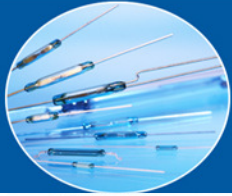


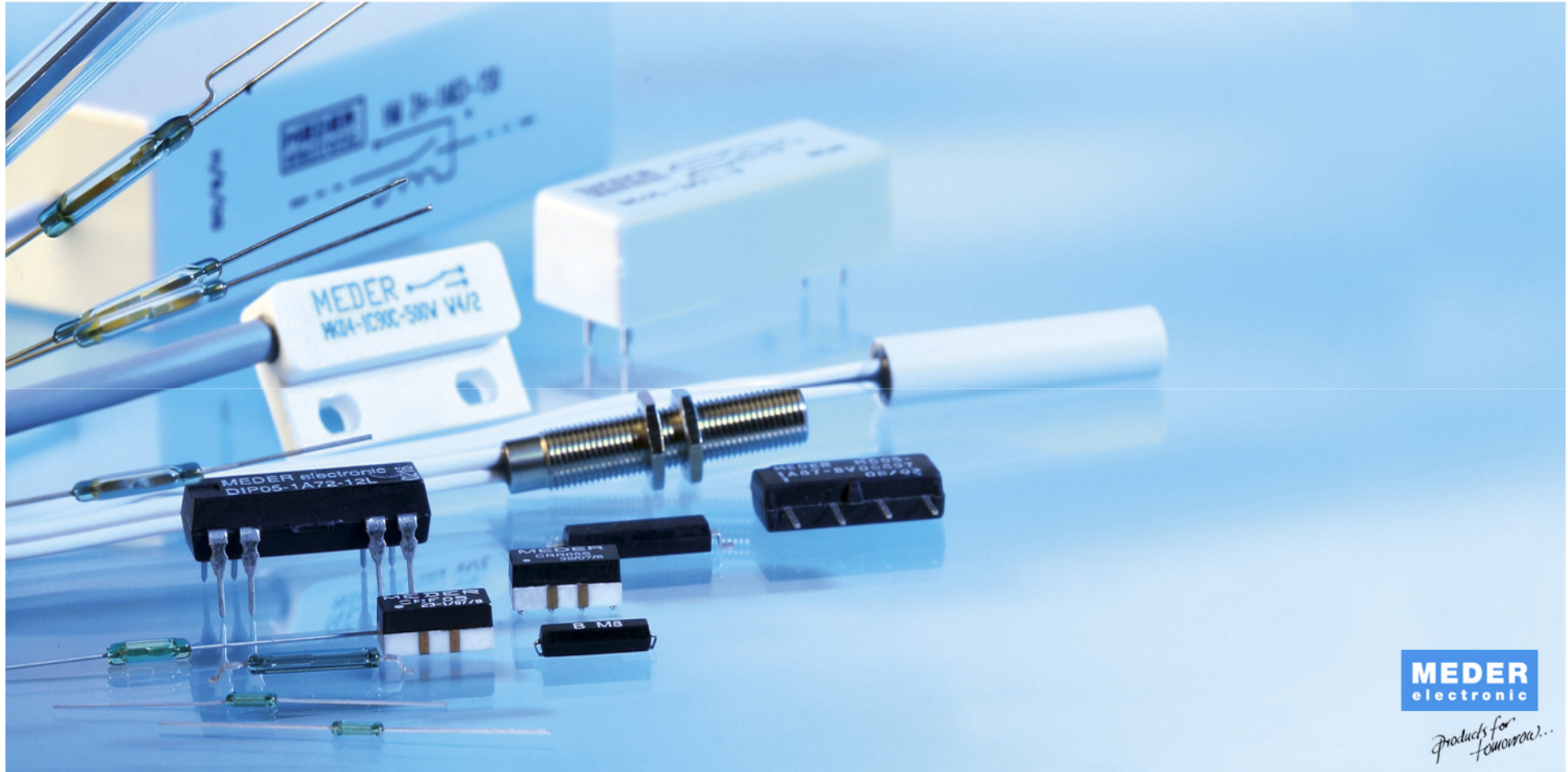
REED SWITCHES

REED SENSORS

REED RELAYS



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Products for tomorrow...

