FAULT FINDING ON .681

ELLA CEDARHOLM, WHOI

ROCHESTER
0.681
POWER OPTIC
KTUBE
A309063

ESTER

R OPTIC

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- THREE COPPER POWER
- TWO FIBER STEEL LIGHT
- ONE *UNINSULATED* KTUBE

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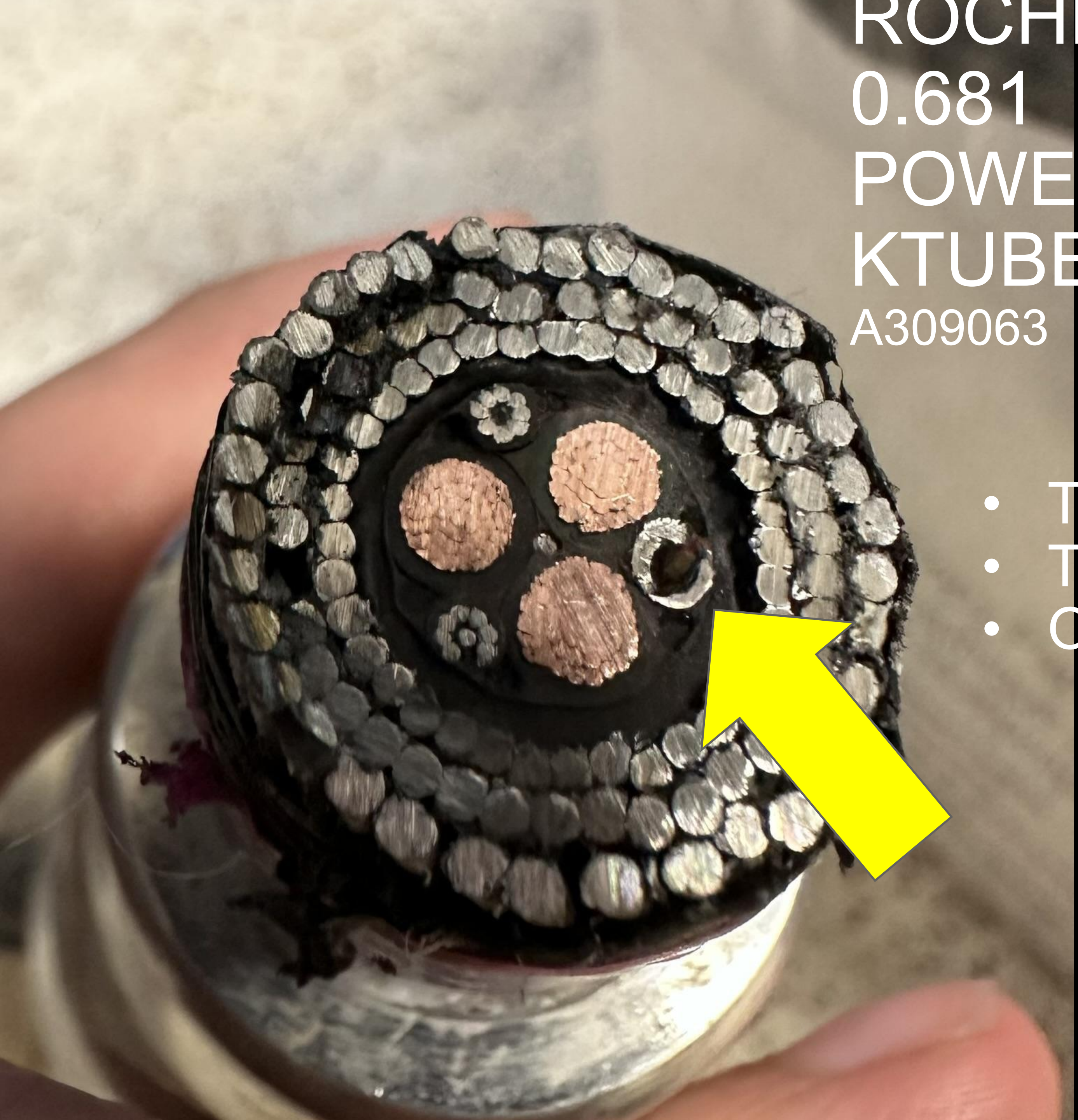

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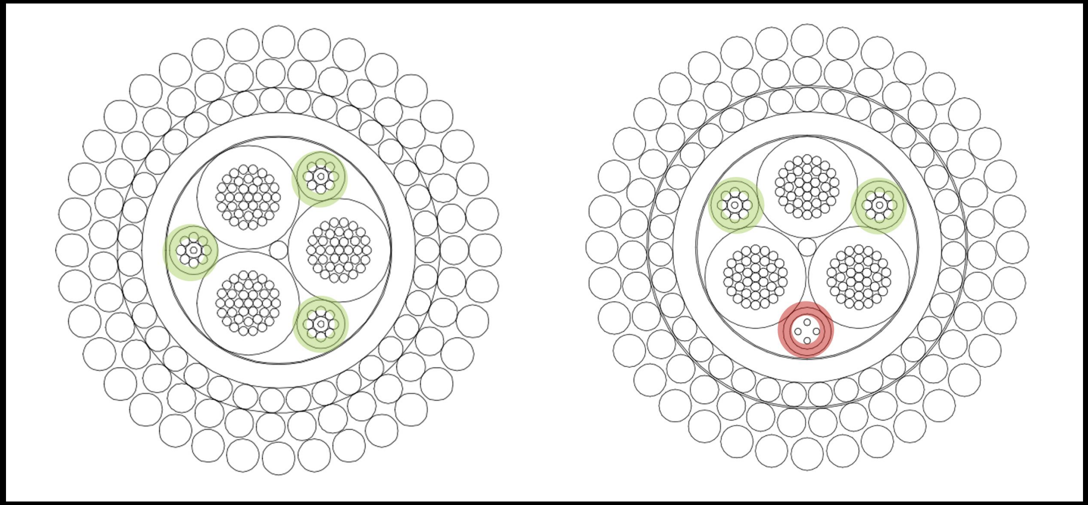

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TWO REELS IN THE UNOLS FLEET

