

# Field Testing for Shorted Casings

AUCSC May 2019  
System Diagnostics  
J. Block

**DOT Regulations for Natural Gas Transmission  
Line Title 49 CFR 192.467 External corrosion  
control: Electrical isolation**

–(c) Except for unprotected copper inserted in ferrous pipe, each pipeline must be electrically isolated from metallic casings that are a part of the underground system. However, if isolation is not achieved because it is impractical, other measures must be taken to minimize corrosion of the pipeline inside the casing.

–(d) Inspection and electrical tests must be made to assure that electrical isolation is adequate.

## **DOT Regulations for Hazardous Liquid Lines**

Title 49 CFR 195.575

(a) electrically isolate each buried or submerged pipeline from other metallic structures, unless you electrically interconnect and cathodically protect the pipeline and the other structures as a single unit.

(c) inspect and electrically test each electrical isolation to assure the isolation is adequate.

## **NACE Standard SP0169 Requirements**

□ 10.4.4 effectiveness of isolating fittings, continuity bonds, and casing isolation should be evaluated during periodic surveys. This may be accomplished by electrical measurements.

## **NACE Standard SP0200 Requirements**

6.2 Monitoring: One or more of the following basic electrical test methods should be used to monitor pipelines and casings on an annual basis.

–6.2.1 Potential Survey

–6.2.2 Internal Resistance

–6.2.3 Four-Wire IR Drop

–6.2.4 Cycling Rectifier

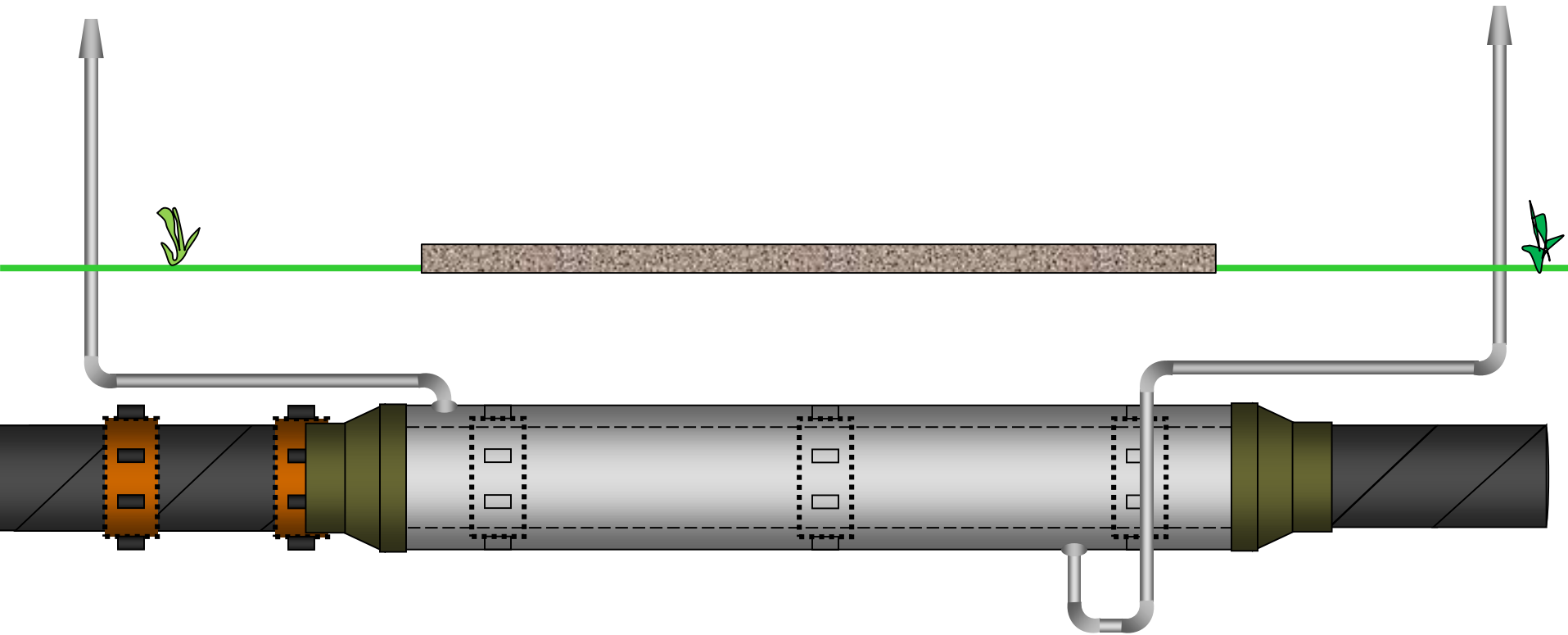
–6.2.5 Casing Depolarization

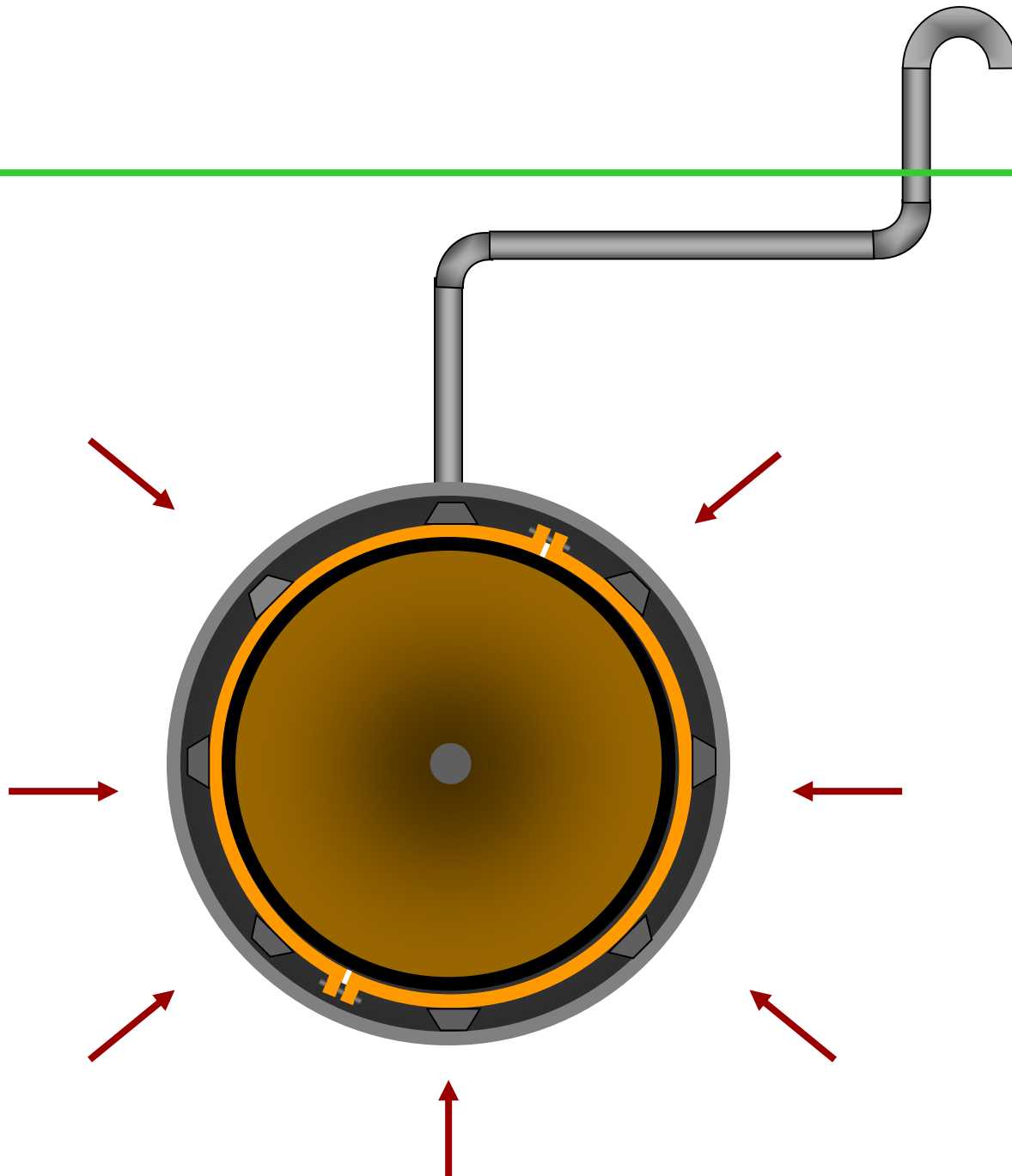
–6.2.6 Direct Resistance Measurement

–6.2.7 Pipe/Cable Locator

# Casing Testing: One LDC Approach



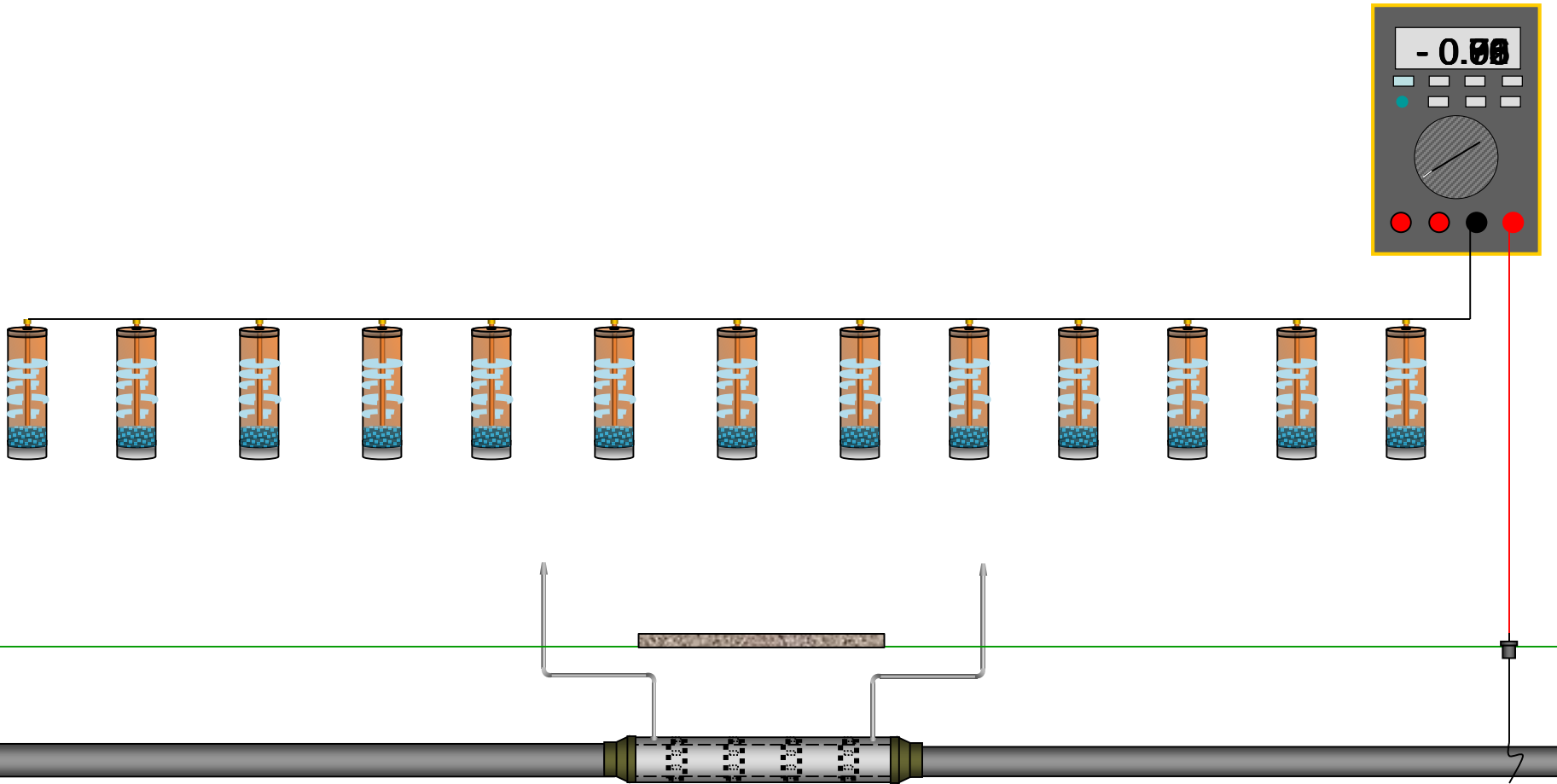


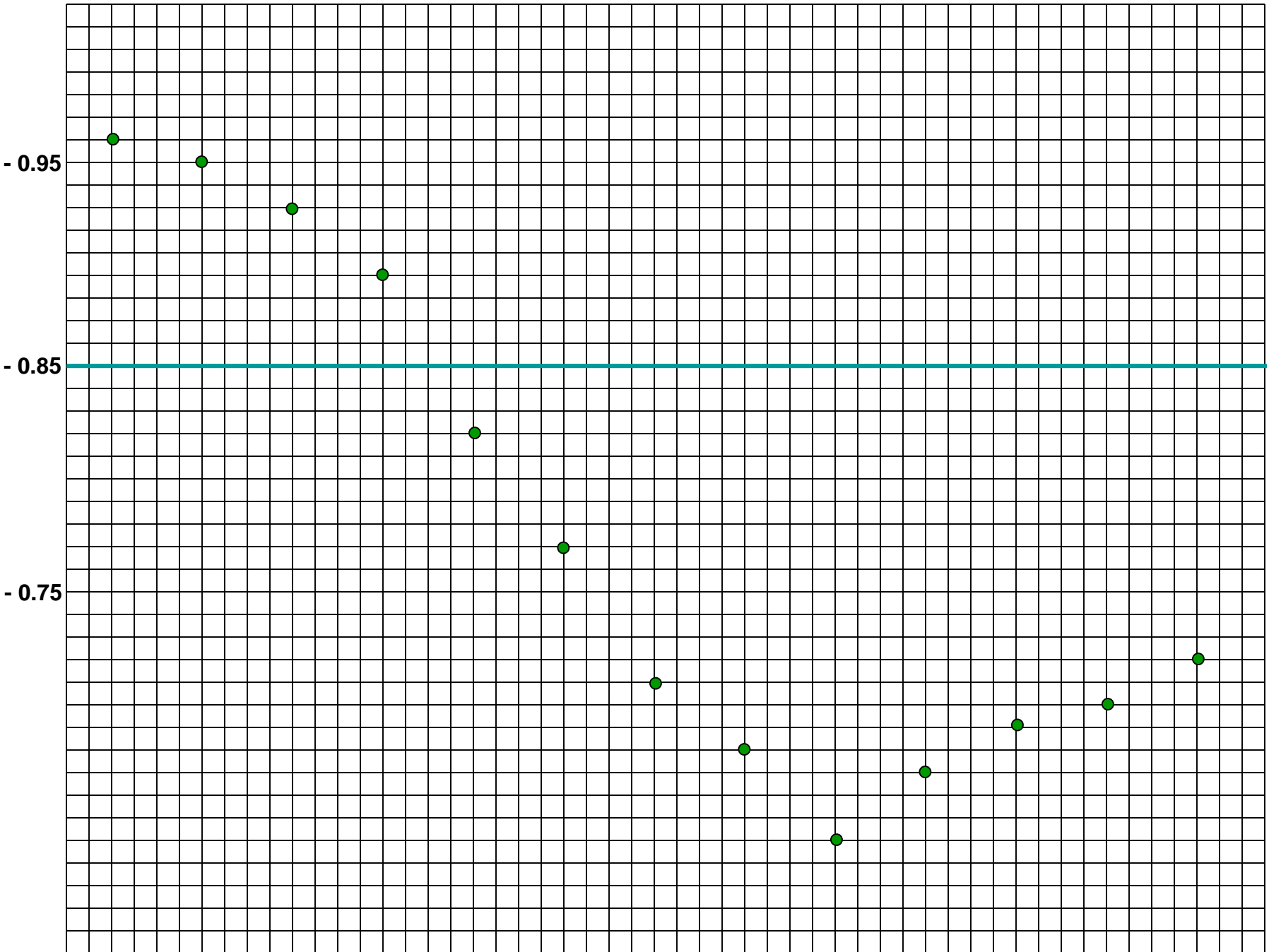


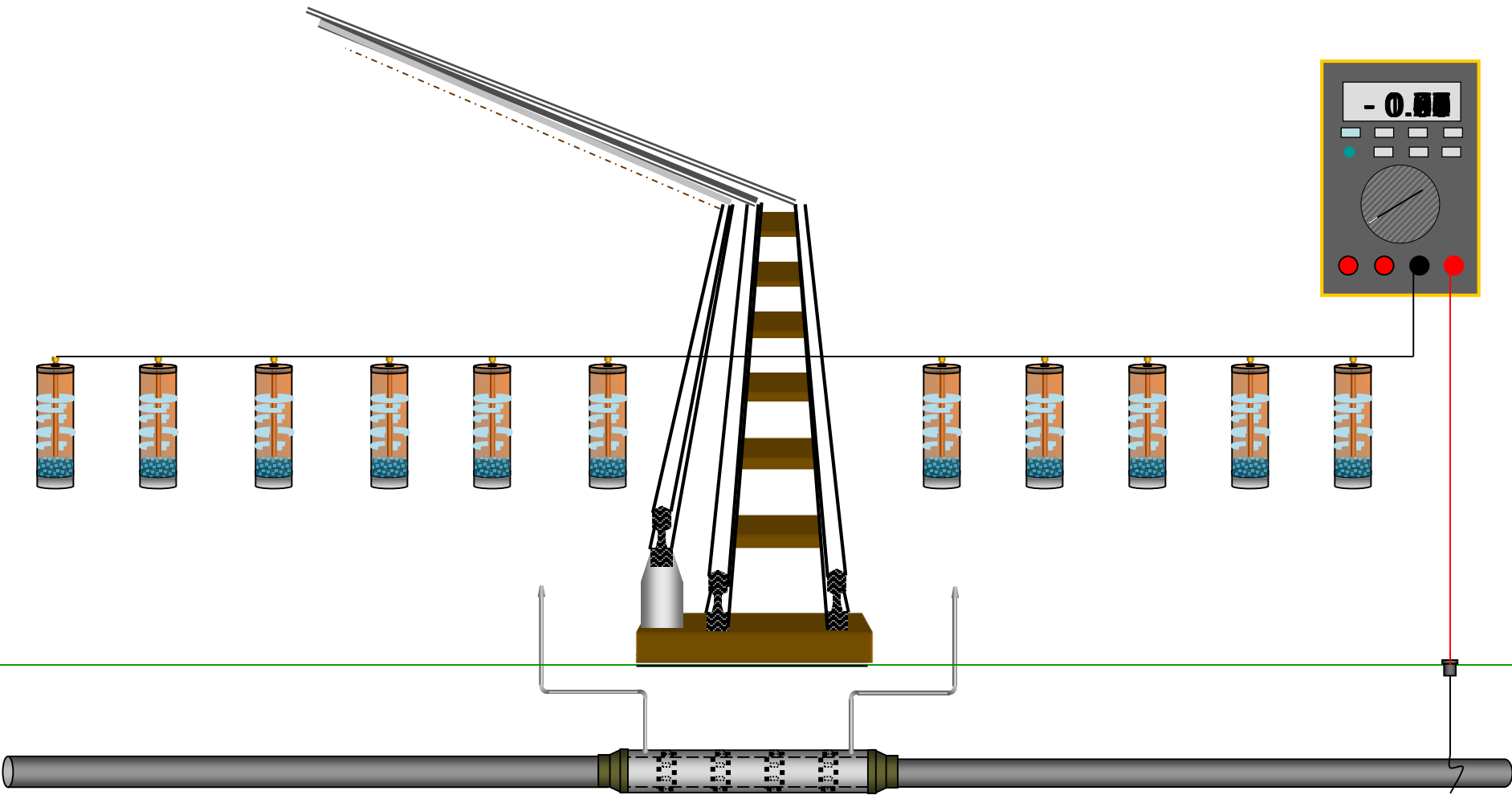


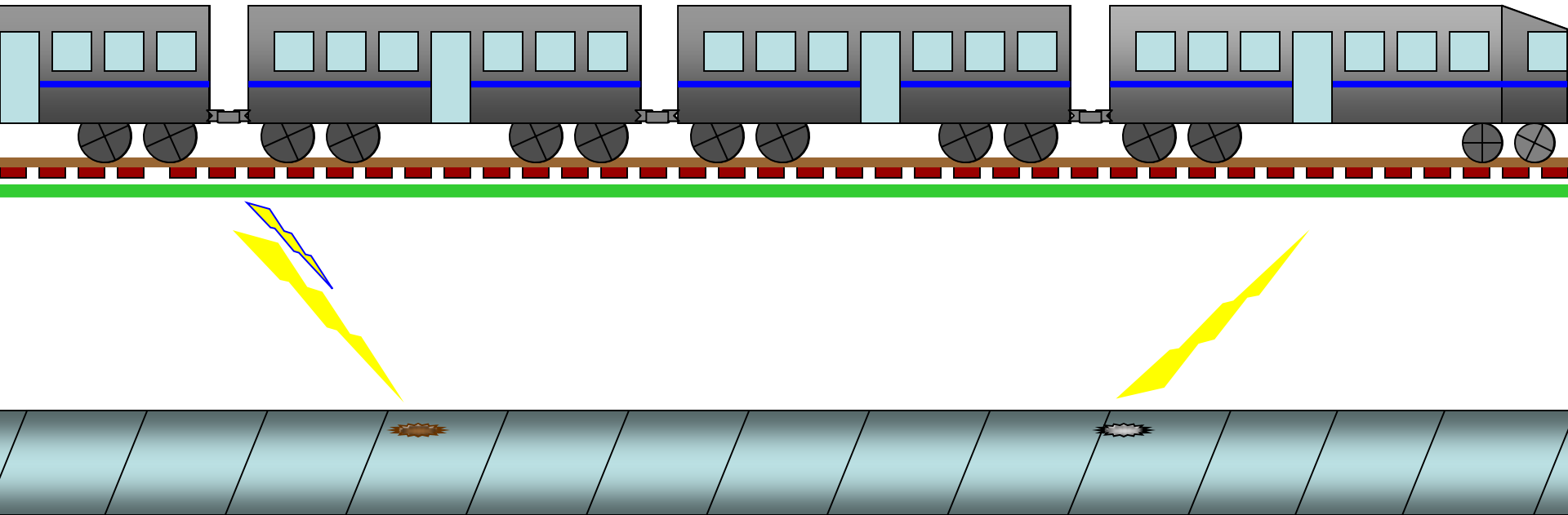


# CIS Survey

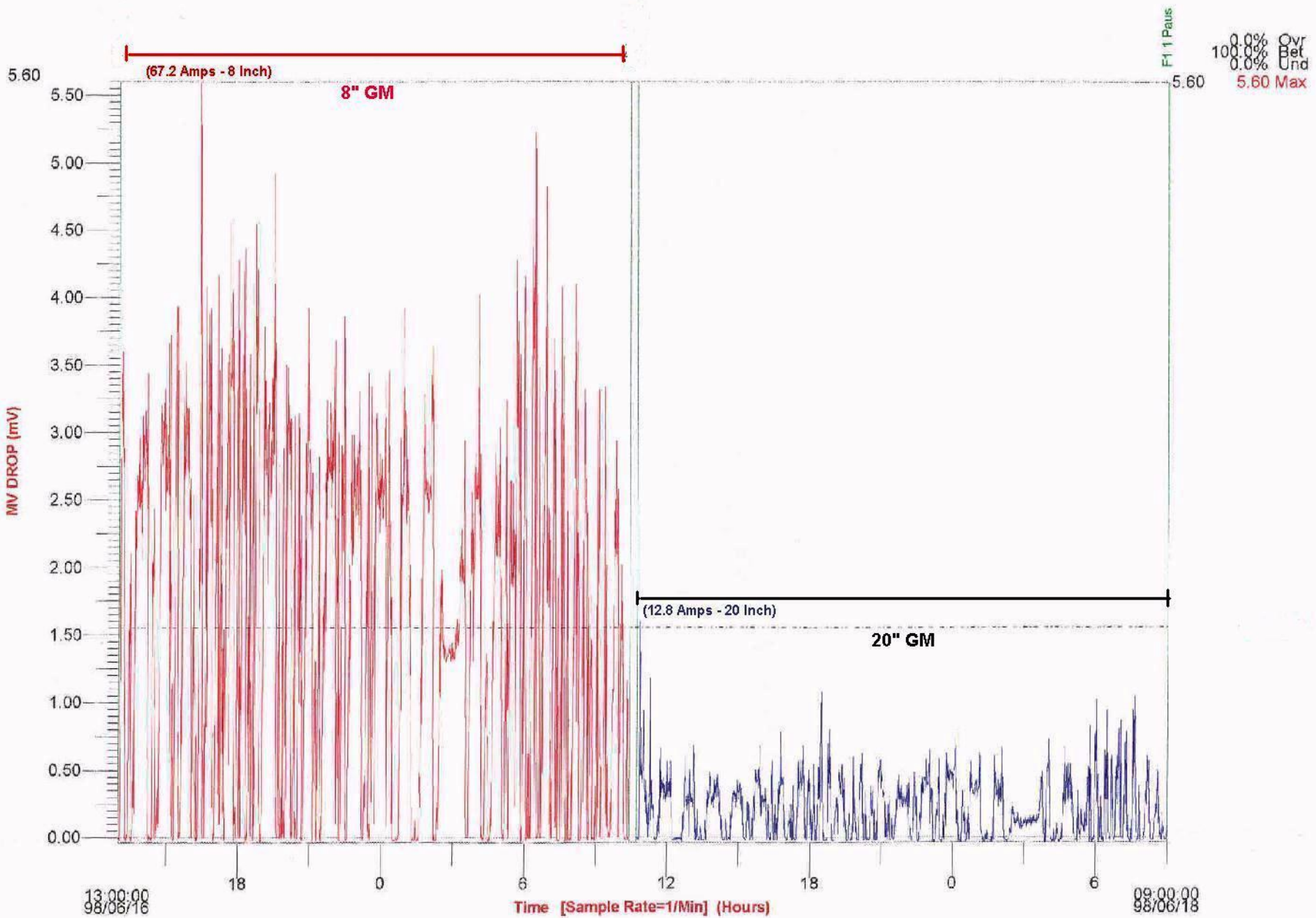






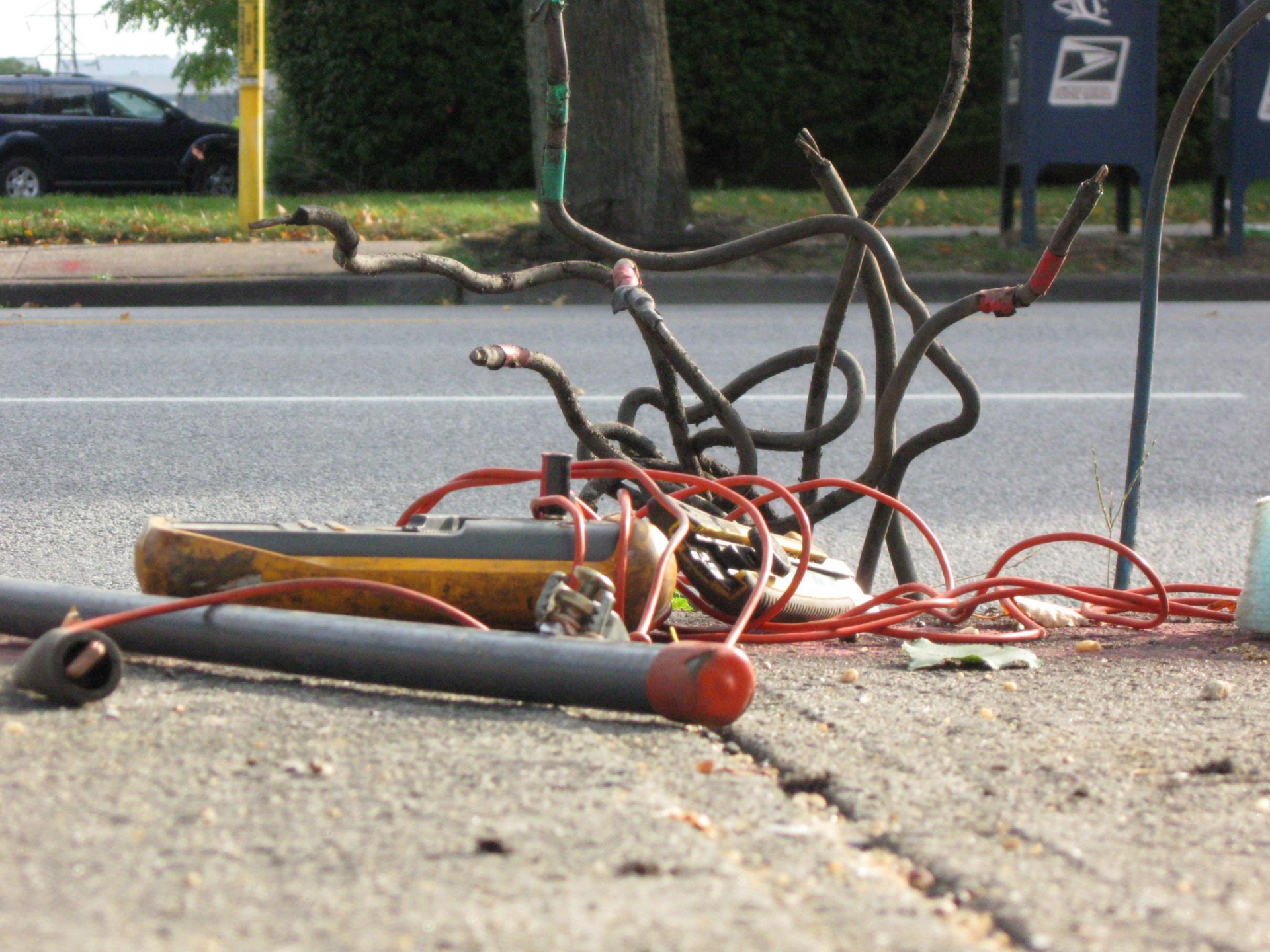


**Coated Steel Pipe  
with coating  
defects**



1	20" DS MV	Date:	6/16/98		
2	8" DS MV	Drawn:	RTF		
		Approved:	RTF		
		1- Data File:			8" SHUNT...1 MV = 12 AMPS
		2- Data File:			20" SHUNT...1 MV = 8 AMPS

8" AND 20" SHUNTS..



# Casing Test: C = clear E = electrolytic M = metallic

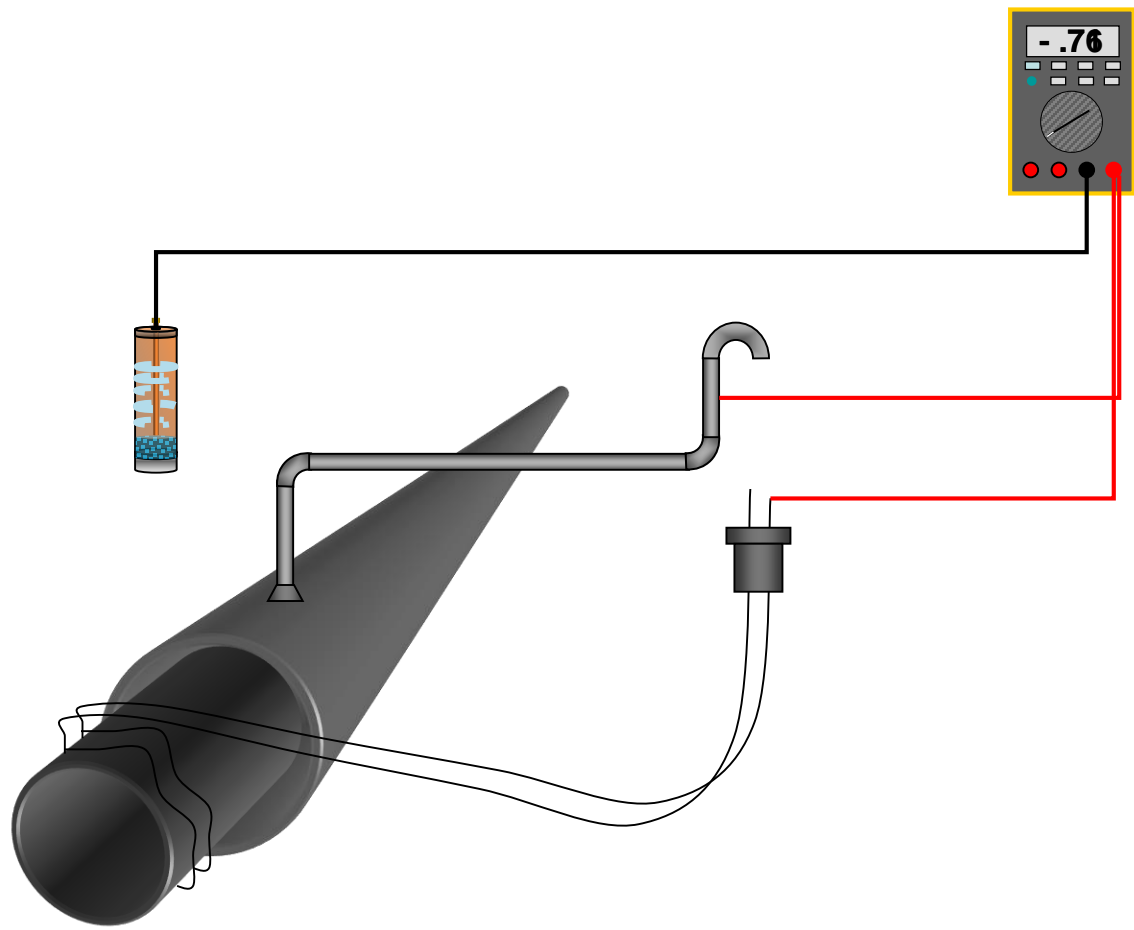
P/S	Structure-to-soil readings that have similar value may indicate an electrolytic condition or metallic short between the pipe and casing. Structure-to-soil readings that have the same value may indicate a metallic short	C	E	M
DC Voltage Shift	DC current applied to one structure drives the other structure more negative, may indicate a metallic short. DC current applied to one structure drives the other structure less negative or none, indicates a cleared casing	C	E	M
