12 at sta. 4+902

Pipeline Route Fuel Oil Pipeline
Section TS11-TS12 from : sta. 4+550 to : sta. 4+910
Test Post No. before Defect TS11 sta. 4+550 Distance to Defect 352 m.
Test Post No. after Defect TS12 sta. 4+910 Distance from Defect 8 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P.S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	4.550	11.60331	99.86918	Dry Soil	-1.292	-0.740	552	
Defect		4.902	11.60389	99.87242	Dry Soil			628	
TP after Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335	-0.705	630	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 82.2 mV Severity = x < 15% Low
%IR = 13 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 552 - (552 - 630) \times (4.55 - 4.902) / (4.55 - 4.91) = 628 \text{ mV}$$

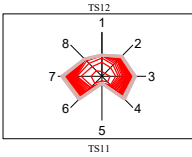
-Show how to calculate over the line to remote earth voltage drop

$$= 22 + 20 \times 9 + 1 + 1.8 + 1.4 + 2 + 1.6 + 2 + 1.8 + 2 + 1.8 + 2.6 + 2 + 2 + 2 + 1.6 + 1.6 = 82.2 \text{ mV}$$

-Show how to calculate %IR

$$= 82.2 \times 100 / 628 = 13 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325



Note/Comment :

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325

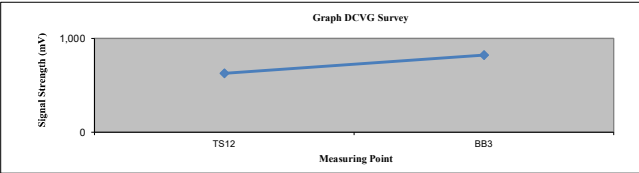
Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc) Volt	Amp	Output (dc) while DCVG		Remarks
			North	East			Volt	Amp	
1	R	TS15	11.60326	99.86853	50 V	80 A	8.80 V	44.6 A	C2F1 sta. 6+715
3	TP	BB3	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	

Installed Type : R=Existing Rectifier, TA=Temporary Anode Grounded at Test Post

Signal Strength Data									
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P.S Potential (V)		Signal Strength (mV)	>80 mV Accept
			North	East		"ON"	"OFF"		
1	TP	TS12	11.60356	99.87251	Dry Soil	-1.335	-0.705	630	Yes
3	TP	BB3	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	Yes

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "
☒ After surveying, we have found " 19 Defect points "



1	Defect about	sta. 4+919	N = 13.60351	E = 99.87260	about 9	m. after	TS12	sta. 4+910
2	Defect about	sta. 4+929	N = 13.60355	E = 99.87269	about 19	m. after	TS12	sta. 4+910
3	Defect about	sta. 4+934	N = 13.60355	E = 99.87273	about 24	m. after	TS12	sta. 4+910
4	Defect about	sta. 5+036	N = 13.60360	E = 99.87337	about 93	m. after	TS12	sta. 4+910
5	Defect about	sta. 5+049	N = 13.60366	E = 99.87387	about 126	m. after	TS12	sta. 4+910
6	Defect about	sta. 5+049	N = 13.60369	E = 99.87379	about 139	m. after	TS12	sta. 4+910
7	Defect about	sta. 5+068	N = 13.60369	E = 99.87396	about 158	m. after	TS12	sta. 4+910
8	Defect about	sta. 5+083	N = 13.60370	E = 99.87410	about 173	m. after	TS12	sta. 4+910
9	Defect about	sta. 5+122	N = 13.60375	E = 99.87446	about 212	m. after	TS12	sta. 4+910
10	Defect about	sta. 5+154	N = 13.60371	E = 99.87476	about 244	m. after	TS12	sta. 4+910
11	Defect about	sta. 5+162	N = 13.60370	E = 99.87483	about 252	m. after	TS12	sta. 4+910
12	Defect about	sta. 5+181	N = 13.60371	E = 99.87501	about 271	m. after	TS12	sta. 4+910
13	Defect about	sta. 5+200	N = 13.60370	E = 99.87519	about 290	m. after	TS12	sta. 4+910
14	Defect about	sta. 5+213	N = 13.60379	E = 99.87531	about 303	m. after	TS12	sta. 4+910
15	Defect about	sta. 5+218	N = 13.60380	E = 99.87535	about 308	m. after	TS12	sta. 4+910
16	Defect about	sta. 5+222	N = 13.60376	E = 99.87535	about 312	m. after	TS12	sta. 4+910
17	Defect about	sta. 5+247	N = 13.60384	E = 99.87562	about 337	m. after	TS12	sta. 4+910
18	Defect about	sta. 5+269	N = 13.60387	E = 99.87582	about 359	m. after	TS12	sta. 4+910
19	Defect about	sta. 5+298	N = 13.60389	E = 99.87609	about 388	m. after	TS12	sta. 4+910

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 4+919

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 2 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 406 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P.S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335	-0.705	630	
Defect		4.919	11.60351	99.87260	Dry Soil			634	
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 27.6 mV Severity = x < 15% Low
%IR = 4 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 630 - (630 - 823) \times (4.91 - 4.919) / (4.91 - 5.325) = 634 \text{ mV}$$

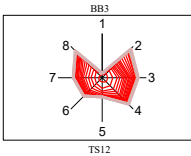
-Show how to calculate over the line to remote earth voltage drop

$$= 4 + 2.8 + 2 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1.8 + 1.8 = 27.6 \text{ mV}$$

-Show how to calculate %IR

$$= 27.6 \times 100 / 634 = 4 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT: : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 4+929

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 19 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 396 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335	-0.705	630	
Defect		4.929	11.60351	99.87260	Dry Soil			639	
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 110.6 mV Severity =

< 15% Low
x 16-35% Medium
36-60% High
> 61% Very high

%IR = 17

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 4.929) / (4.91 - 5.325)
= 639 mV

-Show how to calculate over the line to remote earth voltage drop
= 30+20+18+8+8+4+3+2+2+1.8+1+1.6+1.6
= 110.6 mV

-Show how to calculate %IR
= 110.6 x 100 / 639
= 17 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 29 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT: : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 4+934

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 24 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 391 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335	-0.705	630	
Defect		4.934	11.60351	99.87273	Dry Soil			641	
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 105.6 mV Severity =

< 15% Low
x 16-35% Medium
36-60% High
> 61% Very high

%IR = 16

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 4.934) / (4.91 - 5.325)
= 641 mV

-Show how to calculate over the line to remote earth voltage drop
= 25+18+15+10+8+8+3+2.8+3+1.8+1.8+1.6+1
= 105.6 mV

-Show how to calculate %IR
= 105.6 x 100 / 641
= 16 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 29 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT: : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 5+003

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 93 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 322 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335	-0.705	630	
Defect		5.003	11.60364	99.87317	Dry Soil			673	
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 11.4 mV Severity =

< 15% Low
x 16-35% Medium
36-60% High
> 61% Very high

%IR = 2

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.003) / (4.91 - 5.325)
= 673 mV

-Show how to calculate over the line to remote earth voltage drop
= 5+3.6+1.8+0.4+0.2+0.2+0.2
= 11.4 mV

-Show how to calculate %IR
= 11.4 x 100 / 673
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 29 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT: : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 5+036

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 126 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 289 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335	-0.705	630	
Defect		5.036	11.60364	99.87367	Dry Soil			689	
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 13.2 mV Severity =

< 15% Low
x 16-35% Medium
36-60% High
> 61% Very high

%IR = 2

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.036) / (4.91 - 5.325)
= 689 mV

-Show how to calculate over the line to remote earth voltage drop
= 2.4+0.8+0.6+0.2+0.8+0.8+0.6+1+0.8+0.8+1+0.8+0.4+0.4+0.2+0.2+0.2
= 13.2 mV

-Show how to calculate %IR
= 13.2 x 100 / 689
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 29 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 5+049

Pipeline Route Fuel Oil Pipeline

Section TS12-BB3 from : sta. 4+910 to : sta. 5+325

Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 139 m.

Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 276 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.049	11.60389	99.87379	Dry Soil	-1.575 -0.752	695
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 209.8 mV
%IR = 30Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

= 630 - (630 - 823) x (4.91 - 5.049) / (4.91 - 5.325)
= 695 mV

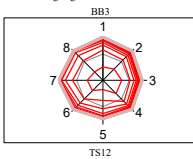
-Show how to calculate over the line to remote earth voltage drop

= 74+70+34+18+5.2+1.6+1.4+1.2+1+0.8+0.6+0.6+0.4+0.4+0.2+0.2+0.2
= 209.8 mV

-Show how to calculate %IR

= 209.8 x 100 / 695
= 30 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 5+083

Pipeline Route Fuel Oil Pipeline

Section TS12-BB3 from : sta. 4+910 to : sta. 5+325

Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 173 m.

Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 242 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.083	11.60379	99.87410	Dry Soil	-1.575 -0.752	710
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 12.6 mV
%IR = 2Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

= 630 - (630 - 823) x (4.91 - 5.083) / (4.91 - 5.325)
= 710 mV

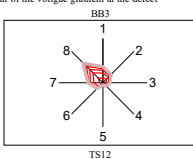
-Show how to calculate over the line to remote earth voltage drop

= 3+3.4+2+2+1+0.8+0.2+0.2
= 12.6 mV

-Show how to calculate %IR

= 12.6 x 100 / 710
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 5+068

Pipeline Route Fuel Oil Pipeline

Section TS12-BB3 from : sta. 4+910 to : sta. 5+325

Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 158 m.

Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 257 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.068	11.60389	99.87386	Dry Soil	-1.575 -0.752	703
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 28.2 mV
%IR = 4Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

= 630 - (630 - 823) x (4.91 - 5.068) / (4.91 - 5.325)
= 703 mV

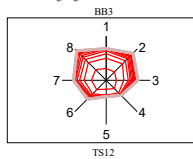
-Show how to calculate over the line to remote earth voltage drop

= 10+7+3+2+1.6+1.6+1.2+0.8+0.6+0.2+0.2
= 28.2 mV

-Show how to calculate %IR

= 28.2 x 100 / 703
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 5+122

Pipeline Route Fuel Oil Pipeline

Section TS12-BB3 from : sta. 4+910 to : sta. 5+325

Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 212 m.

Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 203 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.122	11.60379	99.87446	Dry Soil	-1.575 -0.752	729
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 262.2 mV
%IR = 36Severity =
x < 15% Low
x 16-35% Medium
x 36-60% High
x > 61% Very high

-Show how to calculate signal strength at the defect

= 630 - (630 - 823) x (4.91 - 5.122) / (4.91 - 5.325)
= 729 mV

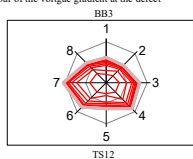
-Show how to calculate over the line to remote earth voltage drop

= 100+80+30+20+8+6+5+4
= 262.2 mV

-Show how to calculate %IR

= 262.2 x 100 / 729
= 36 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#10 at sta. 5+154

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 244 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 171 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.154	11.60371	99.87476	Dry Soil		743
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

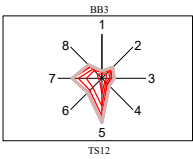
Over the line to remote earth voltage drop = 110.0 mV Severity = x < 15% Low
%IR = 15 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.154) / (4.91 - 5.325)
= 743 mV

-Show how to calculate over the line to remote earth voltage drop
= 39+30+25+12+4
= 110.0 mV

-Show how to calculate %IR
= 110 x 100 / 743
= 15 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#12 at sta. 5+181

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 271 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 144 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.181	11.60371	99.87501	Dry Soil		756
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

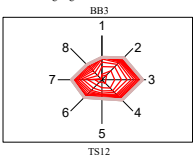
Over the line to remote earth voltage drop = 92.0 mV Severity = x < 15% Low
%IR = 12 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.181) / (4.91 - 5.325)
= 756 mV

-Show how to calculate over the line to remote earth voltage drop
= 9+20+15+13+10+6+5+4+4+3+3
= 92.0 mV

-Show how to calculate %IR
= 92 x 100 / 756
= 12 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#11 at sta. 5+162

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 252 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 163 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.162	11.60379	99.87483	Dry Soil		747
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

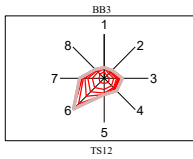
Over the line to remote earth voltage drop = 59.0 mV Severity = x < 15% Low
%IR = 8 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.162) / (4.91 - 5.325)
= 747 mV

-Show how to calculate over the line to remote earth voltage drop
= 8+10+8+8+15+10
= 59.0 mV

-Show how to calculate %IR
= 59 x 100 / 747
= 8 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#13 at sta. 5+200

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 290 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 125 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.200	11.60379	99.87519	Dry Soil		765
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

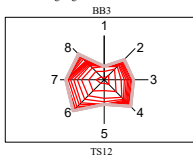
Over the line to remote earth voltage drop = 89.2 mV Severity = x < 15% Low
%IR = 12 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.2) / (4.91 - 5.325)
= 765 mV

-Show how to calculate over the line to remote earth voltage drop
= 10+22+14+10+10+6+6+5+2.6+2+1.6
= 89.2 mV

-Show how to calculate %IR
= 89.2 x 100 / 765
= 12 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#14 at sta. 5+213

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 303 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 112 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.213	11.60379	99.87531	Dry Soil		771
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

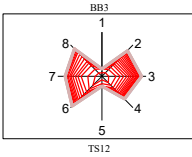
Over the line to remote earth voltage drop = 114.2 mV
%IR = 15 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.213) / (4.91 - 5.325)
= 771 mV

-Show how to calculate over the line to remote earth voltage drop
= 34+15+10+9+9+7+6+4+4+3+2.8+3+2.8+2.6+2
= 114.2 mV

-Show how to calculate %IR
= 114.2 x 100 / 771
= 15 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#16 at sta. 5+222

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 312 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 103 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.222	11.60379	99.87531	Dry Soil		775
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

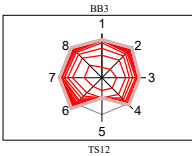
Over the line to remote earth voltage drop = 147.8 mV
%IR = 19 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.222) / (4.91 - 5.325)
= 775 mV

-Show how to calculate over the line to remote earth voltage drop
= 42+30+16+10+10+5+7+3+3+4+2+3+2+3+1.6+2+1.6+2+1.6+1.4+1.2
= 147.8 mV

-Show how to calculate %IR
= 147.8 x 100 / 775
= 19 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By CPE S.Tanya Supervisor 30 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#15 at sta. 5+218

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 308 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 107 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.218	11.60389	99.87531	Dry Soil		773
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

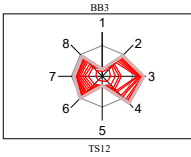
Over the line to remote earth voltage drop = 170.0 mV
%IR = 22 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.218) / (4.91 - 5.325)
= 773 mV

-Show how to calculate over the line to remote earth voltage drop
= 34+20+15+9+66+5+5+5+5+3+3
= 170.0 mV

-Show how to calculate %IR
= 170 x 100 / 773
= 22 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#17 at sta. 5+247

Pipeline Route Fuel Oil Pipeline
Section TS12-BB3 from : sta. 4+910 to : sta. 5+325
Test Post No. before Defect TS12 sta. 4+910 Distance to Defect 337 m.
Test Post No. after Defect BB3 sta. 5+325 Distance from Defect 78 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	4.910	11.60356	99.87251	Dry Soil	-1.335 -0.705	630
Defect		5.247	11.60389	99.87562	Dry Soil		787
TP after Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575 -0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

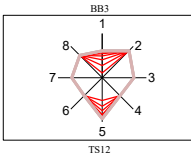
Over the line to remote earth voltage drop = 65.0 mV
%IR = 8 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 630 - (630 - 823) x (4.91 - 5.247) / (4.91 - 5.325)
= 787 mV

-Show how to calculate over the line to remote earth voltage drop
= 36+9+7+6.4+2.8+2+1.8
= 65.0 mV

-Show how to calculate %IR
= 65 x 100 / 787
= 8 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter

Defect No. Defect#18 at sta. S+269

Pipeline Route		Fuel Oil Pipeline			
Section	TS12-BB3	from :	sta. 4+910	to :	sta. 5+325
Test Post No. before Defect	TS12		Distance to Defect	359	m.
Test Post No. after Defect	BB3		Distance from Defect	56	m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	4.910	13.00156	99.897251	Dry Soil	-1.335	-0.705	630	
Defect		5.269	13.00387	99.87592	Dry Soil			797	
TP after Defect	TP	5.325	13.00389	99.87634	Dry Soil	-1.575	-0.752	823	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

102.0

 mV Severity =

x

 < 15% Low

%IR =

13

--

 16-35% Medium

-Show how to calculate signal strength at the defect

$$= 630 - (630 - 823) \times (4.91 - 5.269) / (4.91 - 5.325)$$
$$= 797 \text{ mV}$$

-Show how to calculate over the line to remote earth voltage drop

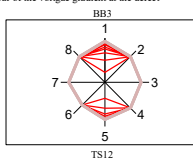
$$= 25+30+18+10+5+4.8+4+2.8+1.6+0.8$$
$$= 102.0 \text{ mV}$$

-Show how to calculate %IR

$$= 102 \times 100 / 797$$

$$= 13 \%$$

-Show the contour of the voltage gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	30 March 2022
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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 289
	: Cu/CuSO ₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13 from : sta. 5+325 to : sta. 5+690

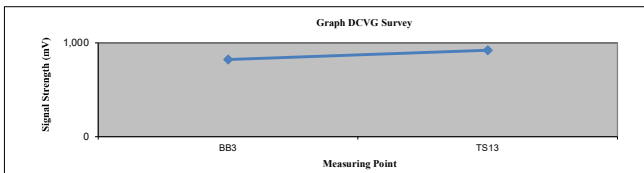
Interrupted Transformer Rectifier Data										
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG			Remarks
			North	East	Volt	Amp	Volt	Amp	Tap	
1	R	TS15	13.60728	99.88453	50 V	80 A	8.80 V	44.6 A	C2F1	sta.6+715

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

Signal Strength Data									
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
1	TP	BB3	13.60389	99.87634	Dry Soil	-1.575	-0.752	823	Yes
3	TP	TS13	13.60711	99.87568	Dry Soil	-1.667	-0.744	923	Yes

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion		After surveying, we have found " No Defect point "
	X	After surveying, we have found " 24 Defect points "



1	Defect about	$s=5332$	$N=13.00095$	$E=98.97828$	about	7	m.	after	B33	sta.	$s=5325$
2	Defect about	$s=5345$	$N=13.00096$	$E=98.97825$	about	20	m.	after	B33	sta.	$s=5325$
3	Defect about	$s=5358$	$N=13.00017$	$E=98.97823$	about	33	m.	after	B33	sta.	$s=5325$
4	Defect about	$s=5381$	$N=13.00048$	$E=98.97821$	about	56	m.	after	B33	sta.	$s=5325$
5	Defect about	$s=5405$	$N=13.00459$	$E=98.97817$	about	80	m.	after	B33	sta.	$s=5325$
6	Defect about	$s=5417$	$N=13.03470$	$E=98.97816$	about	92	m.	after	B33	sta.	$s=5325$
7	Defect about	$s=5428$	$N=13.00479$	$E=98.97812$	about	103	m.	after	B33	sta.	$s=5325$
8	Defect about	$s=5452$	$N=13.00000$	$E=98.97808$	about	127	m.	after	B33	sta.	$s=5325$
9	Defect about	$s=5472$	$N=13.00018$	$E=98.97807$	about	147	m.	after	B33	sta.	$s=5325$
10	Defect about	$s=5480$	$N=13.00025$	$E=98.97805$	about	155	m.	after	B33	sta.	$s=5325$
11	Defect about	$s=5494$	$N=13.00036$	$E=98.97808$	about	169	m.	after	B33	sta.	$s=5325$
12	Defect about	$s=5504$	$N=13.00046$	$E=98.97899$	about	179	m.	after	B33	sta.	$s=5325$
13	Defect about	$s=5508$	$N=13.00050$	$E=98.97899$	about	183	m.	after	B33	sta.	$s=5325$
14	Defect about	$s=5524$	$N=13.00064$	$E=98.97896$	about	199	m.	after	B33	sta.	$s=5325$
15	Defect about	$s=5537$	$N=13.00076$	$E=98.97895$	about	212	m.	after	B33	sta.	$s=5325$
16	Defect about	$s=5550$	$N=13.00092$	$E=98.97891$	about	230	m.	after	B33	sta.	$s=5325$
17	Defect about	$s=5570$	$N=13.00098$	$E=98.97885$	about	245	m.	after	B33	sta.	$s=5325$
18	Defect about	$s=5587$	$N=13.00022$	$E=98.97887$	about	262	m.	after	B33	sta.	$s=5325$
19	Defect about	$s=5591$	$N=13.00031$	$E=98.97885$	about	272	m.	after	B33	sta.	$s=5325$
20	Defect about	$s=5621$	$N=13.00052$	$E=98.97880$	about	296	m.	after	B33	sta.	$s=5325$
21	Defect about	$s=5634$	$N=13.00063$	$E=98.97876$	about	309	m.	after	B33	sta.	$s=5325$
22	Defect about	$s=5642$	$N=13.00071$	$E=98.97875$	about	317	m.	after	B33	sta.	$s=5325$
23	Defect about	$s=5663$	$N=13.00081$	$E=98.97853$	about	328	m.	after	B33	sta.	$s=5325$

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter

Defect No. Defect#19 at sta. S+298

Pipeline Route	Fuel Oil Pipeline			
Section	TS12-BB3	from :	sta. 4+910	to : sta. 5+325
Test Post No. before Defect	TS12	sta.	4+910	Distance to Defect 388 m.
Test Post No. after Defect	BB3	sta.	5+325	Distance from Defect 27 m.

Defect Signal Strength Data								
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential(V)	Signal Strength	Remarks
			North	East	Type	"ON"	"OFF"	
TP before Defect	TP	4.910	13.80156	99.897251	Dry Soil	-1.335	-0.705	630
Defect		5.298	13.60589	99.87669	Dry Soil			810
TP after Defect	TP	5.325	13.60589	99.87634	Dry Soil	-1.575	-0.752	823

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

100.0

 mV Severity =

x

 < 15% Low

%IR =

12

--

 16-35% Medium

$$= 630 - (630 - 823) \times (4.91 - 5.298) / (4.91 - 5.325)$$

$$= 810 \text{ mV}$$

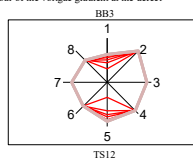
-Show how to calculate over the line to remote earth voltage drop
= 100
= 100.0 mV

-Show how to calculate %IR

$$= 100 \times 100 / 810$$

$$= 12 \%$$

- Show the contour of the voltage gradient at the defect



Note/Comment :

Test By	CPE	S.Tanva	Supervisor	30 March 2022
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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT	: DCVG Survey Meter
	: Current Interrupter
	: Digital Multimeter Fluke 289
	: Cu/CuSO ₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13 from : sta. 5+325 to : sta. 5+690

24 Defect about sta. 5+666 N = 13.60691 E = 99.87570 about 341 m. after BB3 sta. 5+325



Note/Comment :

Test By	CPE	S.anya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 5+332

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13 from : sta. 5+325 to : sta. 5+690

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 2 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 358 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.332	11.60395	99.87628	Dry Soil		825
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 104.4 mV

%IR = 13

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

$$= 823 - (823 - 923) \times (5.325 - 5.332) / (5.325 - 5.69)$$
$$= 825 \text{ mV}$$

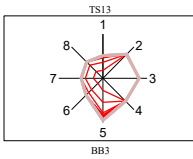
-Show how to calculate over the line to remote earth voltage drop

$$= 30 + 30 + 26 + 5 + 3 + 3 + 4 + 1 + 0.8 + 0.8 + 0.6 + 0.6 + 0.4$$
$$= 104.4 \text{ mV}$$

-Show how to calculate %IR

$$= 104.4 \times 100 / 825$$
$$= 13 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 5+358

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13 from : sta. 5+325 to : sta. 5+690

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 33 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 332 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.358	11.60417	99.87621	Dry Soil		832
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 140.0 mV

%IR = 17

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

$$= 823 - (823 - 923) \times (5.325 - 5.358) / (5.325 - 5.69)$$
$$= 832 \text{ mV}$$

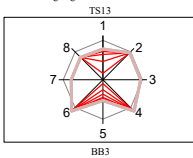
-Show how to calculate over the line to remote earth voltage drop

$$= 140$$
$$= 140.0 \text{ mV}$$

-Show how to calculate %IR

$$= 140 \times 100 / 832$$
$$= 17 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 5+345

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13 from : sta. 5+325 to : sta. 5+690

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 20 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 345 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.345	11.60406	99.87625	Dry Soil		828
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 25.0 mV

%IR = 3

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

$$= 823 - (823 - 923) \times (5.325 - 5.345) / (5.325 - 5.69)$$
$$= 828 \text{ mV}$$

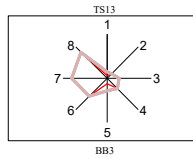
-Show how to calculate over the line to remote earth voltage drop

$$= 25$$
$$= 25.0 \text{ mV}$$

-Show how to calculate %IR

$$= 25 \times 100 / 828$$
$$= 3 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 5+381

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13 from : sta. 5+325 to : sta. 5+690

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 56 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 309 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.381	11.60438	99.87621	Dry Soil		838
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 160.0 mV

%IR = 19

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

$$= 823 - (823 - 923) \times (5.325 - 5.381) / (5.325 - 5.69)$$
$$= 838 \text{ mV}$$

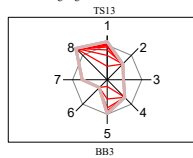
-Show how to calculate over the line to remote earth voltage drop

$$= 160$$
$$= 160.0 \text{ mV}$$

-Show how to calculate %IR

$$= 160 \times 100 / 838$$
$$= 19 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 5+405

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 80 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 285 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.405	11.60659	99.87617	Dry Soil		845
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

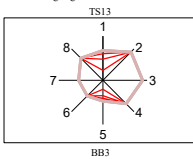
Over the line to remote earth voltage drop = 36.0 mV
%IR = 4Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.405) / (5.325 - 5.69)
= 845 mV

-Show how to calculate over the line to remote earth voltage drop
= 36
= 36.0 mV

-Show how to calculate %IR
= 36 x 100 / 845
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 5+428

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 103 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 262 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.428	11.60659	99.87612	Dry Soil		851
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

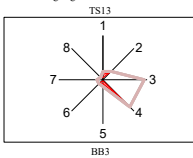
Over the line to remote earth voltage drop = 28.0 mV
%IR = 3Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.428) / (5.325 - 5.69)
= 851 mV

-Show how to calculate over the line to remote earth voltage drop
= 28
= 28.0 mV

-Show how to calculate %IR
= 28 x 100 / 851
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 5+417

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 92 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 273 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.417	11.60659	99.87616	Dry Soil		848
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

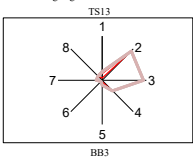
Over the line to remote earth voltage drop = 28.0 mV
%IR = 3Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.417) / (5.325 - 5.69)
= 848 mV

-Show how to calculate over the line to remote earth voltage drop
= 28
= 28.0 mV

-Show how to calculate %IR
= 28 x 100 / 848
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 5+452

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 127 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 238 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.452	11.60659	99.87568	Dry Soil		858
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

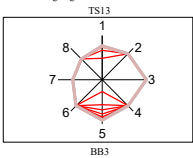
Over the line to remote earth voltage drop = 120.0 mV
%IR = 14Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.452) / (5.325 - 5.69)
= 858 mV

-Show how to calculate over the line to remote earth voltage drop
= 120
= 120.0 mV

-Show how to calculate %IR
= 120 x 100 / 858
= 14 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 5+472

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 147 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 218 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.472	11.60510	99.87607	Dry Soil		863
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

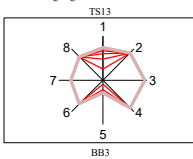
Over the line to remote earth voltage drop = 76.0 mV
%IR = 9Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.472) / (5.325 - 5.69)
= 863 mV

-Show how to calculate over the line to remote earth voltage drop
= 76
= 76.0 mV

-Show how to calculate %IR
= 76 x 100 / 863
= 9 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#11 at sta. 5+494

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 169 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 196 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.494	11.60524	99.87599	Dry Soil		869
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

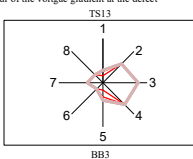
Over the line to remote earth voltage drop = 16.0 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.494) / (5.325 - 5.69)
= 869 mV

-Show how to calculate over the line to remote earth voltage drop
= 16
= 16.0 mV

-Show how to calculate %IR
= 16 x 100 / 869
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#10 at sta. 5+480

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 155 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 210 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.480	11.60522	99.87605	Dry Soil		865
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

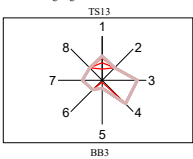
Over the line to remote earth voltage drop = 32.0 mV
%IR = 4Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.48) / (5.325 - 5.69)
= 865 mV

-Show how to calculate over the line to remote earth voltage drop
= 32
= 32.0 mV

-Show how to calculate %IR
= 32 x 100 / 865
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#12 at sta. 5+504

Pipeline Route Fuel Oil Pipeline

Section BB3-TS13

Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 179 m.

Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 186 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.504	11.60524	99.87599	Dry Soil		872
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

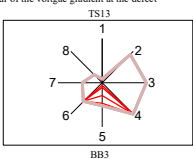
Over the line to remote earth voltage drop = 20.0 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.504) / (5.325 - 5.69)
= 872 mV

-Show how to calculate over the line to remote earth voltage drop
= 20
= 20.0 mV

-Show how to calculate %IR
= 20 x 100 / 872
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#13 at sta. 5+508

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 183 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 182 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.508	11.60590	99.87599	Dry Soil		873
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 22.0 mV
%IR = 2

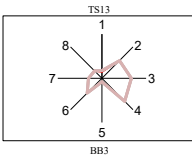
Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.508) / (5.325 - 5.69)
= 873 mV

-Show how to calculate over the line to remote earth voltage drop
= 22
= 22.0 mV

-Show how to calculate %IR
= 22 x 100 / 873
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#15 at sta. 5+537

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 212 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 153 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.537	11.60592	99.87599	Dry Soil		881
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 38.0 mV
%IR = 4

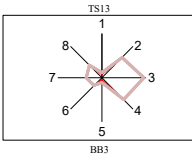
Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.537) / (5.325 - 5.69)
= 881 mV

-Show how to calculate over the line to remote earth voltage drop
= 38
= 38.0 mV

-Show how to calculate %IR
= 38 x 100 / 881
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#14 at sta. 5+524

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 199 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 166 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.524	11.60594	99.87596	Dry Soil		878
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 100.0 mV
%IR = 11

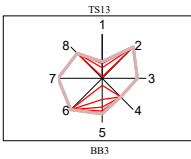
Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.524) / (5.325 - 5.69)
= 878 mV

-Show how to calculate over the line to remote earth voltage drop
= 100
= 100.0 mV

-Show how to calculate %IR
= 100 x 100 / 878
= 11 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#16 at sta. 5+555

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 230 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 135 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.555	11.60592	99.87599	Dry Soil		886
TP after Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 66.0 mV
%IR = 7

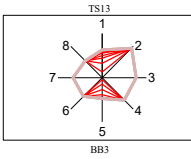
Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.555) / (5.325 - 5.69)
= 886 mV

-Show how to calculate over the line to remote earth voltage drop
= 66
= 66.0 mV

-Show how to calculate %IR
= 66 x 100 / 886
= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#17 at sta. 5+570

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 245 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 120 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	
Defect		5.570	11.60866	99.87588	Dry Soil			890	
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744	923	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 14.0 mV Severity = x < 15% Low
%IR = 2 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.57) / (5.325 - 5.69)
= 890 mV

-Show how to calculate over the line to remote earth voltage drop
= 14
= 14.0 mV

-Show how to calculate %IR
= 14 x 100 / 890
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 31 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#19 at sta. 5+597

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 272 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 93 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	
Defect		5.597	11.60621	99.87588	Dry Soil			898	
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744	923	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 22.0 mV Severity = x < 15% Low
%IR = 2 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.597) / (5.325 - 5.69)
= 898 mV

-Show how to calculate over the line to remote earth voltage drop
= 22
= 22.0 mV

-Show how to calculate %IR
= 22 x 100 / 898
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 31 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#18 at sta. 5+587

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 262 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 103 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	
Defect		5.587	11.60822	99.87587	Dry Soil			895	
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744	923	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 15.0 mV Severity = x < 15% Low
%IR = 2 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.587) / (5.325 - 5.69)
= 895 mV

-Show how to calculate over the line to remote earth voltage drop
= 15
= 15.0 mV

-Show how to calculate %IR
= 15 x 100 / 895
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 31 March 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#20 at sta. 5+621

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 296 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 69 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752	823	
Defect		5.621	11.60632	99.87588	Dry Soil			904	
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744	923	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 24.0 mV Severity = x < 15% Low
%IR = 3 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.621) / (5.325 - 5.69)
= 904 mV

-Show how to calculate over the line to remote earth voltage drop
= 24
= 24.0 mV

-Show how to calculate %IR
= 24 x 100 / 904
= 3 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By CPE S.Tanya Supervisor 31 March 2022

T. 0-2924-3024, 0-2924-9553-4 F. 0-2924-1744 www.cpe-eng.co.th / e-mail : cpe@cpe-eng.co.th

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#21 at sta. 5+634

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 309 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 56 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.634	11.60601	99.87573	Dry Soil		908
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

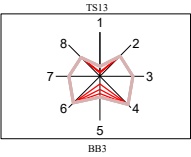
Over the line to remote earth voltage drop = 36.0 mV Severity = x < 15% Low
%IR = 4 16-35% Medium
36-60% High
> 61% Very High

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.634) / (5.325 - 5.69)
= 908 mV

-Show how to calculate over the line to remote earth voltage drop
= 36
= 36.0 mV

-Show how to calculate %IR
= 36 x 100 / 908
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#23 at sta. 5+653

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 328 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 37 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.653	11.60601	99.87573	Dry Soil		913
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

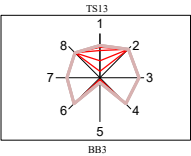
Over the line to remote earth voltage drop = 64.0 mV Severity = x < 15% Low
%IR = 7 16-35% Medium
36-60% High
> 61% Very High

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.653) / (5.325 - 5.69)
= 913 mV

-Show how to calculate over the line to remote earth voltage drop
= 64
= 64.0 mV

-Show how to calculate %IR
= 64 x 100 / 913
= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#22 at sta. 5+642

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 317 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 48 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.642	11.60601	99.87573	Dry Soil		910
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

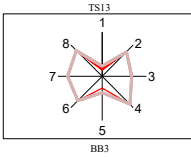
Over the line to remote earth voltage drop = 80.0 mV Severity = x < 15% Low
%IR = 9 16-35% Medium
36-60% High
> 61% Very High

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.642) / (5.325 - 5.69)
= 910 mV

-Show how to calculate over the line to remote earth voltage drop
= 80
= 80.0 mV

-Show how to calculate %IR
= 80 x 100 / 910
= 9 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#24 at sta. 5+666

Pipeline Route Fuel Oil Pipeline
Section BB3-TS13 from : sta. 5+325 to : sta. 5+690
Test Post No. before Defect BB3 sta. 5+325 Distance to Defect 341 m.
Test Post No. after Defect TS13 sta. 5+690 Distance from Defect 24 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.325	11.60389	99.87634	Dry Soil	-1.575	-0.752
Defect		5.666	11.60601	99.87573	Dry Soil		916
TP after Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.667	-0.744

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

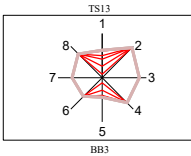
Over the line to remote earth voltage drop = 48.0 mV Severity = x < 15% Low
%IR = 5 16-35% Medium
36-60% High
> 61% Very High

-Show how to calculate signal strength at the defect
= 823 - (823 - 923) x (5.325 - 5.666) / (5.325 - 5.69)
= 916 mV

-Show how to calculate over the line to remote earth voltage drop
= 48
= 48.0 mV

-Show how to calculate %IR
= 48 x 100 / 916
= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	31 March 2022
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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS13-TS14

from : sta. 5+690 to : sta. 6+230

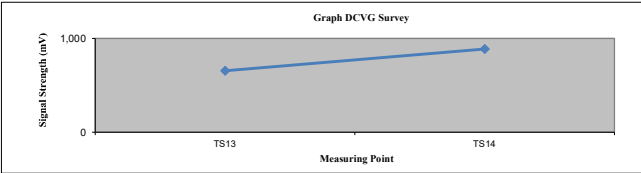
Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG		
			North	East	Volt	Amp	Volt	Amp	Tap
1	R	TS15	13.60729	99.87581	50 V	80 A	6.37 V	27.3 A	C1F3
			sta.6+715						

Installed Type : R=Existing Rectifier, TA=Temporary Anode Groundbed at Test Post

Signal Strength Data									
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	>80 mV Accept
			North	East		"ON"	"OFF"		
1	TP	TS13	13.60711	99.87588	Dry Soil	-1.321	-0.665	656	Yes
3	TP	TS14	13.60751	99.88016	Dry Soil	-1.724	-0.836	888	Yes

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "
☒ After surveying, we have found " 29 Defect points "



1	Defect about	sta.	5+700	N = 13.60720	E = 99.87567	about	10	m.	after	TS13	sta.	5+690
2	Defect about	sta.	5+780	N = 13.60750	E = 99.87604	about	90	m.	after	TS13	sta.	5+690
3	Defect about	sta.	5+803	N = 13.60750	E = 99.87625	about	113	m.	after	TS13	sta.	5+690
4	Defect about	sta.	5+812	N = 13.60748	E = 99.87633	about	122	m.	after	TS13	sta.	5+690
5	Defect about	sta.	5+829	N = 13.60755	E = 99.87649	about	139	m.	after	TS13	sta.	5+690
6	Defect about	sta.	5+842	N = 13.60747	E = 99.87661	about	152	m.	after	TS13	sta.	5+690
7	Defect about	sta.	5+847	N = 13.60747	E = 99.87665	about	157	m.	after	TS13	sta.	5+690
8	Defect about	sta.	5+872	N = 13.60746	E = 99.87688	about	182	m.	after	TS13	sta.	5+690
9	Defect about	sta.	5+885	N = 13.60747	E = 99.87700	about	195	m.	after	TS13	sta.	5+690
10	Defect about	sta.	5+897	N = 13.60747	E = 99.87711	about	207	m.	after	TS13	sta.	5+690
11	Defect about	sta.	5+908	N = 13.60746	E = 99.87721	about	218	m.	after	TS13	sta.	5+690
12	Defect about	sta.	5+923	N = 13.60747	E = 99.87735	about	233	m.	after	TS13	sta.	5+690
13	Defect about	sta.	5+937	N = 13.60744	E = 99.87748	about	247	m.	after	TS13	sta.	5+690
14	Defect about	sta.	5+943	N = 13.60749	E = 99.87753	about	253	m.	after	TS13	sta.	5+690
15	Defect about	sta.	5+973	N = 13.60746	E = 99.87780	about	283	m.	after	TS13	sta.	5+690
16	Defect about	sta.	5+985	N = 13.60747	E = 99.87791	about	295	m.	after	TS13	sta.	5+690
17	Defect about	sta.	6+032	N = 13.60750	E = 99.87834	about	342	m.	after	TS13	sta.	5+690
18	Defect about	sta.	6+084	N = 13.60748	E = 99.87882	about	394	m.	after	TS13	sta.	5+690
19	Defect about	sta.	6+089	N = 13.60747	E = 99.87887	about	399	m.	after	TS13	sta.	5+690
20	Defect about	sta.	6+094	N = 13.60747	E = 99.87891	about	404	m.	after	TS13	sta.	5+690
21	Defect about	sta.	6+106	N = 13.60745	E = 99.87902	about	416	m.	after	TS13	sta.	5+690
22	Defect about	sta.	6+131	N = 13.60749	E = 99.87925	about	441	m.	after	TS13	sta.	5+690
23	Defect about	sta.	6+143	N = 13.60748	E = 99.87936	about	453	m.	after	TS13	sta.	5+690

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect01 at sta. 5+700

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

from : sta. 5+690 to : sta. 6+230

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 10 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 530 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	13.60711	99.87588	Dry Soil	-1.321	-0.665	656	
Defect		5.700	13.60720	99.87567	Dry Soil			660	
TP after Defect	TP	6.230	13.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

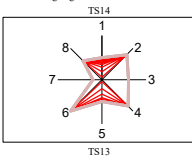
Over the line to remote earth voltage drop = 50.0 mV Severity = ☒ < 15% Low
%IR = ☒ 16-35% Medium
☐ 36-60% High
☐ > 61% Very high

-Show how to calculate signal strength at the defect
= 656 - (656 - 888) x (5.69 - 5.7) / (5.69 - 6.23)
= 660 mV

-Show how to calculate over the line to remote earth voltage drop
= 50
= 50.0 mV

-Show how to calculate %IR
= 50 x 100 / 660
= 8 %

-Show the contour of the voltag gradient at the defect



Note/Comment :

CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 289
: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline
Section TS13-TS14

from : sta. 5+690 to : sta. 6+230

24	Defect about	sta.	6+153	N = 13.60748	E = 99.87945	about	463	m.	after	TS13	sta.	5+690
25	Defect about	sta.	6+164	N = 13.60746	E = 99.87955	about	474	m.	after	TS13	sta.	5+690
26	Defect about	sta.	6+175	N = 13.60748	E = 99.87965	about	485	m.	after	TS13	sta.	5+690
27	Defect about	sta.	6+187	N = 13.60748	E = 99.87976	about	497	m.	after	TS13	sta.	5+690
28	Defect about	sta.	6+211	N = 13.60748	E = 99.87998	about	521	m.	after	TS13	sta.	5+690
29	Defect about	sta.	6+223	N = 13.60749	E = 99.88009	about	533	m.	after	TS13	sta.	5+690



Note/Comment :

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect02 at sta. 5+780

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

from : sta. 5+690 to : sta. 6+230

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 90 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 450 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	13.60711	99.87588	Dry Soil	-1.321	-0.665	656	
Defect		5.780	13.60750	99.87604	Dry Soil			695	
TP after Defect	TP	6.230	13.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

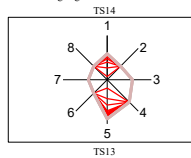
Over the line to remote earth voltage drop = 61.6 mV Severity = ☒ < 15% Low
%IR = ☒ 16-35% Medium
☐ 36-60% High
☐ > 61% Very high

-Show how to calculate signal strength at the defect
= 656 - (656 - 888) x (5.69 - 5.78) / (5.69 - 6.23)
= 695 mV

-Show how to calculate over the line to remote earth voltage drop
= 13+17+10+9+2.8+1.8+1.6+1.6+1+1+0.8+0.8+0.6+0.2+0.2+0.2
= 61.6 mV

-Show how to calculate %IR
= 61.6 x 100 / 695
= 9 %

-Show the contour of the voltag gradient at the defect



Note/Comment :

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 5+803

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 113 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 427 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665
Defect		5.803	11.60750	99.87623	Dry Soil		705
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 75.0 mV
%IR = 11Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.803) / (5.69 - 6.23)
= 705 mV

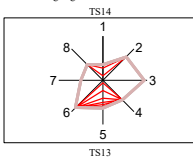
-Show how to calculate over the line to remote earth voltage drop

= 75
= 75.0 mV

-Show how to calculate %IR

= 75 x 100 / 705
= 11 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 5+829

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 139 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 401 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665
Defect		5.829	11.60751	99.87649	Dry Soil		716
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 50.0 mV
%IR = 7Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.829) / (5.69 - 6.23)
= 716 mV

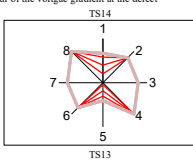
-Show how to calculate over the line to remote earth voltage drop

= 50
= 50.0 mV

-Show how to calculate %IR

= 50 x 100 / 716
= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 5+812

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 122 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 418 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665
Defect		5.812	11.60750	99.87623	Dry Soil		708
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 75.0 mV
%IR = 11Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.812) / (5.69 - 6.23)
= 708 mV

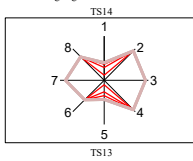
-Show how to calculate over the line to remote earth voltage drop

= 75
= 75.0 mV

-Show how to calculate %IR

= 75 x 100 / 708
= 11 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 5+842

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 152 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 388 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665
Defect		5.842	11.60751	99.87649	Dry Soil		721
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 30.0 mV
%IR = 4Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.842) / (5.69 - 6.23)
= 721 mV

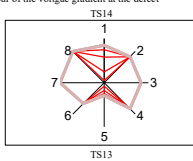
-Show how to calculate over the line to remote earth voltage drop

= 30
= 30.0 mV

-Show how to calculate %IR

= 30 x 100 / 721
= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 5+847

Pipeline Route Fuel Oil Pipeline
Section TS13-TS14 from : sta. 5+690 to : sta. 6+230
Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 157 m.
Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 383 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	13.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		5.847	13.60747	99.87665	Dry Soil			723	
TP after Defect	TP	6.230	13.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

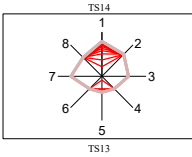
Over the line to remote earth voltage drop = $\frac{15.8}{2}$ mV Severity = $\frac{x}{2}$ < 15% Low
%IR = $\frac{2}{2}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $656 - (656 - 888) \times (5.69 - 5.847) / (5.69 - 6.23)$
= 723 mV

-Show how to calculate over the line to remote earth voltage drop
= 30
= 15.8 mV

-Show how to calculate %IR
= $15.8 \times 100 / 723$
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 5+885

Pipeline Route Fuel Oil Pipeline
Section TS13-TS14 from : sta. 5+690 to : sta. 6+230
Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 195 m.
Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 245 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		5.885	11.60747	99.87760	Dry Soil			740	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

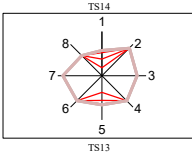
Over the line to remote earth voltage drop = $\frac{44.0}{5}$ mV Severity = $\frac{x}{5}$ < 15% Low
%IR = $\frac{5}{5}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $656 - (656 - 888) \times (5.69 - 5.885) / (5.69 - 6.23)$
= 740 mV

-Show how to calculate over the line to remote earth voltage drop
= 44
= 44.0 mV

-Show how to calculate %IR
= $44 \times 100 / 740$
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 5+872

Pipeline Route Fuel Oil Pipeline
Section TS13-TS14 from : sta. 5+690 to : sta. 6+230
Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 182 m.
Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 358 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		5.872	11.60746	99.87668	Dry Soil			734	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

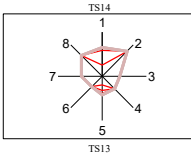
Over the line to remote earth voltage drop = $\frac{24.0}{3}$ mV Severity = $\frac{x}{3}$ < 15% Low
%IR = $\frac{3}{3}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $656 - (656 - 888) \times (5.69 - 5.872) / (5.69 - 6.23)$
= 734 mV

-Show how to calculate over the line to remote earth voltage drop
= 24
= 24.0 mV

-Show how to calculate %IR
= $24 \times 100 / 734$
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#10 at sta. 5+897

Pipeline Route Fuel Oil Pipeline
Section TS13-TS14 from : sta. 5+690 to : sta. 6+230
Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 207 m.
Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 333 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		5.897	11.60757	99.87711	Dry Soil			745	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

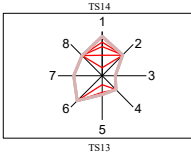
Over the line to remote earth voltage drop = $\frac{44.6}{5}$ mV Severity = $\frac{x}{5}$ < 15% Low
%IR = $\frac{5}{5}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $656 - (656 - 888) \times (5.69 - 5.897) / (5.69 - 6.23)$
= 745 mV

-Show how to calculate over the line to remote earth voltage drop
= $9+14+10+5+5+1.6$
= 44.6 mV

-Show how to calculate %IR
= $44.6 \times 100 / 745$
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#11 at sta. 5+908

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 218 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 322 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.321	-0.665
							656
Defect		5.908	11.60746	99.87721	Dry Soil		750
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836
							888

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 15.0 mV

%IR = 2

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.908) / (5.69 - 6.23)

= 750 mV

-Show how to calculate over the line to remote earth voltage drop

= 15

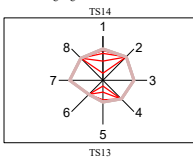
= 15.0 mV

-Show how to calculate %IR

= 15 x 100 / 750

= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#13 at sta. 5+937

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 247 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 293 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.321	-0.665
							656
Defect		5.937	11.60748	99.87748	Dry Soil		762
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836
							888

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 50.0 mV

%IR = 7

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.937) / (5.69 - 6.23)

= 762 mV

-Show how to calculate over the line to remote earth voltage drop

= 50

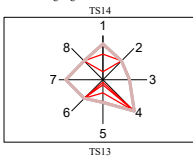
= 50.0 mV

-Show how to calculate %IR

= 50 x 100 / 762

= 7 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#12 at sta. 5+923

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 233 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 307 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.321	-0.665
							656
Defect		5.923	11.60747	99.87753	Dry Soil		756
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836
							888

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 40.0 mV

%IR = 5

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.923) / (5.69 - 6.23)

= 756 mV

-Show how to calculate over the line to remote earth voltage drop

= 40

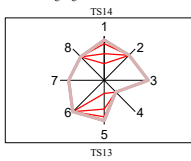
= 40.0 mV

-Show how to calculate %IR

= 40 x 100 / 756

= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#14 at sta. 5+943

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 253 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 287 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87588	Dry Soil	-1.321	-0.665
							656
Defect		5.943	11.60750	99.87753	Dry Soil		765
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836
							888

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 24.0 mV

%IR = 3

Severity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 5.943) / (5.69 - 6.23)

= 765 mV

-Show how to calculate over the line to remote earth voltage drop

= 24

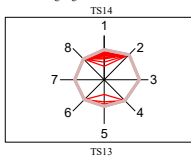
= 24.0 mV

-Show how to calculate %IR

= 24 x 100 / 765

= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#15 at sta. 5+973

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 283 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 257 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		5.973	11.60706	99.87780	Dry Soil			778	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{10.4}{1}$ mVSeverity = $\frac{x}{1}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 656 - (656 - 888) \times (5.69 - 5.973) / (5.69 - 6.23)$$
$$= 778 \text{ mV}$$

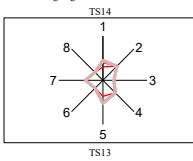
-Show how to calculate over the line to remote earth voltage drop

$$= 7.2 + 2.4 + 0.8$$
$$= 10.4 \text{ mV}$$

-Show how to calculate %IR

$$= 10.4 \times 100 / 778$$
$$= 1 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#16 at sta. 5+985

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 295 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 245 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		5.985	11.60704	99.87791	Dry Soil			783	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{317.2}{41}$ mVSeverity = $\frac{x}{1}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 656 - (656 - 888) \times (5.69 - 5.985) / (5.69 - 6.23)$$
$$= 783 \text{ mV}$$

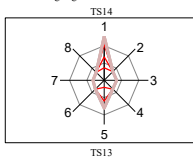
-Show how to calculate over the line to remote earth voltage drop

$$= 90 + 80 + 90 + 50 + 4 + 1 + 0.6 + 0.6 + 0.4 + 0.2 + 0.2 + 0.2$$
$$= 317.2 \text{ mV}$$

-Show how to calculate %IR

$$= 317.2 \times 100 / 783$$
$$= 41 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#17 at sta. 6+032

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 342 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 198 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.00711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.032	11.00750	99.87834	Dry Soil			803	
TP after Defect	TP	6.230	11.00751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{5.2}{1}$ mVSeverity = $\frac{x}{1}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 656 - (656 - 888) \times (5.69 - 6.032) / (5.69 - 6.23)$$
$$= 803 \text{ mV}$$

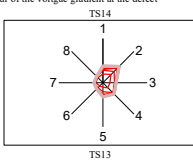
-Show how to calculate over the line to remote earth voltage drop

$$= 2.6 + 1 + 1 + 0.6$$
$$= 5.2 \text{ mV}$$

-Show how to calculate %IR

$$= 5.2 \times 100 / 803$$
$$= 1 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#18 at sta. 6+084

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 394 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 146 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.00711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.084	11.00748	99.87892	Dry Soil			825	
TP after Defect	TP	6.230	11.00751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{183.4}{22}$ mVSeverity = $\frac{x}{1}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

$$= 656 - (656 - 888) \times (5.69 - 6.084) / (5.69 - 6.23)$$
$$= 825 \text{ mV}$$

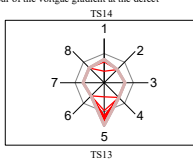
-Show how to calculate over the line to remote earth voltage drop

$$= 60 + 60 + 22 + 5 + 5 + 6 + 4 + 2 + 2 + 1.8 + 1.8 + 1.8 + 1.6 + 1 + 1 + 0.8 + 0.8 + 0.8$$
$$= 183.4 \text{ mV}$$

-Show how to calculate %IR

$$= 183.4 \times 100 / 825$$
$$= 22 \%$$

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#19 at sta. 6+089

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 392 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 141 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	13.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.089	13.60747	99.87987	Dry Soil			827	
TP after Defect	TP	6.230	13.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{80.0}{10}$ mVSeverity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 6.089) / (5.69 - 6.23)

= 827 mV

-Show how to calculate over the line to remote earth voltage drop

= 80

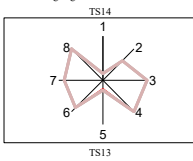
= 80.0 mV

-Show how to calculate %IR

= 80 x 100 / 827

= 10 %

-Show the contour of the voltagae gradient at the defect



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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#21 at sta. 6+106

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 416 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 124 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	13.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.106	13.60742	99.87902	Dry Soil			835	
TP after Defect	TP	6.230	13.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{70.0}{3}$ mVSeverity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 6.106) / (5.69 - 6.23)

= 835 mV

-Show how to calculate over the line to remote earth voltage drop

= 70

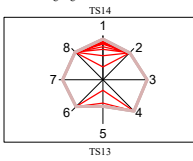
= 70.0 mV

-Show how to calculate %IR

= 70 x 100 / 835

= 8 %

-Show the contour of the voltagae gradient at the defect



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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#20 at sta. 6+094

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 404 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 136 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.094	11.60747	99.87981	Dry Soil			830	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{150.0}{18}$ mVSeverity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 6.094) / (5.69 - 6.23)

= 830 mV

-Show how to calculate over the line to remote earth voltage drop

= 150

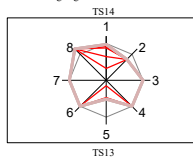
= 150.0 mV

-Show how to calculate %IR

= 150 x 100 / 830

= 18 %

-Show the contour of the voltagae gradient at the defect



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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#22 at sta. 6+131

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 441 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 99 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.131	11.60769	99.87925	Dry Soil			845	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = $\frac{30.0}{4}$ mVSeverity =

x	< 15% Low
	16-35% Medium
	36-60% High
	> 61% Very high

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 6.131) / (5.69 - 6.23)

= 845 mV

-Show how to calculate over the line to remote earth voltage drop

= 30

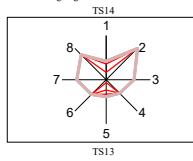
= 30.0 mV

-Show how to calculate %IR

= 30 x 100 / 845

= 4 %

-Show the contour of the voltagae gradient at the defect



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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#23 at sta. 6+143

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 453 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 87 m.