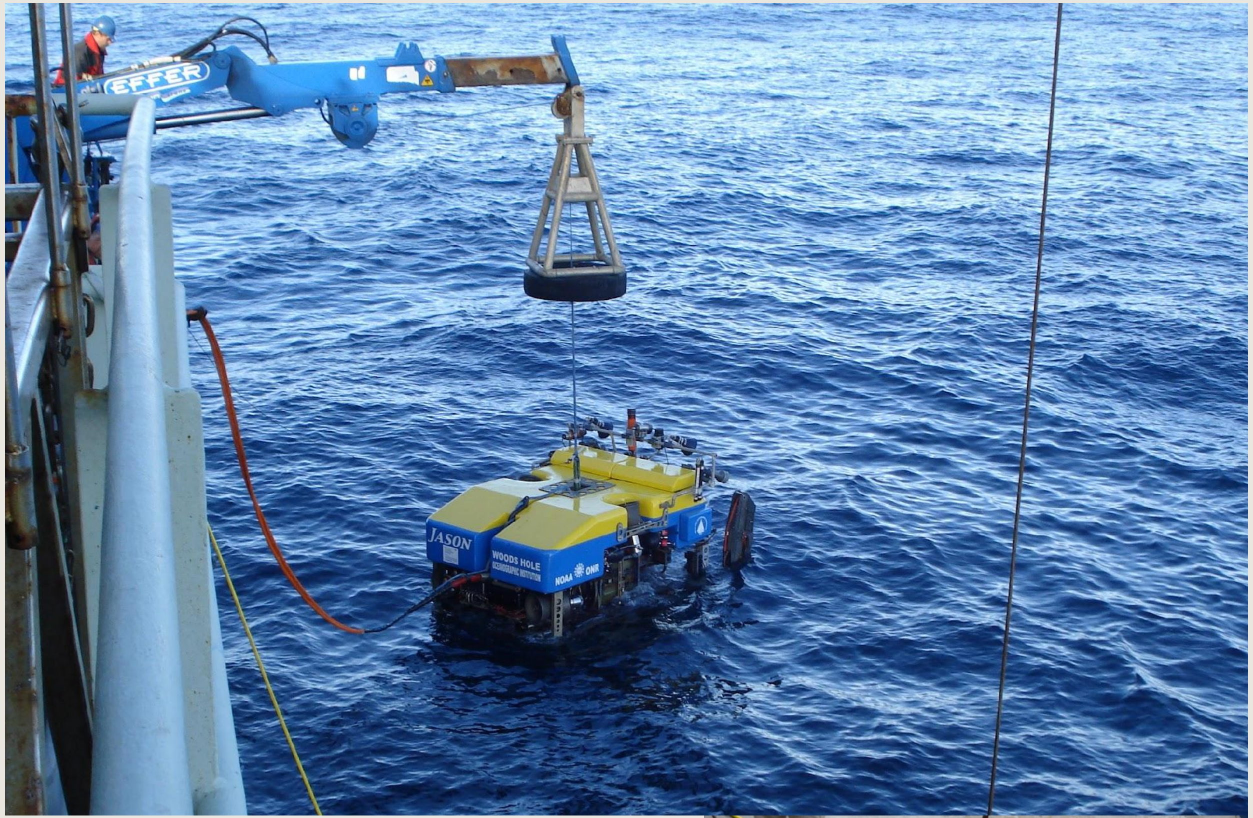
R/V Atlantis

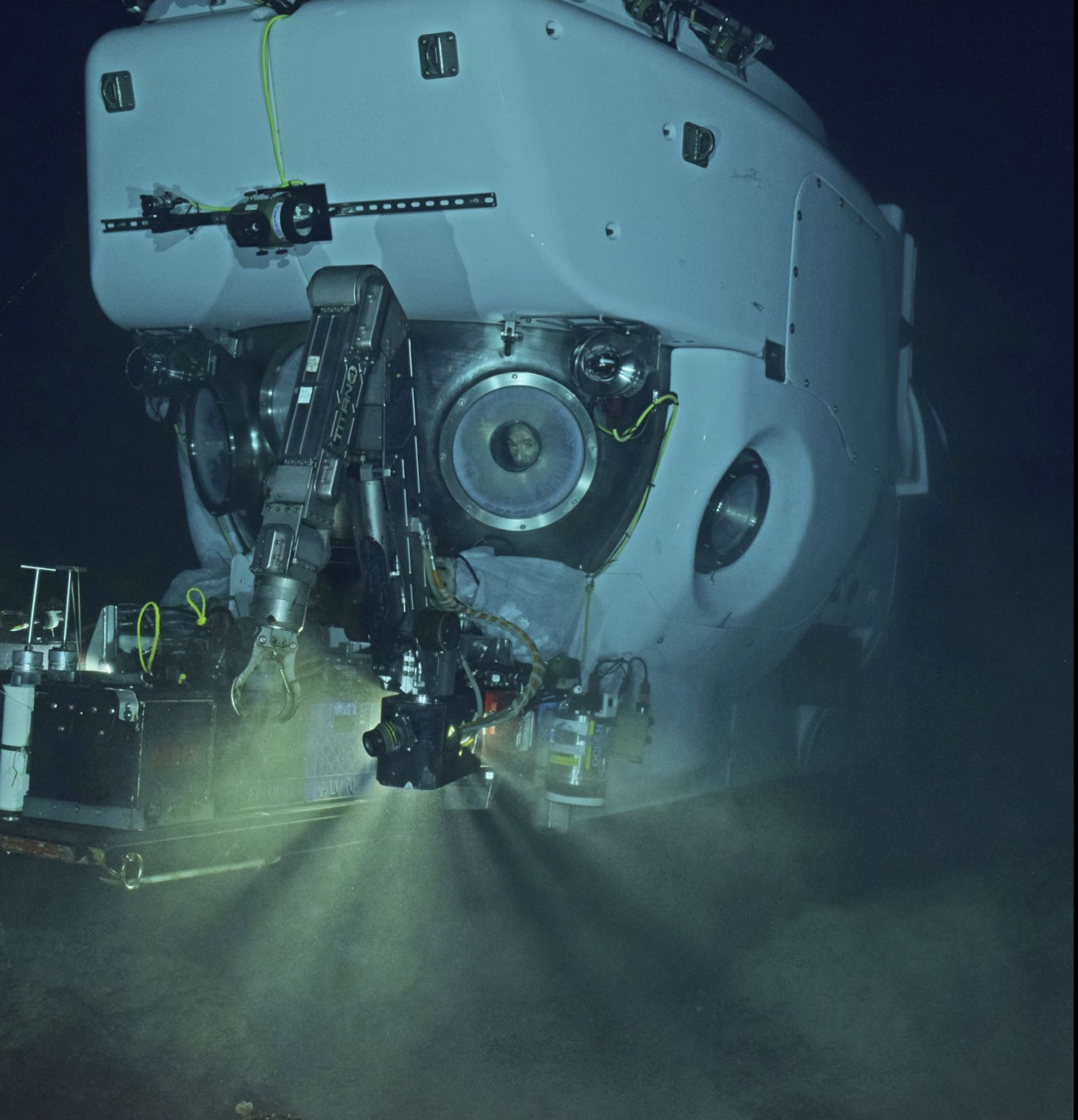
Deep Submergence Laboratory

APPLICATIONS

Remote Operated Vehicles

- **Jason and Medea**
- **Alvin Observation Vehicle**

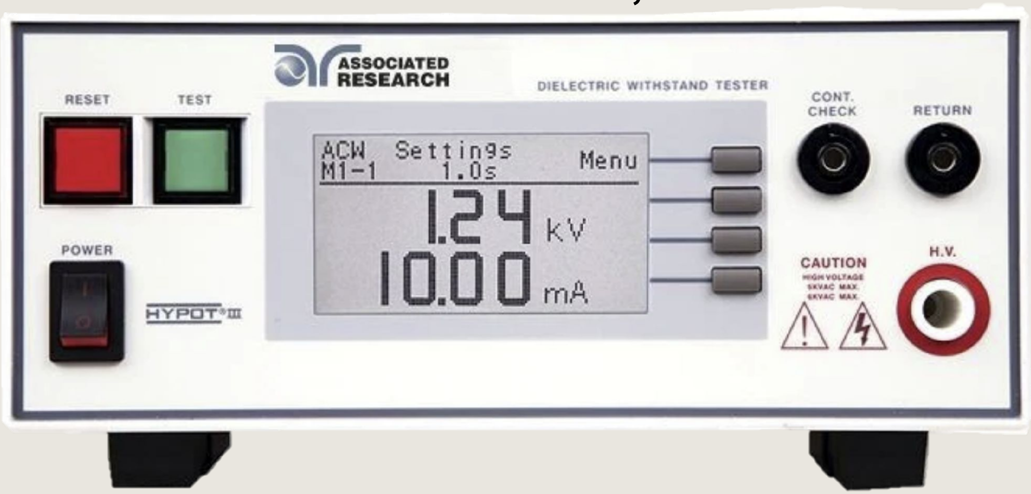




SUMMER 2024
5800M DIVES
IN ALASKA

HIPOT TESTING

Dielectric Withstand Tester, Model 3765

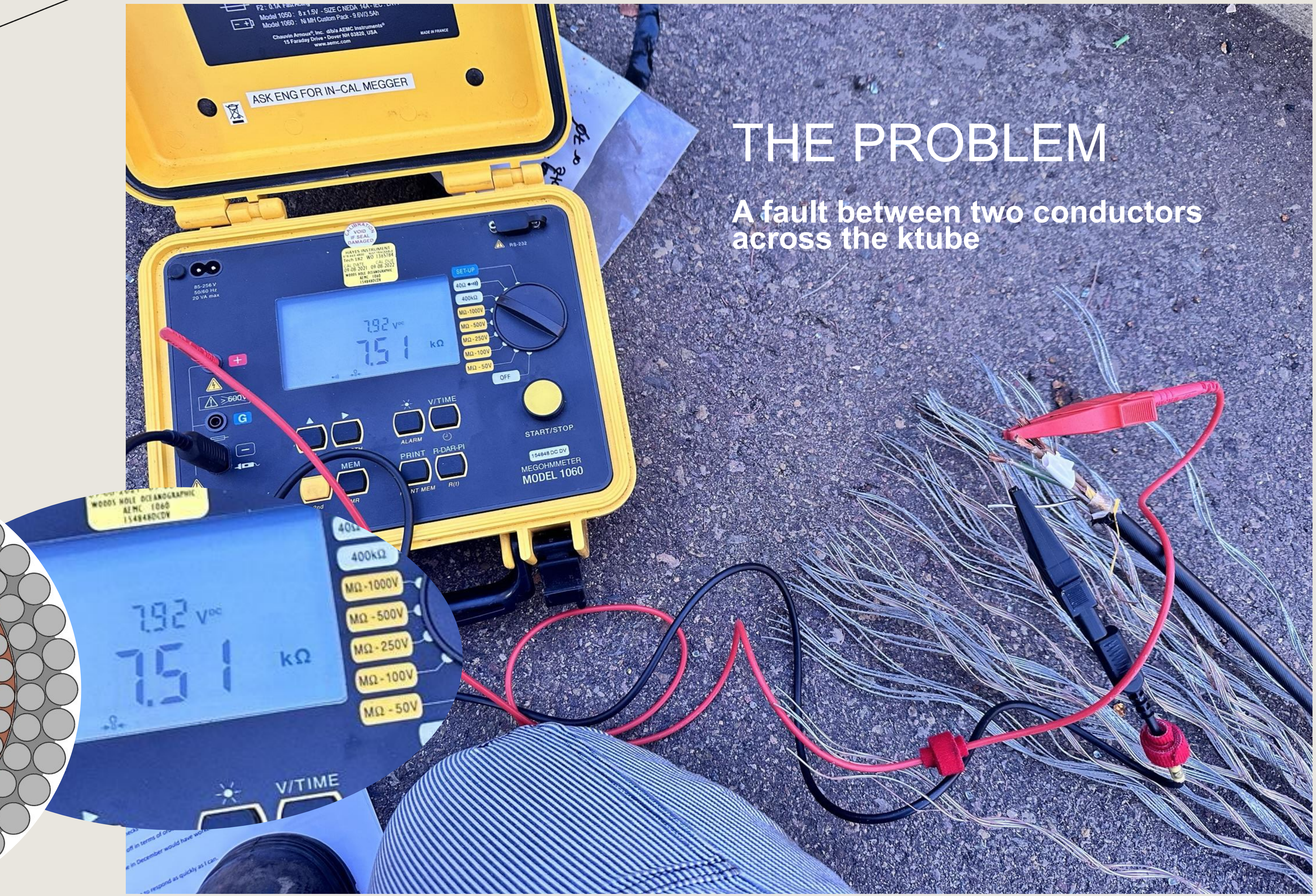


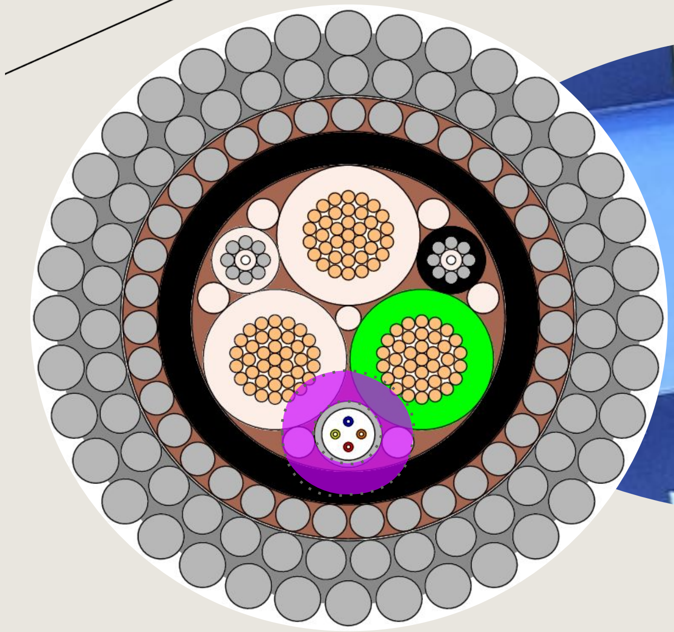