$P \Omega$ -earth & $C \Omega$ - earth	Calculated resistance to earth values that are similar may indicate an electrolytic condition. Calculated resistance to earth values that have the same value may indicate a metallic short	C	E	M
$P \Omega$ - $C \Omega$	Calculated resistance between pipe and casing that is $\leq$ to 1 $\Omega$ may indicate an electrolytic condition or possibly a metallic short. If resistance value is $\leq$ the sum of the pipe-to-earth and casing-to-earth, this may indicate an electrolytic condition or metallic short.	C	E	M
Signal Locator	Application of a signal locator between the casing and the pipeline that is greatly reduce or lost may indicate a metallic short. Application of a signal locator between the casing and the pipeline that is maintained along the pipeline indicates a cleared crossing.	C	E	M
Head-Set	Connecting a head-set between the casing and the pipeline will present an audible tone. Tone indicates a voltage potential which may indicate a cleared casing or an electrolytic condition. Lack of an audible tone may indicate a metallic short.	C	E	M



# Structure to Soil Potential

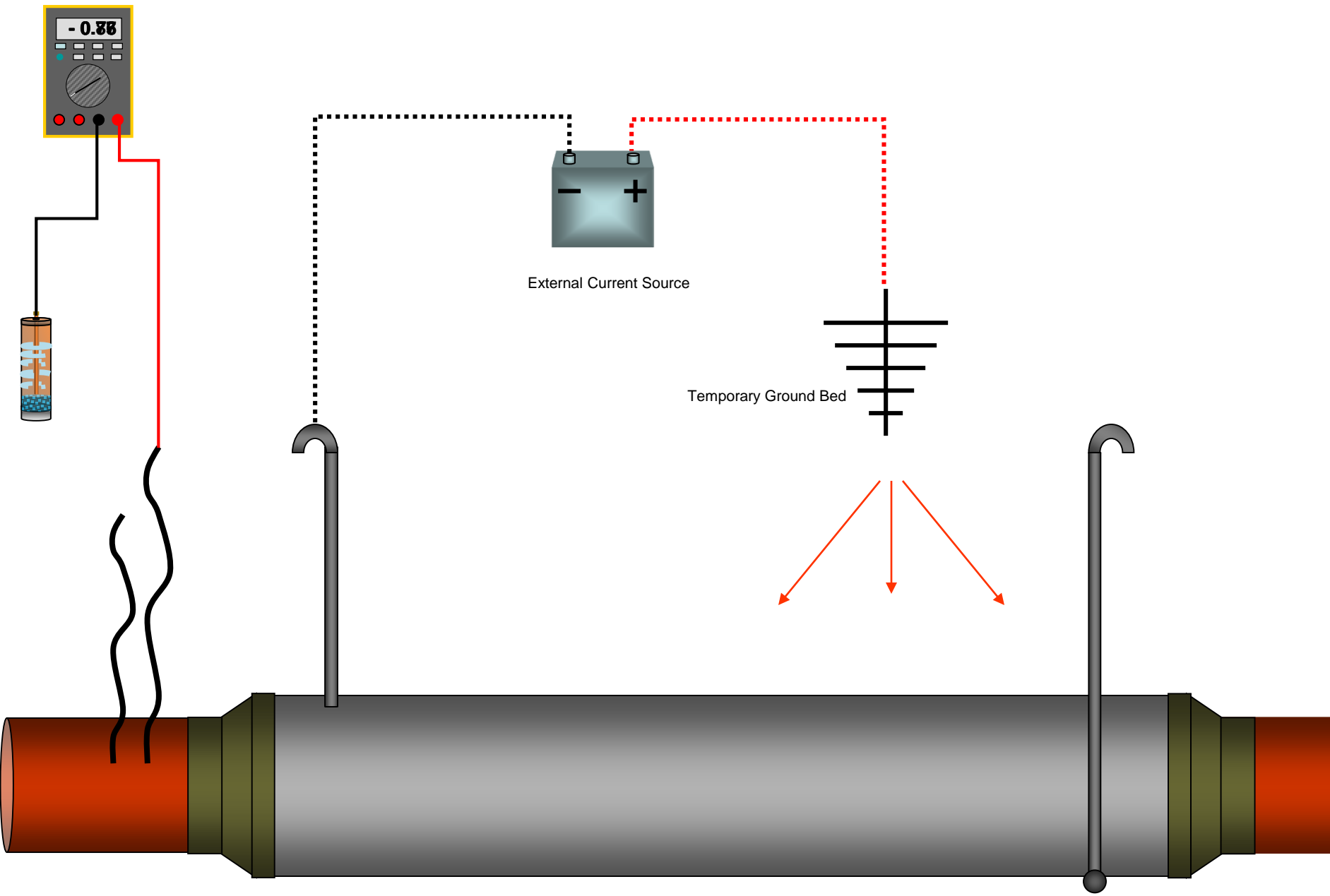
Structure-to-soil readings that have similar value may indicate an electrolytic condition or metallic short between the pipe and casing.