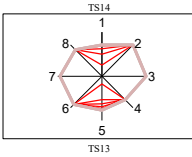
Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	13.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.143	13.60748	99.87595	Dry Soil			851	
TP after Defect	TP	6.230	13.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 40.0 mV
%IR = 5Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 656 - (656 - 888) x (5.69 - 6.143) / (5.69 - 6.23)
= 851 mV-Show how to calculate over the line to remote earth voltage drop
= 40
= 40.0 mV-Show how to calculate %IR
= 40 x 100 / 851
= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#25 at sta. 6+164

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 474 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 66 m.

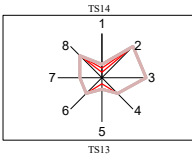
Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential(V) "ON" "OFF"		Signal Strength (mV)	Remarks
			North	East					
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.164	11.60704	99.87595	Dry Soil			860	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 10.0 mV
%IR = 1Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 656 - (656 - 888) x (5.69 - 6.164) / (5.69 - 6.23)
= 860 mV-Show how to calculate over the line to remote earth voltage drop
= 10
= 10.0 mV-Show how to calculate %IR
= 10 x 100 / 860
= 1 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#24 at sta. 6+153

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 463 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 77 m.

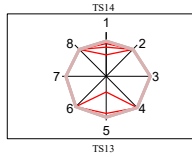
Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.153	11.60704	99.87945	Dry Soil			855	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 70.0 mV
%IR = 8Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 656 - (656 - 888) x (5.69 - 6.153) / (5.69 - 6.23)
= 855 mV-Show how to calculate over the line to remote earth voltage drop
= 70
= 70.0 mV-Show how to calculate %IR
= 70 x 100 / 855
= 8 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#26 at sta. 6+175

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 485 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 55 m.

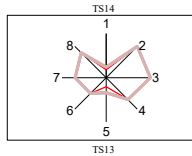
Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665	656	
Defect		6.175	11.60704	99.87595	Dry Soil			864	
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836	888	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 10.0 mV
%IR = 1Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high-Show how to calculate signal strength at the defect
= 656 - (656 - 888) x (5.69 - 6.175) / (5.69 - 6.23)
= 864 mV-Show how to calculate over the line to remote earth voltage drop
= 10
= 10.0 mV-Show how to calculate %IR
= 10 x 100 / 864
= 1 %

-Show the contour of the voltagae gradient at the defect



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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#27 at sta. 6+187

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 497 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 43 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665
Defect		6.187	11.60730	99.87596	Dry Soil	-1.724	-0.836
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 65.4 mV
%IR = 8Severity =
☒ < 15% Low
☐ 16-35% Medium
☐ 36-60% High
☐ > 61% Very High

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 6.187) / (5.69 - 6.23)

= 870 mV

-Show how to calculate over the line to remote earth voltage drop

= 12+44+5+1.8+1+0.8+0.8

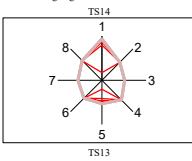
= 65.4 mV

-Show how to calculate %IR

= 65.4 x 100 / 870

= 8 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#29 at sta. 6+223

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 533 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 7 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665
Defect		6.223	11.60730	99.88049	Dry Soil	-1.724	-0.836
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 36.0 mV
%IR = 2Severity =
☒ < 15% Low
☐ 16-35% Medium
☐ 36-60% High
☐ > 61% Very High

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 6.223) / (5.69 - 6.23)

= 885 mV

-Show how to calculate over the line to remote earth voltage drop

= 36

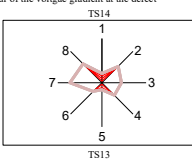
= 36.0 mV

-Show how to calculate %IR

= 36 x 100 / 885

= 4 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#28 at sta. 6+187

Pipeline Route Fuel Oil Pipeline

Section TS13-TS14

Test Post No. before Defect TS13 sta. 5+690 Distance to Defect 497 m.

Test Post No. after Defect TS14 sta. 6+230 Distance from Defect 43 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	5.690	11.60711	99.87568	Dry Soil	-1.321	-0.665
Defect		6.187	11.60730	99.87596	Dry Soil	-1.724	-0.836
TP after Defect	TP	6.230	11.60751	99.88016	Dry Soil	-1.724	-0.836

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 42.0 mV
%IR = 5Severity =
☒ < 15% Low
☐ 16-35% Medium
☐ 36-60% High
☐ > 61% Very High

-Show how to calculate signal strength at the defect

= 656 - (656 - 888) x (5.69 - 6.187) / (5.69 - 6.23)

= 870 mV

-Show how to calculate over the line to remote earth voltage drop

= 42

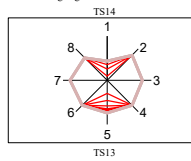
= 42.0 mV

-Show how to calculate %IR

= 42 x 100 / 870

= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 289

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

from : sta. 6+230 to : sta. 6+715

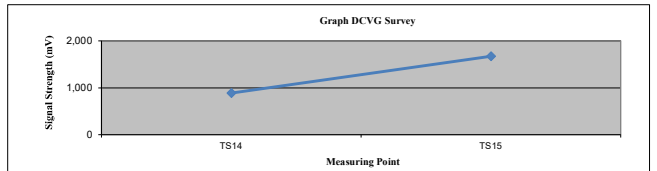
Interrupted Transformer Rectifier Data									
No.	Installed Type	Location	GPS(WGS84)		Rated (dc)		Output (dc) while DCVG		Remarks
			North	East	Volt	Amp	Volt	Amp	
1	R	TS15	11.60728	99.88453	50 V	80 A	6.37 V	27.3 A	C1F3 sta.6+715

Installed Type : R=Existing Rectifier, TA=Temporary Anode Grounded at Test Post

Signal Strength Data							
No.	Measuring Point	Location	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
1	TP	TS14	11.60751	99.88016	Dry Soil	-1.724	-0.836
3	TP	TS15	11.60728	99.88453	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

conclusion ☐ After surveying, we have found " No Defect point "
☒ After surveying, we have found " 25 Defect points "

1	Defect about	sta. 6+238	N = 13.60750	E = 99.88023	about 8	m.	after	TS14	sta. 6+230
2	Defect about	sta. 6+254	N = 13.60752	E = 99.88038	about 24	m.	after	TS14	sta. 6+230
3	Defect about	sta. 6+282	N = 13.60750	E = 99.88064	about 52	m.	after	TS14	sta. 6+230
4	Defect about	sta. 6+340	N = 13.60727	E = 99.88108	about 110	m.	after	TS14	sta. 6+230
5	Defect about	sta. 6+384	N = 13.60723	E = 99.88149	about 154	m.	after	TS14	sta. 6+230
6	Defect about	sta. 6+402	N = 13.60726	E = 99.88166	about 172	m.	after	TS14	sta. 6+230
7	Defect about	sta. 6+417	N = 13.60728	E = 99.88180	about 187	m.	after	TS14	sta. 6+230
8	Defect about	sta. 6+423	N = 13.60726	E = 99.88186	about 193	m.	after	TS14	sta. 6+230
9	Defect about	sta. 6+430	N = 13.60726	E = 99.88192	about 200	m.	after	TS14	sta. 6+230
10	Defect about	sta. 6+440	N = 13.60725	E = 99.88197	about 210	m.	after	TS14	sta. 6+230
11	Defect about	sta. 6+462	N = 13.60725	E = 99.88217	about 232	m.	after	TS14	sta. 6+230
12	Defect about	sta. 6+474	N = 13.60728	E = 99.88228	about 244	m.	after	TS14	sta. 6+230
13	Defect about	sta. 6+487	N = 13.60727	E = 99.88240	about 257	m.	after	TS14	sta. 6+230
14	Defect about	sta. 6+534	N = 13.60725	E = 99.88283	about 304	m.	after	TS14	sta. 6+230
15	Defect about	sta. 6+558	N = 13.60726	E = 99.88305	about 328	m.	after	TS14	sta. 6+230
16	Defect about	sta. 6+571	N = 13.60726	E = 99.88317	about 341	m.	after	TS14	sta. 6+230
17	Defect about	sta. 6+587	N = 13.60729	E = 99.88331	about 357	m.	after	TS14	sta. 6+230
18	Defect about	sta. 6+605	N = 13.60726	E = 99.88348	about 375	m.	after	TS14	sta. 6+230
19	Defect about	sta. 6+613	N = 13.60725	E = 99.88355	about 383	m.	after	TS14	sta. 6+230
20	Defect about	sta. 6+636	N = 13.60727	E = 99.88376	about 406	m.	after	TS14	sta. 6+230
21	Defect about	sta. 6+649	N = 13.60727	E = 99.88388	about 419	m.	after	TS14	sta. 6+230
22	Defect about	sta. 6+665	N = 13.60728	E = 99.88403	about 435	m.	after	TS14	sta. 6+230
23	Defect about	sta. 6+697	N = 13.60726	E = 99.88433	about 467	m.	after	TS14	sta. 6+230

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CATHODIC PROTECTION DCVG COATING SURVEY

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

from : sta. 6+230 to : sta. 6+715

24 Defect about sta. 6+706 N = 13.60726 E = 99.88441 about 476 m. after TS14 sta. 6+230
25 Defect about sta. 6+708 N = 13.60726 E = 99.88443 about 478 m. after TS14 sta. 6+230



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#02 at sta. 6+254

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

from : sta. 6+230 to : sta. 6+715

Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 24 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 461 m.

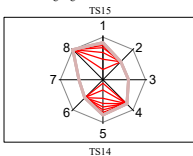
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	6.230	12.99044 100.10199	Dry Soil	-1.724 -0.836	888	
Defect		6.254	13.60726 99.88443	Dry Soil		927	
TP after Defect	TP	6.715	12.99110 100.10119	Dry Soil	-2.456 -0.781	1,675	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 125.0 mV
%IR = 13Severity =
x < 15% Low
16-35% Medium
36-60% High
x > 61% Very high-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.254) / (6.23 - 6.715)
= 927 mV-Show how to calculate over the line to remote earth voltage drop
= 125
= 125.0 mV-Show how to calculate %IR
= 125 x 100 / 927
= 13 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#01 at sta. 6+238

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

from : sta. 6+230 to : sta. 6+715

Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 8 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 477 m.

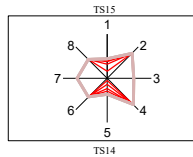
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	6.230	12.99044 100.10199	Dry Soil	-1.724 -0.836	888	
Defect		6.238	13.60726 99.88443	Dry Soil		901	
TP after Defect	TP	6.715	12.99110 100.10119	Dry Soil	-2.456 -0.781	1,675	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 42.0 mV
%IR = 5Severity =
x < 15% Low
16-35% Medium
36-60% High
x > 61% Very high-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.238) / (6.23 - 6.715)
= 901 mV-Show how to calculate over the line to remote earth voltage drop
= 42
= 42.0 mV-Show how to calculate %IR
= 42 x 100 / 901
= 5 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#03 at sta. 6+282

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

from : sta. 6+230 to : sta. 6+715

Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 52 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 433 m.

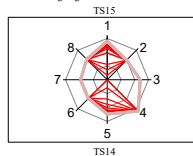
Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84) North East	Ground Type	P.S.Potential (V) "ON" "OFF"	Signal Strength (mV)	Remarks
TP before Defect	TP	6.230	12.99044 100.10199	Dry Soil	-1.724 -0.836	888	
Defect		6.282	13.60726 99.88443	Dry Soil		972	
TP after Defect	TP	6.715	12.99110 100.10119	Dry Soil	-2.456 -0.781	1,675	

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 400.0 mV
%IR = 41Severity =
x < 15% Low
16-35% Medium
36-60% High
x > 61% Very high-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.282) / (6.23 - 6.715)
= 972 mV-Show how to calculate over the line to remote earth voltage drop
= 400
= 400.0 mV-Show how to calculate %IR
= 400 x 100 / 972
= 41 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#04 at sta. 6+340

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 110 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 375 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10099	Dry Soil	-1.724	-0.836	888	
Defect		6.340	12.60722	99.88108	Dry Soil			1,066	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 21.6 mV %IR = 2 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.34) / (6.23 - 6.715)
= 1,066 mV

-Show how to calculate over the line to remote earth voltage drop
= 7+3.6+2+2+1.6+0.8+0.8+0.6+0.6+0.6+0.6+0.4+0.4
= 21.6 mV

-Show how to calculate %IR
= 21.6 x 100 / 1066
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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CPEEngineering and Service

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Electricity Generating Authority of Thailand.

Ratchaburi Power Plant, Fuel Oil Pipeline DCVG Test Inspection Project.

Data Record Sheet.

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#06 at sta. 6+402

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 172 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 213 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10099	Dry Soil	-1.724	-0.836	888	
Defect		6.402	12.60723	99.88104	Dry Soil			1,167	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 25.0 mV %IR = 2 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.402) / (6.23 - 6.715)
= 1,167 mV

-Show how to calculate over the line to remote earth voltage drop
= 25
= 25.0 mV

-Show how to calculate %IR
= 25 x 100 / 1167
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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Electricity Generating Authority of Thailand.

Ratchaburi Power Plant, Fuel Oil Pipeline DCVG Test Inspection Project.

Data Record Sheet.

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#05 at sta. 6+384

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 154 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 331 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10099	Dry Soil	-1.724	-0.836	888	
Defect		6.384	12.60722	99.88149	Dry Soil			1,138	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 70.0 mV %IR = 6 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.384) / (6.23 - 6.715)
= 1,138 mV

-Show how to calculate over the line to remote earth voltage drop
= 70
= 70.0 mV

-Show how to calculate %IR
= 70 x 100 / 1138
= 6 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	2 April 2022
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Ratchaburi Power Plant, Fuel Oil Pipeline DCVG Test Inspection Project.

Data Record Sheet.

CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#07 at sta. 6+417

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 187 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 298 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10099	Dry Soil	-1.724	-0.836	888	
Defect		6.417	12.60723	99.88100	Dry Soil			1,191	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 27.0 mV %IR = 2 Severity = x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.417) / (6.23 - 6.715)
= 1,191 mV

-Show how to calculate over the line to remote earth voltage drop
= 27
= 27.0 mV

-Show how to calculate %IR
= 27 x 100 / 1191
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#08 at sta. 6+423

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15 from : sta. 6+230 to : sta. 6+715

Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 193 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 292 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724 -0.836	888
Defect		6.423	13.60726	99.98186	Dry Soil		1,201
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456 -0.781	1,675

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

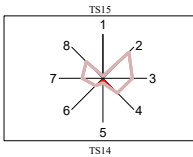
Over the line to remote earth voltage drop = $\frac{25.0}{2}$ mV Severity = $\frac{x}{2}$ < 15% Low
%IR = $\frac{2}{2}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.423) / (6.23 - 6.715)$
= 1,201 mV

-Show how to calculate over the line to remote earth voltage drop
= 25
= 25.0 mV

-Show how to calculate %IR
= $25 \times 100 / 1201$
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By CPE S.Tanya Supervisor 3 April 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#10 at sta. 6+440

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15 from : sta. 6+230 to : sta. 6+715

Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 210 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 275 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724 -0.836	888
Defect		6.440	13.60727	99.98197	Dry Soil		1,229
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456 -0.781	1,675

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

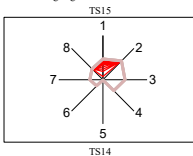
Over the line to remote earth voltage drop = $\frac{12.0}{1}$ mV Severity = $\frac{x}{1}$ < 15% Low
%IR = $\frac{1}{1}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.44) / (6.23 - 6.715)$
= 1,229 mV

-Show how to calculate over the line to remote earth voltage drop
= 12
= 12.0 mV

-Show how to calculate %IR
= $12 \times 100 / 1229$
= 1 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By CPE S.Tanya Supervisor 3 April 2022

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#09 at sta. 6+430

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15 from : sta. 6+230 to : sta. 6+715

Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 200 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 285 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724 -0.836	888
Defect		6.430	13.60726	99.98192	Dry Soil		1,213
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456 -0.781	1,675

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

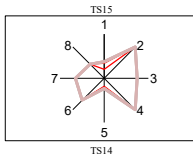
Over the line to remote earth voltage drop = $\frac{20.0}{2}$ mV Severity = $\frac{x}{2}$ < 15% Low
%IR = $\frac{2}{2}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.43) / (6.23 - 6.715)$
= 1,213 mV

-Show how to calculate over the line to remote earth voltage drop
= 20
= 20.0 mV

-Show how to calculate %IR
= $20 \times 100 / 1213$
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#11 at sta. 6+462

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15 from : sta. 6+230 to : sta. 6+715

Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 232 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 253 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V) "ON" "OFF"	Signal Strength (mV)
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724 -0.836	888
Defect		6.462	13.60727	99.98217	Dry Soil		1,264
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456 -0.781	1,675

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

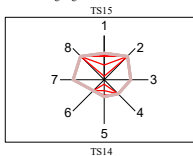
Over the line to remote earth voltage drop = $\frac{15.0}{1}$ mV Severity = $\frac{x}{1}$ < 15% Low
%IR = $\frac{1}{1}$ 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.462) / (6.23 - 6.715)$
= 1,264 mV

-Show how to calculate over the line to remote earth voltage drop
= 15
= 15.0 mV

-Show how to calculate %IR
= $15 \times 100 / 1264$
= 1 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#12 at sta. 6+474

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 244 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.474	11.60729	99.80228	Dry Soil		1.284
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

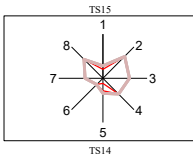
Over the line to remote earth voltage drop = $\frac{7.0}{1}$ mVSeverity = $\frac{x}{1}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.474) / (6.23 - 6.715)$
= 1,284 mV

-Show how to calculate over the line to remote earth voltage drop
= 7
= 7.0 mV

-Show how to calculate %IR
= $7 \times 100 / 1284$
= 1 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#14 at sta. 6+534

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 204 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.534	11.60729	99.80281	Dry Soil		1.281
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

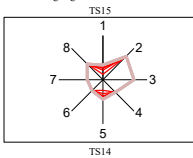
Over the line to remote earth voltage drop = $\frac{15.0}{1}$ mVSeverity = $\frac{x}{1}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.534) / (6.23 - 6.715)$
= 1,381 mV

-Show how to calculate over the line to remote earth voltage drop
= 15
= 15.0 mV

-Show how to calculate %IR
= $15 \times 100 / 1381$
= 1 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#13 at sta. 6+487

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 257 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.487	11.60729	99.80240	Dry Soil		1.305
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

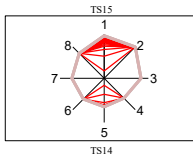
Over the line to remote earth voltage drop = $\frac{30.0}{2}$ mVSeverity = $\frac{x}{2}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.487) / (6.23 - 6.715)$
= 1,305 mV

-Show how to calculate over the line to remote earth voltage drop
= 30
= 30.0 mV

-Show how to calculate %IR
= $30 \times 100 / 1305$
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#15 at sta. 6+558

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 328 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.558	11.60729	99.80303	Dry Soil		1.420
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

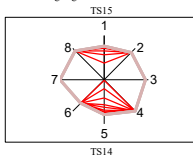
Over the line to remote earth voltage drop = $\frac{80.0}{6}$ mVSeverity = $\frac{x}{6}$ < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= $888 - (888 - 1675) \times (6.23 - 6.558) / (6.23 - 6.715)$
= 1,420 mV

-Show how to calculate over the line to remote earth voltage drop
= 80
= 80.0 mV

-Show how to calculate %IR
= $80 \times 100 / 1420$
= 6 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#16 at sta. 6+571

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 341 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 144 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836	888	
Defect		6.571	12.60726	99.88317	Dry Soil			1,441	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 12.0 mV Severity = x < 15% Low
%IR = 1 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.571) / (6.23 - 6.715)
= 1,441 mV

-Show how to calculate over the line to remote earth voltage drop
= 12
= 12.0 mV

-Show how to calculate %IR
= 12 x 100 / 1441
= 1 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#18 at sta. 6+605

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 375 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 110 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836	888	
Defect		6.605	12.60726	99.88317	Dry Soil			1,497	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 30.0 mV Severity = x < 15% Low
%IR = 2 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.605) / (6.23 - 6.715)
= 1,497 mV

-Show how to calculate over the line to remote earth voltage drop
= 30
= 30.0 mV

-Show how to calculate %IR
= 30 x 100 / 1497
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#17 at sta. 6+587

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 357 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 128 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836	888	
Defect		6.587	12.60726	99.88317	Dry Soil			1,467	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 24.0 mV Severity = x < 15% Low
%IR = 2 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.587) / (6.23 - 6.715)
= 1,467 mV

-Show how to calculate over the line to remote earth voltage drop
= 24
= 24.0 mV

-Show how to calculate %IR
= 24 x 100 / 1467
= 2 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT : DCVG Survey Meter
: Current Interrupter
: Digital Multimeter Fluke 189
: Cu/CuSO₄ Reference Electrode

Defect No. Defect#19 at sta. 6+613

Pipeline Route Fuel Oil Pipeline
Section TS14-TS15 from : sta. 6+230 to : sta. 6+715
Test Post No. before Defect TS14 sta. 6+230 Distance to Defect 383 m.
Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 102 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836	888	
Defect		6.613	12.60726	99.88317	Dry Soil			1,509	
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop = 50.0 mV Severity = x < 15% Low
%IR = 3 16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.613) / (6.23 - 6.715)
= 1,509 mV

-Show how to calculate over the line to remote earth voltage drop
= 50
= 50.0 mV

-Show how to calculate %IR
= 50 x 100 / 1509
= 3 %

-Show the contour of the voltagae gradient at the defect

Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#20 at sta. 6+636

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 486 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.636	12.98722	99.98376	Dry Soil		1.547
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

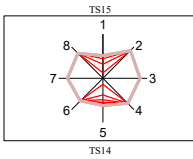
Over the line to remote earth voltage drop = 44.0 mV
%IR = 3Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.636) / (6.23 - 6.715)
= 1,547 mV

-Show how to calculate over the line to remote earth voltage drop
= 44
= 44.0 mV

-Show how to calculate %IR
= 44 x 100 / 1547
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#22 at sta. 6+665

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 435 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.665	12.98722	99.98401	Dry Soil		1.594
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

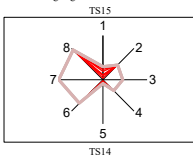
Over the line to remote earth voltage drop = 40.0 mV
%IR = 3Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.665) / (6.23 - 6.715)
= 1,594 mV

-Show how to calculate over the line to remote earth voltage drop
= 40
= 40.0 mV

-Show how to calculate %IR
= 40 x 100 / 1594
= 3 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#21 at sta. 6+649

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 419 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.649	12.98722	99.98388	Dry Soil		1.568
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

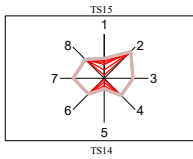
Over the line to remote earth voltage drop = 34.0 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.649) / (6.23 - 6.715)
= 1,568 mV

-Show how to calculate over the line to remote earth voltage drop
= 34
= 34.0 mV

-Show how to calculate %IR
= 34 x 100 / 1568
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect#23 at sta. 6+697

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 467 m.