High Potential Voltage Test

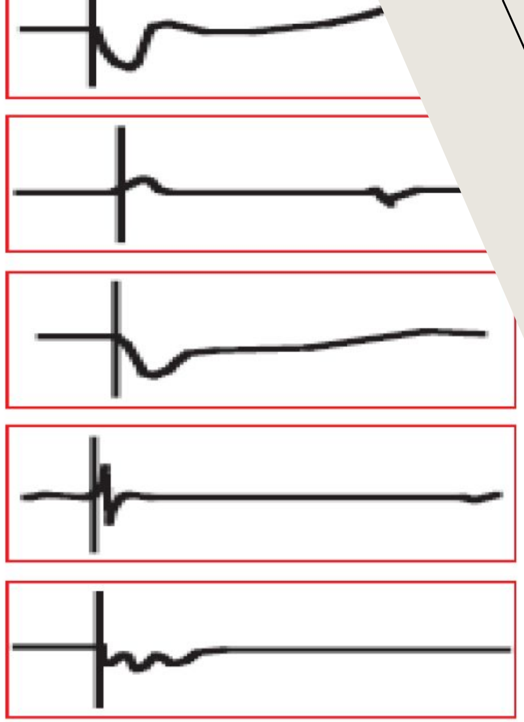
- Voltage rating 2800V
- Leakage cutoff 600mA
- Test one conductor with everything else grounded
- Stresses the dielectric material, can worsen existing insulation problems

THE PROBLEM

A fault between two conductors across the ktube







S

Wa

Long

Use of TDR

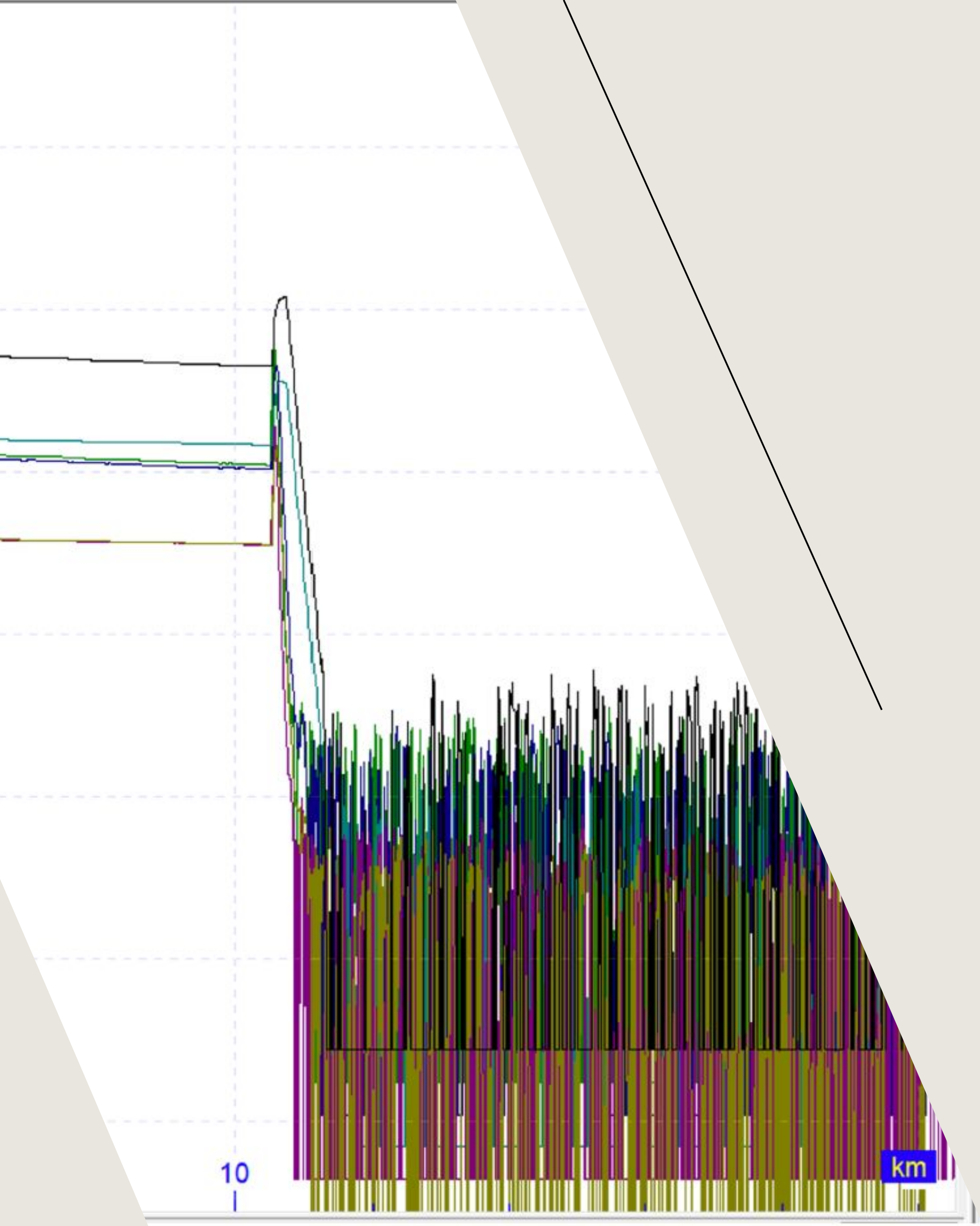
Identify the location of both ends of the cable.