Reed Switch Basics part I

08/01/2010

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REED SWITCHES

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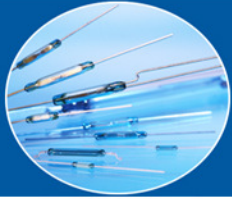
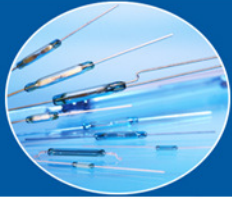


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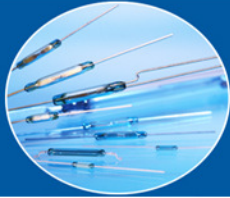
- What is a Reed Switch?
- Reed Switch Basic Structure
- Reed Switch Lead Material - Ruthenium
- Reed Switch Lead Material – Iridium
- AT Ranges
- Basic Parameters



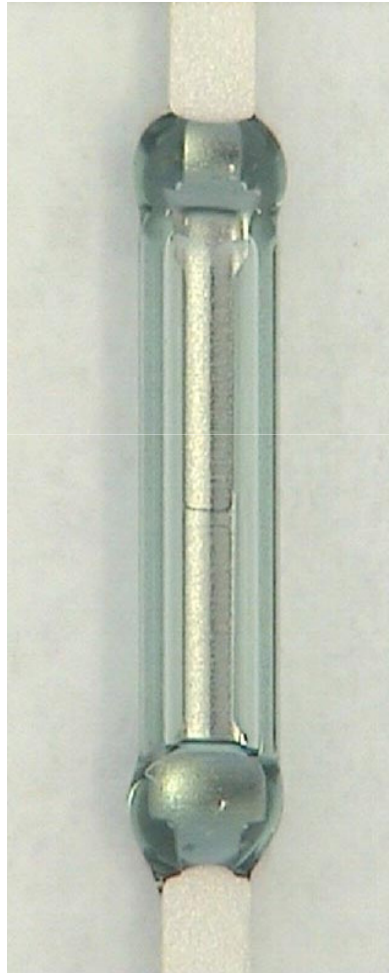
What is a Reed Switch?

- A Reed Switch is a small electromechanical device having two ferromagnetic reeds hermetically sealed in a glass envelope, and when brought into a magnetic field the reeds will close, creating a switching function. They range in length from 2.0 inches long to as small as 0.025 inches long.

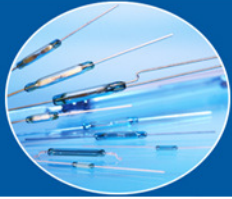




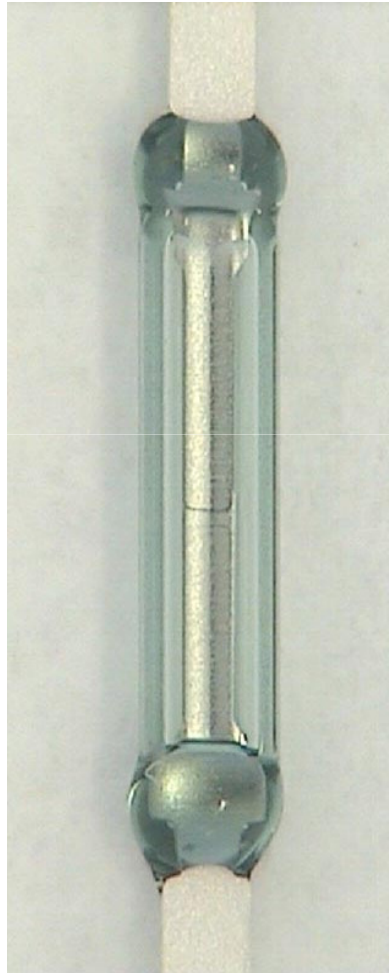
Reed Switch Basic Structure



- **Materials :**
- The two reed leads are made up of Nickel/Iron (NiFe) alloy (52% nickel).
- To be affected by a magnetic field the reed leads must be ferromagnetic.
- The three most popular materials in nature and easy to anneal are ferromagnetic: iron, cobalt, and nickel.