Defect Signal Strength Data							
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	P/S Potential (V)	
			North	East		"ON"	"OFF"
TP before Defect	TP	6.230	12.99044	100.10199	Dry Soil	-1.724	-0.836
Defect		6.697	12.98722	99.98413	Dry Soil		1.646
TP after Defect	TP	6.715	12.99110	100.10119	Dry Soil	-2.456	-0.781

Measuring Point : TP=Test Post, R=Riser

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

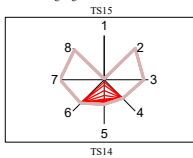
Over the line to remote earth voltage drop = 40.0 mV
%IR = 2Severity =
x < 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect
= 888 - (888 - 1675) x (6.23 - 6.697) / (6.23 - 6.715)
= 1,646 mV

-Show how to calculate over the line to remote earth voltage drop
= 40
= 40.0 mV

-Show how to calculate %IR
= 40 x 100 / 1646
= 2 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect024 at sta. 6+706

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance to Defect 476 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 9 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	PS Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.98044	101.10399	Dry Soil	-1.724	-0.836	888	
Defect	TP	6.706	13.00726	99.88044	Dry Soil			1,660	
TP after Defect	TP	6.715	12.99110	101.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

180.0
11

mV

Severity =

x

< 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 888 - (888 - 1675) x (6.23 - 6.706) / (6.23 - 6.715)
= 1,660 mV

-Show how to calculate over the line to remote earth voltage drop

= 180

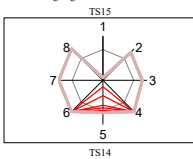
= 180.0 mV

-Show how to calculate %IR

= 180 x 100 / 1664

= 11 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT CONCLUSION

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Criterion < 15% Low, 16-35% Medium, 36-60% High, > 61% Very high

Pipeline Route Fuel Oil Pipeline

Defect Conclusion												
Item No.	Defect No.	Sta.	Section	Survey Date	GPS(WGS84)		Ground Type	Signal Strength (mV)	Over the line to remote earth voltage drop (mV)	%IR	Severity	Remarks
					North	East						
1	1	0+281	TS3-BB1	18/3/2022	13.59988	99.83240	Dry Soil	1,445	186.8	13	Low	
2	2	0+385	TS3-BB1	21/3/2022	13.59938	99.83320	Dry Soil	1,356	23.8	2	Low	
3	3	0+509	TS3-BB1	09/3/2022	13.60007	99.83373	Dry Soil	1,250	34.2	3	Low	
4	4	0+536	TS3-BB1	09/3/2022	13.60099	99.83385	Dry Soil	1,226	41.6	3	Low	
5	5	0+612	TS3-BB1	09/3/2022	13.60120	99.83418	Dry Soil	1,161	130.4	11	Low	
6	6	0+659	TS3-BB1	21/3/2022	13.60156	99.83440	Dry Soil	1,121	39.0	3	Low	
7	7	0+700	TS3-BB1	21/3/2022	13.60189	99.83457	Dry Soil	1,086	21.2	2	Low	
8	8	0+736	TS3-BB1	21/3/2022	13.60218	99.83477	Dry Soil	1,055	23.6	2	Low	
9	9	0+761	TS3-BB1	21/3/2022	13.60234	99.83486	Dry Soil	1,034	47.4	5	Low	
10	1	0+785	BB1-BB2	21/3/2022	13.60243	99.83501	Dry Soil	1,013	26.4	3	Low	
11	2	0+800	BB1-BB2	21/3/2022	13.60240	99.83514	Dry Soil	1,009	78.8	8	Low	
12	3	0+870	BB1-BB2	21/3/2022	13.60229	99.83577	Dry Soil	992	15.6	2	Low	
13	4	0+880	BB1-BB2	21/3/2022	13.60234	99.83586	Dry Soil	990	17.0	2	Low	
14	5	0+917	BB1-BB2	21/3/2022	13.60214	99.83619	Dry Soil	981	8.4	1	Low	
15	1	0+985	BB2-TS4	22/3/2022	13.60222	99.83601	Dry Soil	960	315.8	33	Medium	
16	2	1+025	BB2-TS4	22/3/2022	13.60222	99.83718	Dry Soil	945	23.4	2	Low	
17	3	1+059	BB2-TS4	22/3/2022	13.60217	99.83749	Dry Soil	932	19.2	2	Low	
18	1	1+101	TS4-TS5	22/3/2022	13.60209	99.83788	Dry Soil	770	67.0	9	Low	
19	2	1+119	TS4-TS5	22/3/2022	13.60205	99.83804	Dry Soil	767	210.6	27	Medium	
20	3	1+136	TS4-TS5	22/3/2022	13.60201	99.83819	Dry Soil	765	33.2	4	Low	
21	4	1+148	TS4-TS5	22/3/2022	13.60199	99.83830	Dry Soil	763	41.2	5	Low	
22	5	1+160	TS4-TS5	22/3/2022	13.60195	99.83840	Dry Soil	761	131.0	17	Medium	
23	6	1+203	TS4-TS5	18/3/2022	13.60185	99.83879	Dry Soil	755	66.8	9	Low	
24	7	1+213	TS4-TS5	18/3/2022	13.60184	99.83888	Dry Soil	754	89.4	12	Low	
25	8	1+251	TS4-TS5	18/3/2022	13.60176	99.83922	Dry Soil	749	33.4	4	Low	
26	9	1+419	TS4-TS5	18/3/2022	13.60130	99.84070	Dry Soil	725	17.6	2	Low	
27	1	1+476	TS5-TS6	18/3/2022	13.60128	99.84123	Dry Soil	713	8.2	1	Low	
28	2	1+505	TS5-TS6	18/3/2022	13.60129	99.84149	Dry Soil	707	49.8	7	Low	
29	1	1+869	TS6-TS7	21/3/2022	13.60210	99.84473	Dry Soil	807	52.0	6	Low	
30	2	1+892	TS6-TS7	21/3/2022	13.60219	99.84493	Dry Soil	798	19.0	2	Low	
31	3	1+925	TS6-TS7	21/3/2022	13.60229	99.84522	Dry Soil	784	14.4	2	Low	
32	4	1+937	TS6-TS7	21/3/2022	13.6023	99.84533	Dry Soil	780	17.4	2	Low	
33	5	1+949	TS6-TS7	21/3/2022	13.60233	99.84544	Dry Soil	775	23.2	3	Low	
34	6	1+954	TS6-TS7	21/3/2022	13.60235	99.84548	Dry Soil	773	30.2	4	Low	
35	7	1+973	TS6-TS7	21/3/2022	13.6024	99.84565	Dry Soil	765	26.6	3	Low	
36	8	1+982	TS6-TS7	21/3/2022	13.60244	99.84572	Dry Soil	761	29.8	4	Low	
37	9	2+011	TS6-TS7	21/3/2022	13.6025	99.84599	Dry Soil	749	29.4	4	Low	
38	10	2+025	TS6-TS7	21/3/2022	13.60253	99.84611	Dry Soil	744	86.0	12	Low	
39	1	2+439	TS7-TS8	21/3/2022	13.60192	99.84074	Dry Soil	646	23.8	4	Low	
40	2	2+486	TS7-TS8	21/3/2022	13.60182	99.85001	Dry Soil	637	7.0	1	Low	
41	3	2+591	TS7-TS8	21/3/2022	13.60181	99.85112	Dry Soil	618	97.8	16	Medium	
42	4	2+617	TS7-TS8	21/3/2022	13.60186	99.85135	Dry Soil	613	29.9	5	Low	
43	5	2+625	TS7-TS8	21/3/2022	13.60184	99.85144	Dry Soil	612	7.4	1	Low	

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CATHODIC PROTECTION DCVG DEFECT MEASUREMENT

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Defect No. Defect025 at sta. 6+708

Pipeline Route Fuel Oil Pipeline

Section TS14-TS15

Test Post No. before Defect TS14 sta. 6+230 from : sta. 6+230 to : sta. 6+715

Test Post No. after Defect TS15 sta. 6+715 Distance to Defect 478 m.

Test Post No. after Defect TS15 sta. 6+715 Distance from Defect 2 m.

Defect Signal Strength Data									
Location	Measuring Point	Sta.	GPS(WGS84)		Ground Type	PS Potential (V)		Signal Strength (mV)	Remarks
			North	East		"ON"	"OFF"		
TP before Defect	TP	6.230	12.98044	101.10399	Dry Soil	-1.724	-0.836	888	
Defect	TP	6.708	13.00726	99.88044	Dry Soil			1,664	
TP after Defect	TP	6.715	12.99110	101.10119	Dry Soil	-2.456	-0.781	1,675	

Measuring Point : TP=Test Post, R=Riser Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Over the line to remote earth voltage drop =

220.0
13

mV

Severity =

x

< 15% Low
16-35% Medium
36-60% High
> 61% Very high

-Show how to calculate signal strength at the defect

= 888 - (888 - 1675) x (6.23 - 6.708) / (6.23 - 6.715)
= 1,664 mV

-Show how to calculate over the line to remote earth voltage drop

= 220

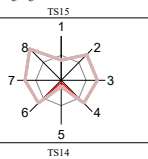
= 220.0 mV

-Show how to calculate %IR

= 220 x 100 / 1664

= 13 %

-Show the contour of the voltagae gradient at the defect



Note/Comment :

Test By	CPE	S.Tanya	Supervisor	3 April 2022
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CATHODIC PROTECTION DCVG DEFECT CONCLUSION

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference Electrode

Criterion < 15% Low, 16-35% Medium, 36-60% High, > 61% Very high

Pipeline Route Fuel Oil Pipeline

Defect Conclusion												
Item No.	Defect No.	Sta.	Section	Survey Date	GPS(WGS84)		Ground Type	Signal Strength (mV)	Over the line to remote earth voltage drop (mV)	%IR	Severity	Remark
					North	East						
44	1	2+640	TS8-TS9	21/3/2022	13.60185	99.85156	Dry Soil	609	9.8	2	Low	
45	2	2+665	TS8-TS9	21/3/2022	13.60185	99.85179	Dry Soil	605	109.8	18	Medium	
46	1	3+523	TS9-TS10	24/3/2022	13.60249	99.8597	Dry Soil	661	36.8	6	Low	
47	2	3+555	TS9-TS10	24/3/2022	13.60252	99.85999	Dry Soil	653	46.2	7	Low	
48	3	3+583	TS9-TS10	24/3/2022	13.60259	99.86024	Dry Soil	646	11.0	2	Low	
49	4	3+618	TS9-TS10	24/3/2022	13.60261	99.86057	Dry Soil	637	22.6	4	Low	
50	5	3+683	TS9-TS10	24/3/2022	13.60266	99.86117	Dry Soil	621	17.4	3	Low	
51	6	3+694	TS9-TS10	24/3/2022	13.60263	99.86127	Dry Soil	618	27.4	4	Low	
52	7	3+703	TS9-TS10	24/3/2022	13.60269	99.86134	Dry Soil	616	75.8	12	Low	
53	8	3+727	TS9-TS10	24/3/2022	13.60273	99.86156	Dry Soil	610	35.2	6	Low	
54	9	3+743	TS9-TS10	24/3/2022	13.60263	99.8617	Dry Soil	606	51.8	9	Low	
55	10	3+760	TS9-TS10	24/3/2022	13.60268	99.86186	Dry Soil	601	38.5	6	Low	
56	11	3+783	TS9-TS10	25/3/2022	13.60273	99.86207	Dry Soil	596	17.8	3	Low	
57	12	3+802	TS9-TS10	25/3/2022	13.60275	99.86224	Dry Soil	591	22.0	4	Low	
58	13	3+814	TS9-TS10	25/3/2022	13.60277	99.86235	Dry Soil	588	34.0	6	Low	
59	14	3+826	TS9-TS10	25/3/2022	13.60277	99.86246	Dry Soil	585	26.6	5	Low	
60	15	3+840	TS9-TS10	25/3/2022	13.60277	99.86259	Dry Soil	581	41.8	7	Low	
61	16	3+858	TS9-TS10	25/3/2022	13.60277	99.86276	Dry Soil	577	9.6	2	Low	
62	17	3+863	TS9-TS10	25/3/2022	13.60281	99.86281	Dry Soil	575	18.6	3	Low	
63	18	3+874	TS9-TS10	25/3/2022	13.60279	99.86291	Dry Soil	573	24.8	4	Low	
64	19	3+881	TS9-TS10	25/3/2022	13.60279	99.86298	Dry Soil	571	52.2	9	Low	
65	20	3+911	TS9-TS10	25/3/2022	13.60279	99.86326	Dry Soil	563	62.4	11	Low	
66	21	3+928	TS9-TS10	25/3/2022	13.6028	99.86342	Dry Soil	559	6.0	1	Low	
67	22	3+942	TS9-TS10	25/3/2022	13.60283	99.86355	Dry Soil	556	34.8	5	Low	
68	23	3+971	TS9-TS10	25/3/2022	13.60283	99.86382	Dry Soil	548	13.6	2	Low	
69	1	3+997	TS10-TS11	26/3/2022	13.60287	99.86406	Dry Soil	514	82.0	16	Medium	
70	2	4+015	TS10-TS11	26/3/2022	13.60288	99.86421	Dry Soil	515	31.6	6	Low	
71	3	4+026	TS10-TS11	26/3/2022	13.60292	99.86433	Dry Soil	516	61.8	8	Low	
72	4	4+042	TS10-TS11	26/3/2022	13.60291	99.86448	Dry Soil	517	42.8	12	Low	
73	5	4+065	TS10-TS11	26/3/2022	13.60291	99.86469	Dry Soil	519	54.0	10	Low	
74	6	4+085	TS10-TS11	26/3/2022	13.60293	99.86487	Dry Soil	520	90.0	17	Medium	
75	7	4+106	TS10-TS11	26/3/2022	13.60292	99.86506	Dry Soil	522	95.8	18	Medium	
76	8	4+150	TS10-TS11	26/3/2022	13.60295	99.86525	Dry Soil	525	102.0	19	Medium	
77	9	4+224	TS10-TS11	26/3/2022	13.60303	99.86615	Dry Soil	530	110.6	6	Low	
78	10	4+256	TS10-TS11	26/3/2022	13.60306	99.86645	Dry Soil	532	111.6	21	Medium	
79	11	4+291	TS10-TS11	26/3/2022	13.60302	99.86687	Dry Soil	534	15.6	3	Low	
80	12	4+314	TS10-TS11	26/3/2022	13.60305	99.86702	Dry Soil	536	100.0	10	Low	
81	13	4+362	TS10-TS11	26/3/2022	13.60317	99.86742	Dry Soil	539	182.0	34	Medium	
82	14	4+419	TS10-TS11	26/3/2022	13.60321	99.86797	Dry Soil	543	29.0	5	Low	
83	15	4+431	TS10-TS11	26/3/2022	13.6032	99.86806	Dry Soil	544	29.0	5	Low	
84	16	4+448	TS10-TS11	26/3/2022	13.60319	99.86822	Dry Soil	545	40.2	7	Low	
85	17	4+458	TS10-TS11	26/3/2022	13.60318	99.86831	Dry Soil	546	24.8	5	Low	
86	18	4+541	TS10-TS11	26/3/2022	13.60323	99.86907	Dry Soil	551	175.2	32	Medium	
87	1	4+598	TS11-TS12	28/3/2022	13.60332	99.86962	Dry Soil	572	7.6	1	Low	
88	2	4+642	TS11-TS12	28/3/2022	13.60336	99.87003	Dry Soil	572	48.6	8	Low	
89	3	4+670	TS11-TS12	28/3/2022	13.60335	99.87029	Dry Soil	578	31.2	5	Low	
90	4	4+694	TS11-TS12	28/3/2022	13.60307	99.87101	Dry Soil	583	118.8	20	Medium	

CATHODIC PROTECTION DCVG DEFECT CONCLUSION

TEST INSTRUMENT

: DCVG Survey Meter

: *Current Interrupter*

31.1 333.33 333.33

: Digital Multimeter Fluke 189

Criterion	< 15% Low,	16-35% Medium,	36-60% High,	> 61% Very high
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[illegible]

Defect Conclusion													
Item No.	Defect No.	Sta.	Section	Survey Date	GPS(WGS84) North	East	Ground Type	Signal Strength (mV)	Over the line to remote earth voltage drop (mV)	%IR	Severity	Remarks	
91	5	4+723	TS11-TS12	29/10/2022	10.6034	99.8770	Dry Soil	589	50.6	9	Low		
92	6	4+738	TS11-TS12	29/10/2022	10.6032	99.8709	Dry Soil	593	26.6	4	Low		
93	7	4+795	TS11-TS12	29/10/2022	10.6030	99.8743	Dry Soil	605	18.8	3	Low		
94	8	4+809	TS11-TS12	29/10/2022	10.6051	99.8756	Dry Soil	608	63	10	Low		
95	9	4+855	TS11-TS12	29/10/2022	10.6053	99.8799	Dry Soil	618	43.6	7	Low		
96	10	4+872	TS11-TS12	29/10/2022	10.6051	99.8724	Dry Soil	622	231.6	37	High		
97	11	4+891	TS11-TS12	29/10/2022	10.6056	99.8731	Dry Soil	626	135.8	22	Medium		
98	12	4+902	TS11-TS12	29/10/2022	10.6055	99.8732	Dry Soil	628	82.2	13	Low		
99	1	4+919	TS12-BB3	29/10/2022	10.6051	99.8726	Dry Soil	634	27.6	4	Low		
100	2	4+929	TS12-BB3	29/10/2022	10.6053	99.8769	Dry Soil	639	110.6	17	Medium		
101	3	4+934	TS12-BB3	29/10/2022	10.6055	99.8773	Dry Soil	641	105.6	16	Medium		
102	4	5+003	TS12-BB3	30/10/2022	10.606	99.8737	Dry Soil	673	11.4	2	Low		
103	5	5+036	TS12-BB3	30/10/2022	10.6066	99.8767	Dry Soil	689	13.2	2	Low		
104	6	5+049	TS12-BB3	30/10/2022	10.6069	99.8779	Dry Soil	695	209.8	30	Medium		
105	7	5+068	TS12-BB3	30/10/2022	10.6069	99.8706	Dry Soil	703	28.2	4	Low		
106	8	5+083	TS12-BB3	30/10/2022	10.607	99.8741	Dry Soil	710	12.6	2	Low		
107	9	5+122	TS12-BB3	30/10/2022	10.6075	99.8746	Dry Soil	729	262.2	36	High		
108	10	5+154	TS12-BB3	30/10/2022	10.6077	99.8746	Dry Soil	743	110.5	15	Low		
109	11	5+162	TS12-BB3	30/10/2022	10.607	99.8743	Dry Soil	747	59.0	8	Low		
110	12	5+181	TS12-BB3	30/10/2022	10.6071	99.8750	Dry Soil	756	92.0	12	Low		
111	13	5+200	TS12-BB3	30/10/2022	10.607	99.8759	Dry Soil	765	89.2	12	Low		
112	14	5+213	TS12-BB3	30/10/2022	10.6079	99.8751	Dry Soil	771	114.2	15	Low		
113	15	5+218	TS12-BB3	30/10/2022	10.608	99.8755	Dry Soil	773	170.0	32	Medium		
114	16	5+222	TS12-BB3	30/10/2022	10.6076	99.8755	Dry Soil	775	147.8	19	Medium		
115	17	5+247	TS12-BB3	30/10/2022	10.6084	99.8762	Dry Soil	787	65.0	8	Low		
116	18	5+269	TS12-BB3	30/10/2022	10.6087	99.8752	Dry Soil	797	102.0	13	Low		
117	19	5+298	TS12-BB3	30/10/2022	10.6039	99.8769	Dry Soil	810	100.0	12	Low		
118	1	5+322	BB3-TS13	31/10/2022	10.6095	99.8768	Dry Soil	825	104.4	13	Low		
119	2	5+345	BB3-TS13	31/10/2022	10.6092	99.8762	Dry Soil	828	25.0	3	Low		
120	3	5+358	BB3-TS13	31/10/2022	10.6043	99.8761	Dry Soil	832	140.0	17	Medium		
121	4	5+381	BB3-TS13	31/10/2022	10.6038	99.8763	Dry Soil	838	169.0	19	Medium		
122	5	5+405	BB3-TS13	31/10/2022	10.6099	99.8767	Dry Soil	845	36.0	4	Low		
123	6	5+417	BB3-TS13	31/10/2022	10.6067	99.8766	Dry Soil	848	28.0	3	Low		
124	7	5+428	BB3-TS13	31/10/2022	10.6079	99.8762	Dry Soil	851	28.0	3	Low		
125	8	5+452	BB3-TS13	31/10/2022	10.605	99.8768	Dry Soil	858	120.0	14	Low		
126	9	5+472	BB3-TS13	31/10/2022	10.6018	99.8767	Dry Soil	863	76.0	9	Low		
127	10	5+480	BB3-TS13	31/10/2022	10.6025	99.8768	Dry Soil	865	32.0	4	Low		
128	11	5+494	BB3-TS13	31/10/2022	10.6036	99.8758	Dry Soil	869	16.0	2	Low		
129	12	5+504	BB3-TS13	31/10/2022	10.6046	99.8799	Dry Soil	872	20.0	2	Low		
130	13	5+508	BB3-TS13	31/10/2022	10.6051	99.8799	Dry Soil	873	22.0	3	Low		
131	14	5+524	BB3-TS13	31/10/2022	10.6094	99.8796	Dry Soil	878	100.0	11	Low		
132	15	5+537	BB3-TS13	31/10/2022	10.6092	99.8795	Dry Soil	881	38.0	4	Low		
133	16	5+555	BB3-TS13	31/10/2022	10.6092	99.8791	Dry Soil	886	66.0	7	Low		
134	17	5+570	BB3-TS13	31/10/2022	10.6096	99.8788	Dry Soil	890	14.0	2	Low		
135	18	5+587	BB3-TS13	31/10/2022	10.6022	99.8787	Dry Soil	895	15.0	2	Low		
136	19	5+597	BB3-TS13	31/10/2022	10.6021	99.8785	Dry Soil	898	22.0	2	Low		
137	20	5+621	BB3-TS13	31/10/2022	10.6022	99.8788	Dry Soil	904	24.0	3	Low		
138	21	5+634	BB3-TS13	31/10/2022	10.6063	99.8776	Dry Soil	908	36.0	4	Low		

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CATHODIC PROTECTION DCVG DEFECT CONCLUSION

TEST INSTRUMENT

: DCVG Survey Meter

; Current Interrupter

Digital Multimeter Error: 180

: Digital Multimeter Fluke 189

Criterion	< 15% Low,	16-35% Medium,	36-60% High,	> 61% Very high
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Pipeline Route	Fuel Oil Pipeline
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[illegible]

Ground Type : Wet Soil, Dry Soil, Asphalt, Concrete

Note/Comment :

[illegible]

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CATHODIC PROTECTION DCVG DEFECT CONCLUSION

TEST INSTRUMENT

: DCVG Survey Meter

Current Interrupter

70-1-100-000 70-1-100-000

: Digital Multimeter Fluke 189

Criterion	< 15% Low,	16-35% Medium,	36-60% High,	> 61% Very high
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Pipeline Route	Fuel Oil Pipeline
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Defect Conclusion											
Item No.	Defect No.	Sta.	Section	Survey	GPS(WGS84)	Dry Type	Signal Strength (mV)	Over the line to remote cable voltage drop (mV)	%IR	Severity	Remark
				North	East						
139	22	S+642	BB3-TS13	31/3/2022	13.60671	Dry Soil	910	80.0	9	Low	
140	23	S+653	BB3-TS13	31/3/2022	13.60681	Dry Soil	913	64.0	7	Low	
141	24	S+666	BB3-TS13	31/3/2022	13.60691	Dry Soil	916	48.0	5	Low	
142	1	S+700	TS13-TS14	24/2/2022	13.6072	Dry Soil	660	50.0	8	Low	
143	2	S+780	TS13-TS14	24/2/2022	13.6075	Dry Soil	695	61.6	9	Low	
144	3	S+803	TS13-TS14	24/2/2022	13.6075	Dry Soil	705	75.0	11	Low	
145	4	S+812	TS13-TS14	24/2/2022	13.60748	Dry Soil	708	75.0	11	Low	
146	5	S+829	TS13-TS14	24/2/2022	13.60753	Dry Soil	716	50.0	7	Low	
147	6	S+842	TS13-TS14	24/2/2022	13.60747	Dry Soil	721	30.0	4	Low	
148	7	S+847	TS13-TS14	24/2/2022	13.60747	Dry Soil	723	15.8	2	Low	
149	8	S+872	TS13-TS14	24/2/2022	13.60746	Dry Soil	734	24.0	3	Low	
150	9	S+885	TS13-TS14	24/2/2022	13.60747	Dry Soil	740	44.0	6	Low	
151	10	S+897	TS13-TS14	24/2/2022	13.60747	Dry Soil	745	44.6	6	Low	
152	11	S+908	TS13-TS14	24/2/2022	13.60746	Dry Soil	750	15.0	2	Low	
153	12	S+923	TS13-TS14	24/2/2022	13.60747	Dry Soil	756	40.0	5	Low	
154	13	S+937	TS13-TS14	24/2/2022	13.60744	Dry Soil	762	50.0	7	Low	
155	14	S+943	TS13-TS14	24/2/2022	13.60749	Dry Soil	765	24.0	3	Low	
156	15	S+973	TS13-TS14	24/2/2022	13.60746	Dry Soil	778	10.4	1	Low	
157	16	S+985	TS13-TS14	24/2/2022	13.60747	Dry Soil	783	317.2	41	High	
158	17	S+032	TS13-TS14	24/2/2022	13.6075	Dry Soil	803	5.2	1	Low	
159	18	S+084	TS13-TS14	24/2/2022	13.60748	Dry Soil	825	183.4	22	Medium	
160	19	S+089	TS13-TS14	24/2/2022	13.60747	Dry Soil	827	80.0	10	Low	
161	20	S+094	TS13-TS14	24/2/2022	13.60747	Dry Soil	830	150.0	18	Medium	
162	21	S+106	TS13-TS14	24/2/2022	13.60745	Dry Soil	835	70.0	8	Low	
163	22	S+131	TS13-TS14	24/2/2022	13.60749	Dry Soil	845	30.0	4	Low	
164	23	S+143	TS13-TS14	24/2/2022	13.60748	Dry Soil	851	40.0	5	Low	
165	24	S+153	TS13-TS14	24/2/2022	13.60748	Dry Soil	855	70.0	8	Low	
166	25	S+164	TS13-TS14	24/2/2022	13.60746	Dry Soil	860	10.0	1	Low	
167	26	S+175	TS13-TS14	24/2/2022	13.60748	Dry Soil	864	66.4	10	Low	
168	27	S+187	TS13-TS14	24/2/2022	13.60748	Dry Soil	870	65.4	8	Low	
169	28	S+175	TS13-TS14	24/2/2022	13.60748	Dry Soil	870	10.0	1	Low	
170	29	S+223	TS13-TS14	24/2/2022	13.60749	Dry Soil	885	36.0	4	Low	
171	1	S+238	TS14-TS15	24/2/2022	13.6075	Dry Soil	901	42.0	5	Low	
172	2	S+254	TS14-TS15	24/2/2022	13.60752	Dry Soil	927	125.0	13	Low	
173	3	S+282	TS14-TS15	24/2/2022	13.6075	Dry Soil	972	400.0	41	High	
174	4	S+340	TS14-TS15	24/2/2022	13.60727	Dry Soil	1,066	21.6	2	Low	
175	5	S+384	TS14-TS15	24/2/2022	13.60723	Dry Soil	1,138	70.0	6	Low	
176	6	S+404	TS14-TS15	24/2/2022	13.60726	Dry Soil	1,167	25.0	2	Low	
177	7	S+417	TS14-TS15	24/2/2022	13.60728	Dry Soil	1,191	27.0	2	Low	
178	8	S+423	TS14-TS15	24/2/2022	13.60726	Dry Soil	1,201	25.0	2	Low	
179	9	S+430	TS14-TS15	24/2/2022	13.60726	Dry Soil	1,213	20.0	2	Low	
180	10	S+440	TS14-TS15	24/2/2022	13.60725	Dry Soil	1,229	12.0	1	Low	
181	11	S+462	TS14-TS15	24/2/2022	13.60725	Dry Soil	1,264	15.0	1	Low	
182	12	S+474	TS14-TS15	24/2/2022	13.60728	Dry Soil	1,284	7.0	1	Low	
183	13	S+487	TS14-TS15	24/2/2022	13.60727	Dry Soil	1,305	30.0	2	Low	
184	14	S+534	TS14-TS15	24/2/2022	13.60725	Dry Soil	1,381	15.0	1	Low	
185	15	S+558	TS14-TS15	24/2/2022	13.60726	Dry Soil	1,420	80.0	6	Low	
186	16	S+571	TS14-TS15	24/2/2022	13.60726	Dry Soil	1,441	12.0	1	Low	

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3. CONCLUSION

Conclusion.