Identify the faulty cable with an insulation tester. If the fault is low resistance, determine the value – a TDR can only identify faults below 200 Ω. An insulation test lowest measurement may only be 10 kΩ so a kilo-ohm range or multimeter may be required to fill in the

TESTING - TDR

Time Domain Reflectometer (TDR)

- Megger TDR2050
- Strength and timing of low voltage pulse reflections
- For controlled impedance cable (coax, ethernet)
- Limited to faults below 200 ohms

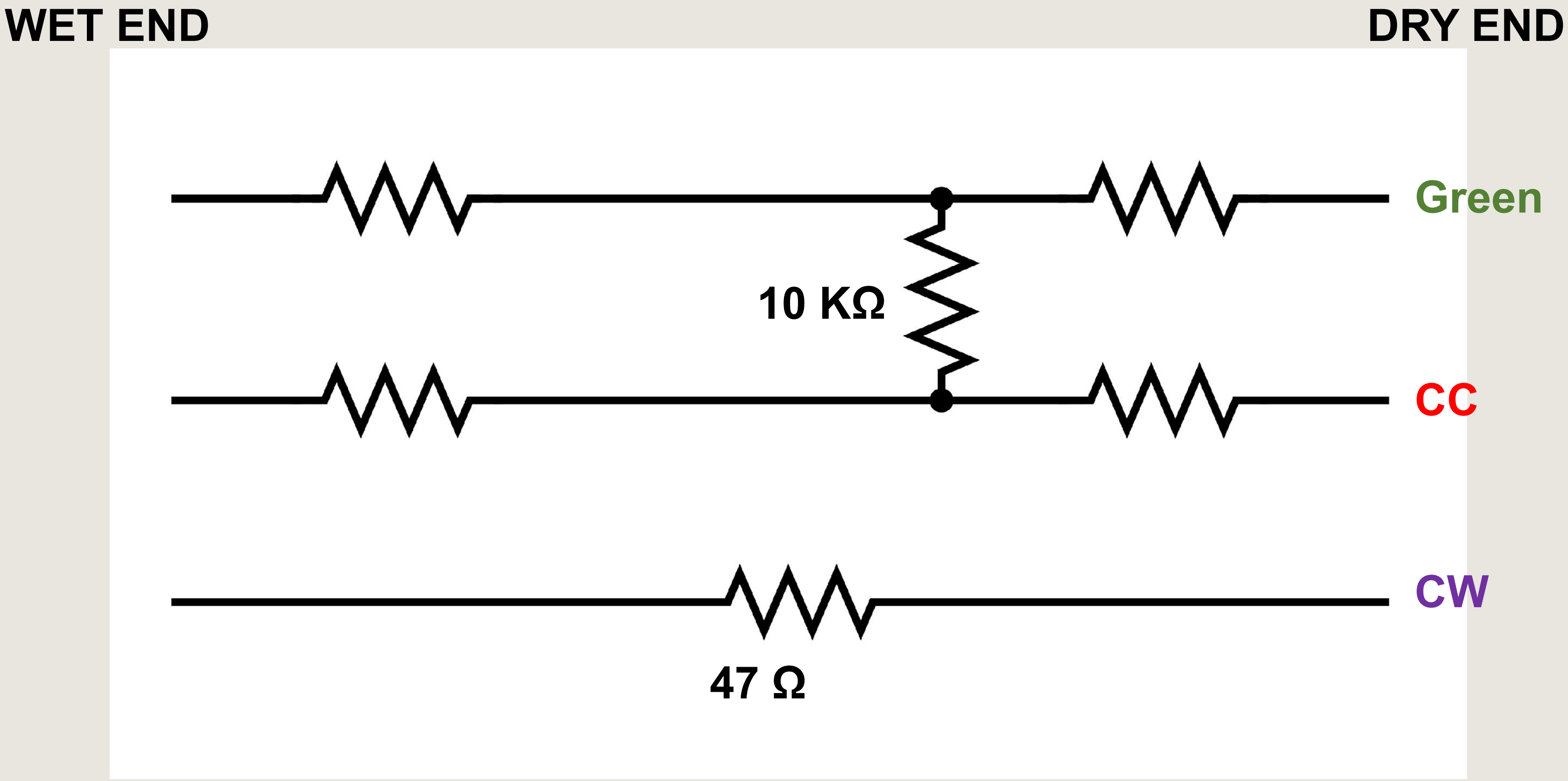


TESTING - OTDR

Optical Time Domain Reflectometer (OTDR)

- Noyes OFL280 FlexTester
- Strength and timing of high-powered light pulse reflections
- No fiber optic damage associated with electrical fault