Reed Switch Basic Structure

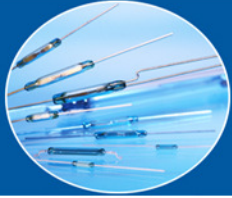


- **Materials :**
- The tips of the two reeds are either plated or sputtered with rhodium, ruthenium or iridium, with an under layer of either gold, copper or Tungsten
- The under layer is usually $0.25\mu\text{m}$ to $0.5\mu\text{m}$ with the outer layer usually $1.0\mu\text{m}$ to $2.0\mu\text{m}$

REED SWITCHES

REED SENSORS

REED RELAYS

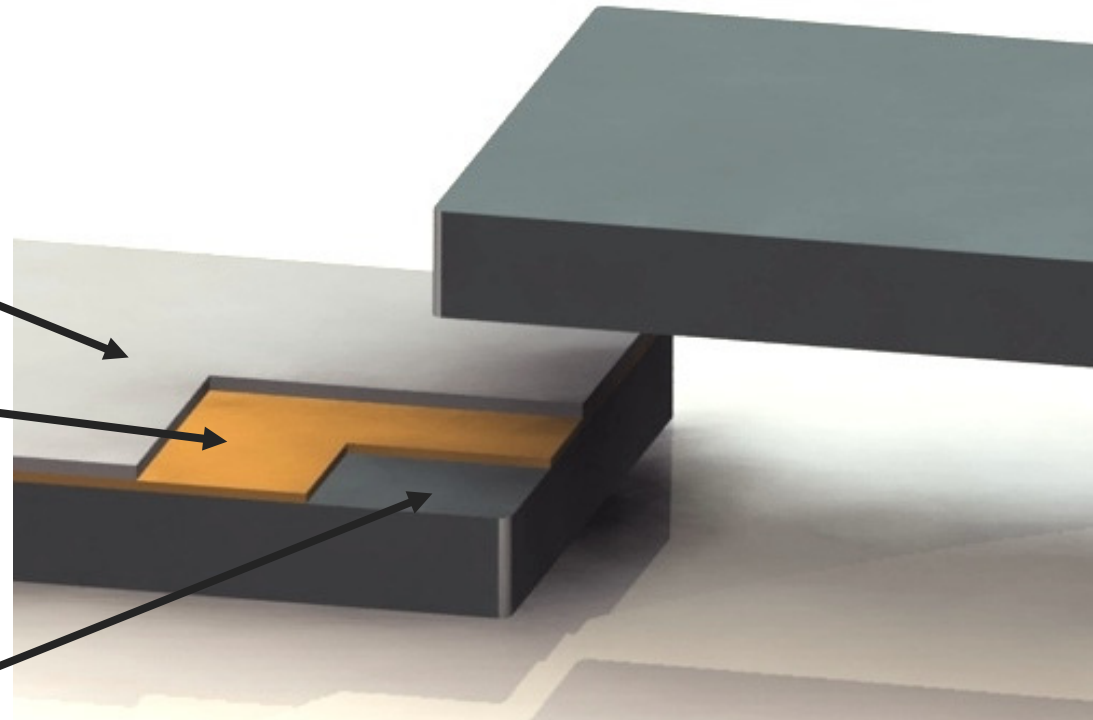


Reed Switch Lead Material - Ruthenium

Ruthenium

Tungsten

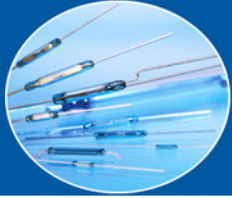
NiFe base metal



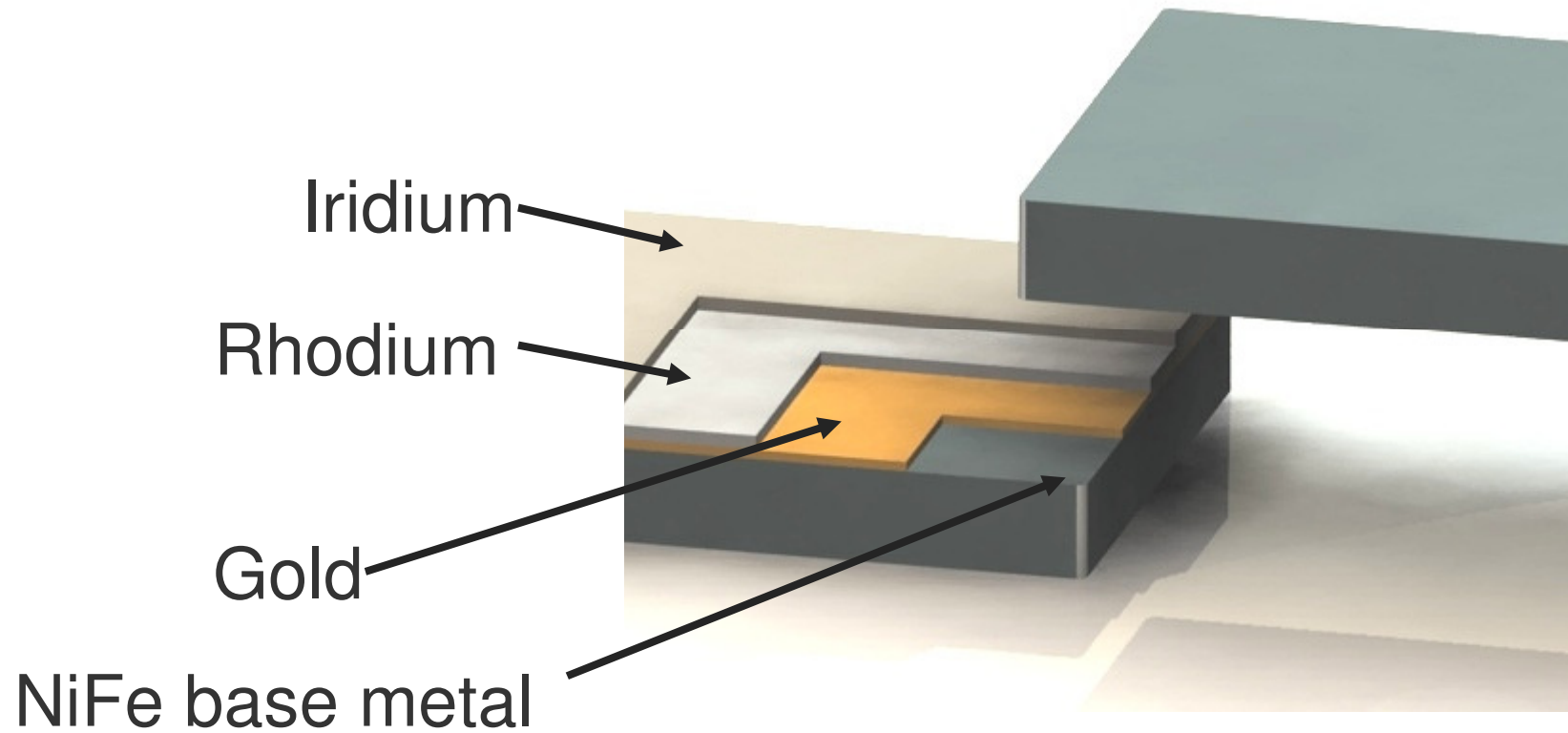
REED SWITCHES

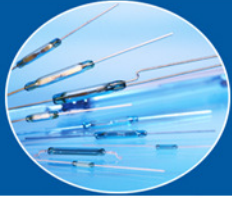
REED SENSORS

REED RELAYS

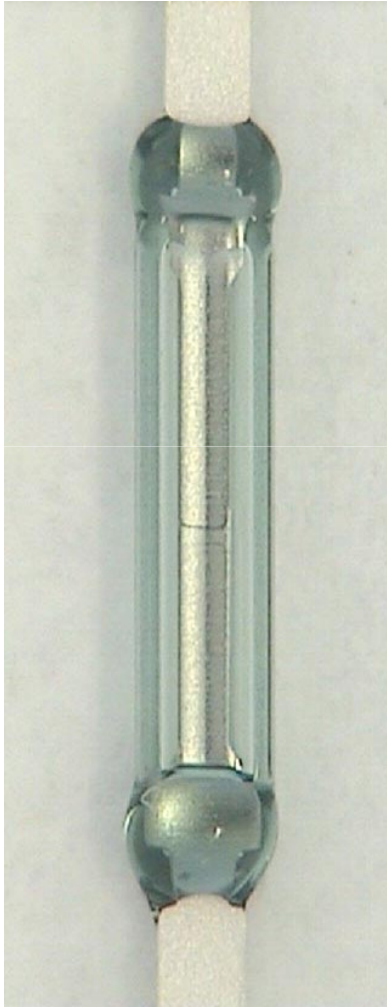


Reed Switch Lead Material - Iridium

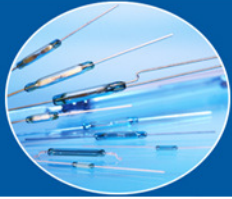




Reed Switch Basic Structure