After DCVG surveying, we can conclude that :

We have found 195 defects, divided by

- 4 High severity defects
- 24 Medium severity defects
- 167 Low severity defects

In this conclusion section, we will show especially location of High and Medium severity.

- **4 High severity defects**

Sta.	4+872	section	TS11-TS12	=	37	% IR
Sta.	5+122	section	TS12-BB3	=	36	% IR
Sta.	5+985	section	TS13-TS14	=	41	% IR
Sta.	6+282	section	TS14-TS15	=	41	% IR

- **24 Medium severity defects**

Sta.	0+985	section	BB2-TS4	=	33	% IR
Sta.	1+119	section	TS4-TS5	=	27	% IR
Sta.	1+160	section	TS4-TS5	=	17	% IR
Sta.	2+591	section	TS7-TS8	=	16	% IR
Sta.	2+665	section	TS8-TS9	=	18	% IR
Sta.	3+997	section	TS10-TS11	=	16	% IR
Sta.	4+085	section	TS10-TS11	=	17	% IR
Sta.	4+106	section	TS10-TS11	=	18	% IR
Sta.	4+150	section	TS10-TS11	=	19	% IR
Sta.	4+256	section	TS10-TS11	=	21	% IR
Sta.	4+314	section	TS10-TS11	=	19	% IR
Sta.	4+362	section	TS10-TS11	=	34	% IR
Sta.	4+541	section	TS10-TS11	=	32	% IR
Sta.	4+694	section	TS11-TS12	=	20	% IR
Sta.	4+891	section	TS11-TS12	=	22	% IR
Sta.	4+929	section	TS12-BB3	=	17	% IR
Sta.	4+934	section	TS12-BB3	=	16	% IR
Sta.	5+049	section	TS12-BB3	=	30	% IR
Sta.	5+218	section	TS12-BB3	=	22	% IR
Sta.	5+222	section	TS12-BB3	=	19	% IR
Sta.	5+358	section	BB3-TS13	=	17	% IR
Sta.	5+381	section	BB3-TS13	=	19	% IR
Sta.	6+084	section	TS13-TS14	=	22	% IR
Sta.	6+094	section	TS13-TS14	=	18	% IR

4. APPENDIX

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CONTENT

- 4.1. Digital Multimeter Fluke 289
- 4.2. DCVG Survey Meter
- 4.3. Cu/CuSO₄ Reference Electrode
- 4.4. Current Interrupter

DIGITAL MULTIMETERS**Fluke 289 and 287 True-rms Logging Multimeters****Find little problems before they become big ones**

The Fluke 289 and 287 are high performance industrial logging multimeters. The large 50,000 count, 1/4 VGA dot matrix display and multiple on screen displays give you sharp, clear readings. Use the logging function with expanded memory for unattended monitoring of signals over time. With on-board TrendCapture, you can graphically review up to 10,000 recorded events and logged readings. Then, zoom on trend provides an unprecedented ability to zoom in up to 14 times to view and analyze data—all without needing a PC.

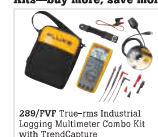
- Two terminal 50 ohm range with 1 milliohm resolution, 10 mA source current. Useful for measuring and comparing differences in motor winding resistance or contact resistance [289]
- Low-pass filter for accurate voltage and frequency measurements on adjustable speed motor drives and other electrically noisy equipment [289]
- Add the wireless data logging capabilities of Fluke Connect® with Share-Live™ video call with the i3000 FC connector
- True-rms ac bandwidth 100 kHz; dBV/dBm; dc mV resolution 1 µV; Megohm range up to 500 MΩ
- Conductance 50.00 nS
- Min/Max/Avg/duty cycle/pulse width
- Isolated optical DMM interface with USB PC connection
- Over 200 hours logging capacity with new power saving function
- Lo Ohm capability; Lo Z volts; Lo Pass Filter

Specifications

Functions	Range and resolution	Basic accuracy
AC or dc voltage	50,000 mV, 500.00 mV, 5,000.0 V, 50,000 V	0.025 %
AC current dc current	500.00 µA, 5000.0 µA, 50,000 mA, 500.00 A, 5,000.0 A, 10,000 A	0.15 %
Temperature (excluding probe)	-200.0 °C to 1350.0 °C (-328.0 °F to 2462.0 °F)	0.7 % (true-rms)
Resistance	50,000 Ω, 500.0 Ω, 5,000.0 kΩ, 50,000 kΩ, 500.00 kΩ, 5,000.0 MΩ, 50,000 MΩ, 500.0 MΩ	1.0 %
Capacitance	1,000 nF, 10.00 nF, 100.0 nF, 1,000 pF, 10.00 pF, 100.0 pF, 1000 pF, 10.00 mF, 100 mF	0.05 %
Frequency	99.999 Hz, 999.99 Hz, 9.9999 kHz, 99.999 kHz, 999.99 kHz	0.005 %

Ordering information

Models	Included accessories
FLUKE-289 True-rms Industrial Logging Multimeter with TrendCapture	Test leads, alligator clips, holster, AA batteries installed, information packet
FLUKE-287 True-rms Electronics Logging Multimeter with TrendCapture	Test leads, alligator clips, holster, AA batteries installed, information packet

**Kits—buy more, save more**

289/PVF True-rms Industrial Logging Multimeter Combo Kit with TrendCapture

Recommended accessories

TL175 TwistGuard™ Test Leads
i3000 FC Connector



DCVG

DC Voltage Gradient
Technology & Supply Ltd.
Wigan, England

A complete set of DCVG Pipeline Coating Integrity Survey Equipment

www.dcvg.com

The MCM Line of Electrodes

MODEL RE-5:

Standard Model. Flat CPT Porous Plug, for general use in soil and (with Submersible Adapter) for use in water. Approx. Overall Size: 1 3/4" dia. X 6" long. Dry Weight: 4 oz.



MODEL RE-5C:

Similar to Model RE-5 **except** supplied with a cone-shaped CPT porous plug. For use in soft soils. Provides lower contact resistance. When pushed into soft soils the shape of the plug helps the electrode to "stand up". Approx. Overall Size: 1 3/4" dia. X 6 1/4" long. Dry Weight: 5 oz.



MODEL RE-7:

Long, slim model with beveled CPT porous plug. For general purpose use in soil or in a 1" diameter augured hole in pavement. Approx. Overall Size: 1" dia. X 8 1/2" long. Dry Weight: 5 oz.



MODEL RE-5/U:

For use on underside of bridge decks, parking garages, etc. in upside-down position.



MODEL RE-3A:

Large diameter (3") Flat CPT porous plug provides greater contact area. Flat plug provides lower contact resistance than rounded or serrated plug when placed in direct contact with flat surfaces. Especially useful on pavements, dry sand, frozen soil, etc. Stands by itself. Approx. Overall Size: 3" dia. X 5" long. Dry Weight: 16 oz.



MODEL PH-50:

Antimony Reference Electrode
Antimony electrode used in conjunction with a Copper/Copper Sulphate reference electrode and voltmeter to measure the PH of soil. The tube assembly of the electrode is etched with the conversion table of millivolts to PH. Approx. Overall Size: 1/2" dia. X 8" long.



MODEL RE-7AG:

Silver/Silver Chloride Reference Electrode Kit: Land/Sea
Used on land with Lexan tube, CPT ceramic plug and KCL filling solution. Used in sea water with perforated Lexan tube, brass submersible weights (any number of weights can be attached together; two included in kit) and standard 8" submersible adapter (available in additional lengths).



All copper sulphate electrodes are shipped dry, but include a charge of high-purity copper sulphate crystals. A protective cap for the CPT porous plug is also supplied. Special lengths of RE-5, RE-5C and RE-7 are available on order. Use and Maintenance Instructions furnished with each electrode.

CURRENT INTERRUPTER



CATHODIC PROTECTION DCVG DEFECT CONCLUSION											
TEST INSTRUMENT										: DCVG Survey Meter	
										: Current Interrupter	
										: Digital Multimeter Fluke 189	
										: Cu/CuSO ₄ Reference Electrode	
Criterion < 15% Low, 16-35% Medium, 36-60% High, > 61% Very High											
Pipeline Route Fuel Oil Pipeline											
Defect Conclusion											
Item No.	Defect No.	Sta.	Section	Survey Date	GPS(WGS84)	Ground Type	Signal Strength (mV)	Over the line to remote earth voltage drop (mV)	%IR	Severity	Remark
					North	East					
1	1	0+281	TS3-BB1	18/3/2022	13.5988	99.83240	Dry Soil	1,445	186.8	13	Low
2	2	0+385	TS3-BB1	21/3/2022	13.5988	99.83220	Dry Soil	1,356	23.8	2	Low
3	3	0+509	TS3-BB1	18/3/2022	13.6007	99.83373	Dry Soil	1,250	34.2	3	Low
4	4	0+536	TS3-BB1	18/3/2022	13.6009	99.83385	Dry Soil	1,226	41.6	3	Low
5	5	0+612	TS3-BB1	18/3/2022	13.6020	99.83418	Dry Soil	1,161	130.4	11	Low
6	6	0+659	TS3-BB1	21/3/2022	13.6016	99.83440	Dry Soil	1,121	39.0	3	Low
7	7	0+700	TS3-BB1	21/3/2022	13.6018	99.83457	Dry Soil	1,086	21.2	2	Low
8	8	0+736	TS3-BB1	21/3/2022	13.60218	99.83472	Dry Soil	1,055	23.6	2	Low
9	9	0+761	TS3-BB1	21/3/2022	13.60234	99.83486	Dry Soil	1,034	47.4	5	Low
10	1	0+785	BB1-BB2	21/3/2022	13.60243	99.83501	Dry Soil	1,013	26.4	3	Low
11	2	0+800	BB1-BB2	21/3/2022	13.60240	99.83514	Dry Soil	1,009	78.8	8	Low
12	3	0+870	BB1-BB2	22/3/2022	13.60229	99.83577	Dry Soil	992	15.6	2	Low
13	4	0+880	BB1-BB2	22/3/2022	13.60224	99.83586	Dry Soil	990	17.0	2	Low
14	5	0+917	BB1-BB2	22/3/2022	13.60214	99.83619	Dry Soil	981	8.4	1	Low
15	1	0+985	BB2-TS4	22/3/2022	13.60222	99.83681	Dry Soil	960	315.8	33	Medium
16	2	1+025	BB2-TS4	22/3/2022	13.60222	99.83718	Dry Soil	945	23.4	2	Low
17	3	1+059	BB2-TS4	22/3/2022	13.60217	99.83749	Dry Soil	932	19.2	2	Low
18	1	1+101	TS4-TS5	22/3/2022	13.60209	99.83789	Dry Soil	770	67.0	9	Low
19	2	1+119	TS4-TS5	22/3/2022	13.60205	99.83804	Dry Soil	767	210.6	27	Medium
20	3	1+136	TS4-TS5	22/3/2022	13.60201	99.83819	Dry Soil	765	33.2	4	Low
21	4	1+148	TS4-TS5	22/3/2022	13.60199	99.83830	Dry Soil	763	41.2	5	Low
22	5	1+160	TS4-TS5	22/3/2022	13.60195	99.83840	Dry Soil	761	131.0	17	Medium
23	6	1+203	TS4-TS5	18/3/2022	13.60185	99.83879	Dry Soil	755	66.8	9	Low
24	7	1+213	TS4-TS5	18/3/2022	13.60184	99.83888	Dry Soil	754	89.4	12	Low
25	8	1+251	TS4-TS5	18/3/2022	13.60176	99.83922	Dry Soil	749	33.4	4	Low
26	9	1+419	TS4-TS5	18/3/2022	13.60130	99.84070	Dry Soil	725	17.6	2	Low
27	1	1+476	TS5-TS6	18/3/2022	13.60128	99.84123	Dry Soil	713	8.2	1	Low
28	2	1+505	TS5-TS6	18/3/2022	13.60129	99.84149	Dry Soil	707	49.8	7	Low
29	1	1+869	TS6-TS7	23/3/2022	13.60210	99.84473	Dry Soil	807	52.0	6	Low
30	2	1+892	TS6-TS7	23/3/2022	13.60219	99.84493	Dry Soil	798	19.0	2	Low
31	3	1+925	TS6-TS7	23/3/2022	13.60229	99.84522	Dry Soil	784	14.4	2	Low
32	4	1+937	TS6-TS7	23/3/2022	13.6023	99.84533	Dry Soil	780	17.4	2	Low
33	5	1+949	TS6-TS7	23/3/2022	13.60233	99.84544	Dry Soil	775	23.2	3	Low
34	6	1+954	TS6-TS7	23/3/2022	13.60235	99.84548	Dry Soil	773	30.2	4	Low
35	7	1+973	TS6-TS7	23/3/2022	13.6024	99.84565	Dry Soil	765	26.6	3	Low
36	8	1+982	TS6-TS7	23/3/2022	13.60244	99.84572	Dry Soil	761	29.8	4	Low
37	9	2+011	TS6-TS7	23/3/2022	13.6025	99.84598	Dry Soil	749	29.4	4	Low
38	10	2+025	TS6-TS7	23/3/2022	13.60253	99.84611	Dry Soil	744	86.0	12	Low
39	1	2+439	TS7-TS8	23/3/2022	13.60192	99.84974	Dry Soil	646	23.8	4	Low
40	2	2+486	TS7-TS8	23/3/2022	13.60182	99.85016	Dry Soil	637	7.0	1	Low
41	3	2+591	TS7-TS8	23/3/2022	13.60181	99.85113	Dry Soil	618	97.8	18	Medium
42	4	2+617	TS7-TS8	23/3/2022	13.60186	99.85127	Dry Soil	613	29.9	5	Low
43	5	2+625	TS7-TS8	23/3/2022	13.60184	99.85144	Dry Soil	612	7.4	1	Low

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CATHODIC PROTECTION DCVG DEFECT CONCLUSION

TEST INSTRUMENT

: DCVG Survey Meter

: Current Interrupter

: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference ElectrodeCriteria < 15% Low, 16-35% Medium, 36-60% High, > 61% Very high
Pipeline Route Fuel Oil Pipeline

Defect Conclusion											
Item No.	Defect No.	Sta.	Section	Survey Date	GPS(WGS84) North East	Ground Type	Signal Strength (mV)	Over the line to remote earth voltage drop (mV)	%IR	Severity	Remark
44	1	2+640	TS8-TS9	23/3/2022	13.60185 99.85136	Dry Soil	609	9.8	2	Low	
45	2	2+665	TS8-TS9	23/3/2022	13.60185 99.85179	Dry Soil	605	109.8	16	Medium	scabrous
46	1	3+523	TS9-TS10	24/3/2022	13.60249 99.8597	Dry Soil	661	36.8	6	Low	
47	2	3+555	TS9-TS10	24/3/2022	13.60252 99.85999	Dry Soil	653	46.2	7	Low	
48	3	3+583	TS9-TS10	24/3/2022	13.60259 99.86024	Dry Soil	646	11.0	2	Low	
49	4	3+618	TS9-TS10	24/3/2022	13.60261 99.86057	Dry Soil	637	22.6	4	Low	
50	5	3+683	TS9-TS10	24/3/2022	13.60266 99.86117	Dry Soil	621	17.4	3	Low	
51	6	3+694	TS9-TS10	24/3/2022	13.60263 99.86127	Dry Soil	618	27.4	4	Low	
52	7	3+703	TS9-TS10	24/3/2022	13.60269 99.86134	Dry Soil	616	75.8	12	Low	scabrous
53	8	3+727	TS9-TS10	24/3/2022	13.60273 99.86156	Dry Soil	610	35.2	6	Low	
54	9	3+743	TS9-TS10	24/3/2022	13.60263 99.86187	Dry Soil	606	51.8	9	Low	
55	10	3+760	TS9-TS10	25/3/2022	13.60268 99.86186	Dry Soil	601	38.5	6	Low	
56	11	3+783	TS9-TS10	25/3/2022	13.60273 99.86207	Dry Soil	596	17.8	3	Low	
57	12	3+802	TS9-TS10	25/3/2022	13.60275 99.86224	Dry Soil	591	22.0	4	Low	
58	13	3+814	TS9-TS10	25/3/2022	13.60277 99.86235	Dry Soil	588	34.0	6	Low	
59	14	3+826	TS9-TS10	25/3/2022	13.60277 99.86246	Dry Soil	585	26.6	5	Low	
60	15	3+840	TS9-TS10	25/3/2022	13.60277 99.86259	Dry Soil	581	41.8	7	Low	scabrous
61	16	3+858	TS9-TS10	25/3/2022	13.60277 99.86276	Dry Soil	577	9.6	2	Low	
62	17	3+863	TS9-TS10	25/3/2022	13.60281 99.86281	Dry Soil	575	18.6	3	Low	
63	18	3+874	TS9-TS10	25/3/2022	13.60279 99.86291	Dry Soil	573	24.8	4	Low	
64	19	3+881	TS9-TS10	25/3/2022	13.60279 99.86299	Dry Soil	571	52.2	9	Low	
65	20	3+911	TS9-TS10	25/3/2022	13.60279 99.86326	Dry Soil	563	62.4	11	Low	
66	21	3+928	TS9-TS10	25/3/2022	13.6028 99.86342	Dry Soil	559	6.0	1	Low	
67	22	3+942	TS9-TS10	25/3/2022	13.60283 99.86335	Dry Soil	556	34.8	6	Low	
68	23	3+971	TS9-TS10	25/3/2022	13.60283 99.86382	Dry Soil	548	13.6	2	Low	
69	1	4+997	TS10-TS11	26/3/2022	13.60287 99.86406	Dry Soil	514	81.0	16	Medium	scabrous
70	2	4+013	TS10-TS11	26/3/2022	13.60288 99.86423	Dry Soil	515	32.6	6	Low	
71	3	4+026	TS10-TS11	26/3/2022	13.60292 99.86432	Dry Soil	516	41.8	8	Low	
72	4	4+042	TS10-TS11	26/3/2022	13.60291 99.86448	Dry Soil	517	62.8	12	Low	
73	5	4+065	TS10-TS11	26/3/2022	13.60291 99.86469	Dry Soil	519	54.0	10	Low	
74	6	4+085	TS10-TS11	26/3/2022	13.60292 99.86487	Dry Soil	520	90.0	17	Medium	scabrous
75	7	4+106	TS10-TS11	26/3/2022	13.60292 99.86506	Dry Soil	522	95.8	18	Medium	scabrous
76	8	4+150	TS10-TS11	26/3/2022	13.60295 99.86547	Dry Soil	525	102.0	19	Medium	scabrous
77	9	4+224	TS10-TS11	26/3/2022	13.60301 99.86615	Dry Soil	530	30.6	6	Low	
78	10	4+256	TS10-TS11	26/3/2022	13.60306 99.86645	Dry Soil	532	111.6	23	Medium	scabrous
79	11	4+291	TS10-TS11	26/3/2022	13.60305 99.86677	Dry Soil	534	15.6	3	Low	
80	12	4+314	TS10-TS11	26/3/2022	13.60304 99.86678	Dry Soil	536	100.0	19	Medium	scabrous
81	13	4+362	TS10-TS11	26/3/2022	13.60317 99.86732	Dry Soil	539	182.0	24	Medium	scabrous
82	14	4+419	TS10-TS11	26/3/2022	13.60321 99.86795	Dry Soil	543	29.0	5	Low	
83	15	4+431	TS10-TS11	26/3/2022	13.6032 99.86809	Dry Soil	544	29.0	5	Low	
84	16	4+448	TS10-TS11	26/3/2022	13.60319 99.86822	Dry Soil	545	40.2	7	Low	
85	17	4+458	TS10-TS11	26/3/2022	13.60318 99.86831	Dry Soil	546	24.8	5	Low	
86	18	4+541	TS10-TS11	26/3/2022	13.60323 99.86907	Dry Soil	551	175.2	22	Medium	scabrous
87	1	4+598	TS11-TS12	26/3/2022	13.60332 99.86962	Dry Soil	572	7.6	1	Low	
88	2	4+642	TS11-TS12	26/3/2022	13.60336 99.87003	Dry Soil	572	48.6	8	Low	
89	3	4+670	TS11-TS12	26/3/2022	13.60335 99.87029	Dry Soil	578	31.2	5	Low	
90	4	4+694	TS11-TS12	26/3/2022	13.60387 99.87301	Dry Soil	583	118.8	20	Medium	scabrous

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CATHODIC PROTECTION DCVG DEFECT CONCLUSION

TEST INSTRUMENT

: DCVG Survey Meter

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: Digital Multimeter Fluke 189

: Cu/CuSO₄ Reference ElectrodeCriteria < 15% Low, 16-35% Medium, 36-60% High, > 61% Very high
Pipeline Route Fuel Oil Pipeline

Defect Conclusion											
Item No.	Defect No.	Sta.	Section	Survey Date	GPS(WGS84) North East	Ground Type	Signal Strength (mV)	Over the line to remote earth voltage drop (mV)	%IR	Severity	Remarks
139	22	5+642	BB3-TS13	31/3/2022	13.60671 99.87575	Dry Soil	910	80.0	9	Low	
140	23	5+653	BB3-TS13	31/3/2022	13.60681 99.87573	Dry Soil	913	64.0	7	Low	
141	24	5+666	BB3-TS13	31/3/2022	13.60691 99.8757	Dry Soil	916	48.0	5	Low	
142	1	5+700	TS13-TS14	24/2/2022	13.6072 99.87567	Dry Soil	660	50.0	8	Low	
143	2	5+780	TS13-TS14	24/2/2022	13.6075 99.87604	Dry Soil	695	61.6	9	Low	
144	3	5+803	TS13-TS14	24/2/2022	13.6075 99.87625	Dry Soil	705	75.0	11	Low	
145	4	5+812	TS13-TS14	24/2/2022	13.60748 99.87633	Dry Soil	708	75.0	11	Low	
146	5	5+829	TS13-TS14	24/2/2022	13.60753 99.87649	Dry Soil	716	50.0	7	Low	
147	6	5+842	TS13-TS14	24/2/2022	13.60747 99.87661	Dry Soil	721	30.0	4	Low	
148	7	5+847	TS13-TS14	24/2/2022	13.60747 99.87665	Dry Soil	723	15.8	2	Low	
149	8	5+872	TS13-TS14	24/2/2022	13.60746 99.87688	Dry Soil	734	24.0	3	Low	
150	9	5+885	TS13-TS14	24/2/2022	13.60747 99.8771	Dry Soil	740	44.0	6	Low	
151	10	5+897	TS13-TS14	24/2/2022	13.60747 99.87711	Dry Soil	745	44.6	6	Low	
152	11	5+908	TS13-TS14	24/2/2022	13.60746 99.87721	Dry Soil	750	15.0	2	Low	
153	12	5+923	TS13-TS14	24/2/2022	13.60747 99.87735	Dry Soil	756	40.0	5	Low	
154	13	5+937	TS13-TS14	24/2/2022	13.60744 99.87748	Dry Soil	762	50.0	7	Low	
155	14	5+943	TS13-TS14	24/2/2022	13.60749 99.87753	Dry Soil	765	24.0	3	Low	
156	15	5+973	TS13-TS14	24/2/2022	13.60746 99.8778	Dry Soil	778	10.4	1	Low	
157	16	5+985	TS13-TS14	24/2/2022	13.60747 99.87791	Dry Soil	783	317.2	41	High	scabrous
158	17	6+032	TS13-TS14	24/2/2022	13.6075 99.87834	Dry Soil	803	5.2	1	Low	scabrous
159	18	6+084	TS13-TS14	24/2/2022	13.60748 99.87882	Dry Soil	825	183.4	22	Medium	scabrous
160	19	6+089	TS13-TS14	24/2/2022	13.60747 99.87887	Dry Soil	827	80.0	10	Low	
161	20	6+094	TS13-TS14	24/2/2022	13.60747 99.87891	Dry Soil	830	150.0	15	Medium	scabrous
162	21	6+106	TS13-TS14	24/2/2022	13.60745 99.87902	Dry Soil	835	70.0	8	Low	
163	22	6+131	TS13-TS14	24/2/2022	13.60749 99.87925	Dry Soil	845	30.0	4	Low	
164	23	6+143	TS13-TS14	24/2/2022	13.60748 99.87936	Dry Soil	851	40.0	5	Low	
165	24	6+153	TS13-TS14	24/2/2022	13.60748 99.87945	Dry Soil	855	70.0	8	Low	
166	25	6+164	TS13-TS14	24/2/2022	13.60746 99.87955	Dry Soil	860	10.0	1	Low	
167	26	6+175	TS13-TS14	24/2/2022	13.60748 99.87965	Dry Soil	864	10.0	1	Low	
168	27	6+187	TS13-TS14	24/2/2022	13.60748 99.87976	Dry Soil	870	65.4	8	Low	
169	28	6+175	TS13-TS14	24/2/2022	13.60748 99.87965	Dry Soil	870	10.0	1	Low	
170	29	6+223	TS13-TS14	24/2/2022	13.60749 99.88009	Dry Soil	885	36.0	4	Low	
171	1	6+238	TS14-TS15	24/2/2022	13.6075 99.88021	Dry Soil	901	42.0	5	Low	
172	2	6+254	TS14-TS15	24/2/2022	13.60752 99.88038	Dry Soil	927	125.0	13	Low	
173	3	6+282	TS14-TS15	24/2/2022	13.6075 99.88064	Dry Soil	972	400.0	41	High	scabrous
174	4	6+340	TS14-TS15	24/2/2022	13.60727 99.88108	Dry Soil	1,066	21.6	2	Low	
175	5	6+384	TS14-TS15	24/2/2022	13.60723 99.88149	Dry Soil	1,138	70.0	6	Low	
176	6	6+402	TS14-TS15	24/2/2022	13.60726 99.88166	Dry Soil	1,167	25.0	2	Low	
177	7	6+417	TS14-TS15	24/2/2022	13.60728 99.8818	Dry Soil	1,191	27.0	2	Low	
178	8	6+423	TS14-TS15	24/2/2022	13.60726 99.88186	Dry Soil	1,201	25.0	2	Low	
179	9	6+430	TS14-TS15	24/2/2022	13.60726 99.88192	Dry Soil	1,213	20.0	2	Low	
180	10	6+440	TS14-TS15	24/2/2022	13.60725 99.88197	Dry Soil	1,229	12.0	1	Low	
181	11	6+462	TS14-TS15	24/2/2022	13.60725 99.88217	Dry Soil	1,264	15.0	1	Low	
182	12	6+474	TS14-TS15	24/2/2022	13.60728 99.88238	Dry Soil	1,284	7.0	1	Low	
183	13	6+487	TS14-TS15	24/2/2022	13.60727 99.8824	Dry Soil	1,305	30.0	2	Low	
184	14	6+534	TS14-TS15	24/2/2022	13.60725 99.88283	Dry Soil	1,381	15.0	1	Low	
185	15	6+558	TS14-TS15	24/2/2022	13.60726 99.88305	Dry Soil	1,420	80.0	6	Low	
186	16	6+571	TS14-TS15	31/3/2022	13.60726 99.88317	Dry Soil	1,441	12.0	1	Low	