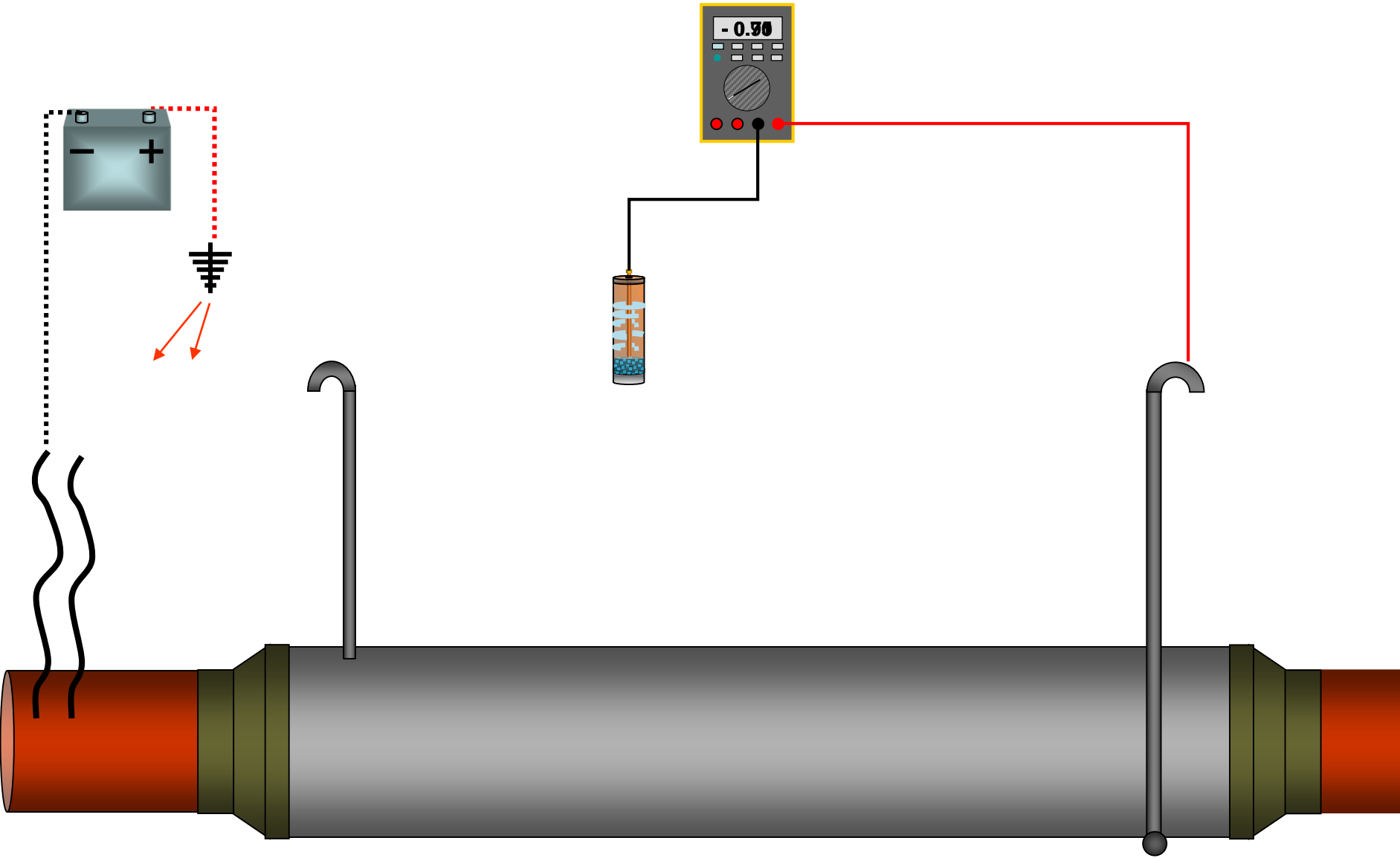
Structure-to-soil readings that have the same value may indicate a metallic short



# DC VOLTAGE SHIFT

DC current applied to one structure drives the other structure more negative, may indicate a metallic short. DC current applied to one structure drives the other structure less negative or none, indicates a cleared casing

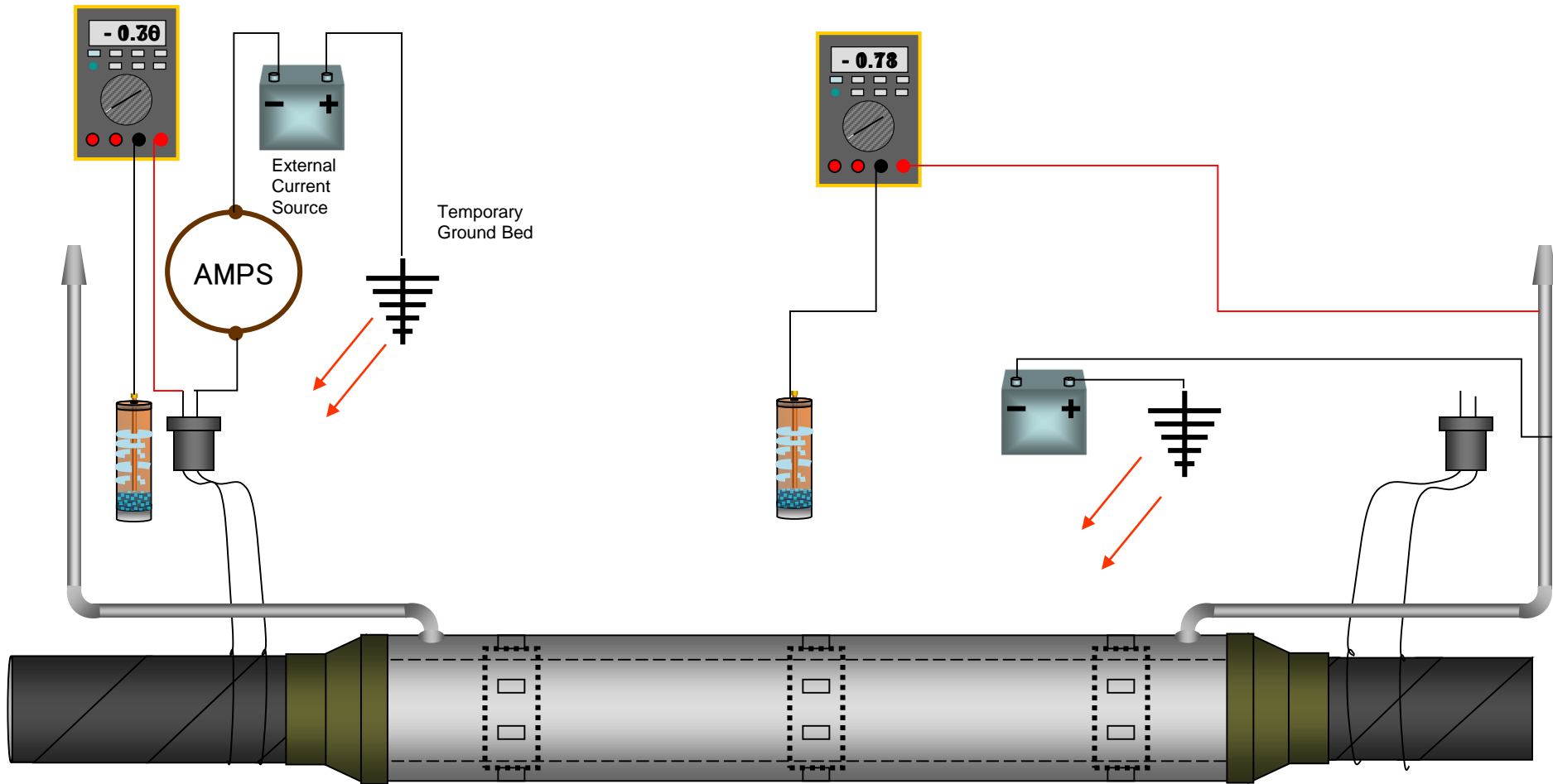




# Pipe $\Omega$ -earth & Casing $\Omega$ -earth

Calculated structure resistance-to-earth values that are similar may indicate an electrolytic condition.

Calculated structure resistance-to-earth values that have the same value may indicate a metallic short



I	On	Off	$\Delta V$	$\Omega$
3.01	- 1.30	- .76	.54	.18

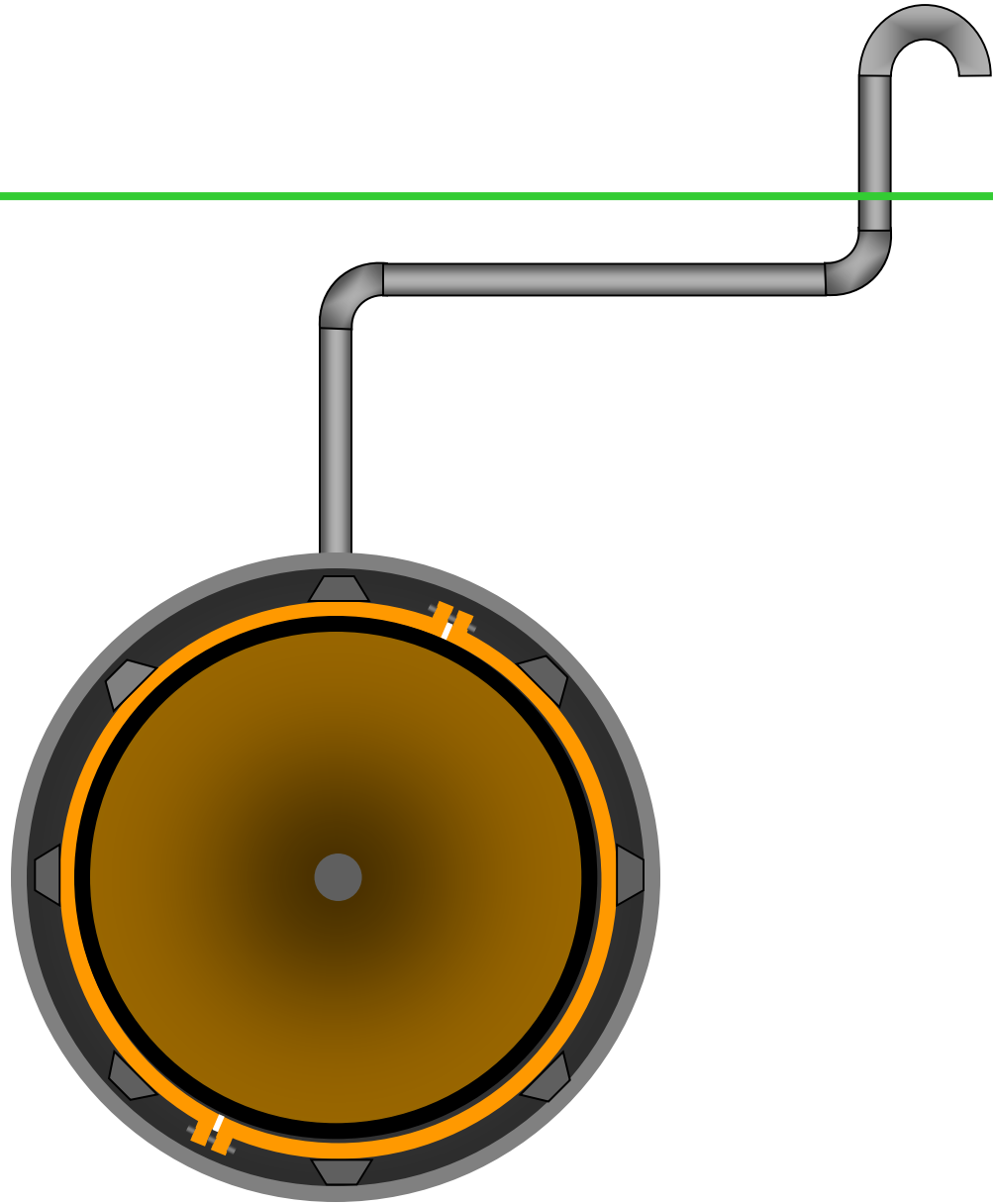
I	On	Off	$\Delta V$	$\Omega$
2.96	- 1.18	- .71	.47	.16

