HAEFELY HIPOTRONICS

MINING EQUIPMENT TESTING

APPLICATION GUIDE

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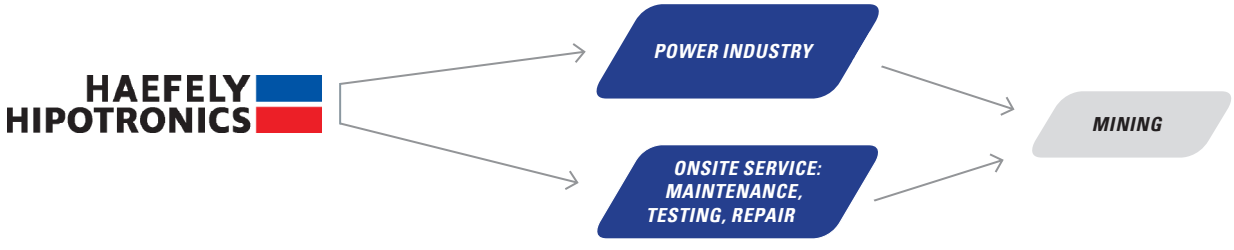
MINING INDUSTRY

Mining facilities are complex environments that require a multitude of electrical apparatus. Each site can use trailing cables, high voltage power cables, switchgear, transformers, as well as full substations and power distribution sites.

Proper maintenance of all electrical power systems is critical to the operation of a mine. The goal is always to minimize downtime, whether electrical maintenance operations are handled internally by a company's service technicians or contracted out to a service company. HAEFELY HIPOTRONICS' rugged and durable equipment provides the reliability required to maintain a safe and operational mining environment.

MARKET SEGMENTS



PRODUCT LINE OVERVIEW

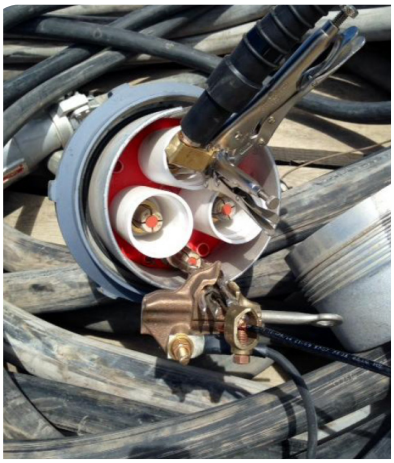
HAEFELY HIPOTRONICS offers a variety of high voltage test and measurement products for the mining industry, from cable fault locators to fully integrated motor test systems. Below are all relevant products for such applications.

TESTS \ PRODUCTS	TDR SERIES	CF SERIES	5250 SERIES	X-WAVE	800 SERIES	5478	MIDAS + 528X	2820a + NK	MTS SERIES
CABLE FAULT PRE-LOCATION	•		•	•					
CABLE FAULT PINPOINTING	•	•	•	•					
CABLE FAULT BURNING		•							
OPEN & SHORT LOCATING	•	•	•	•					
DC HIPOT TESTING		•			•				
INSULATION RESISTANCE / POLARIZATION INDEX					•	•			
POWER FACTOR / C & TAN δ							•	•	
LOAD, NO-LOAD (MOTOR)									•

ENVIRONMENTAL CONSIDERATIONS+

Temperature range for storage:	-10° C - 45° C	
Temperature range for operation:	10° C - 40° C	
Relative humidity:	< 85%	
Maximum altitude:	< 1000 m ASL	> 1000 m, de-rate voltage 1% per 100 m

+ Please consult factory for conditions outside the ranges above.



CABLE FAULT LOCATING

Power cables used in mining may break down for a number of reasons, such as poor splicing and / or terminations, physical damage, extreme tension and current overload. Improper splices or terminations on a cable network account for a majority of cable failures. Physical damage such as a cut, puncture, or crushed insulation by heavy equipment is also very common. Extreme tension from pulling or overstretching may also cause damage to the cable's conductor and insulation.

And after repeated exposure to high current and elevated temperatures, the cable insulation may deteriorate causing it to expand, contract, crack and even retain water. It is almost guaranteed that over the lifetime of a cable one or more of these conditions will occur; if a fault does not occur instantly, the weakened state of the cable will make it more susceptible to failure.