ผลการเจาะระดับด้วยรังสีแกมมา

Station	Section	Date	GPS(N)	GPS(E)	%IR	Severity	result	remark
0+612	T53-881	19/3/2022	13.60120	99.83418	11	Low	ปกติ ไม่พบทรายน้ำมัน	-
0+800	881-882	21/3/2022	13.60240	99.83514	8	Low	ปกติ ไม่พบทรายน้ำมัน	-
0+985	882-T54	22/3/2022	13.60222	99.83681	33	Medium	ปกติ ไม่พบทรายน้ำมัน	-
1+119	T54-T55	22/3/2022	13.60205	99.83804	27	Medium	ปกติ ไม่พบทรายน้ำมัน	-
1+160	T54-T55	22/3/2022	13.60195	99.83860	17	Medium	ปกติ ไม่พบทรายน้ำมัน	-
1+213	T54-T55	18/3/2022	13.60184	99.83888	12	Low	ปกติ ไม่พบทรายน้ำมัน	-
1+505	T55-T56	18/3/2022	13.60129	99.84149	7	Low	ปกติ ไม่พบทรายน้ำมัน	-
2+591	T57-T58	23/3/2022	13.60181	99.85115	16	Medium	ปกติ ไม่พบทรายน้ำมัน	-
2+665	T58-T59	23/3/2022	13.60185	99.85179	18	Medium	ปกติ ไม่พบทรายน้ำมัน	-
2+591	T57-T58	23/3/2022	13.60181	99.85113	16	Medium	ปกติ ไม่พบทรายน้ำมัน	-
2+665	T58-T59	23/3/2022	13.60185	99.85179	18	Medium	ปกติ ไม่พบทรายน้ำมัน	-
3+703	T59-T510	24/3/2022	13.60269	99.86134	12	Low	ปกติ ไม่พบทรายน้ำมัน	-
3+840	T59-T510	25/3/2022	13.60277	99.86259	7	Low	ปกติ ไม่พบทรายน้ำมัน	-
3+997	T510-T511	28/3/2022	13.60287	99.86406	16	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+085	T510-T511	28/3/2022	13.60293	99.86487	17	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+106	T510-T511	28/3/2022	13.60292	99.86506	18	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+150	T510-T511	28/3/2022	13.60295	99.86547	19	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+256	T510-T511	28/3/2022	13.60306	99.86645	21	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+314	T510-T511	28/3/2022	13.60304	99.86698	19	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+362	T510-T511	28/3/2022	13.60317	99.86742	34	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+541	T510-T511	30/3/2022	13.60323	99.86907	32	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+694	T511-T512	28/3/2022	13.60387	99.87051	20	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+872	T511-T512	29/3/2022	13.60351	99.87214	37	High	ปกติ ไม่พบทรายน้ำมัน	-
4+891	T511-T512	29/3/2022	13.60358	99.87231	22	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+929	T512-883	29/3/2022	13.60353	99.87269	17	Medium	ปกติ ไม่พบทรายน้ำมัน	-
4+934	T512-883	29/3/2022	13.60355	99.87273	16	Medium	ปกติ ไม่พบทรายน้ำมัน	-
5+049	T512-883	30/3/2022	13.60369	99.87379	30	Medium	ปกติ ไม่พบทรายน้ำมัน	-
5+122	T512-883	30/3/2022	13.60375	99.87446	36	High	ปกติ ไม่พบทรายน้ำมัน	-
5+218	T512-883	30/3/2022	13.6038	99.87535	22	Medium	ปกติ ไม่พบทรายน้ำมัน	-
5+222	T512-883	30/3/2022	13.60376	99.87535	19	Medium	ปกติ ไม่พบทรายน้ำมัน	-
5+358	883-T513	31/3/2022	13.60417	99.87623	17	Medium	ปกติ ไม่พบทรายน้ำมัน	-
5+381	883-T513	31/3/2022	13.60438	99.87621	19	Medium	ปกติ ไม่พบทรายน้ำมัน	-
5+985	T513-T514	2/4/2022	13.60747	99.87791	41	High	ปกติ ไม่พบทรายน้ำมัน	-
6+084	T513-T514	2/4/2022	13.60748	99.87882	22	Medium	ปกติ ไม่พบทรายน้ำมัน	-
6+094	T513-T514	2/4/2022	13.60747	99.87891	18	Medium	ปกติ ไม่พบทรายน้ำมัน	-
6+282	T514-T515	2/4/2022	13.6075	99.88064	41	High	ปกติ ไม่พบทรายน้ำมัน	-

ผลการเจาะระดับด้วยรังสีแกมมา



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Fuel Oil Pipe Line Leak Test

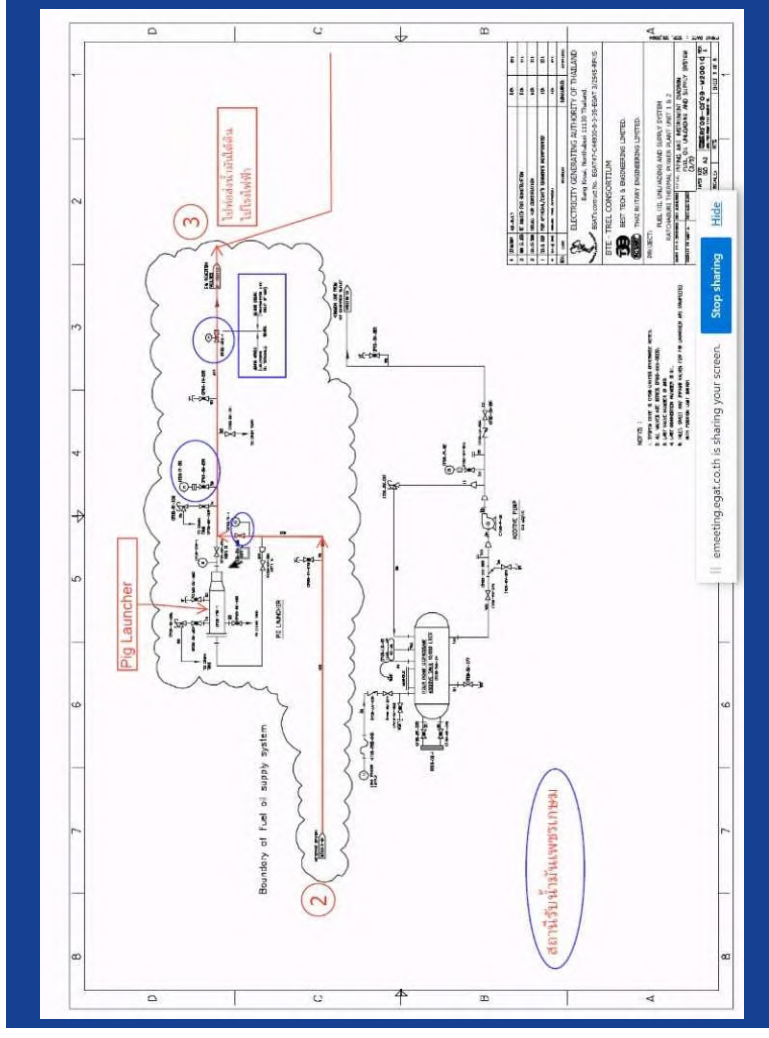
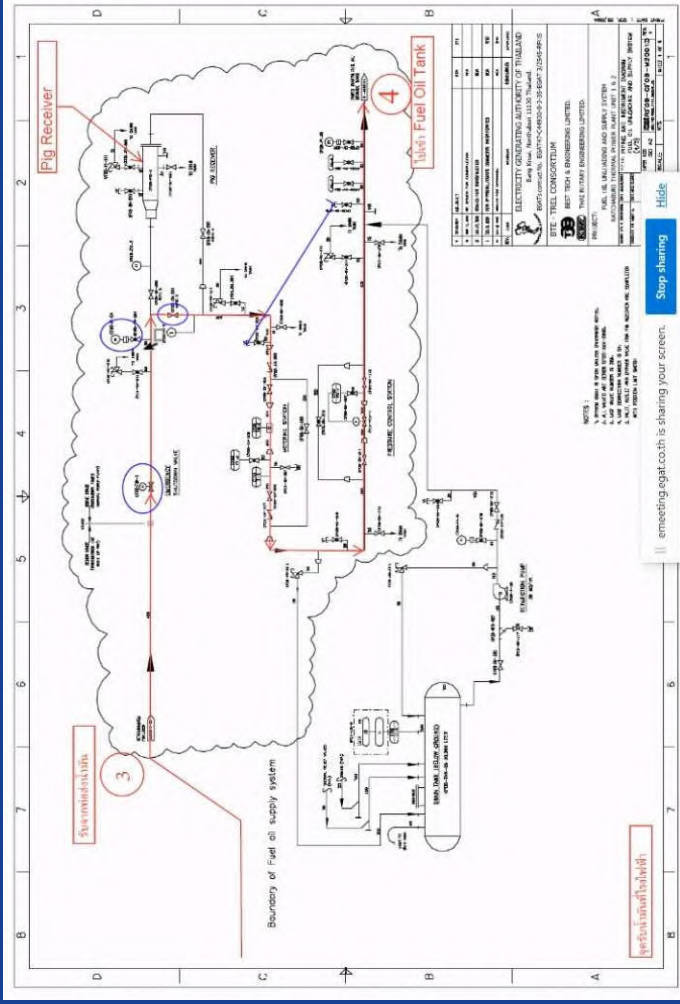
วัตถุประสงค์

เพื่อทดสอบการรั่วไหลของระบบ
ท่อส่งน้ำมันเตา ที่ส่งน้ำมันจาก
สถานีรับน้ำมันเตาเพชรเกษม
(RFOS) มายังโรงไฟฟ้าพลัง
ความร้อนราชบุรี ระยะความ
ยาวท่อประมาณ 7 กิโลเมตร



วิธีการทดสอบ

การรั่วไหลของระบบท่อส่ง
น้ำมันเตาโดยการอัดแรงดัน
น้ำมันด้วยแรงดันประมาณ 3 บาร์
และเพิ่มแรงดันให้ได้แรงดันประมาณ
3.4 บาร์ และปิดวาล์วเพื่อเก็บค่า
แรงดันที่ลดลง



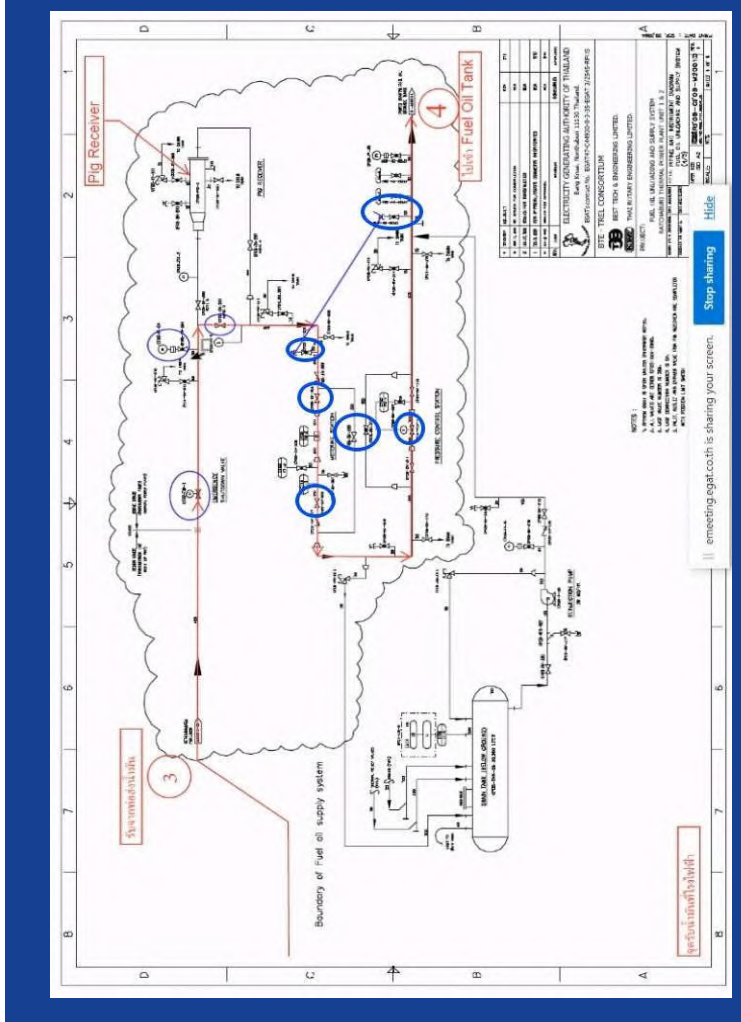
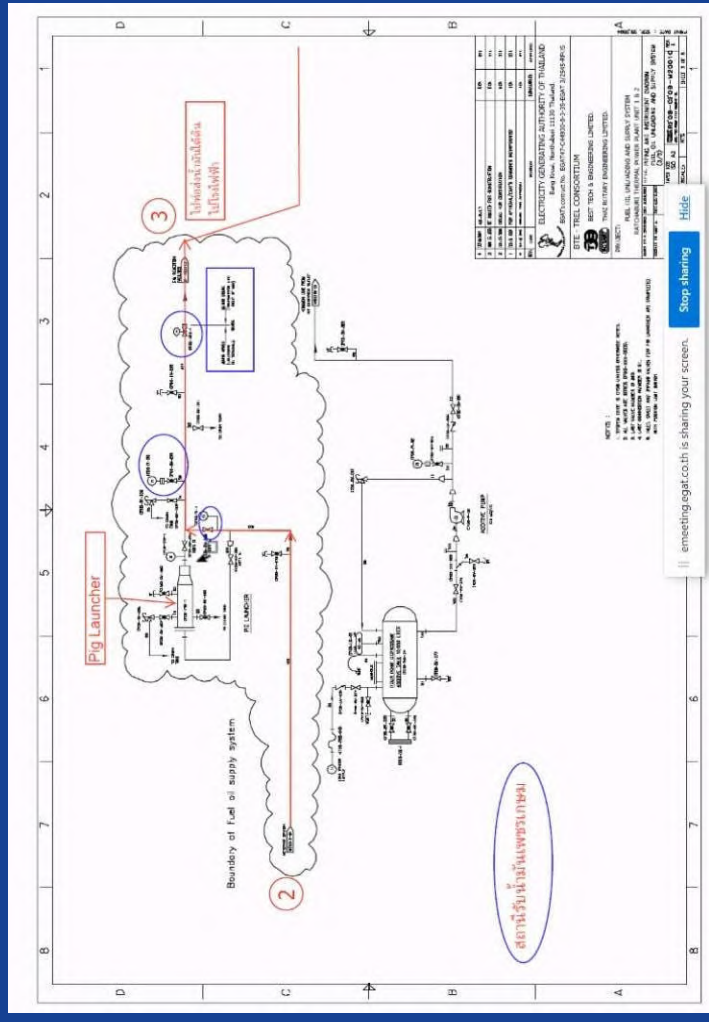
การทดสอบ

09.00 น. เตรียมการทดสอบ



10.01 น. Fuel Oil Fill Line 3.4 Bar

10.03 น. Closed Valve Fill N2 Press 4 Bar



10.29 น. Press. 3.85-3.9 Bar (20 Min.)

10.34 น. Pressure 3.8 Bar (25 Min.)



10.29 น.



10.34 น.

10.13 น. Pressure 4.0 Bar (5 Min. Pass)

10.19 น. Pressure 4.0 Bar (10 Min. Pass)



10.13 น.



10.19 น.

10.18 น. RFOS. ปิดวาล์วร่วม Press. Gauge

10.41 น. Press. 3.8 Bar (4 Bar, 32 Min.)

10.46 น. Press. 3.75 Bar (4 Bar 37 Min.)

10.51 Press. 3.7 Bar (42 Min.)



10.41 น.



10.46 น.



10.51 น.

10.21 น. Stop Pump

10.24 น. Pressure 3.9 Bar (15 Min. Pass)



10.24 น.



10.27 น.

12.30 Press 3.1 Bar ลดลง 0.4 Bar ในเวลา 1ชม.

ตรวจสอบพบน้ำมันรั่วออกที่ Valve Stem

13.31 Press. 2.8 Bar



10.57 น. ถอดสาย N2 ออก

10.57 น. Press 3.65 Bar (4 Bar ,44 Min.)



14.27 Press 2.5 Bar

พบน้ำมันรั่ว อีก 3 จุด

14.50 Press. 2.5 Bar สิ้นสุดการเก็บข้อมูล



11.08 Press 3.6 Bar

11.14 Press. 3.5 Bar

11.30 Press. 3.5 Bar เริ่มเก็บค่าราย ชม.





Ask & Question

บันทึกผลการทดสอบ Pipe For N2 Press. วันที่ 12 ม.ย. 2565

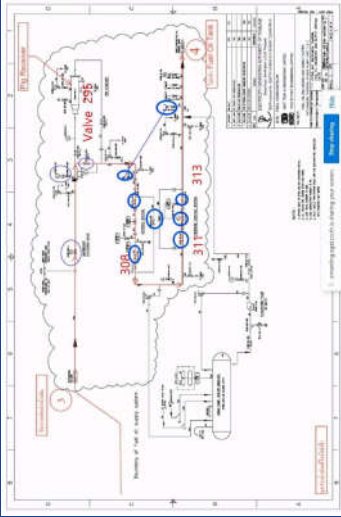
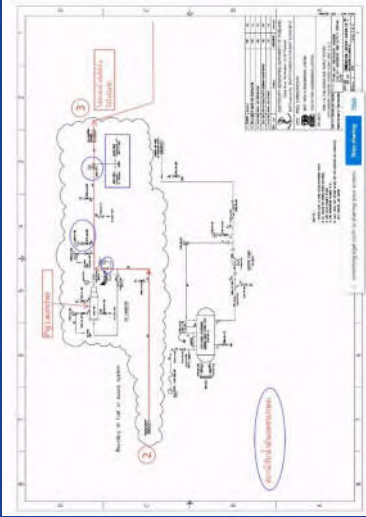
เวลา	Press. ขั้วเข้า	Press. R/COS	Remark
0911		0	Isolate Valve BV-238 - R/COS, ESV-1 Open, Press. Gauge 4.0 Bar
0932	0	0	ตั้ง Fill R/C ถัง Line
0934	0		
0942	0.45		Press. หัวปั๊ม 5.8 Bar
0947		1.8	
0948	1.6		
0949		2.0	
0953	2.45	2.8	
0954		3.0	
0955	2.8		
0956		3.4	
0957	3.0		
0958		3.5	
1000		3.8	
1002	3.4	3.8	Closed BV-295 ปิดลิ้น
1003			Fill Line N2 สิ้นที่รวม Feeds
1007	4.0		
1008	4.0		
1009		4.4	R/COS ลิ้นเปิด ESV-1
1013	4.0		
1016		4.2	R/COS Close ESV-1, เปลี่ยนถัง
1019	3.9		
1021			Stop Pump Unloading
1024	3.9	4.2	
1027			
1029	3.85		
1034	3.8		
1037		3.8	R/COS เปลี่ยนถังใหม่เป็น 10 bar
1041	3.80		
1046	3.78		
1051	3.70		

สรุปผลการทดสอบ

- 1.จากการทดสอบเก็บข้อมูลช่วงแรกหลังจากการ Fill N2 ที่ เวลา 10.08 น.จนถึงเวลา10.51 น.แรงดันภายในท่อ ลดลง จาก 4.0 Bar เหลือ 3.7 Bar ในเวลา 43 นาที
- การลดลงของแรงดันในท่อไม่อาจสรุปได้ว่าท่อน้ำมันรั่ว เนื่องจากอาจเกิดจากปัจจัยการรั่วผ่านหัววาล์วเข้าไปในระบบท่อ หรือระบบท่อน้ำมัน ซึ่งส่วนใหญ่เป็นท่อใต้ดินซึ่งมี อุดหนุ่มีต่ำ จะมีผลต่อการหดตัว และทำให้แรงดันน้ำมัน ลดลงได้ โดยสังเกตได้จากช่วงเริ่มต้นเก็บข้อมูล แรงดันจะคงที่ 4 Bar อีกทั้งในการในการทดสอบแต่ละครั้ง ใช้เวลาในการ Fill น้ำมันในท่อไม่นาน ซึ่งหากท่อน้ำมันรั่ว จะต้องใช้เวลาในการ และเช่นกันกับการ Fill N2 เพื่อเพิ่มแรงดันจาก 3.4 Bar เป็น 4.0 Bar ใช้เวลาประมาณ 2-3 นาทีและปริมาณการใช้ N2 ไม่ถึง 1 ขวด

ปัญหาและอุปสรรค

- 1.การทดสอบได้ติดประเด็นการรั่วไหลภายในระบบใ้มากที่สุด โดยการตรึงระบบที่อาจส่งผลกระทบต่อการทดสอบ ซึ่งหากพบปัญหาการรั่ว (Passing)จะทำให้การทดสอบขาดความน่าเชื่อถือ เช่นครั้งนี้พบว่าลิ้ว 295 Passing Valve 303 รั่วที่ Stem และ BP Valve 305 รั่วหัวแม่แขน
2. การทดสอบหลังเวลา 10.51 น. มีปัจจัยหลายด้านที่ผลการทดสอบขาดความน่าเชื่อถือ เช่น การรั่วไหลของน้ำมันและ Ambient Temp ที่สูงขึ้นซึ่งมีผลต่อแรงดันน้ำมันในท่อ



เอกสารแนบที่ 1-12
คู่มือการตรวจรับน้ำมันเตา

คู่มือการตรวจรับน้ำมันเตา

ระหว่างการผลิตไฟฟ้าฝ่ายผลิตแห่งประเทศไทย บริษัท ปตท. จำกัด (มหาชน) และบริษัท ผลิตไฟฟ้าราชบุรี จำกัด

ขั้นตอนการรับน้ำมันเตาและตรวจรับปริมาณซื้อขาย

1. ก่อนเริ่มทำการรับ-ส่งน้ำมันเตาครั้งแรกในแต่ละ Batch เจ้าหน้าที่ อค-บร. (พนักงานเดินเครื่อง) ทำการ Transfer น้ำมันที่ Unloading Tank สถานีรับน้ำมันเพชรเกษม ให้มีปริมาณคงเหลือเป็นศูนย์ ยกเว้นไม่สามารถดำเนินการได้ให้เจ้าหน้าที่ 3 หน่วยงานทำการวัดเปิดน้ำมันที่ Unloading Tank สถานีรับน้ำมันเพชรเกษม โดยการวัดปริมาณน้ำมันจะดำเนินการเมื่อระดับน้ำมันคงที่ บันทึกเป็นค่าตั้งต้นลงในแบบฟอร์มรายงานการวัดน้ำมัน
2. เจ้าหน้าที่ 3 หน่วยงาน ทำการวัดเปิดที่ Fuel Oil Storage Tank โดยการวัดเปิดจะดำเนินการเมื่อระดับน้ำมันคงที่ และหลังจากสิ้นสุดการเคลื่อนไหวน้ำมันน้อยกว่า 2 ช.ม. และบันทึกเป็นค่าตั้งต้นลงในแบบฟอร์มรายงานการวัดน้ำมัน เครื่องมือและอุปกรณ์ที่นำมาใช้ จะต้องอยู่ในช่วงเวลารับรองการสอบเทียบเครื่องมือวัด (Calibration) โดยต้องนำหลักฐานมาแสดงก่อนใช้งาน มีวิธีการวัดปริมาณดังนี้
 - 2.1 หย่อนเทปวัดระดับน้ำมันจนปลายแท่งทองเหลือง (BOB) กระแทกกับแผ่น Datum Plate แล้วจึงอ่านค่า ให้ดำเนินการวัดจนกว่าจะได้ค่าเท่ากันทั้งสองฝ่าย)
 - 2.2 หย่อน Tank Temperature เพื่อวัดอุณหภูมิของถัง ให้หย่อนที่ 3 ระดับ กึ่งกลางของระดับ ล่าง กลาง และบนของเนื้อน้ำมัน นำค่าที่ได้ทั้ง 3 ค่ามาเฉลี่ย
 - 2.3 ตักน้ำมันเพื่อหาค่า API โดยให้ตัก 3 ระดับ กึ่งกลางของระดับ ล่าง กลาง และบนของเนื้อน้ำมัน แล้วนำมาใส่กระบอก API Gravity เพื่อวัดค่าความถ่วงจำเพาะ (ให้นำมาตัวอย่างลงมาผสมที่พื้นราบด้านล่าง) เมื่อดำเนินการวัด API แล้วเสร็จให้นำตัวอย่างน้ำมันใส่คืนลงในถัง Drain Sump
3. เมื่อรถขนส่งน้ำมันของผู้ค้า เข้าประจำที่จุด Unload เจ้าหน้าที่ ปตท. ตรวจสอบชิลลวด และเอกสาร เช่น ใบส่งจ่ายสินค้า/ใบตรวจสอบการรับน้ำมัน/ใบควบคุมการขนส่ง/ใบรายงานผลการวิเคราะห์คุณภาพ ที่มากับรถยนต์ขนส่งน้ำมันของผู้ค้าให้ชนิดน้ำมันตรงตามที่แจ้ง ตามวิธีปฏิบัติของ ปตท. แล้ว เจ้าหน้าที่ ปตท. รายงานให้อค-บร. (พนักงานเดินเครื่อง) ทราบว่าน้ำมันได้คุณภาพตามกำหนด
4. พนักงานเดินเครื่อง ตรวจสอบพร้อมบันทึกผลลงใน Log sheet และพิจารณาให้เจ้าหน้าที่ ปตท. Unload ลง Unloading Tank
5. เจ้าหน้าที่ ปตท. ทำการ Unload น้ำมันจากรถลง Unloading Tank โดยอยู่ภายใต้การควบคุมของ อค-บร. (พนักงานเดินเครื่อง)
6. เจ้าหน้าที่ 3 หน่วยงาน ทำการวัดปิดที่ Fuel Oil Storage Tank โดยการวัดปิดจะดำเนินการเมื่อระดับน้ำมันคงที่ และหลังจากสิ้นสุดการ Transfer ไม่น้อยกว่า 2 ชั่วโมง มีวิธีการวัดปริมาณตามข้อ 2
7. การวัดปิดกระทำได้ 4 กรณี ดังนี้
 - 7.1 เมื่อส่งมอบครบ 7 วัน หรือ
 - 7.2 เมื่อส่งมอบครบในเดือนนั้น หรือ
 - 7.3 เมื่อมีปริมาณส่งมอบประมาณ 5 ล้านลิตร หรือ
 - 7.4 เมื่อมีการเปลี่ยน Fuel Oil Storage Tank แล้วแต่กรณีใดจะถึงก่อน
8. นำค่าที่วัดได้จากข้อ 6 หักค่าที่วัดได้จากข้อ 2 เป็นปริมาณซื้อขายระหว่าง Batch