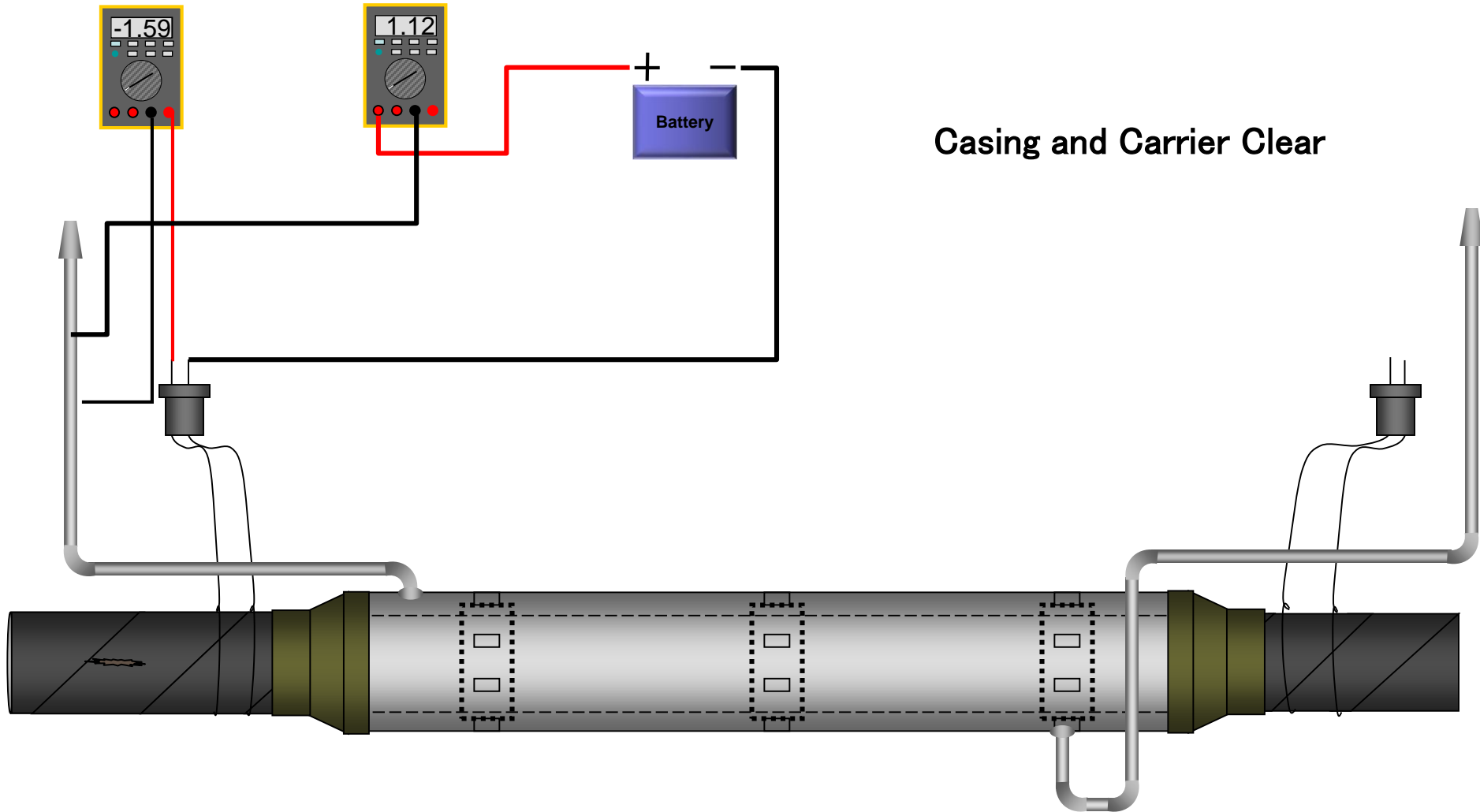
# Pipe $\Omega$ vs. Casing $\Omega$

Calculated resistance between pipe and casing that is  $\leq$  to  $1\Omega$  may indicate an electrolytic condition or possibly a metallic short. If resistance value is  $\leq$  the sum of the pipe-to-earth and casing-to-earth, this may indicate an electrolytic condition or metallic short.