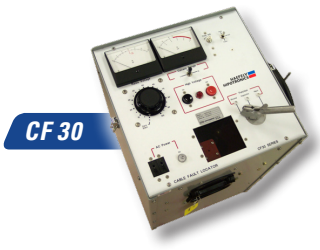
PORTABLE FAULT LOCATORS

HAEFELY HIPOTRONICS' line of **portable cable fault locators** are designed to be used on primary power cables for quick fault detection. Their user-friendly designs and wide range of features benefit users of all experience levels. More information about the new **X-WAVE** as well as our **5250 Series** available in respective catalogs.

	CABLE CLASS		MAX. ENERGY		
	500 V - 15 kV	≤ 32 kV	350 J	1000 J	2000 J
X-WAVE	•		•		
5250-15	•			•	
5250-30	•	•			•

VEHICLE-MOUNTED FAULT LOCATORS

	VOLTAGE LEVEL			CURRENT BURN LEVEL	
	0 - 30 kV	≤ 70 kV	> 70 kV	0 - 50 mA	≤ 100 mA
CF30	•		FOR HIGHER VOLTAGE / ENERGY REQUIREMENTS Please Consult Factory	•	
CF70	•	•		•	•



- ✔ Variable high voltage output
- ✔ Easy to mount on pick-up trucks

DC HIPOT TESTING

800 SERIES

Performing a simple DC Hipot test on cables can be part of a regular maintenance routine to alert users of an imminent failure, as well as after new cable installation to indicate poor/improper splicing or cable terminations. This test can also be used for motor and transformer repair, rewind and maintenance.

HAEFELY HIPOTRONICS' **800PL Series** of portable digital DC Hipot testers are rugged enough for onsite field testing, but also the perfect solution for an indoor shop environment. The series consists of a single-unit equipment that ranges from 15 kV to 80 kV.

MODEL	TEST VOLTAGE (DC) 0-15 kV	≤ 30 kV	≤ 60 kV	≤ 80 kV
840PL-DC	•	•		
880PL-DC	•	•	•	•

FEATURES

- ✔ Full-wave voltage doubling rectifier
- ✔ Zero start interlock and guard circuit
- ✔ Internal discharge solenoid

BENEFITS

- ■ Ideal for field testing applications
- ■ User-friendly control panel
- ■ Minimal set-up time

INSULATION RESISTANCE / POL. INDEX

5478

The **5478 portable teraohmmeter** is a multi-purpose digital tester intended for analyzing, inspecting and maintaining high voltage insulation. Insulation in motors / generators can fail due to excessive heat, moisture, dirt, vibration and / or aging. To detect such deterioration, it is necessary to perform regular insulation resistance tests.

MEASUREMENTS

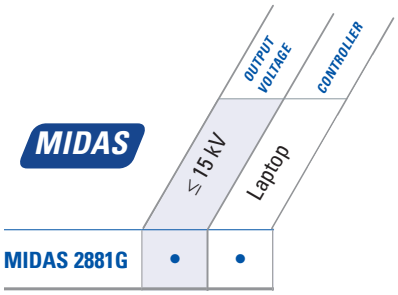
- ✔ Insulation resistance up to 5 TOhm
- ✔ Polarization index
- ✔ Step-up voltage measurement
- ✔ Withstand voltage measurement
- ✔ Diagnostic measurements
- ✔ AC / DC voltage and frequency measurements

POWER FACTOR / C TAN δ

MIDAS SERIES

Electrical insulation undergoes an aging process due to thermal overload, mechanical stress, electrical impurity and environmental factors (temp. / humidity). High voltage insulation will eventually breakdown unless regularly maintained.

The MIDAS 2881G is specifically designed for insulation diagnostics of rotating machines. With its unique 15 kV output voltage, it has more power to test large capacitances of up to 47 nF @ 60 Hz / 56 nF @ 50Hz. Our optional resonating inductors (5288A & **5289**) also give customers the option to test up to up to 2 uF.



APPLICATION NOTE

TYPICAL VALUES / LIMITS FOR C & TAN δ MEASUREMENT

Most newly manufactured electrical equipment will have measured values exceeding testing standards. The construction of each machine, corona shield, etc. will also vary. Therefore, a comparison of measurements (phase-to-phase, two identical machines or against previously obtained results) is highly recommended.

DDX9121b & MIDAS can easily perform combined partial discharge (PD) and C & Tan δ tests without any reconnections.

EXAMPLE: ROTATING MACHINES

Single-phase values for a 500 MVA generator. Values at 1.0 U_N (21 kV); C = 0.27 µf; tan δ = 0.014.