คู่มือการตรวจรับน้ำมันเตา

ระหว่าง บริษัท ผลิตไฟฟ้าราชบุรี จำกัด บริษัท ปตท. จำกัด (มหาชน) และการไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

9. เมื่อสิ้นสุดการรับน้ำมันในครั้งนั้น (Batch) ให้ทำการ Transfer น้ำมันที่ Unloading Tank สถานีรับน้ำมันเพชรเกษมให้มีปริมาณคงเหลือเป็นศูนย์ ยกเว้นไม่สามารถดำเนินการได้ให้เจ้าหน้าที่ 3 หน่วยงาน ทำการวัดปิดน้ำมันที่ Unloading Tank สถานีรับน้ำมันเพชรเกษม โดยการวัดปริมาณน้ำมันจะดำเนินการเมื่อระดับน้ำมันคงที่และหลังจากสิ้นสุดการ Transfer ไม่น้อยกว่า 1 ชั่วโมง บันทึกค่าลงในแบบฟอร์มรายงานการวัดน้ำมัน หลัง Transfer น้ำมันที่ Unloading แล้วเสร็จ หรือวัดปิดน้ำมันที่ Unloading Tank แล้วเสร็จ ให้ดำเนินการวัด ปิดที่ Fuel Oil Storage Tank ตามวิธีการวัดปริมาณตามข้อ 2
10. นำค่าที่วัดได้จากข้อ 9 หักค่าที่วัดได้จากข้อ 2 และ 1 (ข้อ 2+1) เป็นปริมาณซื้อขายในงวดสุดท้าย (สิ้นสุด Batch นั้น)
11. ปตท. นำปริมาณที่ได้จากข้อ 8 หรือข้อ 10 ไปจัดทำใบกำกับภาษี/ใบส่งของ
12. ปตท. ยื่นต้นฉบับใบกำกับภาษีและใบส่งของ ให้เจ้าหน้าที่ มพจ-บร. ลงนามรับเอกสารพร้อมส่งสำเนาคืนให้เจ้าหน้าที่ ปตท. 1 ชุด
13. มพจ-บร. ส่งต้นฉบับใบกำกับภาษี ให้ อบผ.
14. มพจ-บร. ส่งใบส่งของให้กรรมการตรวจรับพิจารณาลงนาม ตามระเบียบ กฟผ. ว่าด้วยการพัสดุ แล้วส่งเอกสารให้กับ อบผ. ส่งสำเนาคืนให้ ปตท.
15. ปตท. นำสำเนาเอกสารใบส่งของตามข้อ 14 แนบกับใบแจ้งหนี้ยื่นที่ อบผ.
16. อบผ. นำส่งเอกสารให้ อจช. ตรวจสอบราคา
17. อจช. ตรวจสอบและยืนยันราคาให้ อบผ.
18. อบผ. ตรวจสอบและชำระเงินให้ ปตท. ตามสัญญาจ้างบริหารเชื้อเพลิง

คู่มือการตรวจรับน้ำมันเตา

ระหว่าง บริษัท ผลิตไฟฟ้าราชบุรี จำกัด บริษัท ปตท. จำกัด (มหาชน) และการไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

เงื่อนไขการขนส่งน้ำมันทางรถยนต์

(การรับน้ำมันที่สถานีรับน้ำมันเตาเพชรเกษม ต้องปฏิบัติตาม EIA ของโรงไฟฟ้าราชบุรี) ดังนี้

สำหรับ บริษัท ปตท. จำกัด (มหาชน) เป็นผู้ดำเนินการ

- จำกัดความเร็วของรถบรรทุกน้ำมันในบริเวณสถานีรับส่งน้ำมัน ไม่ให้วิ่งเกินความเร็ว 40 กิโลเมตร/ชั่วโมง
- กำหนดเส้นทางถนนเดินรถของรถบรรทุกน้ำมัน และติดตามการใช้เส้นทางอย่างเคร่งครัด
- จัดหลักสูตรอบรมพนักงานขับรถให้ตระหนักถึงความปลอดภัยในการใช้วดยานพาหนะ
- กำหนดความเร็วสูงสุดเมื่อผ่านชุมชนไว้ที่ไม่เกิน 60 กิโลเมตร/ชั่วโมง
- กำหนดให้รถบรรทุกน้ำมันเตาทุกคันมีถังดับเพลิงประจำรถ
- กำหนดให้พนักงานขับรถบรรทุกน้ำมันเตาทุกคันมีโทรศัพท์มือถือประจำตัว
- กำหนดให้บริษัทผู้ขายน้ำมันเตาติดต่อประสานงานไว้ล่วงหน้ากับตำรวจทางหลวงและหน่วยงานที่รับผิดชอบ เพื่อให้ความช่วยเหลือได้ทันทั่วถึงกรณีเกิดอุบัติเหตุบนเส้นทางวิ่งของรถบรรทุกขนส่งน้ำมันเตา
- กำหนดให้บริษัทผู้ขายน้ำมันเตาติดต่อประสานงานไว้ล่วงหน้ากับโรงพยาบาลหรือสถานพยาบาลที่อยู่ในเส้นทางหรือใกล้เส้นทางวิ่งของรถบรรทุกขนส่งน้ำมันเตา
- กำหนดเวลาการรับ-ส่ง น้ำมันที่สถานีรับน้ำมันเตาเพชรเกษม
 - วันธรรมดา ระหว่างเวลา 06.00-21.00 น.
 - วันเสาร์-อาทิตย์และวันหยุดราชการระหว่างเวลา 06.00-18.00 น.
- ดำเนินการจัดทำป้ายสะท้อนแสงอย่างน้อย 2 ชุด ประจำไว้ที่รถขนส่งน้ำมันแต่ละคัน เพื่อใช้ในการกรณีรถเสียหรือหยุดเพื่อทำกิจกรรมใดๆ โดยให้จัดวางป้ายไว้ด้านหน้าและหลังรถระยะห่างประมาณ 20 เมตร หากมีการตรวจสอบพบว่ามีคันใดไม่มีป้ายดังกล่าว จะไม่อนุญาตให้รถคันดังกล่าววิ่งขนส่งน้ำมันต่อไป
- ต้องมีการจัดตั้งเงินกองทุน จำนวน 100,000 บาท (หนึ่งแสนบาทถ้วน) เพื่อใช้เป็นค่าใช้จ่ายชดเชยค่าเสียหายในเบื้องต้นให้แก่ผู้เสียหายหรือทายาทของผู้เสียหาย (กรณีเสียชีวิต) ในกรณียานพาหนะของผู้ขายน้ำมันหรือผู้รับขนส่งที่ผู้ขายจัดหาได้ก่อให้เกิดอุบัติเหตุระหว่างขนส่งน้ำมันมายังสถานีรับน้ำมันเตาเพชรเกษมของโรงไฟฟ้า

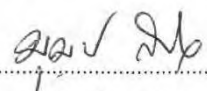
สำหรับบริษัท ผลิตไฟฟ้าราชบุรี จำกัด เป็นผู้ดำเนินการ

- ต้องมีการจัดตั้งเงินกองทุน จำนวน 100,000 บาท (หนึ่งแสนบาทถ้วน) เพื่อใช้เป็นค่าใช้จ่ายชดเชยค่าเสียหายในเบื้องต้นให้แก่ผู้เสียหายหรือทายาทของผู้เสียหาย (กรณีเสียชีวิต) ในกรณียานพาหนะของผู้ขายน้ำมันหรือผู้รับขนส่งที่ผู้ขายจัดหาได้ก่อให้เกิดอุบัติเหตุ ภายในพื้นที่ของสถานีรับส่งน้ำมัน และบริเวณถนนทางเข้าจากถนนเพชรเกษมมายังสถานีรับน้ำมัน อันเนื่องจากการปฏิบัติตามสัญญา ทำให้เกิดความเสียหายต่อชีวิต

การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

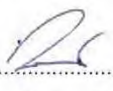
บริษัท ปตท. จำกัด (มหาชน)

บริษัท ผลิตไฟฟ้าราชบุรี จำกัด

ลายมือชื่อ.....

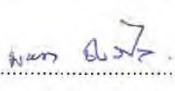
(นายบุญทวี กังวานกิจ)

ผู้อำนวยการฝ่ายจัดการเชื้อเพลิง

ลายมือชื่อ.....

(นายปิยะวัฒน์ เศรษฐนันท์)

ผู้จัดการฝ่ายตลาดรัฐและอุตสาหกรรม

ลายมือชื่อ.....

(นายพัต ชินวิไล)

ผู้อำนวยการฝ่ายการผลิต

เอกสารแนบที่ 1-13

เอกสารเส้นทางการเดินรถบริษัทขนส่งน้ำมัน และจดหมายแจ้งชุมชน



RG 0150/2566

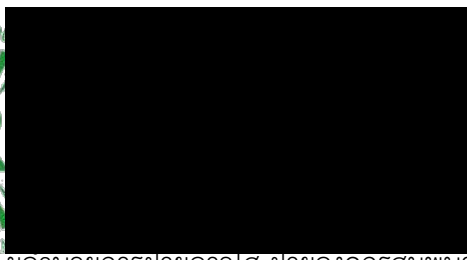
14 มีนาคม 2566

เรื่อง แจ้งข้อมูลการขนส่งน้ำมันเตาไปที่สถานีรับน้ำมันเตาเพชรเกษมของโรงไฟฟ้าราชบุรี

เรียน **นายกองค์การบริหารส่วนตำบลท่าราบและกำนันตำบลท่าราบ**

ด้วย บริษัท ผลิตไฟฟ้าราชบุรี จำกัด (บริษัทฯ) ได้ดำเนินการสั่งซื้อน้ำมันเตาสำหรับใช้เป็นเชื้อเพลิงสำรองในการผลิตกระแสไฟฟ้าของโรงไฟฟ้าพลังความร้อน จากบริษัท ผู้ขนส่งน้ำมัน โดยมีแผนจะจัดส่งน้ำมันเตา ปริมาณ 35 ล้านลิตร มาทำการสำรองที่สถานีรับน้ำมันเตา ซึ่งตั้งอยู่ริมถนนเพชรเกษม โดยจะขนส่งน้ำมันเตาด้วยรถบรรทุกน้ำมัน ใช้เส้นทางถนนเพชรเกษม ตั้งแต่วันที่ 15 มีนาคม 2566 ถึง วันที่ 7 พฤษภาคม 2566 โดยจัดส่งวันจันทร์ถึงวันศุกร์ ระหว่างเวลา 06.00 – 21.00 น. และวันเสาร์ถึงวันอาทิตย์ ระหว่างเวลา 06.00 – 18.00 น. ทั้งนี้บริษัทฯ ผู้ขนส่งน้ำมัน จะหยุดพักการส่งมอบน้ำมันเตาเป็นเวลา 5 วัน ตั้งแต่วันที่ 13 – 17 เมษายน 2566 ซึ่งอาจทำให้เกิดความไม่สะดวกต่อผู้ใช้เส้นทางดังกล่าว ทั้งนี้ บริษัทฯ ได้แจ้งไปยังบริษัท ผู้ขนส่งน้ำมัน ให้เข้มงวดในการใช้รถใช้ถนนอย่างระมัดระวัง โดยคำนึงถึงความปลอดภัยของประชาชนทั่วไปที่ใช้เส้นทางดังกล่าว

จึงเรียนมาเพื่อโปรดทราบและโปรดประชาสัมพันธ์ให้ประชาชนในพื้นที่ของท่านทราบด้วย
จะขอบพระคุณยิ่ง และขอภัยในความไม่สะดวกมา ณ โอกาสนี้ด้วย



ผู้อำนวยการฝ่ายอาวุโส ฝ่ายองค์กรสัมพันธ์

ทำการแทน กรรมการผู้จัดการ



RG 051/2566

19 มกราคม 2566

เรื่อง แจ้งการเดินเครื่องโรงไฟฟ้าพลังความร้อนราชบุรีหน่วยที่ 2 ด้วยเชื้อเพลิงสำรอง(น้ำมันเตา)

เรียน ผู้ว่าราชการจังหวัดราชบุรี/นายอำเภอเมืองราชบุรี/ดำเนินสะดวก/โพธาราม/บางแพ/พลังงานจังหวัด
ราชบุรี/ประธานกลุ่มเครือข่ายโรงเรียนฯ/คณะผู้ตรวจการ โรงไฟฟ้าราชบุรี /นายกเทศมนตรี /นายก อบต./
ท่านัน 9 ตำบล

ด้วย ศูนย์ควบคุมระบบกำลังไฟฟ้าแห่งชาติ การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย ได้สั่งการให้
โรงไฟฟ้าราชบุรีเดินเครื่องโรงไฟฟ้าพลังความร้อนราชบุรีหน่วยที่ 2 ด้วยเชื้อเพลิงน้ำมันเตา โดยมีแผนการ
เดินเครื่องผลิตกระแสไฟฟ้าด้วยเชื้อเพลิงน้ำมันเตา ตั้งแต่วันที่ 23 มกราคม 2566 เป็นต้นไป และหากมีการ
เปลี่ยนแปลงจะแจ้งให้ทราบเป็นระยะๆ

ทั้งนี้ ในการเดินเครื่องผลิตกระแสไฟฟ้าด้วยเชื้อเพลิงน้ำมันเตา โรงไฟฟ้าราชบุรีจะเดินเครื่อง
ควบคู่ไปกับเครื่องกำจัดก๊าซซัลเฟอร์ไดออกไซด์ (Flue Gas Desulfurization : FGD) ซึ่งบริษัทฯ ตระหนัก
และให้ความสำคัญกับชุมชนในเรื่องสิ่งแวดล้อม อาชีวอนามัยและความปลอดภัย ภายใต้มาตรฐาน
ISO14001 และ ISO45001 ตามที่กำหนดไว้อย่างเคร่งครัด

จึงเรียนมาเพื่อโปรดทราบ



ผู้อำนวยการฝ่ายอาวุโส ฝ่ายองค์กรสัมพันธ์
ทำการแทน กรรมการผู้จัดการ

IVMS-OR/OR

Back

(K401) โรงกลั่นน้ำมัน บจก.ไทยออยล์ Lorry Thai Oil (TOP)

(K142) บจก.ผีดิวฟาร์มอู๋

(K401) โรงกลั่นน้ำมัน บจก.ไทยออยล์ Lorry Thai Oil (TOP) - (K142) บจก.ผีดิวฟาร์มอู๋

258.86 km.

The map displays a route starting from Bangkok and heading east towards Chachoengsao. Key locations along the route include Samut Prakan, Samut Sakhon, Samut Songkhram, Ratchaburi, Phetchaburi, and Chachoengsao. The route is marked with a blue line, and various road numbers (e.g., 3, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100) are visible. The map also shows various districts and towns, including Bangkok, Samut Prakan, Samut Sakhon, Samut Songkhram, Ratchaburi, Phetchaburi, and Chachoengsao. The route is marked with a blue line, and various road numbers (e.g., 3, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100) are visible.

เอกสารแนบที่ 1-14

สื่ออบรมกฎหมายจราจรในการขับขี่ผ่านเขตชุมชน และขั้นตอนการลงน้ำมันเตา

สื่ออบรม กฎหมายจราจรในการขับขี่ ผ่านเขตชุมชน และขั้นตอนการลงน้ำมันเตา(โรงไฟฟ้าราชบุรี)



สื่ออบรม กฎหมายจราจรในการขับขี่ ผ่านเขตชุมชน และขั้นตอนการลงน้ำมันเตา(โรงไฟฟ้าราชบุรี)

วัตถุประสงค์

- การใช้ความเร็วตามกฎหมายกำหนดและป้ายเขตชุมชน
- การขับรถเชิงป้องกันอุบัติเหตุ
- เส้นทางขนส่ง และ ข้อกำหนดเรื่องจุดพักและจุดจอดรถ
- ข้อกำหนด ในเขตพื้นที่ลงน้ำมันเตา(โรงไฟฟ้าราชบุรี)
- ขั้นตอนการลงน้ำมันเตา(โรงไฟฟ้าราชบุรี)
- มีความพร้อม ของรถขนส่งและ ความพร้อมของ พพร.



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ขับรถในชุมชน ควรใช้ความเร็วเท่าไร



ขับรถในชุมชน
ควรใช้ความเร็วเท่าไร

มาตรา ๕ ให้รัฐมนตรีว่าการกระทรวงคมนาคมและรัฐมนตรีว่าการกระทรวงมหาดไทยรักษาการตามพระราชบัญญัติในส่วนที่เกี่ยวกับราชการของกระทรวงนั้น และให้มีอำนาจแต่งตั้งเจ้าพนักงานทางหลวงกับออกกฎกระทรวงเพื่อปฏิบัติการตามพระราชบัญญัตินี้ ในเรื่องดังต่อไปนี้

- (๑) กำหนดอัตราความเร็วของยานพาหนะ
- (๒) จัดทำ ปัก คัดตั้งป้ายจราจร เครื่องหมายจราจร เครื่องหมายสัญญาณหรือสัญญาณอาชวอื่น ชีตเส้น เขียนข้อความ หรือเครื่องหมายอื่นใดสำหรับการจราจรบนทางหลวง

๒๕. ในกรณีที่เจ้าพนักงานทางหลวงเห็นว่าการใช้ความเร็วของยานพาหนะเกินกว่าที่กำหนดไว้ในกฎกระทรวง หรือเห็นว่าการใช้ความเร็วของยานพาหนะเกินกว่าที่กำหนดไว้ในกฎกระทรวง

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แนวทางการจัดทำป้ายกำหนดความเร็วที่เหมาะสมในพื้นที่ชุมชน
(เขตกรุงเทพมหานคร เขตเมืองพัทยา หรือเขตเทศบาล)
จำแนกตามประเภทของรถ และจำนวนช่องจราจร

จำนวน ๒ ช่อง

จำกัดความเร็ว
SPEED LIMIT



จำนวน ๔ ช่องจราจร
(ไม่มีเกาะกลาง)

จำกัดความเร็ว
SPEED LIMIT



จำนวน ๔ ช่องจราจร
(มีเกาะกลาง)

จำกัดความเร็ว
SPEED LIMIT

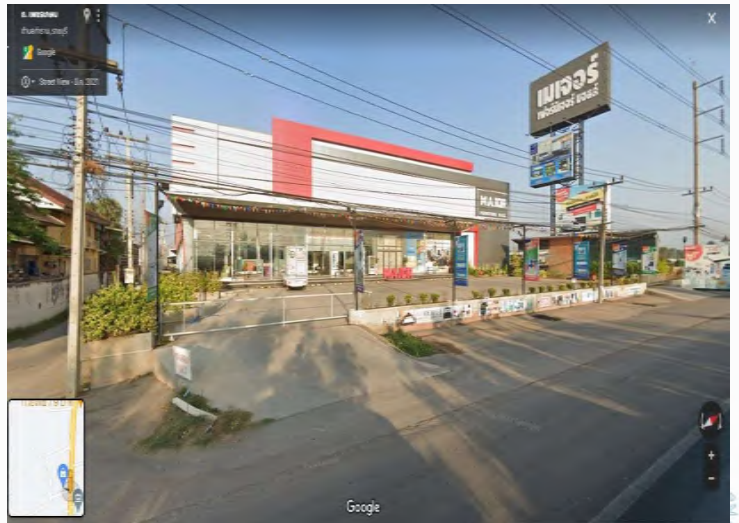


จำนวนมากกว่า ๔ ช่อง

จำกัดความเร็ว
SPEED LIMIT



เส้นทางวิ่งส่งน้ำมัน



ขับรถไปบนถนนเพชรเกษม (มุ่งหน้านครปฐม) จะผ่านศูนย์บริการโตโยต้า เป็นระยะทางอีก
ประมาณ 3 กิโลเมตรจะถึงลูกค้ำ และ มีป้ายเมเจอร์ ก่อนถึงโค้งทางเข้า โรงไฟฟ้า



สถานที่ตั้ง/ทางเข้า จุดสังเกตเมื่อใกล้ถึงจะอยู่ช่วงโค้ง



ฝั่งซ้ายจะเป็นลานจอดรถบรรทุก



ฝั่งขวามือ (ตรงข้าม)จะเป็นปั๊ม NGV



สถานที่ตั้ง/ทางเข้า จุดสังเกตเมื่อใกล้ถึงจะอยู่ช่วงโค้ง (จุดสังเกตมีสะพานลอยข้ามถนนข้างหน้า)



วางตำแหน่งรถให้เผื่อทางเข้าเป็นโค้งหักศอก และอยู่ในช่วงโค้งของถนนใหญ่ (ระวังรถแซงซ้าย)



ข้อควรระวัง

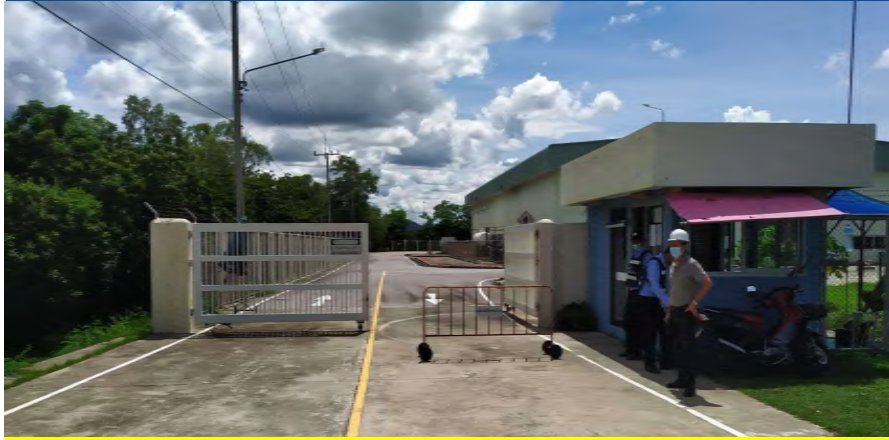
ปากทางเข้า/ออก ลูกค้ำเป็นทางหักศอก ประกอบกับเป็นช่วงทางโค้งอาจทำให้รถที่วิ่งมาเบรกไม่ทัน จนเกิดการเฉี่ยวชนกันได้ รวมถึงทำยรตไปเกี่ยวกับราวกัน



ถนนกว้าง 8 เมตร



ช่วงเวลารับน้ำมัน / ขั้นตอนที่ป้อม รปภ.



วันจันทร์-ศุกร์ รับน้ำมัน

เวลา 06.00-21.00 น.

วันเสาร์-อาทิตย์ และหยุด

นักขัตฤกษ์ รับน้ำมัน

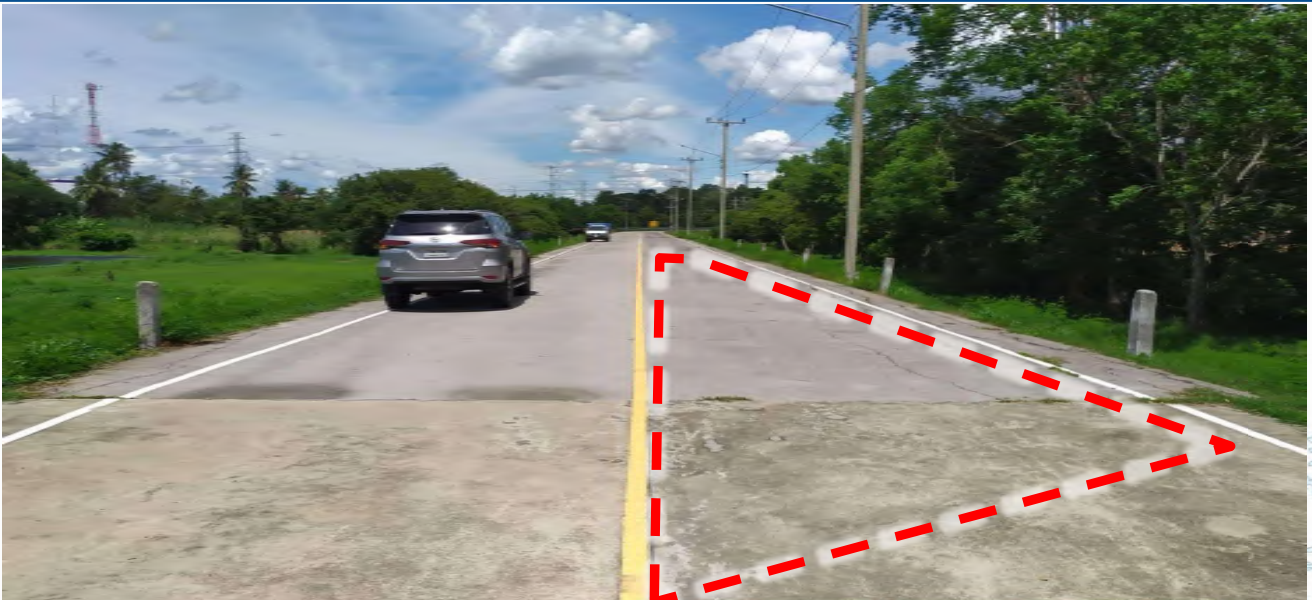
เวลา 06.00-18.00 น.