THE CIRCUIT

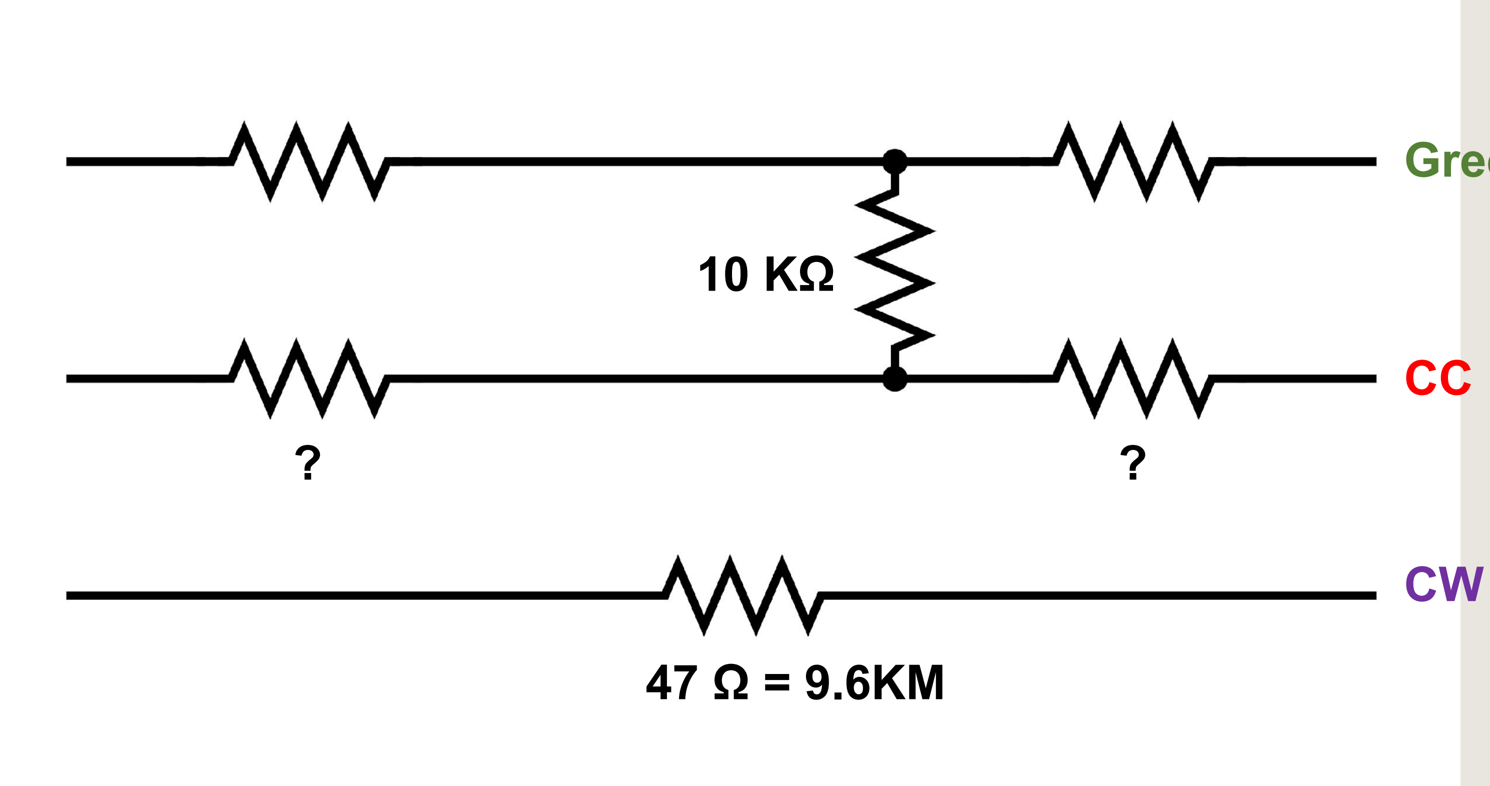


THE CIRCUIT

4.9 Ω / KM

WET END

DRY END



THE CIRCUIT

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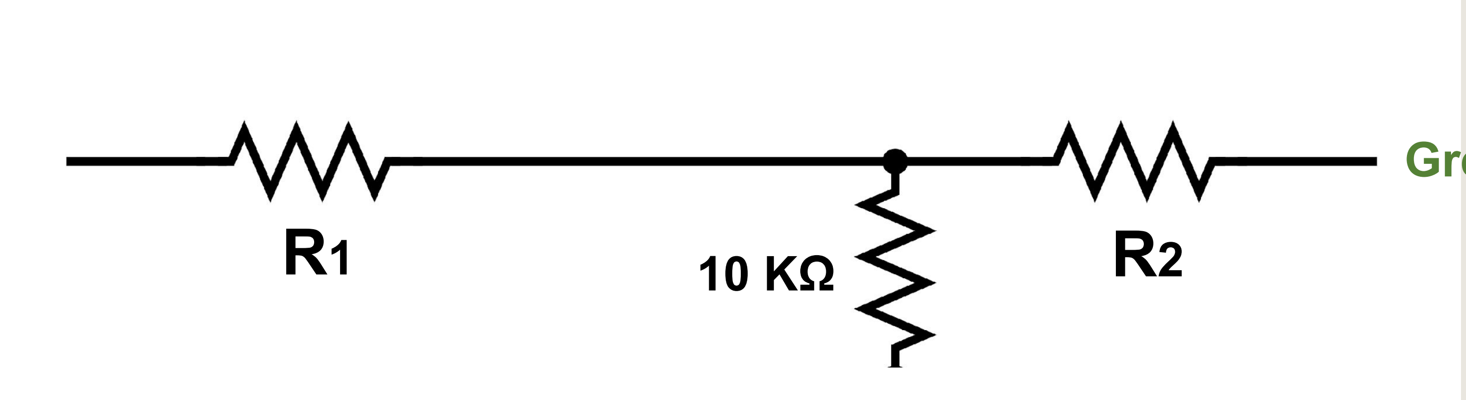
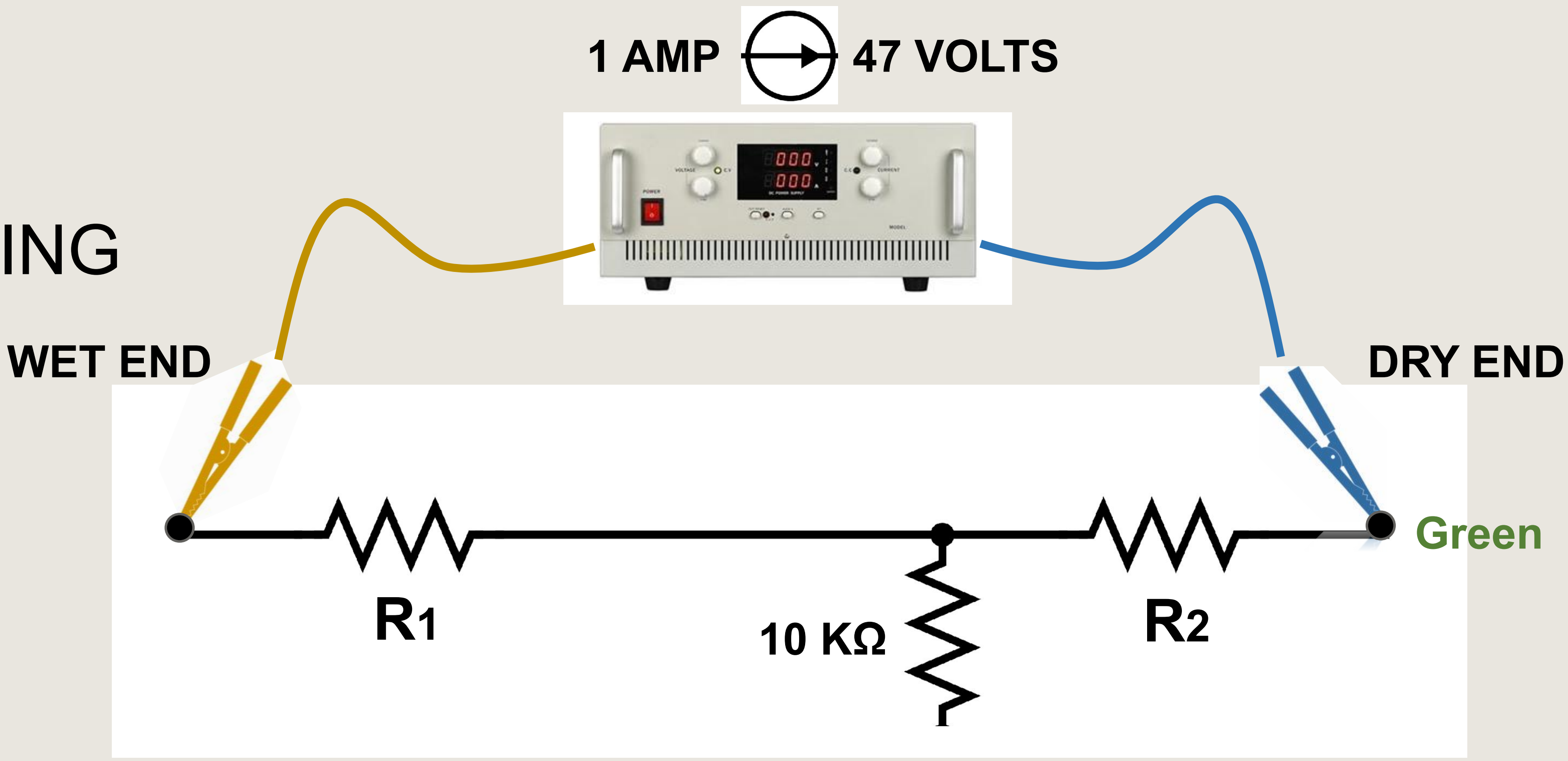


