

Motor Accessories

Motor Accessories

- Overview/Objectives:
 - Space Heaters
 - Auxiliary Boxes
 - Temperature Detectors
 - Terminal Box Acc.
 - Filters
 - Pressure Monitors
 - Leak Detectors
 - Constant Level Oilers
 - Vibration Monitors

Motor Accessories

- Space Heaters
 - Replaceable
 - Coilhead
- Auxiliary Boxes
- Temperature Detectors
 - Resistance Temperature Detectors (RTD's)
 - Thermocouples (T/C's)
 - Thermistor
 - Thermostat (T/stats's)
- Terminal Box Accessories
 - Standoff / Bus Bar
 - Surge Capacitor
 - Lightning Arrestor
 - Current Transformer
 - Load
 - Differential Protection
 - Power Factor Correction Capacitor
- Filters
- Differential Pressure Monitors
 - Switch
 - Gage
- Leak Detector
 - Switch
- Constant Level Oilers
 - Oil-Rite®
 - Trico
- Vibration Monitors
 - Vibration Probes
 - Velocity Transducer
 - Accelerometer
 - Vibration Switch

Motor Accessories – Space Heaters

- Open Motors - Strip or Ring Type Heaters
 - Mounted inside the motor frame. Heaters may be installed without significant disassembly
- Fan Cooled Motors - Ring or Tube Type Heaters
 - Anti-friction motors utilize “ring” type heaters mounted on the inner cap. Motor must be disassembled to install / replace.
 - Sleeve bearing motors utilize “tube” type heaters mounted inside the motor frame. Motor must be disassembled to install / replace.



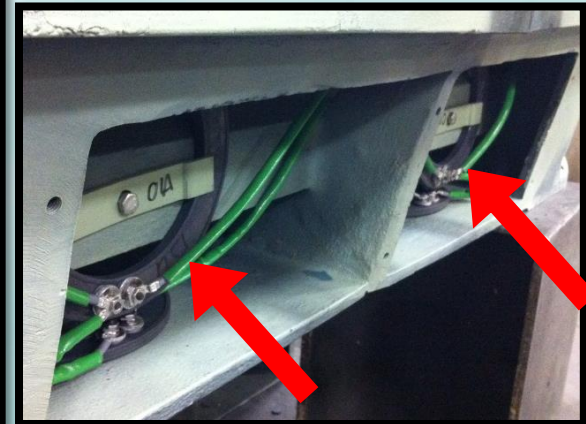
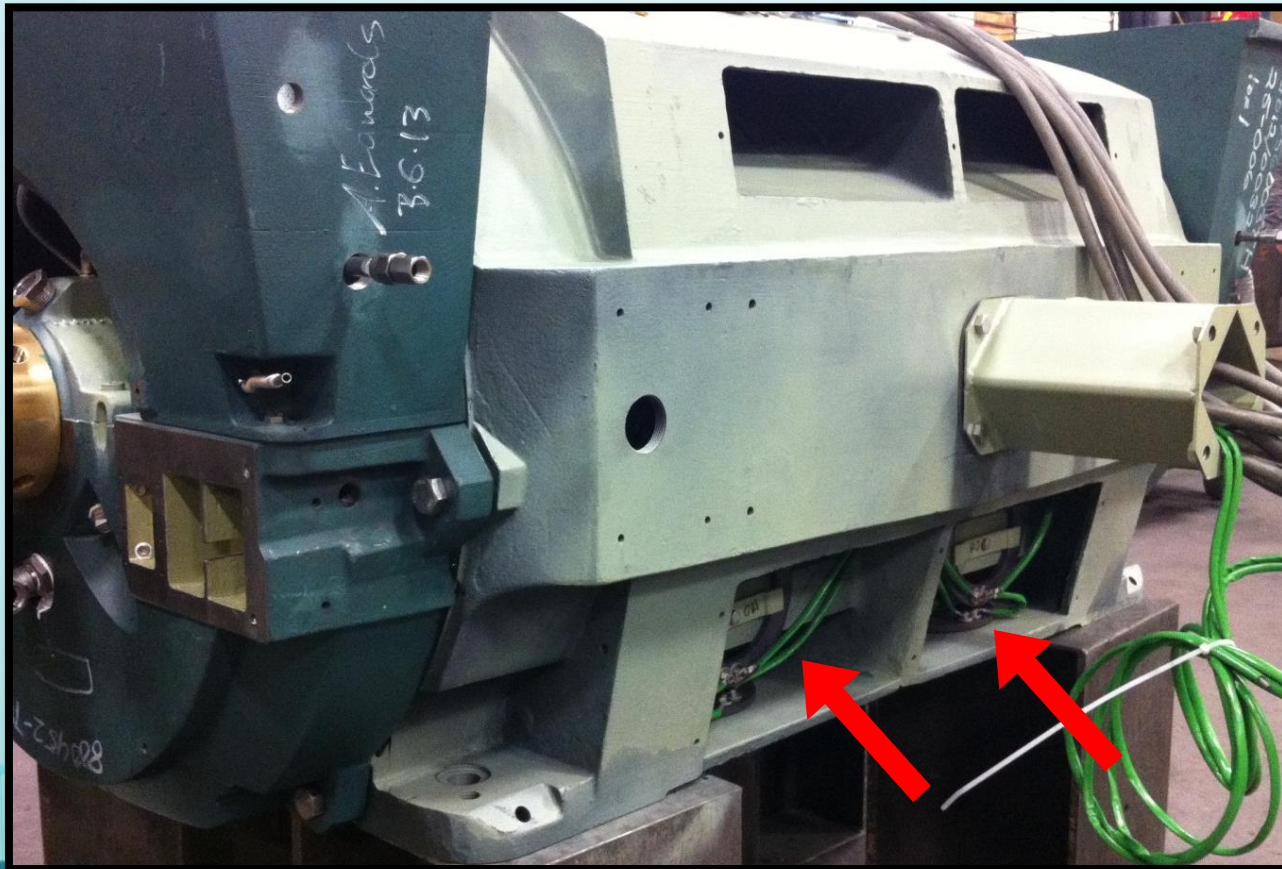
Motor Accessories – Space Heaters