- **Materials :**
- A Glass tube is used for the outer packaging whose Temperature Coefficient of Expansion (TCE) exactly matches the NiFe alloy.
- Both ends of the glass tube are heated and the glass melts and forms the hermetic seal encompassing both ends.
- During the glass sealing process the glass cavity is usually filled with an inert gas (typically nitrogen) or the cavity may be evacuated creating a vacuum. This vacuum usually supports high voltage switching (in excess of 1000 Volts).



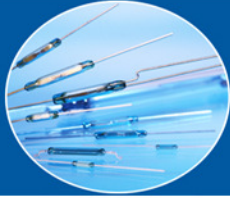
AT Ranges

- An AT range essentially groups several ATs together forming an AT range
- The first row shows a 10 AT to 21 AT range

10	11	12	13	14	15	16	17	18	19	20	21
10	11	12	13	14	15	This represents a 10 to 15 AT range					
10	11	12	This is a 10 to 12 AT range.								

Could this be shipped to a customer as a 10AT to 15 AT range ?

10	11	12	13	14	15	16	17	18	19	20	21
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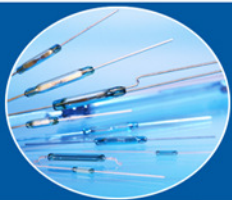
Basic Parameters

- Most companies measure the Reed Switches in Ampere Turns (AT). Universally milliTesla (mT) is a more generally accepted magnetic measurement unit. MEDER is the first and only one to convert over to mT, but continues to reference AT.
- Pull-in and Drop-out are the points referred to when the contacts close and open. AT or mT indicate the relative magnetic strength at these opening and closing points. Also, its very convenient to specify the closure and opening points in distance for specific applications.
- Hysteresis is also another parameter that is useful to measure particularly in liquid level measurement. Its simply the ratio of the drop out and the pull in, and is measured as a percent (%) or decimal.