ความเร็วไม่เกิน 20 กม./ชม.

เกณฑ์กำหนดเวลาที่กำหนด : นับจากรถผ่านเข้าประตูรปภ.มาเท่านั้น ถ้านอกเหนือเวลาดังกล่าวรถต้องจอดรอข้างนอกเท่านั้นจนถึงเวลาที่กำหนด

1. รปภ.จะจดชื่อ นามสกุล และตรวจใบขับขี่พxr. (ใบขับขี่ต้องไม่หมดอายุ หากหมดอายุต้องแนบใบประกาศกฎกระทรวงที่แจ้งบังคับใช้ช่วงโควิดไป)
2. รปภ.จะจดหมายเลขทะเบียนรถ

ช่วงเวลารับน้ำมัน / ขั้นตอนที่ป้อม รปภ. (กรณีไปไม่ทัน หรือ ไปก่อนเวลา)



ต้องจอดรถบรรทุก ชิดซ้าย (กรอบสีแดง) และท้ายแถวที่จอดจะต้องไม่เลยไปบนถนน



1. เดินรถทางเดียวทั้งหมด (One Way)
2. ความเร็วไม่เกิน 20 Km/hrs.
3. เมื่อผ่าน รปภ.มาแล้วสามารถเอารถเข้ามาจอดรอที่ข้างในได้ ระหว่างรอการถูกคัดดำเนินการตามขั้นตอน

แผนผังการเดินรถภายใน (พื้นที่จอดรถภายใน)



ข้อเสนอแนะ/ความต้องการ จากลูกค้า

1. ลูกค้าต้องการเอกสารใบ Lab/Certificate ของน้ำมันติดมากับรถเลย
2. พxr.ต้องสวมใส่หน้ากากอนามัยตลอดเวลาและใบขออนุญาตเดินทางสำหรับพxr.แต่ละคน (ไม่ต้องมีผลตรวจ ATK/PCR, ไม่กำหนดว่าต้องฉีดวัคซีน)
3. ผู้ขนส่งต้องเตรียม ขี้เลื่อยสำหรับซับน้ำมันที่รั่วไหล (ไม่เอาทราย), เศษผ้าเช็ดทำความสะอาด, แผ่นซับ รวมถึงน้ำมันและถุงดำเก็บขยะเหล่านี้มาเอง
4. เน้นในเรื่องของยางรถขนส่งต้องพร้อมไม่ให้มาเกิดเหตุระเบิดในพื้นที่อีก (ในอดีตเคยมีเหตุยางระเบิด ขณะลงน้ำมันเกือบทำให้เจ้าหน้าที่บาดเจ็บ) และเรื่องของน้ำมันเครื่องรั่วซึมต่างๆ โดยจะมีการตรวจสอบตาม Check ทุกครั้ง
5. พxr.ต้องไม่ไปยุ่งเกี่ยวกับการเปิด/ปิดปั๊มต่างๆโดยเด็ดขาด (ให้พxr.ควบคุมเฉพาะในส่วนของตัวเองขนส่งเมื่อเจ้าหน้าที่สั่งเท่านั้น) ส่วนที่เหลือทางลูกค้าจะเป็นคน Operate เอง
6. ไม่อยากให้เกิดเหตุการณ์รั่วไหล/หกหล่นของผลิตภัณฑ์ในพื้นที่
7. มีจัดพักผ่อนให้ พร้อมห้องน้ำ และไฟฟ้าแต่ผู้ขนส่งต้องเตรียมอุปกรณ์มาเอง (ห้ามมีการเติมน้ำจากแก้วเดียวกันโดยเด็ดขาด ให้เตรียมของส่วนตัวมาเองเพื่อป้องกันโควิด)

จอกรถบริเวณจุดรองน้ำมัน



- ดึงเบรกมือ ปลดเกียร์ว่าง ดับเครื่องยนต์ และอุปกรณ์ไฟฟ้าทุกชนิด ปิดกระจกและล็อกประตูห้องโดยสาร
- ลงรถแบบ 3 จุด พร้อมอุปกรณ์ PPE ตรวจสอบความปลอดภัยโดยรอบ
- วางขนหนุนล้อ วางกรวยจราจร วางถังดับเพลิง

- แสดงตนพร้อมทั้งนำส่งเอกสารในการจัดส่ง (ตัว) ให้กับผู้รับน้ำมัน โดยตรวจสอบสถานที่รับน้ำมันต้องตรงกับที่ระบุในตัว โดย พพร. กล่าวท้าทาย ดังนี้

- “สวัสดิ์ครับที่นี้สถานีรับน้ำมันเตา บ.ไฟฟ้าราชนบุรีหรือเปล่าครับ ผมนำน้ำมันเตาจำนวน....มาส่ง กรุณาตรวจสอบเอกสารด้วยครับ”

*** การกล่าวคำท้าทาย เพื่อป้องกันการส่งผิดสถานี

แบบฟอร์มตรวจรถขนส่ง

แบบตรวจสอบรถขนส่งน้ำมันเชื้อเพลิงและการรับน้ำมัน

ประเภทน้ำมันเชื้อเพลิง ☐ เตา ☐ ดีเซล

สถานที่รับน้ำมัน ☐ สถานีเพชรเกษม ☐ โรงไฟฟ้าราชนบุรี (Thermal Power Plant) ☐ โรงไฟฟ้าราชนบุรี (Combined Power Plant)

ชื่อผู้ค้าน้ำมัน

ประเภทรถ

ทะเบียนรถ

ความจุถังน้ำมัน

สีรถ

1. การตรวจสอบรถขนส่งน้ำมันเชื้อเพลิง

1.1 การตรวจสอบสภาพของรถและถังน้ำมัน

1.1.1 มีใบป้องกันของรถ	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.2 มีการติดถังกันชนด้านท้ายรถ	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.3 มี Guard ป้องกันระบบท่อ	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.4 มีการติดป้ายอักษร ภาพ และเครื่องหมาย ของรถขนส่งน้ำมัน	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.5 มีการแสดงรายละเอียดของถังขนส่งน้ำมัน โดยสลักไว้บนแผ่นป้ายโลหะและติดไว้บนถังขนส่งน้ำมันอย่างถาวร หรือสลักลงบนผนังถังขนส่งน้ำมัน สามารถมองเห็นได้ง่าย	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.6 มีอุปกรณ์บริกซ์แบบระบายความดันและสูญญากาศ (Vent)	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.7 มีอุปกรณ์บริกซ์แบบระบายความดันฉุกเฉิน (Emergency Vent)	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.8 มีระบบควบคุมการจ่ายน้ำมันฉุกเฉิน (Emergency Discharge Control)	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.9 มีผลการทดสอบถัง ด้วยความดันไม่น้อยกว่า 20.7 กิโลปาสกาล (3 ปอนด์ต่อตารางนิ้ว) และมีผลการทดสอบถังน้ำมัน และอุปกรณ์ ผลทดสอบไม่เกิน 6 ปี	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.1.10 มีการบรรจุน้ำมันไม่เกินร้อยละ 97 ของความจุแต่ละถัง	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.2.1 มีจุดต่อสายดินสำหรับใช้เชื่อมต่อกับถังกับระบบสายดิน	<input type="radio"/> มี	<input type="radio"/> ไม่มี
1.2.2 มีถังดับเพลิงชนิดผงเคมีแห้งหรือน้ำยาดับเพลิง ขนาดบรรจุไม่น้อยกว่า 6.80 กิโลกรัม	<input type="radio"/> มี	<input type="radio"/> ไม่มี
<input type="checkbox"/> ความสามารถในการดับเพลิงไม่น้อยกว่า 2A 20B มีจำนวนไม่น้อยกว่า 2 ถัง		
<input type="checkbox"/> ความสามารถในการดับเพลิงไม่น้อยกว่า 4A 40B มีจำนวนไม่น้อยกว่า 1 ถัง		

2. การรับน้ำมัน

2.1 มีการป้องกันไม่ให้อากาศเข้าสู่น้ำมันเคลื่อนที่ เช่น ดึงห้ามล้อมือ หรือใช้เข็มขัดยึดรถ	<input type="radio"/> มี	<input type="radio"/> ไม่มี
2.2 มีการต่อสายดินก่อนทำการรับน้ำมันและต่อไว้ตลอดเวลาจนถอดหัวจ่ายน้ำมันออก	<input type="radio"/> มี	<input type="radio"/> ไม่มี
2.3 มีการควบคุมไม่ให้เกิดประกายไฟบริเวณรับน้ำมัน	<input type="radio"/> มี	<input type="radio"/> ไม่มี
2.4 มีการสวมใส่อุปกรณ์ PPE (ผ้าปิดจมูก ถุงมือ ฯลฯ)	<input type="radio"/> มี	<input type="radio"/> ไม่มี
2.5 มีการเตรียมตัวรับน้ำมัน เช่น ผ่าชุด ทหาร ฯลฯ และมีถังดับเพลิงหรือถังดับเพลิง	<input type="radio"/> มี	<input type="radio"/> ไม่มี
2.6 มีการควบคุมน้ำมัน	<input type="radio"/> มี	<input type="radio"/> ไม่มี
2.7 มีการปิดฝาถังน้ำมันของรถขนส่งอย่างเรียบร้อย หลังรับน้ำมันแล้วเสร็จ	<input type="radio"/> มี	<input type="radio"/> ไม่มี

ลงชื่อ	ลงชื่อ
(.....)	(.....)
ตำแหน่ง	ตำแหน่ง
วันที่รับน้ำมัน	วันที่

ต้นฉบับ : ๒ พก.บ.ร.

EF-01/EI-810-53

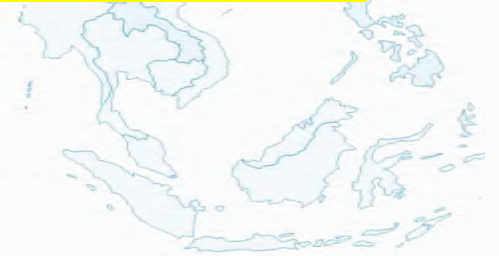
ตัวอย่างแบบฟอร์ม



2. ตรวจเอกสารสภาพซีลและหมายเลขซีล

❖ พxr.ร่วมกับเจ้าหน้าที่รับน้ำมันตรวจสอบซีลที่วาล์วจ่ายด้านล่าง อยู่ในสภาพดี แน่นหนา ไม่ถูกแกะ/ตัดมาก่อนหมายเลขซีลทุกจุดตรงกับที่ระบุในใบส่งสินค้า

❖ พxr. ต้องไม่ดึงซีลออกก่อนที่จะเจ้าหน้าที่รับน้ำมันมาตรวจรับอนุญาตจากเจ้าหน้าที่รับน้ำมันให้ถึงเท่านั้น



การลงน้ำมันในสถานีบริการมีขั้นตอนการปฏิบัติงานแบ่งเป็นดังต่อไปนี้

1. เตรียมรถ ในช่องที่ 5-6 เท่านั้น
2. ตรวจเอกสารสภาพซีลและหมายเลขซีล
3. ตรวจสอบปริมาณน้ำมันในถังรับก่อนลงน้ำมัน
4. ตรวจสอบชนิดน้ำมันและสิ่งเจือปน
5. นำรถเข้าไลน์รับ ต่อท่อและควบคุมการลงน้ำมัน
6. ตรวจสอบน้ำมันค้างถังเดิม น้ำมันค้างถัง
7. ตรวจสอบปริมาณน้ำมันในถังหลังลงน้ำมัน การปฏิบัติหลังลงน้ำมันเสร็จ
8. ตรวจรับน้ำมันขั้นสุดท้ายตรวจสอบเอกสารเซ็นรับ เก็บอุปกรณ์



ขั้นตอนการลงน้ำมัน



1. นำรถเข้าช่อง ที่ 6,5 ก่อนเพื่อให้เจ้าหน้าที่
2. ตรวจสอบ,ตัวอย่างเพื่อวัดคุณภาพน้ำมัน และตรวจสอบสภาพรถ (ตาม Check List)

ขั้นตอนการลงน้ำมัน

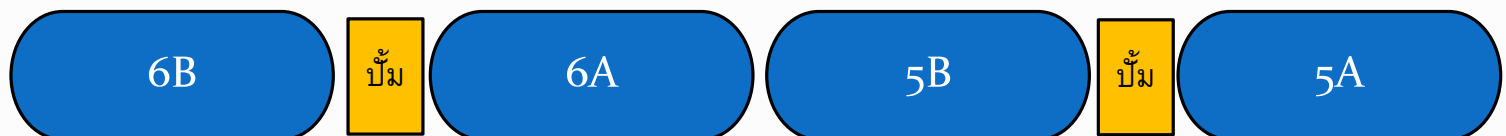


3. เจ้าหน้าที่จะแจ้ง ไลน์ที่จะให้ไปลงน้ำมัน (มี 2 ไลน์ A/B และจะลงที่ละไลน์เท่านั้นไม่มีการ สลับไลน์) และถึงที่จะให้ไปลง พxr.ต้องมาพลิกป้าย ในไลน์และหมายเลขถึงที่ตัวเองต้องไปลงน้ำมัน

ขั้นตอนการลงน้ำมัน (ทางเข้าช่องและถังรับ)



ขั้นตอนการลงน้ำมัน (Lay Out ช่องและถังรับ)

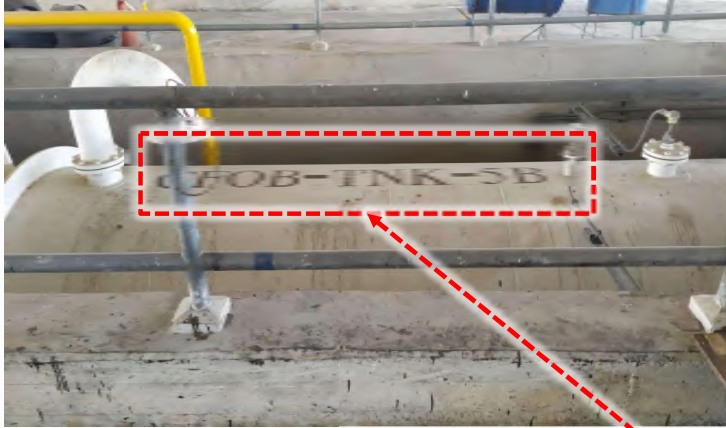


ทางเดินรถ

- ถังรับความจุสูงสุด 40,000 ลิตร (รับน้ำมันสูงสุด 32,000 ลิตร ถ้าเต็มปั้มจะตัดการทำงานอัตโนมัติ และจะต้องย้ายไปลงถังอื่น)
- แต่ละช่องจะมีทั้งหมด 2 ไลน์ ทุละ 2 ถัง รวม 4 ถัง
- รวม 11 ช่อง 22 ไลน์ 44 ถัง

Signature

ขั้นตอนการลงน้ำมัน (ถังรับ)



ตัวอย่าง : รูปถังรับมีหมายเลขระบุไว้ชัดเจน

ขั้นตอนการลงน้ำมัน



4. เมื่อผ่าน ตรวจสอบ,ตัวอย่างเพื่อวัดคุณภาพน้ำมัน และตรวจสอบสภาพรถ (ตาม Check List) แล้วพxr.ต้องวนรถ (ไปทางขวามือ) เพื่อไปเข้า ไลน์และช่อง ที่เจ้าหน้าที่แจ้งให้ไปลงน้ำมัน

ขั้นตอนการลงน้ำมัน



5. เมื่อมาจอดรถยังจุดที่จะลงน้ำมันแล้ว ให้ปฏิบัติตามดังนี้

- ดับเครื่องยนต์ ขึ้นเบรกมือ
- ลงมาวางขออนหนุนล้อให้เรียบร้อย
- คีบสายดินของลูกค้ายาเข้าที่ตัวรถ
- นำถังที่ลูกค้าเตรียมไว้ให้มารองน้ำมัน
- ต่อสายสูบลำของลูกค้า 2 เส้นเข้าที่ตัวรถ

จากนั้นให้รอคำสั่งเข้าหน้าที่เพื่อ เปิดปิควาล์วที่ตัวรถเท่านั้น ส่วนอีกทางลูกค้าจะเป็นผู้ดำเนินการเอง

การต่อท่อรับ

การต่อท่อรับที่ถูกต้อง

ต้องต่อสาย 2 เส้น เข้ากับท่อรถทั้งสองท่อ



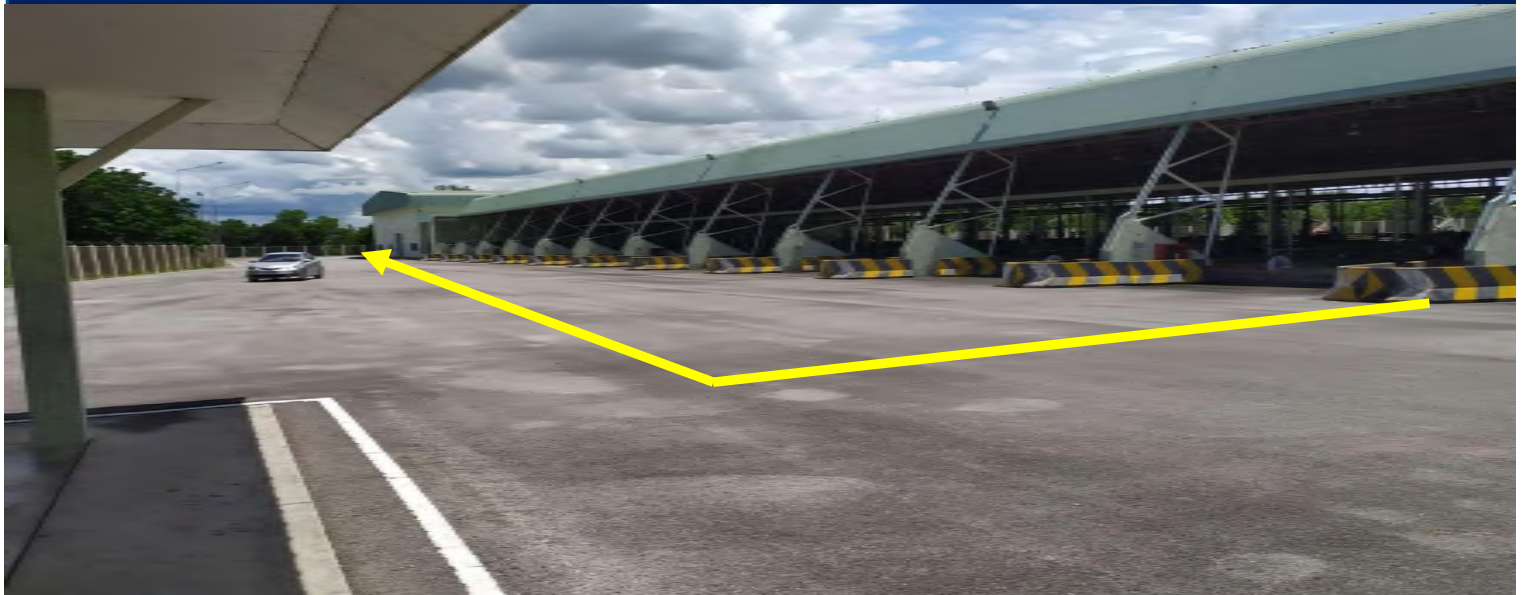
ลักษณะการต่อสายที่ถูกต้อง ตามการ ออกแบบของระบบลงน้ำมันเตา @ สถานีเพชรเกษม
ต่อสายด้าน Suction ทั้ง 2 จุด

การต่อท่อรับ

การต่อท่อที่ไม่ถูกต้อง



ขั้นตอนการลงน้ำมัน



6. เมื่อลงน้ำมันเสร็จเรียบร้อยแล้ว ให้พชร.ขับรถ (ไปทางขวามือ) เพื่อไปเข้าช่อง ที่ 6,5 อีกครั้ง

ขั้นตอนการลงน้ำมัน



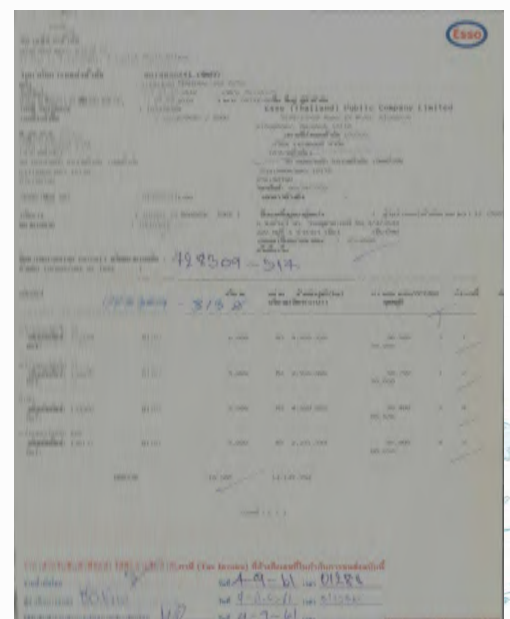
6. นำรถเข้าช่อง ที่ 6,5 เพื่อให้เจ้าหน้าที่ตรวจสอบน้ำมันคงเหลือจากหลังถัง (ส่วนพxr.
เตรนน้ำมันที่เหลือใส่ภาชนะที่เจ้าหน้าที่จัดเตรียมไว้ให้) อาจจะต้องมีการใช้ไม้กวาดหากมีน้ำมัน
เหลือค้างรถ จนแล้วเสร็จจึงนำรถออกไป

ขั้นตอนการลงน้ำมัน

7.ตรวจรับขั้นตอนสุดท้าย

ตรวจสอบเอกสารขนส่งรายเซ็นและ
นำเอกสารสำหรับขนส่ง(สีเหลือง)

นำกลับ



อาคารจุดพักผ่อน

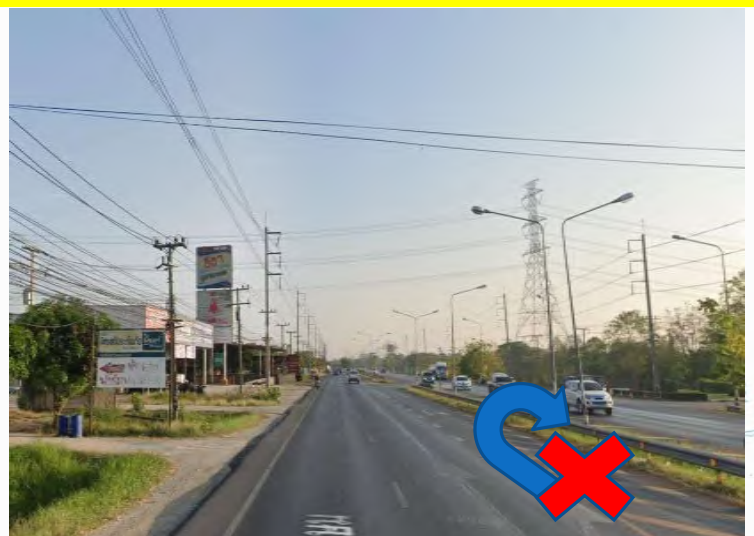
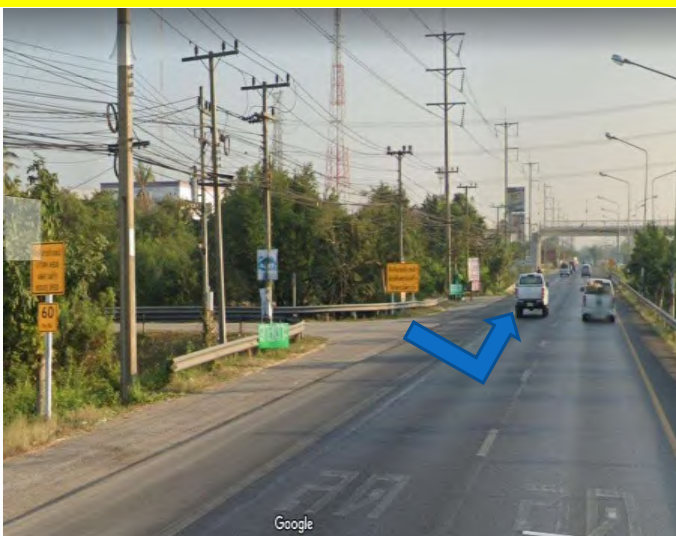


มีอาคารจุดพักผ่อนให้ พร้อมห้องน้ำ และไฟฟ้าทางพงษ์ระวี ต้องเตรียมอุปกรณ์ไฟฟ้าไปเองดังนี้

1. ตู้น้ำร้อน/เย็น (ให้จัดเตรียมมาเอง)
2. ถังน้ำดื่มให้พอเพียง
3. พัดลม (แนะนำพัดลมอุตสาหกรรม)
4. กาแฟ/ขนม
5. ถูดำใส่ขยะ
6. ช่างโควิด เพื่อลดการแพร่เชื้อ งดรายการ 1-4 ให้ จัดเตรียมมาเอง

ข้อควรระวัง

พอออกจากลูกค้ำมาประมาณ 300 เมตร จะมีจุดกลับรถ ไม่แนะนำเนื่องจากจุดดังกล่าวเนื่องจาก กระชั้นชิดเกินไปประกอบกับเป็นช่วงทางโค้งอาจทำให้รถที่วิ่งมาเบรกไม่ทันจนเกิดการเฉี่ยวชนกันได้



แนวทางป้องกัน

จะมีจุดกลับรถห่างออกไปอีกประมาณ 3 กิโลเมตร ก่อนถึงบริษัท โมเดอร์น เอ สตีล ซึ่งรถใหญ่สามารถกลับรถที่จุดดังกล่าวได้



การลงน้ำมันต้องปฏิบัติตามขั้นตอนอย่างเคร่งครัด ทั้งนี้เพื่อ....

- ☒ Safety ปลอดภัย
- ☒ Quality ได้คุณภาพ
- ☒ Quantity เต็มจำนวน
- ☒ On time ตรงเวลา
- ☒ Service mind บริการด้วยใจ

*****กรณีที่เห็นว่าไม่ปลอดภัย ให้ใช้นโยบายหยุดการทำงาน (Stop work Policy)*****



The End