Tube Type Replaceable Space Heater

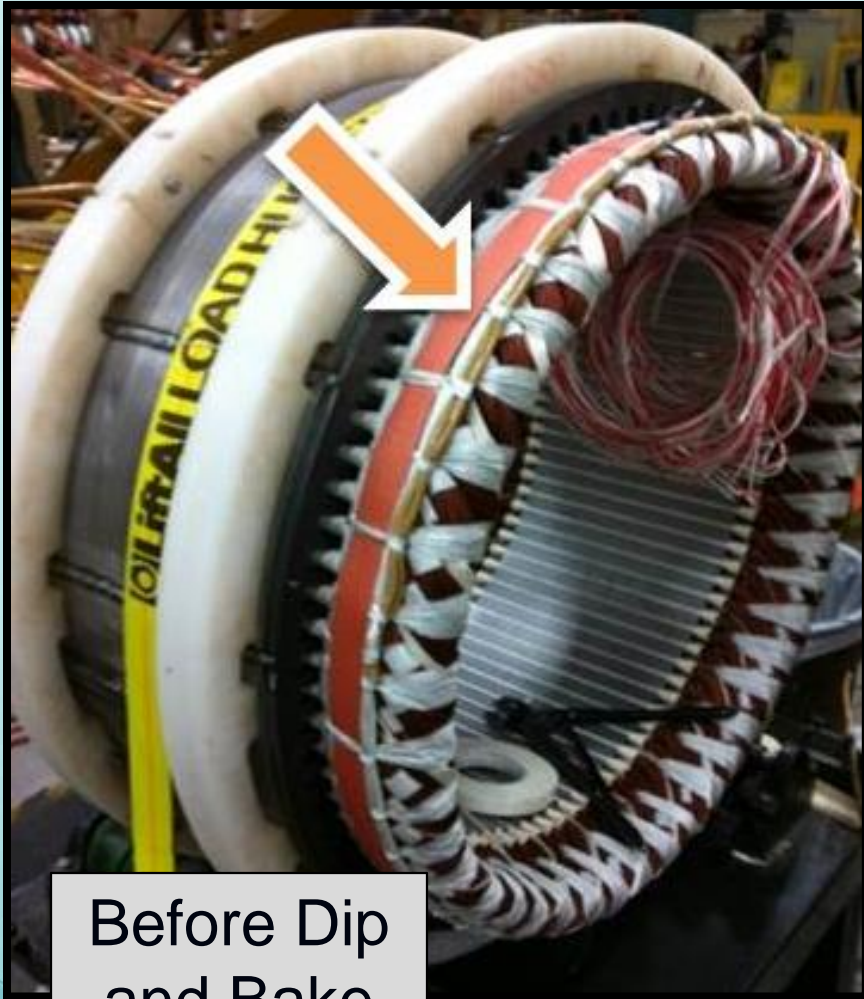
Please note this is not “installed” into the motor bracket. This picture just shows dimensional qualities of the space heater.

Motor Accessories – Space Heaters



Ring Type Replaceable Heater installed in frame stringers.