TREAT LIKE A VOLTAGE DIVIDER OR POTENTIOMETER

$$V_{out} = V_{in} * \frac{R_1}{R_1 + R_2}$$

TESTING



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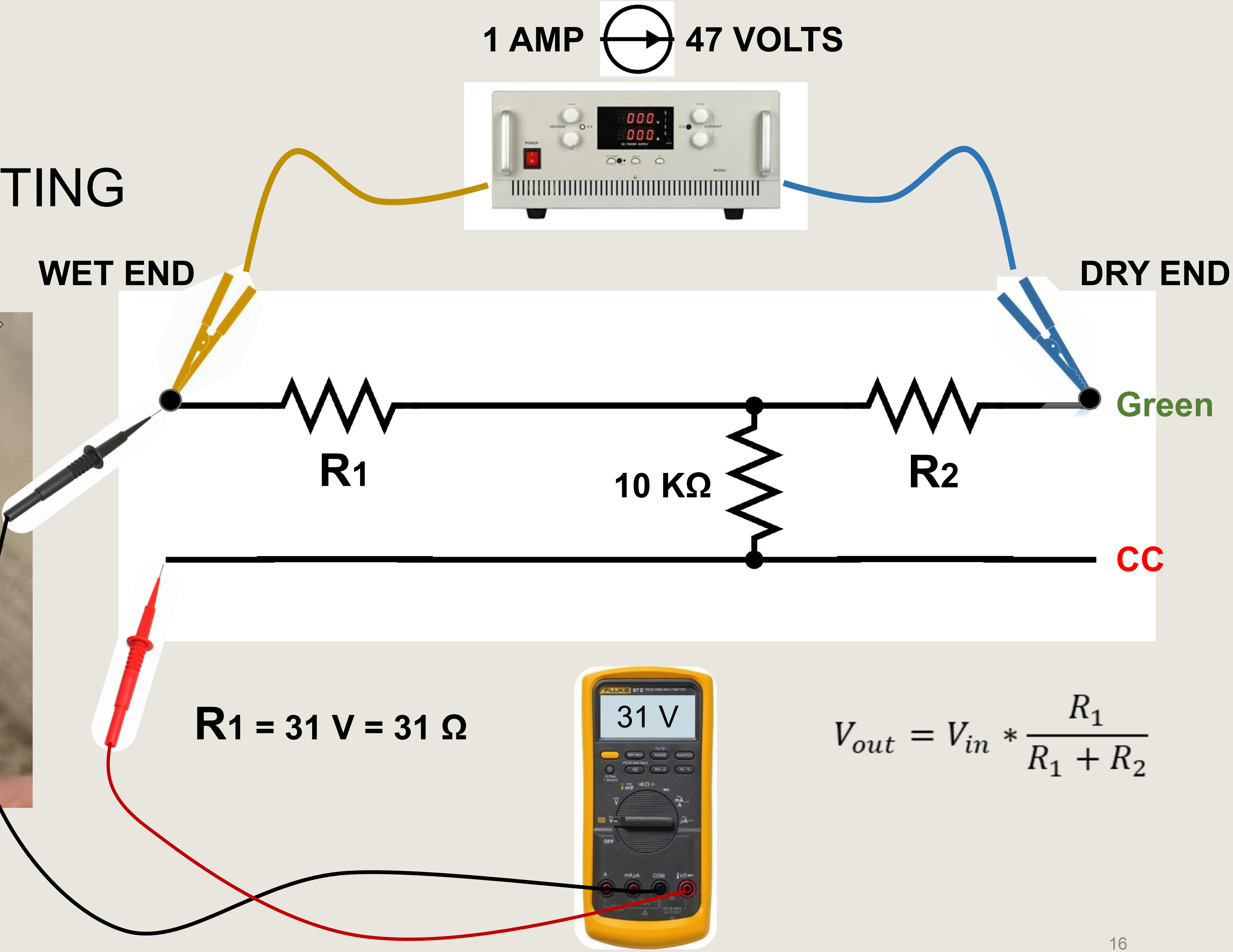