REED SWITCHES

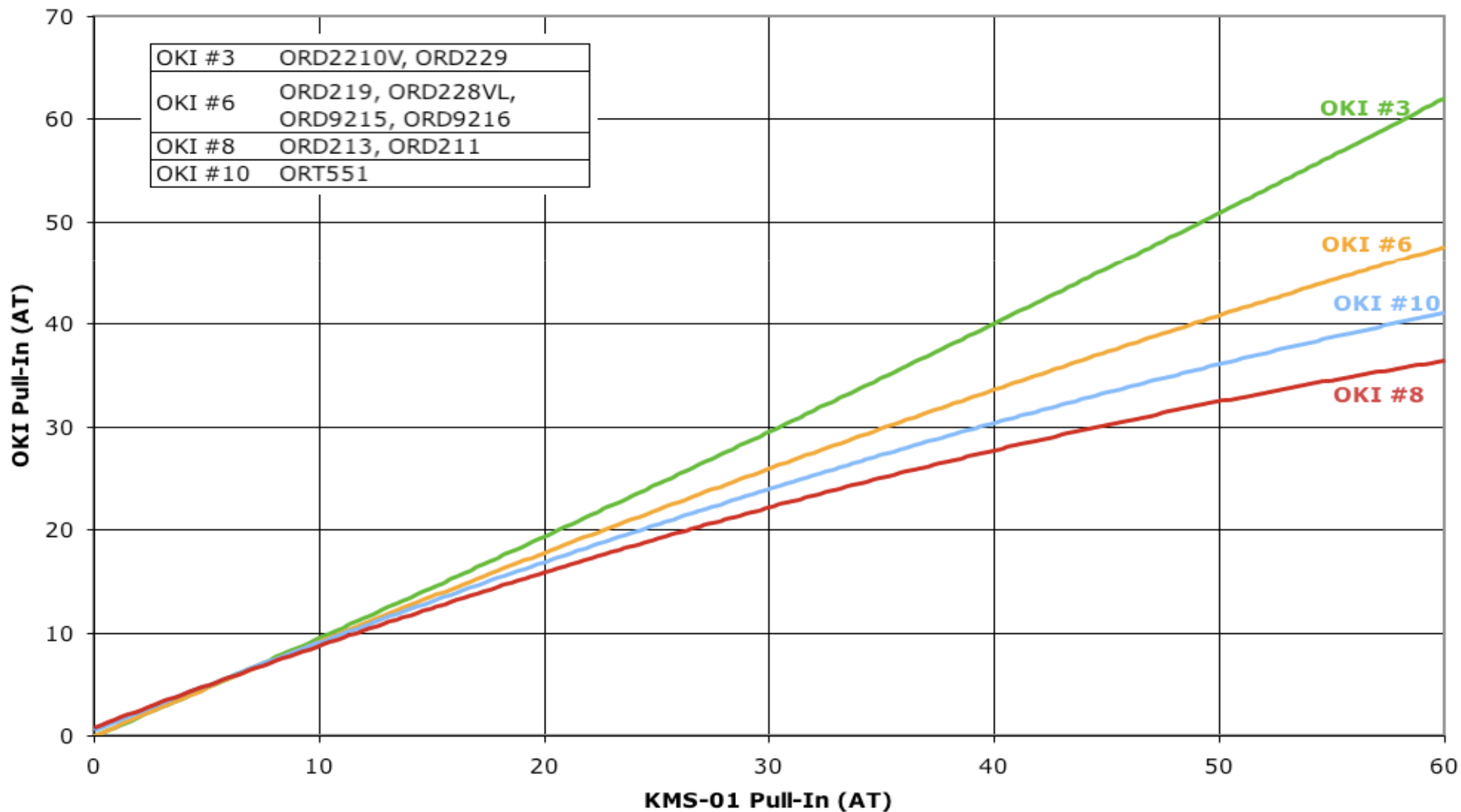
REED SENSORS

REED RELAYS



MEDER vs. OKI AT Conversion

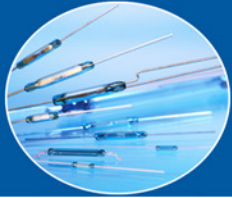
MEDER vs. OKI AT Conversion



REED SWITCHES

REED SENSORS

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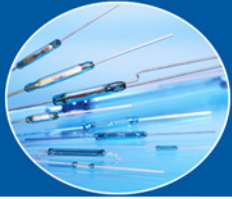
AT

- Near term and long term we are converting over to milliTesla. This will be very helpful for our customers, but will not eliminate the issues described above.
- If all reed switch suppliers converted to milliTesla, it would make things much simpler.
- milliTesla is the universal standard throughout the world; therefore, unifying the magnetic measurement system

REED SWITCHES

REED SENSORS

REED RELAYS



Reed Switch Basics

- **End of part I**

Content of part II:

- How does a Reed Switch/Sensor work?
- What are a Reed Switch's parameters?