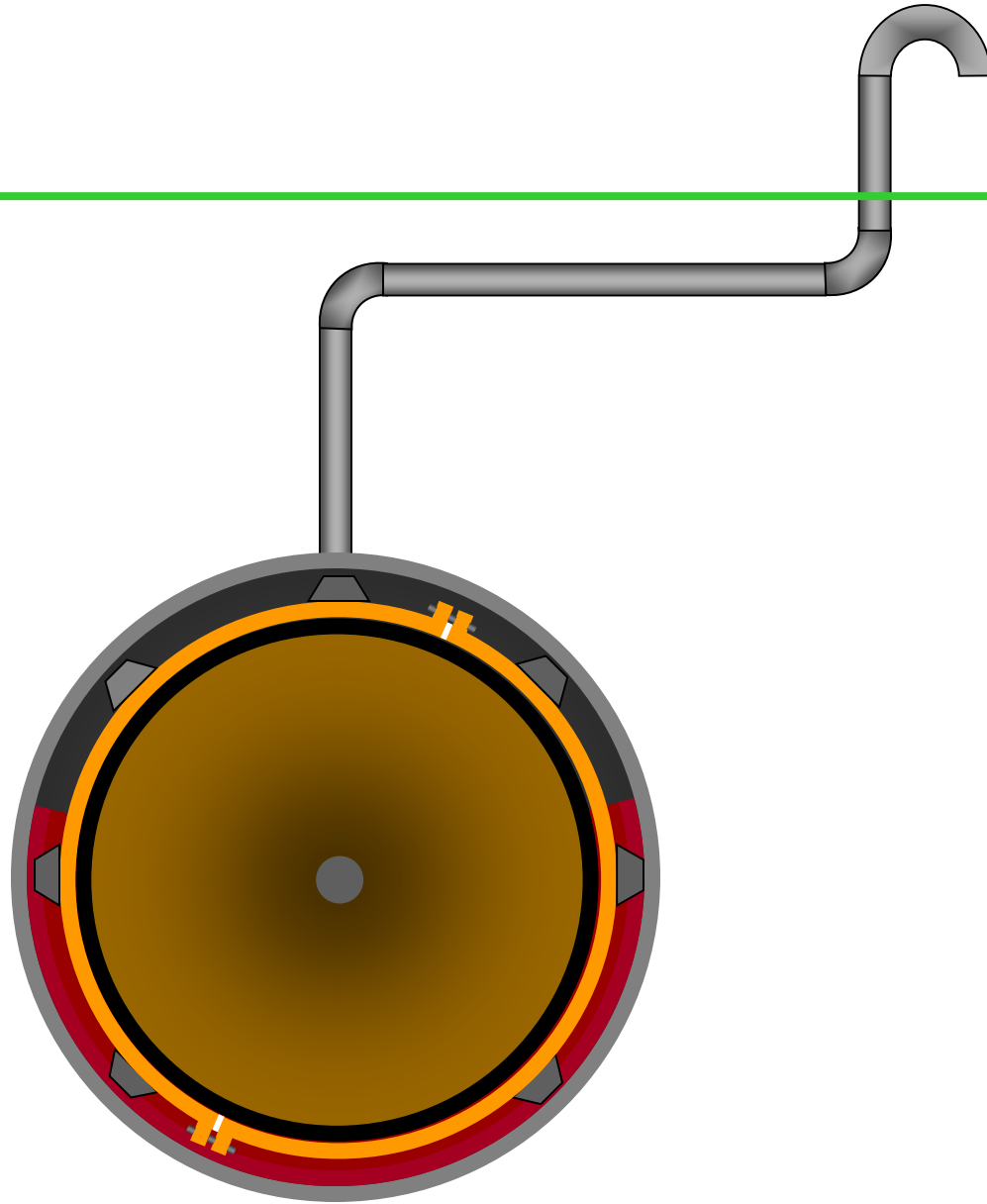
Clear

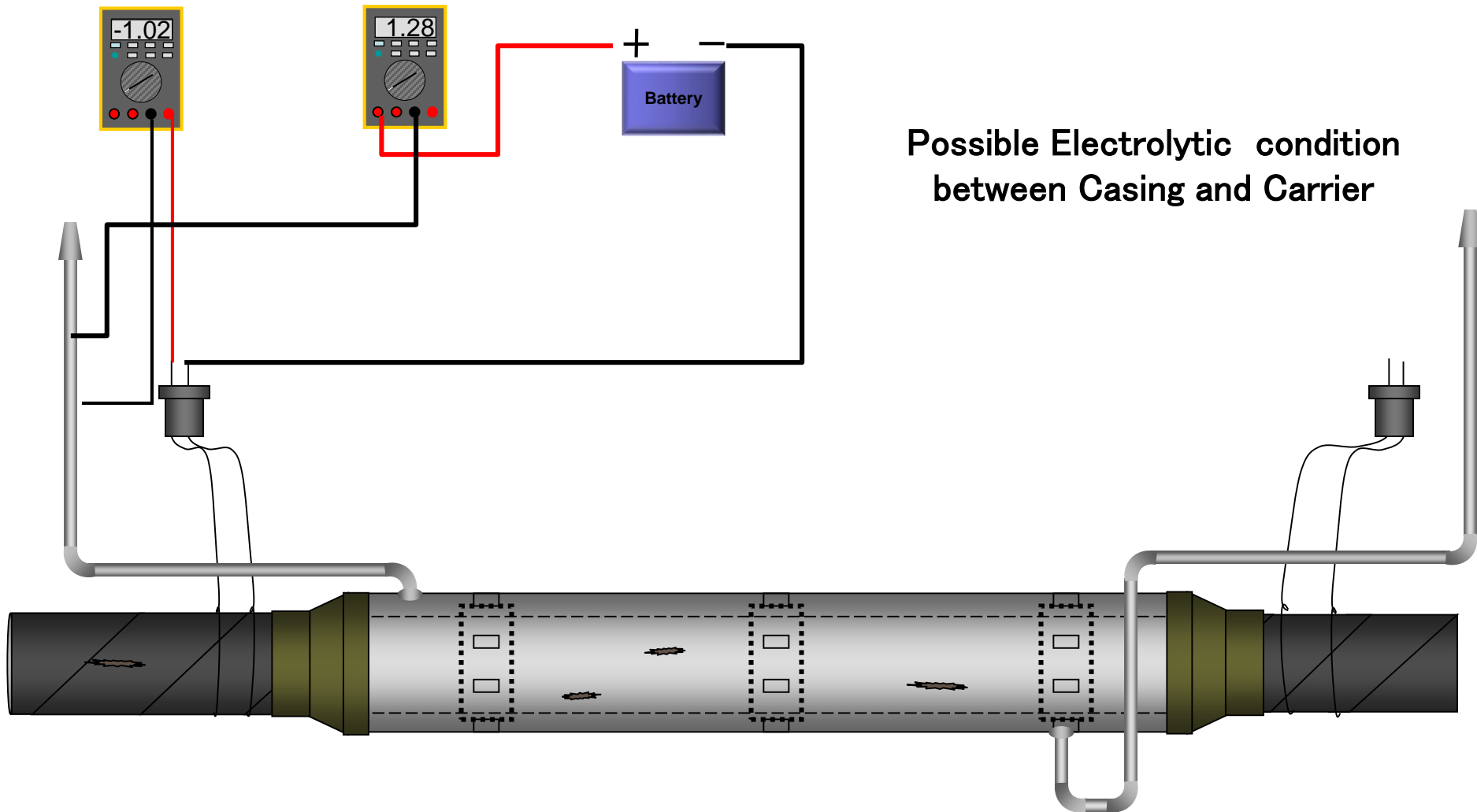




I	On	Off	$\Delta V$	$\Omega$
1.12	- 1.59	- .05	1.54	1.39

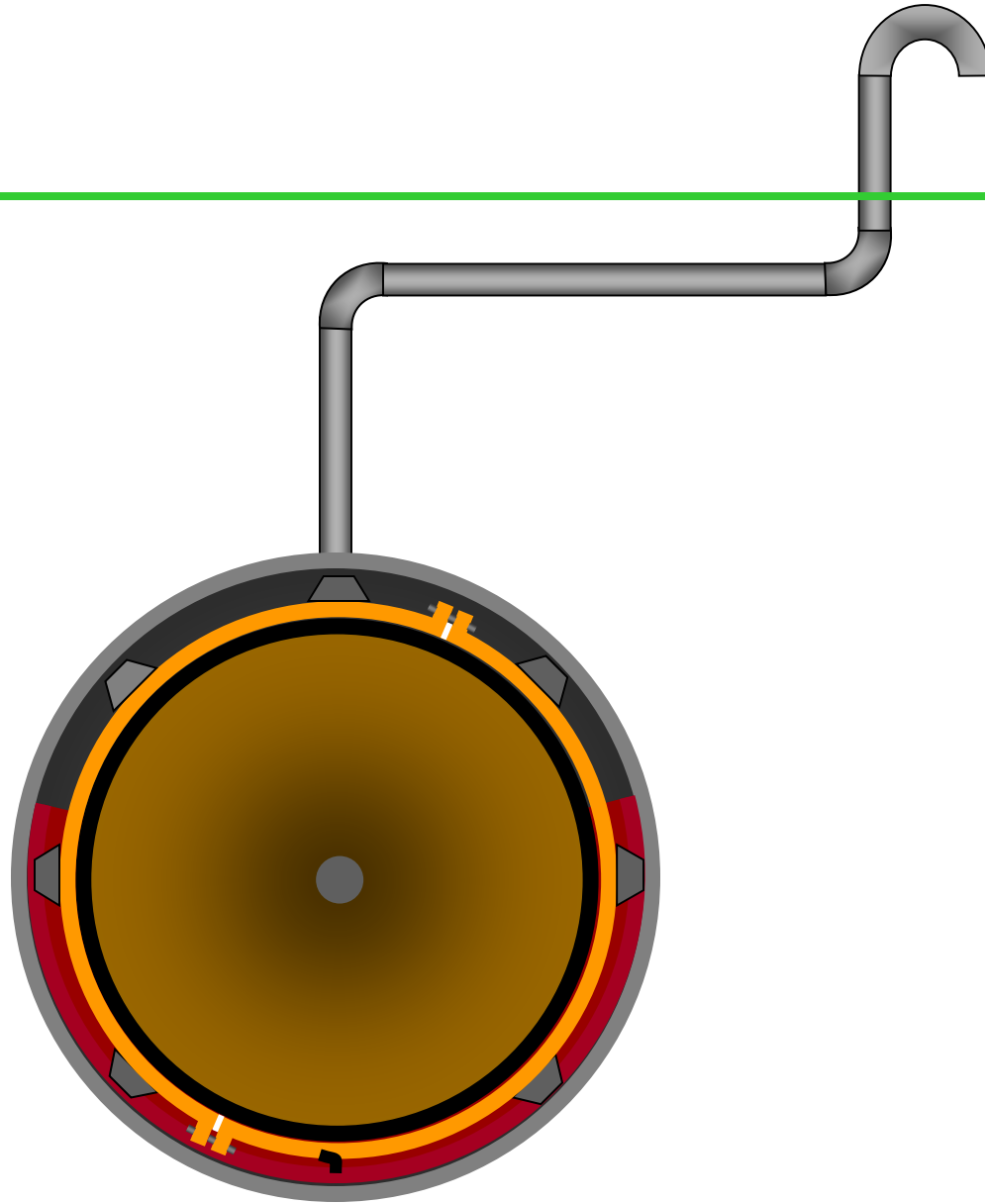
Electrolytic

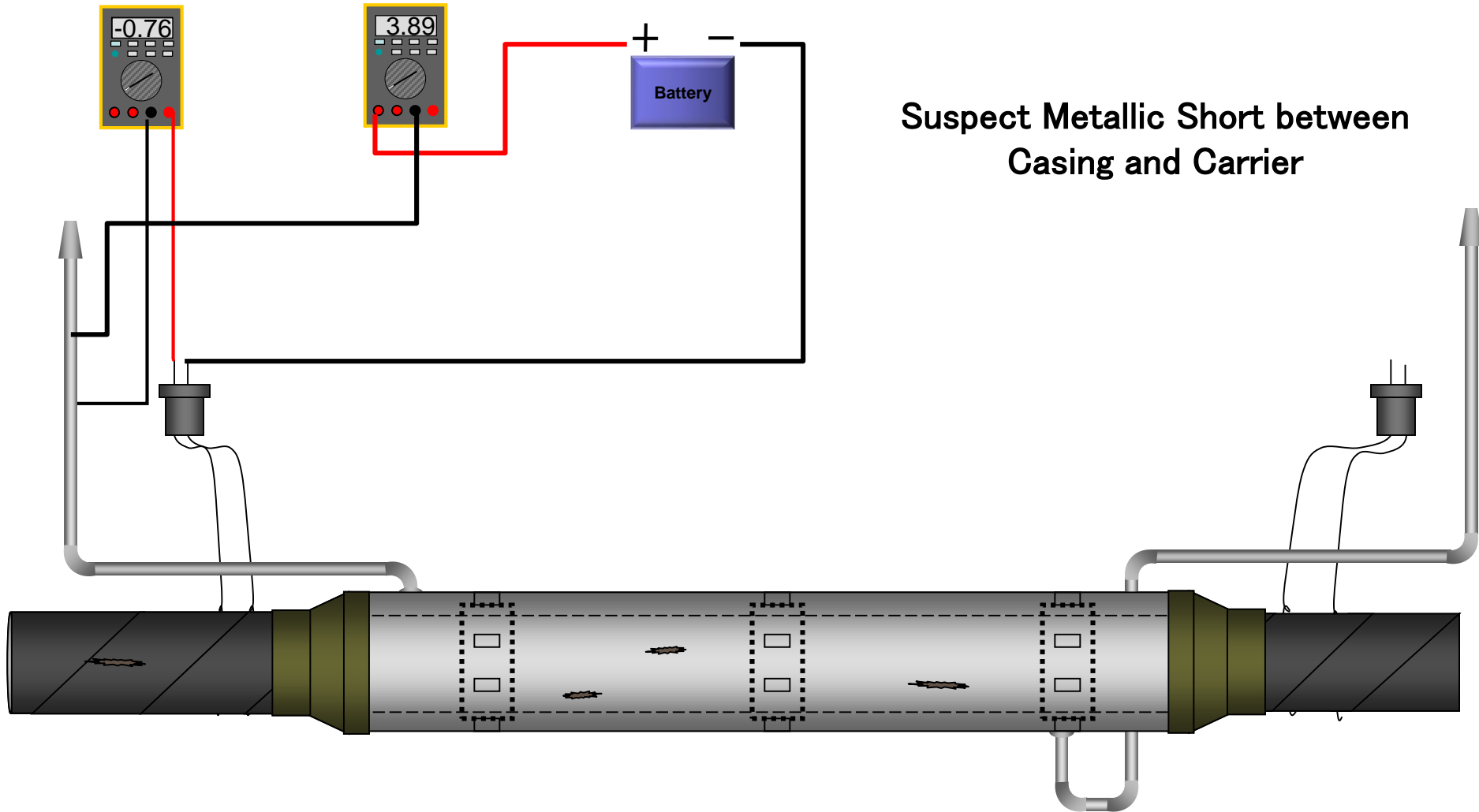




I	On	Off	$\Delta V$	$\Omega$
1.28	- 1.02	- .05	0.97	.75

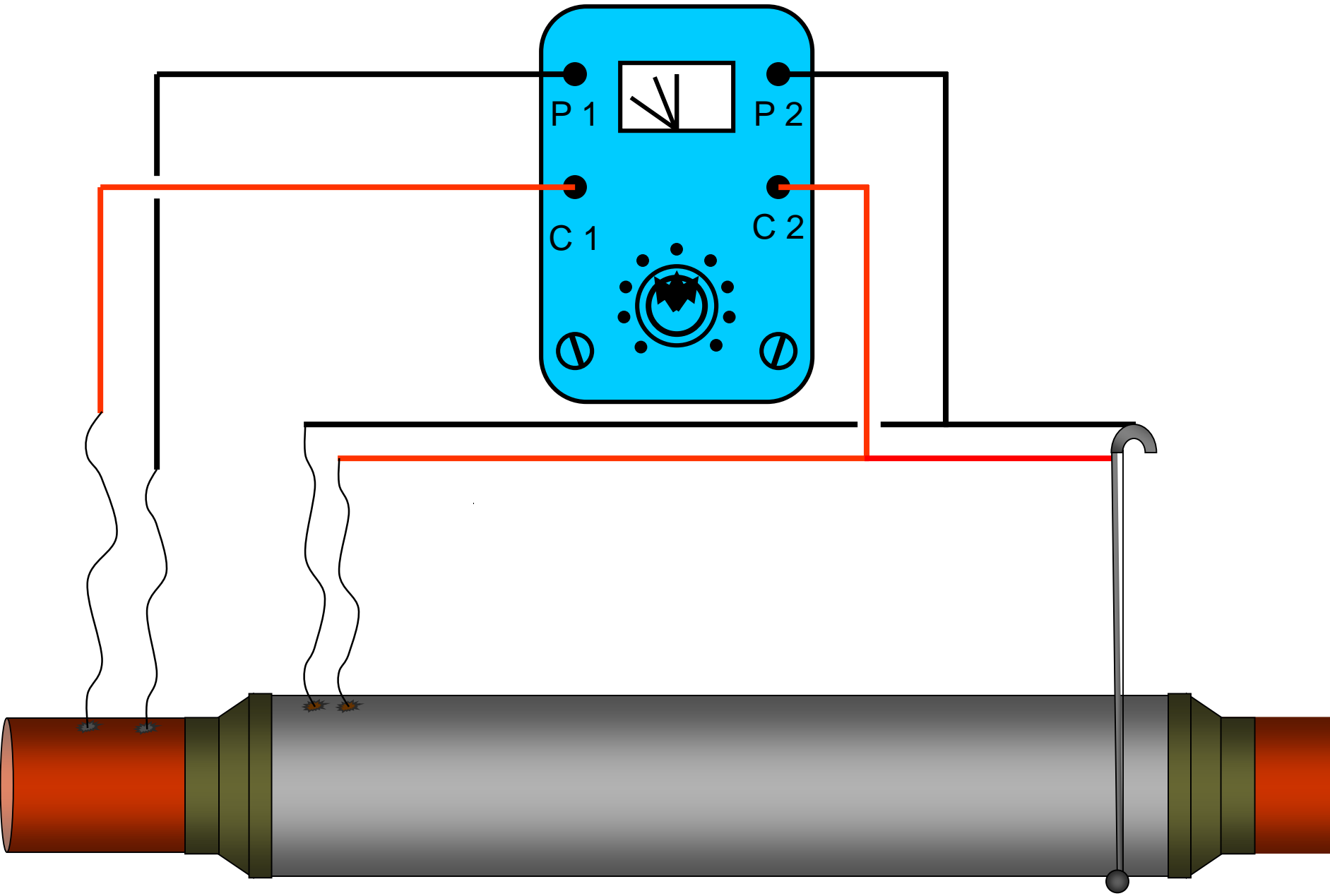
Shorted





I	On	Off	$\Delta V$	$\Omega$
3.89	- 0.76	- .03	0.73	.18

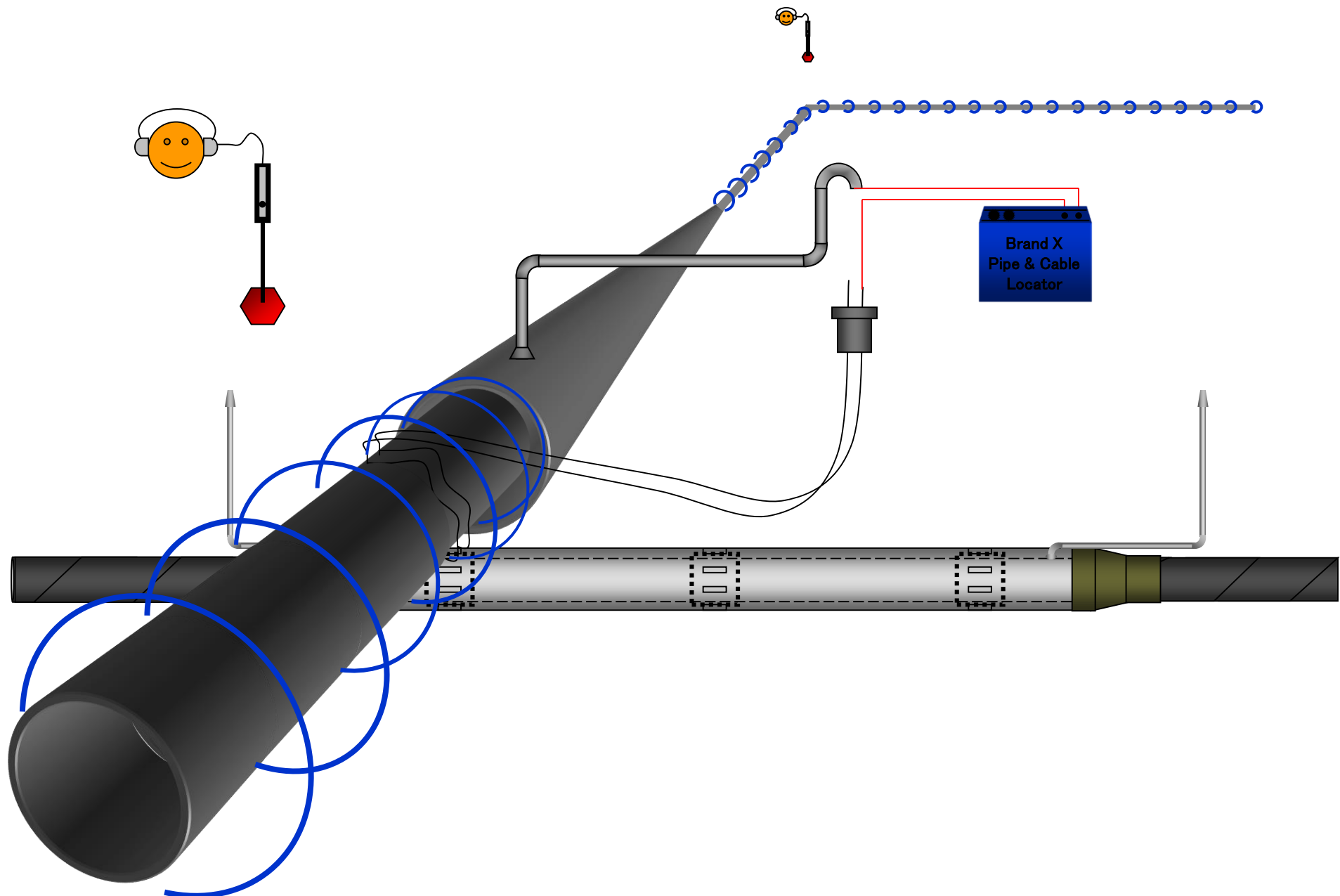