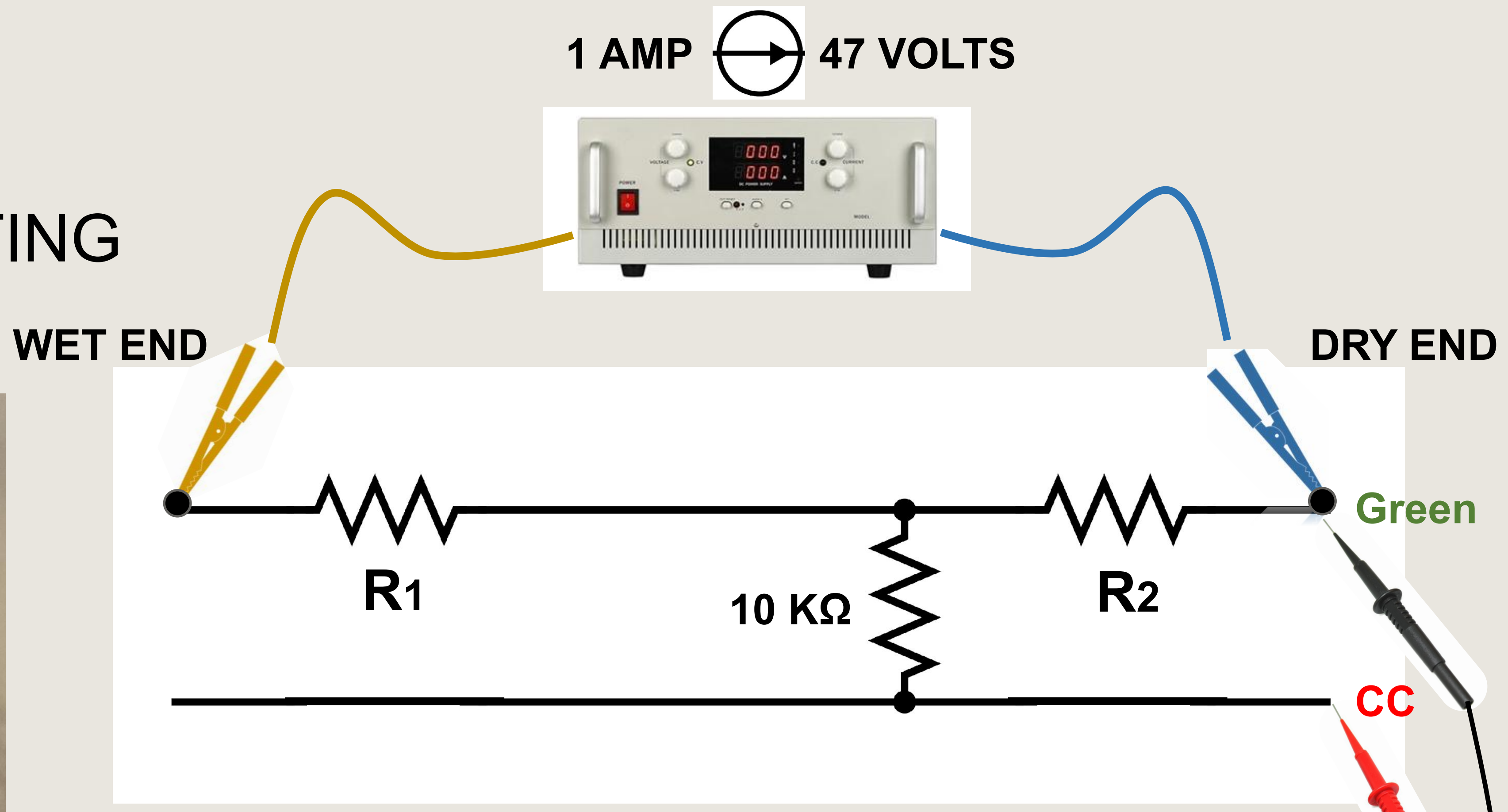
R_1 = 31 V = 31 Ω

$$V_{out} = V_{in} * \frac{R_1}{R_1 + R_2}$$

4.9 Ω / KM

TESTING

4.9 Ω / KM



R_1 = 31 V = 31 Ω

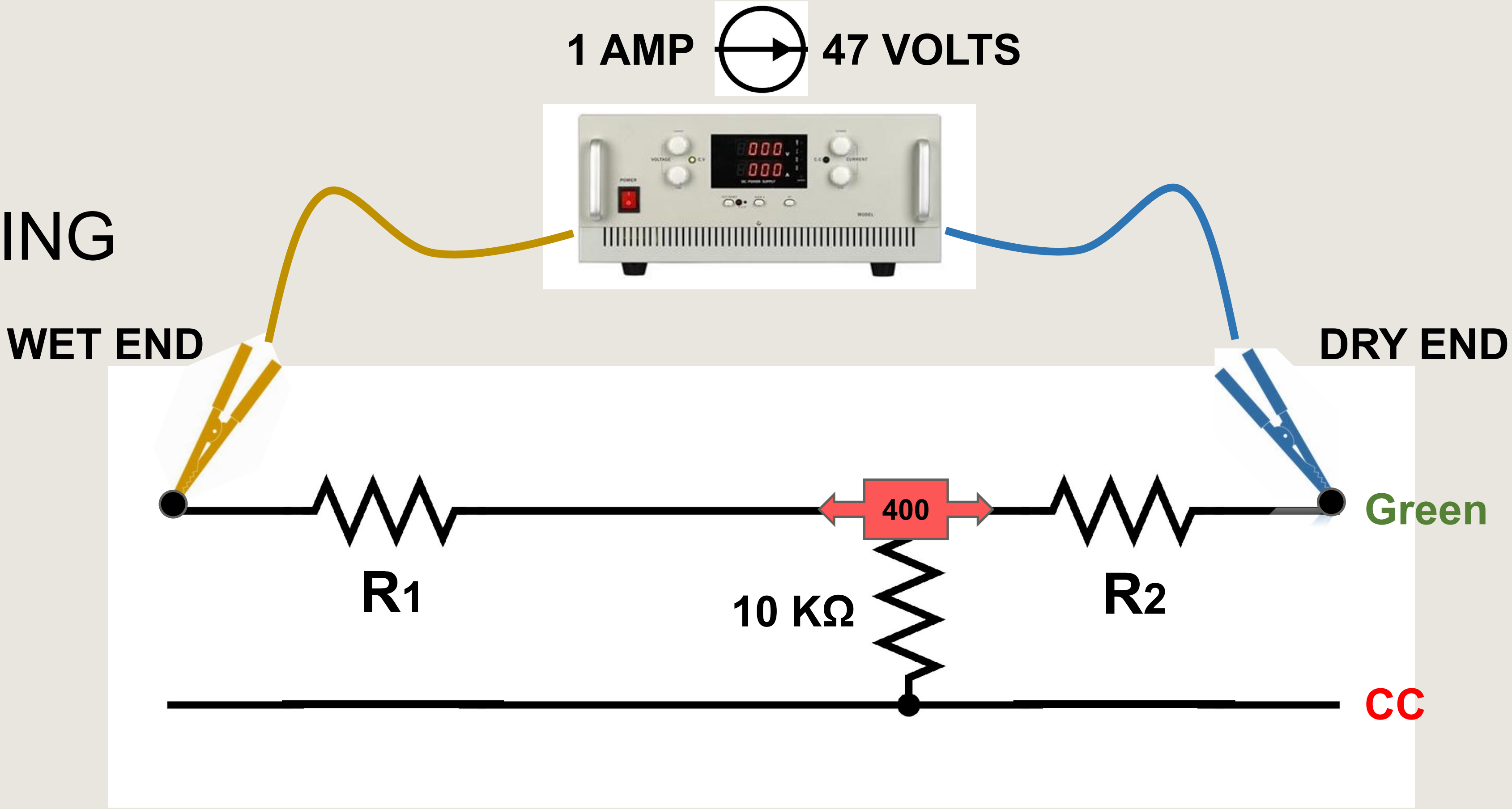
R_2 = 14 V = 14 Ω

45 V = 45 Ω

$$V_{out} = V_{in} * \frac{R_1}{R_1 + R_2}$$

TESTING

4.9 Ω / KM



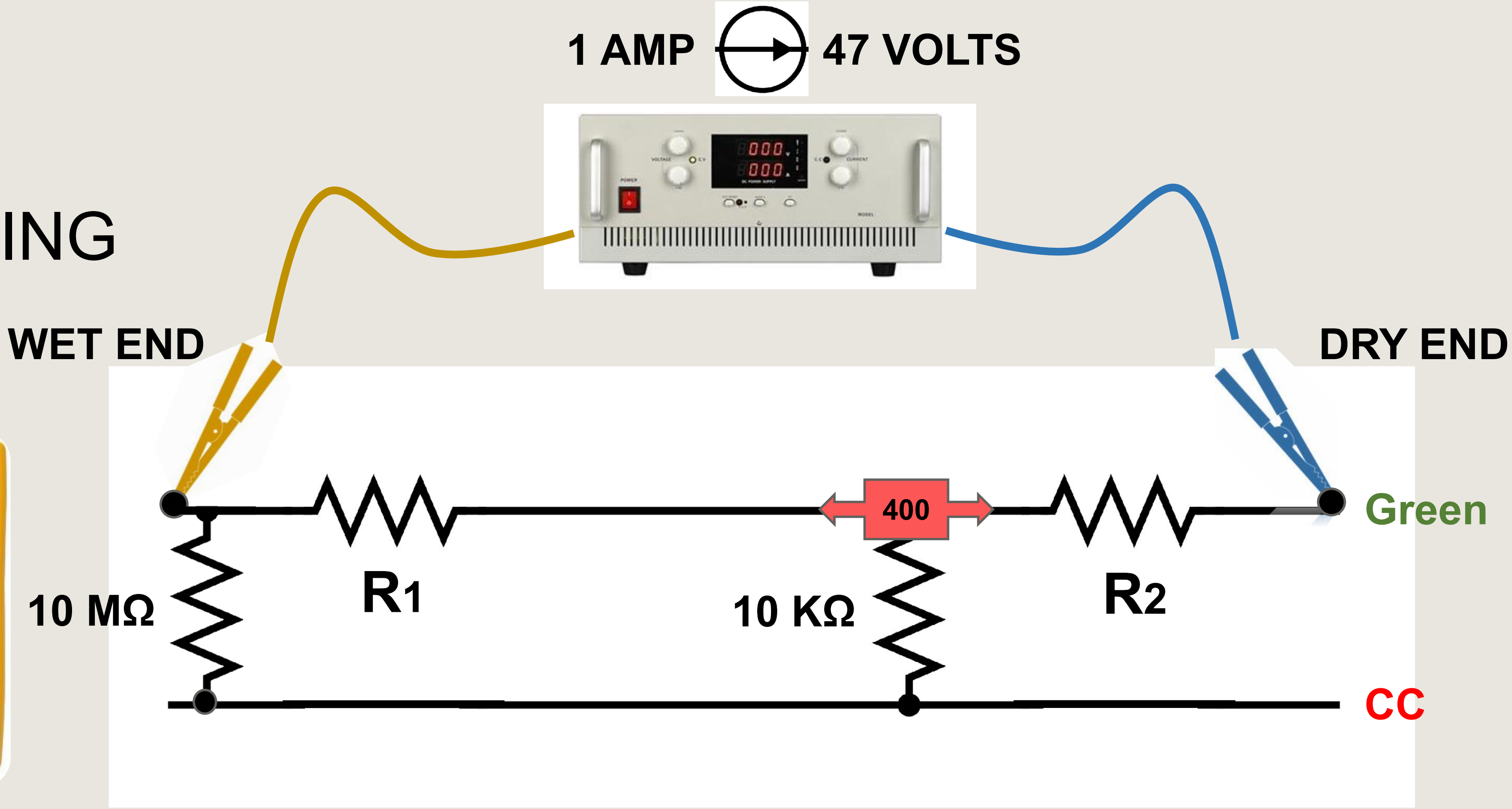
R_1 = 31 V = 31 Ω = 6.3 KM

R_2 = 14 V = 14 Ω = 2.9 KM

9.6 - 9.2 KM = 400M

$$V_{out} = V_{in} * \frac{R_1}{R_1 + R_2}$$

TESTING

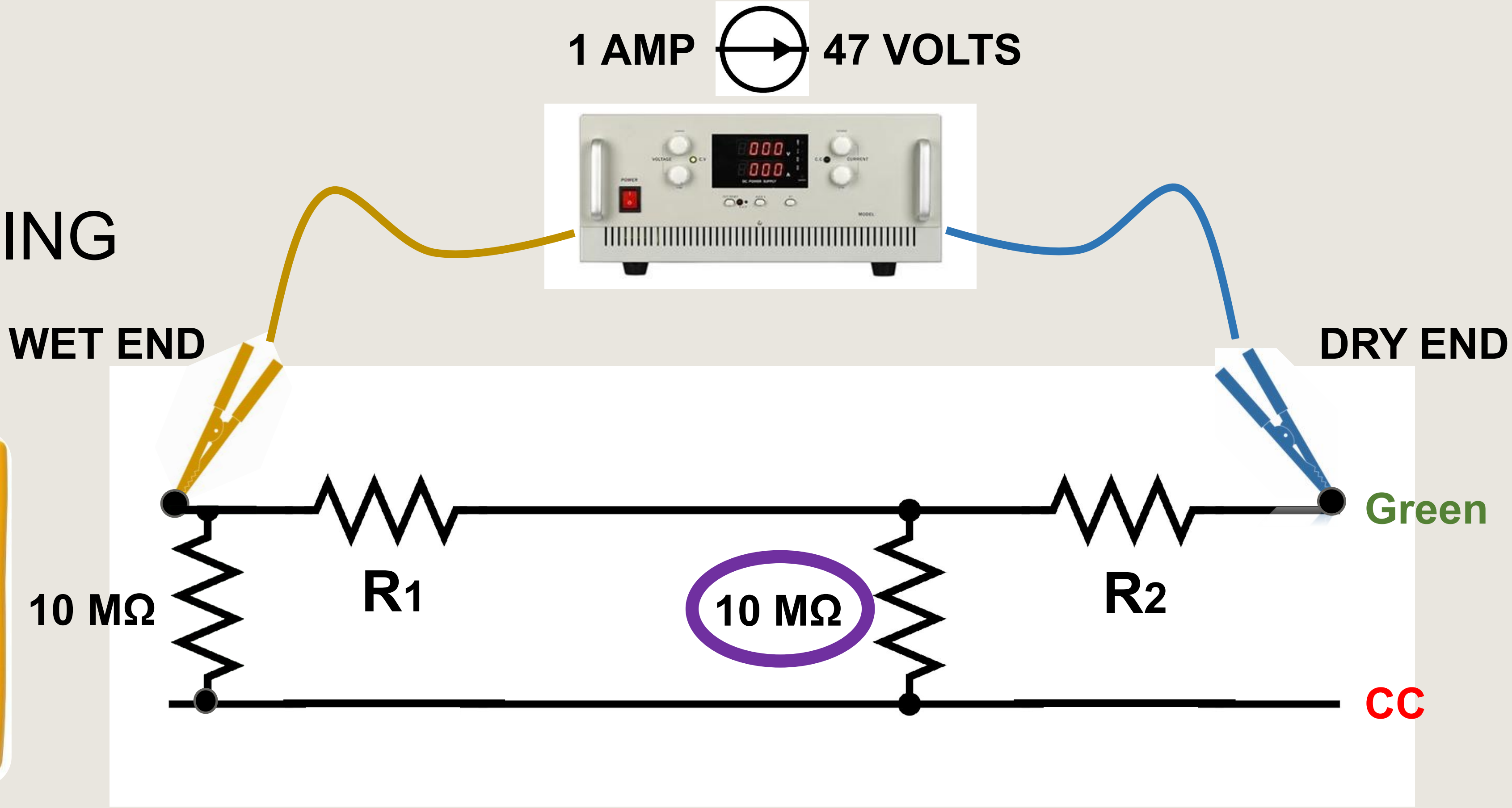


WHAT ARE THE LIMITS OF THIS TEST?
THERE ARE ACTUALLY TWO VOLTAGE DIVIDERS.

$$V_{out} = V_{in} * \frac{R_1}{R_1 + R_2}$$

$$V_{measured} = V_{out} * \frac{R_{voltmeter}}{R_{fault} + R_{voltmeter}} \rightarrow V_{measured} = V_{out} * \frac{10\ M\Omega}{0.01\ M\Omega + 10\ M\Omega} = V_{out} * 0.999$$

TESTING



WHAT ARE THE LIMITS OF THIS TEST?
THERE ARE ACTUALLY TWO VOLTAGE DIVIDERS.