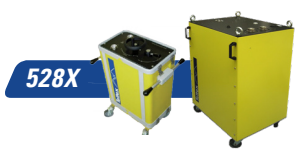
Tan δ at 0.2 U_N	Max. 0.04 Typical value ≤ 0.02
Δ Tan δ (tip-up) *from 0.2U_N-0.6U_N*	Max. 0.006 / 0.2 U_N
Δ Tan δ (tip-up) *from 0.6U_N-1.0U_N*	Max. 0.008 / 0.2 U_N
Or Δ Tan δ / kV	Max. 0.0025

According to IEC 34-1 and VDE 0539 standards.

Insulation quality can be considered as stable.	Δ < 10%
Insulation is slowly and / or quickly degrading or deteriorating.	Δ > 10%

Tan δ $1x10^{-4}$ / 10 kV* / 33 kVA
*maximum 12 kV

Tan δ $1x10^{-4}$ / 15 kV / 100 kVA



The **5288A** & automatic **5289**, are resonating inductors used to increase the power range for testing higher capacitive loads.

MOTOR TESTING

MTS SERIES

Electric motor testing can provide insight into the condition of a motor's electrical makeup and mechanical integrity. The various test parameters offered with our systems can be used to establish and ensure proper performance and operating efficiency of high powered motors.

HAEFELY HIPOTRONICS' 100+ years of combined experience have enabled us to develop the most reliable and efficient AC and DC motor testing equipment on the market today. Our low and high power Motor Test Systems are designed to meet all testing requirements for both load and no-load applications. We are proud to say that we've been sucessfully installing these systems worldwide for decades!

FEATURES

- **Measurement devices are included** with all models: (1) Digital Tachometer; (2) Digital Wattmeter; (3) Temperature Meter (Type - E); (4) Power Factor Meter
- **Emergency OFF switch** and **warning lamp**
- **External interlock provisions**
- **Motorized tap selector switch**
- **Primary overload protection**
- **Interlocked HV taps** for maximum safety
- **Lifting provisions** (crane and forklift)
- Export **all test data** in .CSV

BENEFITS

- Variable transformer offers the most **stable output** available
- **Continuously variable voltage** from near zero to full voltage
- **Complete metering** to verify conditions of motor under test
- **Decreased start-up cost** with minimal mains wiring required
- **Latest technology** with motorized tap switch to ensure reliability and accuracy
- Touchscreen PLC controls allows for **minimal user training**

	(up to)	MTA-150	MTA-300	MTA-500	MTA-750	MTA-1000	MTA-1500	MTA-2000
AC Testing	150 HP / 110 kW	●	●	●	●	●	●	●
	300 HP / 220 kW	○	●	●	●	●	●	●
	500 HP / 370 kW	○	○	●	●	●	●	●
	750 HP / 550 kW	○	○	○	●	●	●	●
	1000 HP / 740 kW		○	○	○	●	●	●
	1500 HP / 1100 kW		○	○	○	○	●	●
	2000 HP / 1490 kW			○	○	○	○	●
	2500 HP / 1865 kW			○	○	○	○	○
	3750 HP / 2795 kW				○	○	○	○
	5000 HP / 3730 kW					○	○	○
	7500 HP / 5595 kW						○	○
	10000 HP / 7460 kW							○

*MTC includes all MTA features plus those listed below.**

	(up to)	(up to)	MTC-150	MTC-300	MTC-500	MTC-750	MTC-1000	MTC-1500	MTC-2000
DC Testing ARMATURE SUPPLY	650V	200A	■	■	■	■	■	■	■
		425A		■	■	■	■	■	■
		625A			■	■	■	■	■
	750V	900A				■	■	■	■
		1200A						■	■
		1500A							■
FIELD SUPPLY	300V	10A	■	■	■	■	■	■	■
	700V	90A		■	■	■	■	■	■

● AC Full-Load and No-Load Test Capabilities
○ AC No-Load Test Capability
■ DC Test Capability

Full-Load and No-Load calculations are approximate and could vary with your specific application.
For Motor Test Systems with AC output only, DC specs are eliminated.
The model prefix MTC applies to systems with both AC and DC testing capabilities.*
For Motor Test Systems with AC capabilities only, the model prefix is MTA.*
Larger and smaller units and other input voltages may be available upon request.
For complete specifications for a particular model, please contact Hipotronics at 845-230-9245.

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