# Soil Resistivity Meter



# Signal Locator

Application of a signal locator between the casing and the pipeline. A signal that is greatly reduced or lost, may indicate a metallic short. Application of a signal locator between the casing and the pipeline that is maintained along the pipeline indicates a cleared crossing.



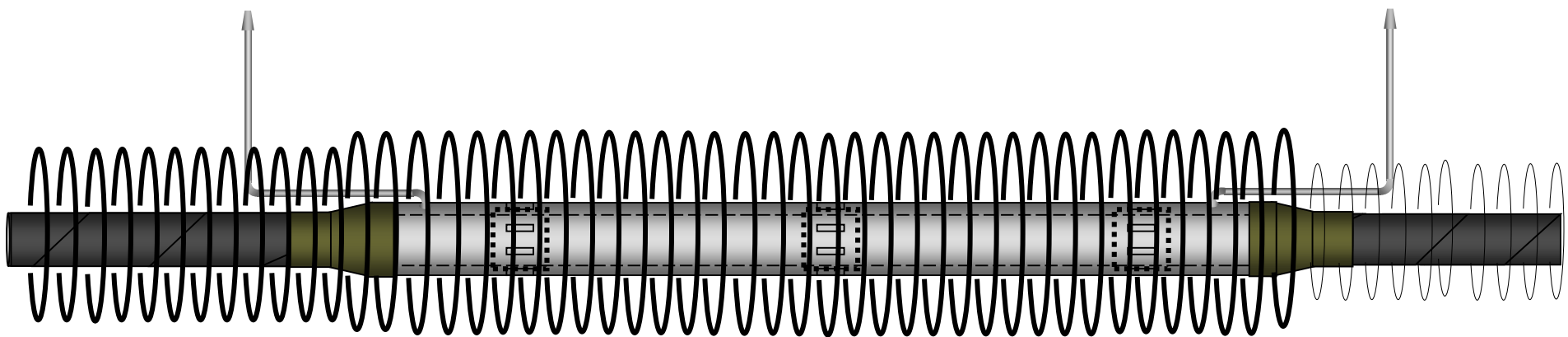
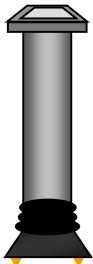


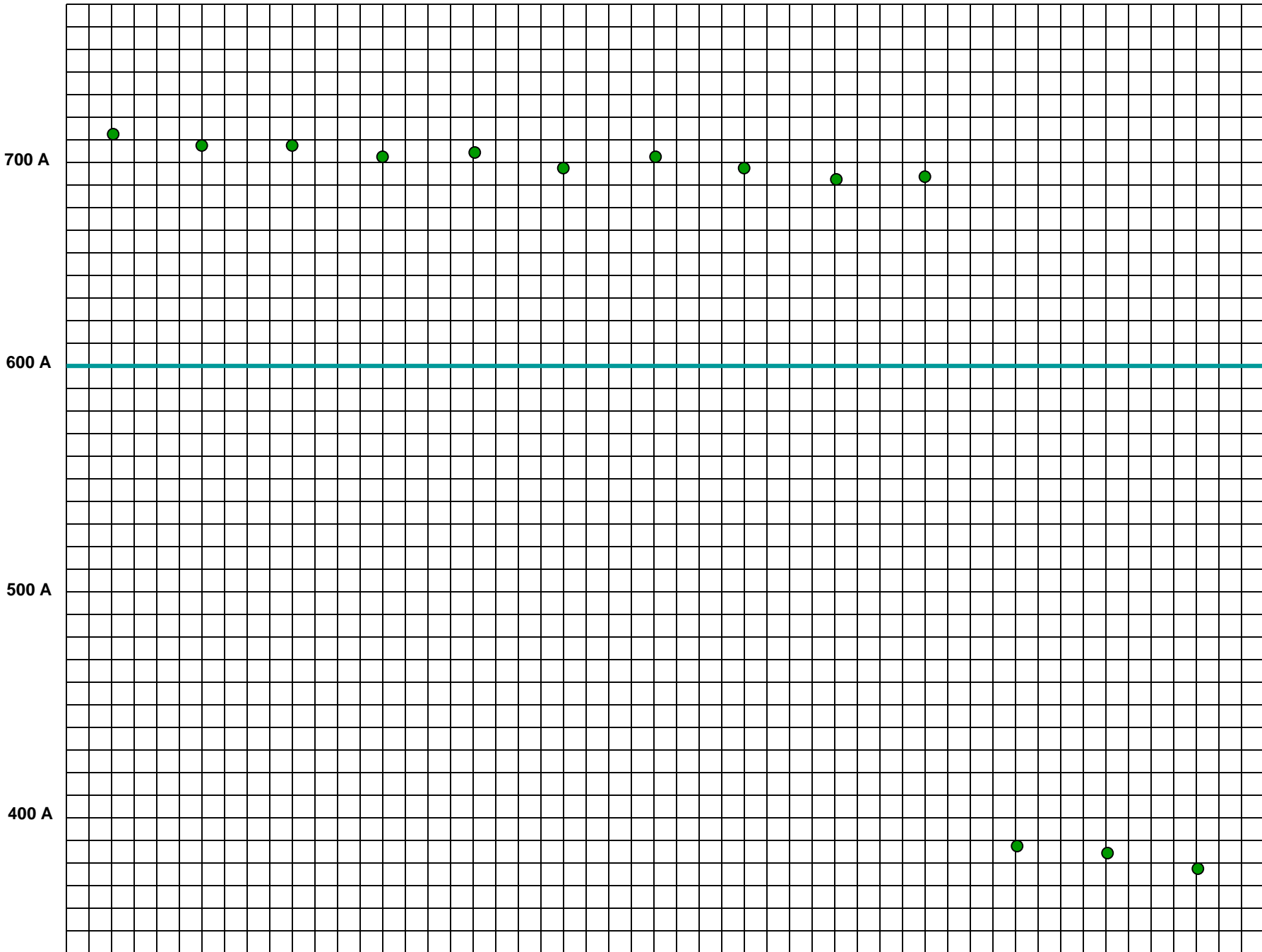


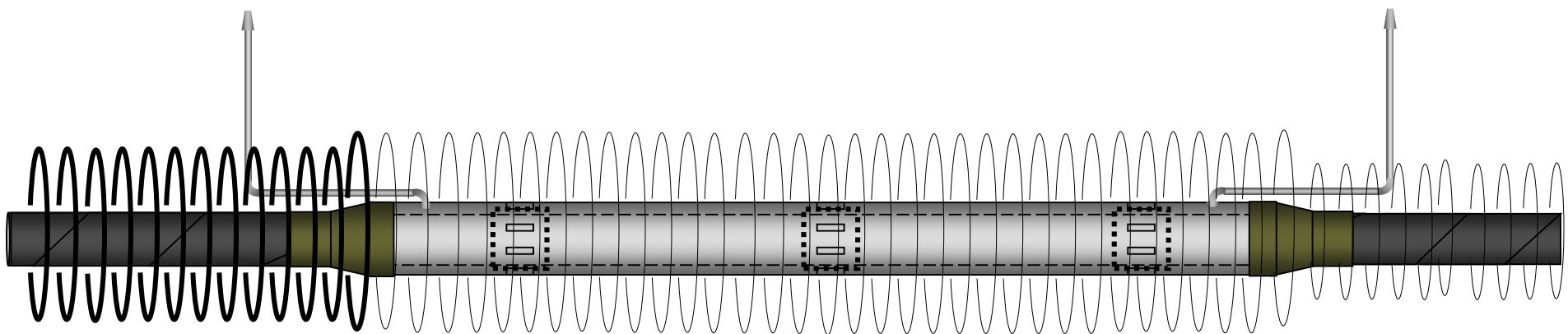
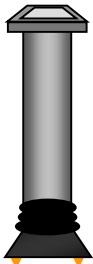