$$V_{measured} = V_{out} * \frac{10M\Omega}{10M\Omega + 10M\Omega} = V_{out} * 0.5$$

$$V_{measured} = V_{out} * \frac{R_{voltmeter}}{R_{fault} + R_{voltmeter}}$$

THE LIMIT

$$V_{measured} = V_{out} * \frac{10M\Omega}{1M\Omega + 10M\Omega} = V_{out} * 0.91$$

SOLUTION – CUT THE CABLE MIDSPAN

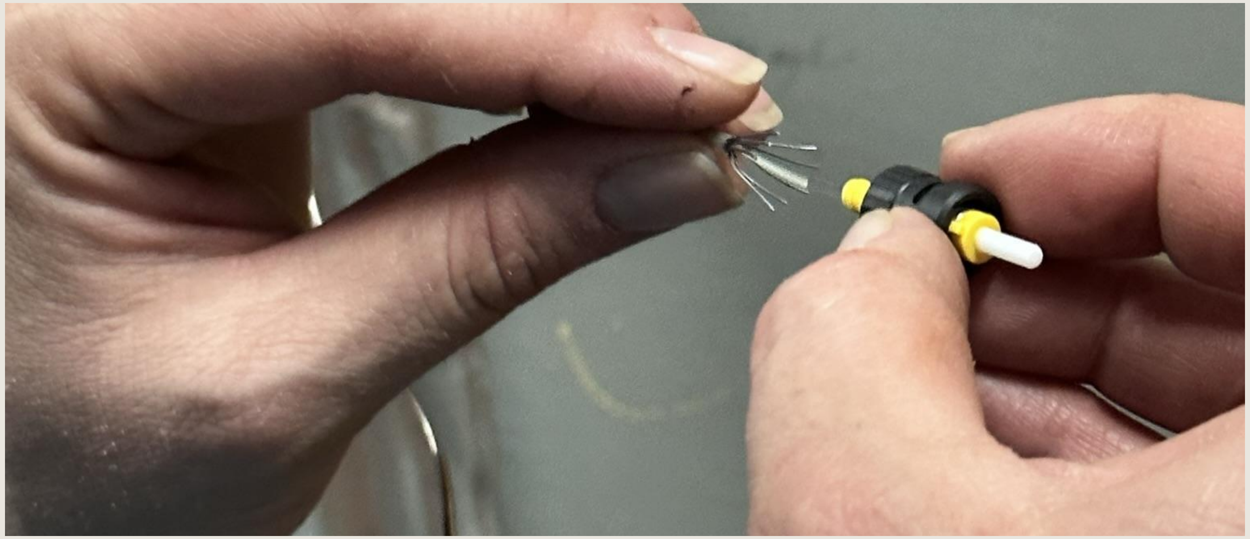
SPOOLED OFF 6.5KM

TESTED AGAIN, CUT ANOTHER 200M

SPOOLED OFF THE REMAINING 3KM

SPOOLED THE GOOD CABLE BACK ON

RETERMINATED



SPECIAL THANKS TO:

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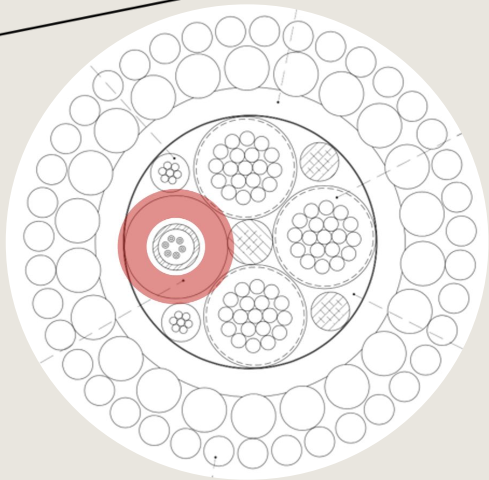
Ana Elmendorf

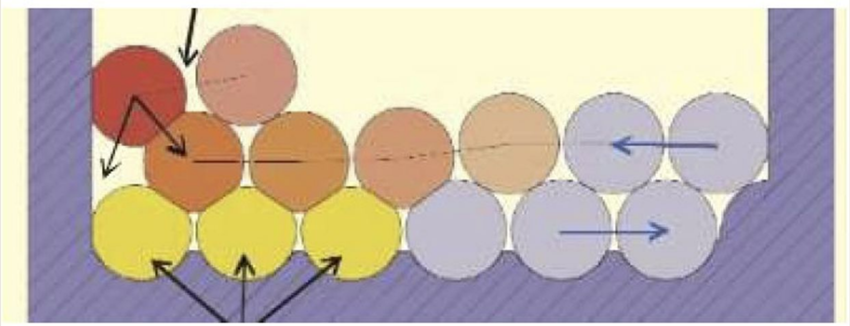
Tom Brown

QUESTIONS/ DISCUSSION

- **What testing options exist for faults >1 MΩ?**
- **When is a TDR the right tool?**
- **What could've caused the insulation damage?**
- **The .681 replacement will likely be Fibron RM0049 with one ktube**



Fibron RM0049



Credit to Lebus Inc.