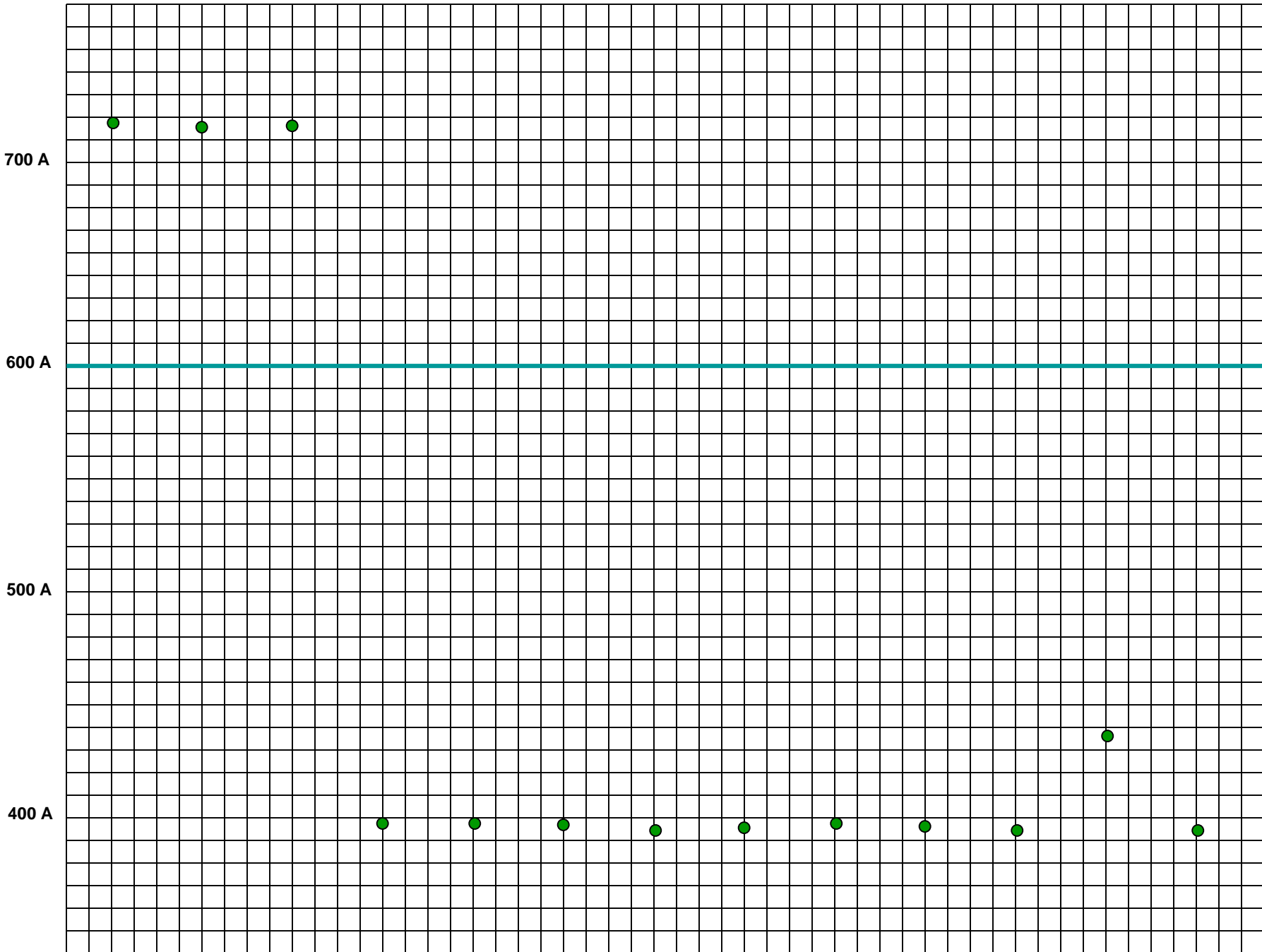


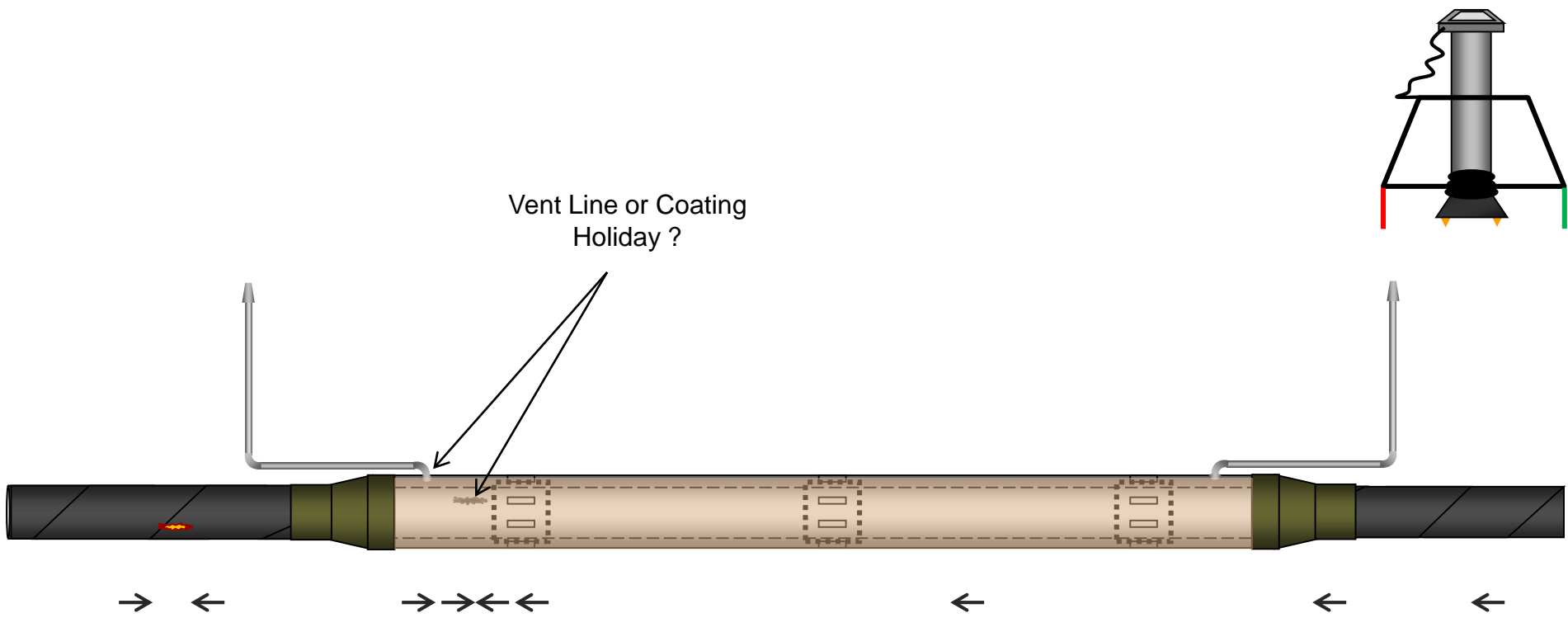






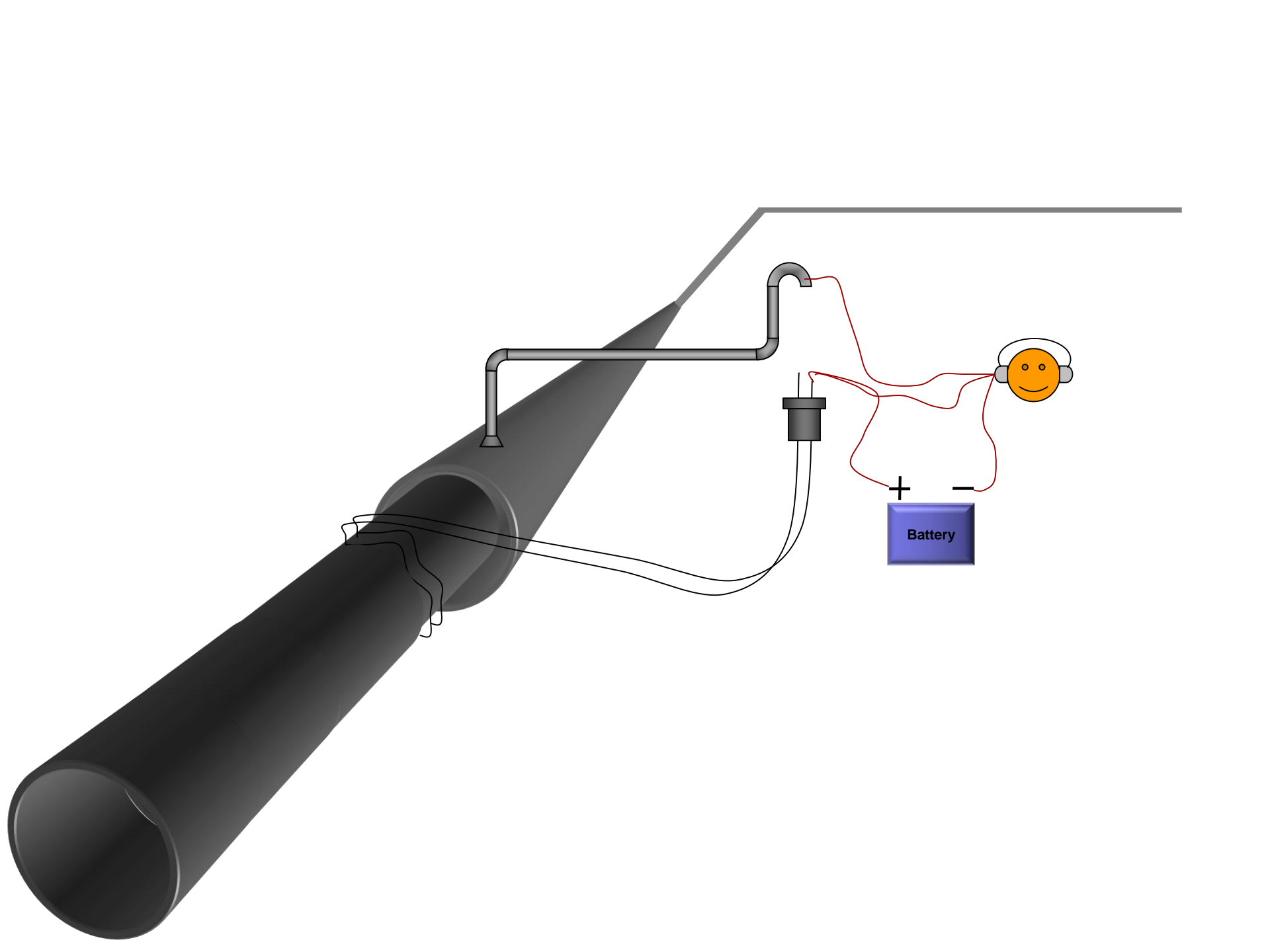






# Head-Set

Connecting a head-set between the casing and the pipeline will present an audible tone. Tone indicates a voltage potential which may indicate a cleared casing or an electrolytic condition. Lack of an audible tone may indicate a metallic short.





Smith Street Casing  
10 " Coal Tar Coating  
Bare Steel 12" Casing







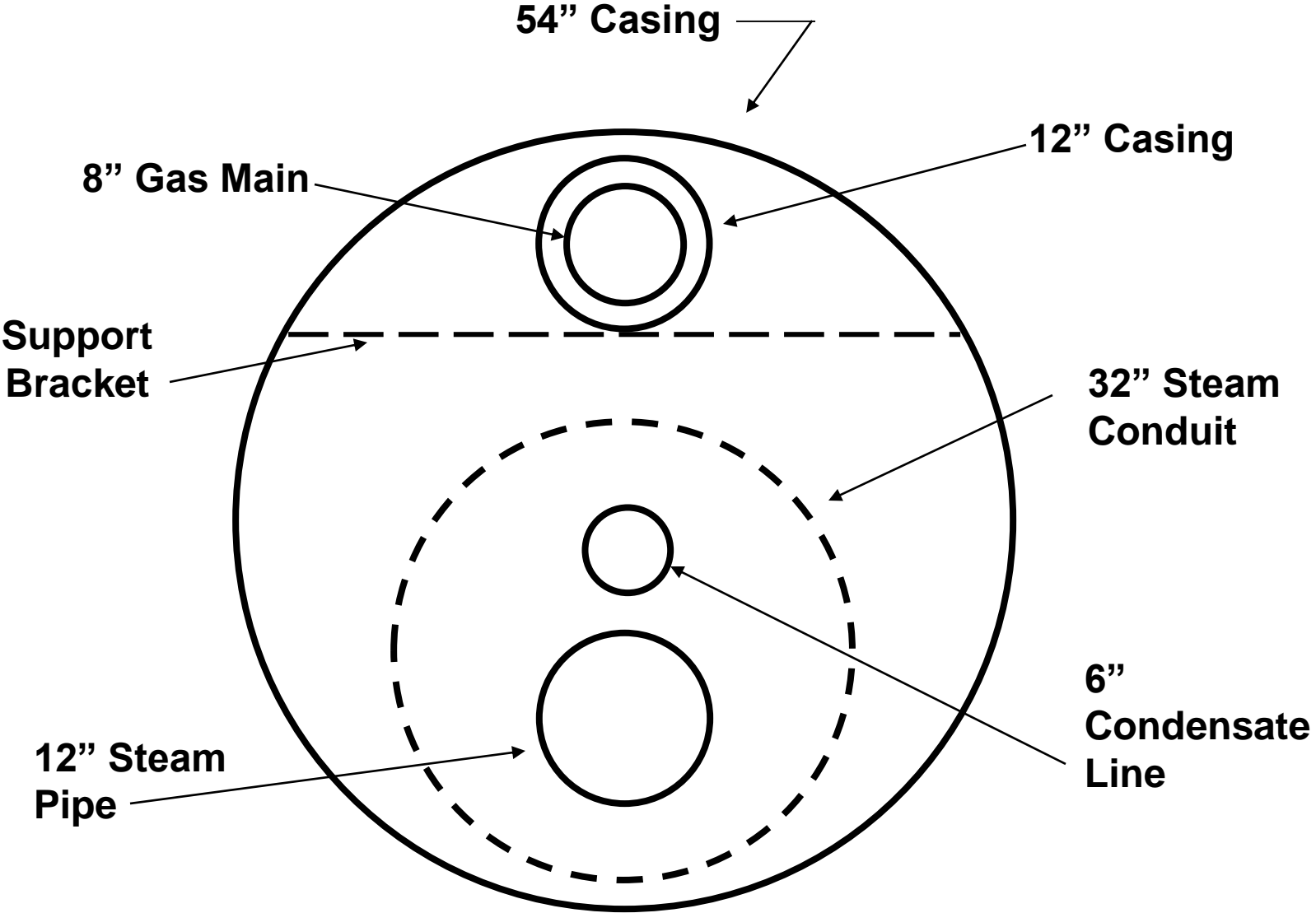
Gas Main 90 ° at top

Gas Main 90 ° at bottom

Steam Conduit 170 °

Ground Water 120 °











2510-35M