Motor Accessories – Space Heaters



Before Dip
and Bake

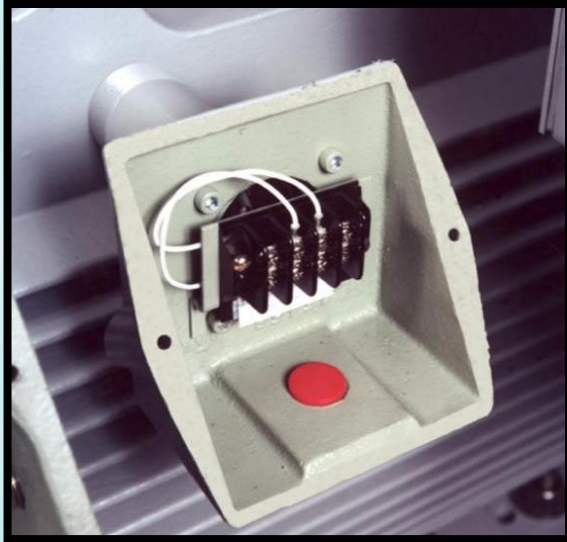


After Dip
and Bake

Coilhead Space Heaters

- Used on both Open and Fan Cooled Motors
 - Install during winding process.
 - Non-replaceable after curing.

Motor Accessories – Auxiliary Boxes

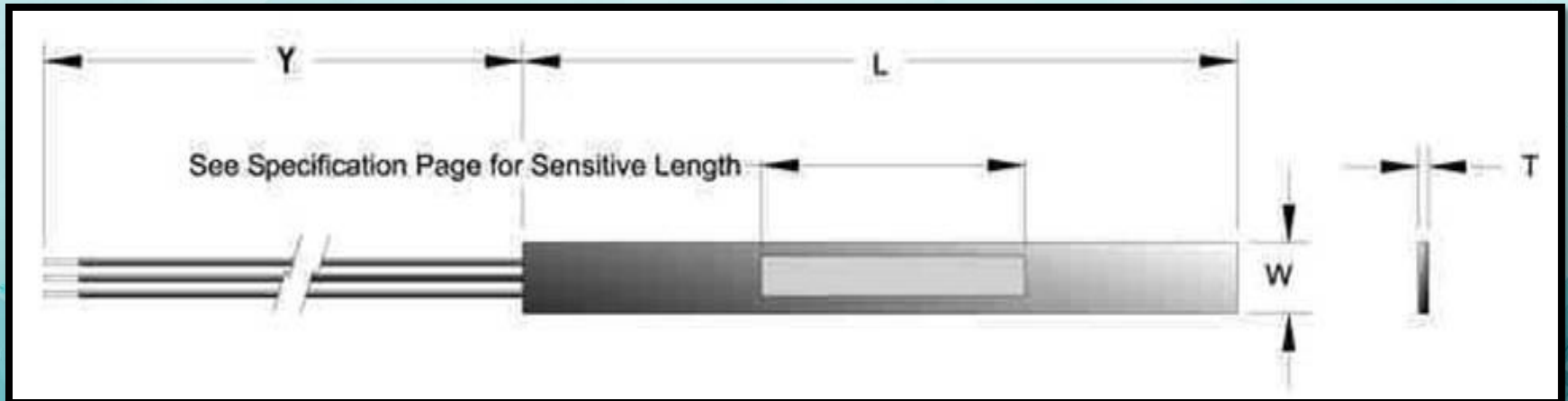


- Mounted to motor frame via pipe nipple
- Boxes available
 - Cast Iron - Standard
 - NEMA 4
 - IP54, 55
 - Fabricated Stainless Steel
 - NEMA 4X
 - IP 54, 55
 - Cast Aluminum
 - IP 54, 55
 - Suitable for Div I

Temperature Devices - Winding

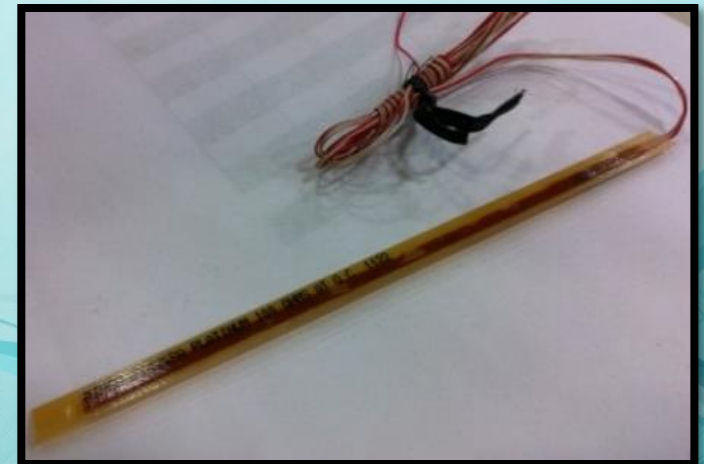
Motor Accessories – RTD's

- Resistance Temperature Detector (RTD) (Temperature Detector)
 - RTD's are thermal sensing devices containing a sensing element that is a non-inductively wound coil molded into a rectangular or round laminate with leads coming from the resistance coil. By knowing the rated change of resistance with temperature, the RTD can be used to continuously measure the internal winding temperature.
 - Types of RTD's
 - 100 ohms at 0° C (Platinum wire) Most Common
 - 120 ohms at 0° C (Nickel wire)
 - 10 ohms at 25° C (Copper wire)

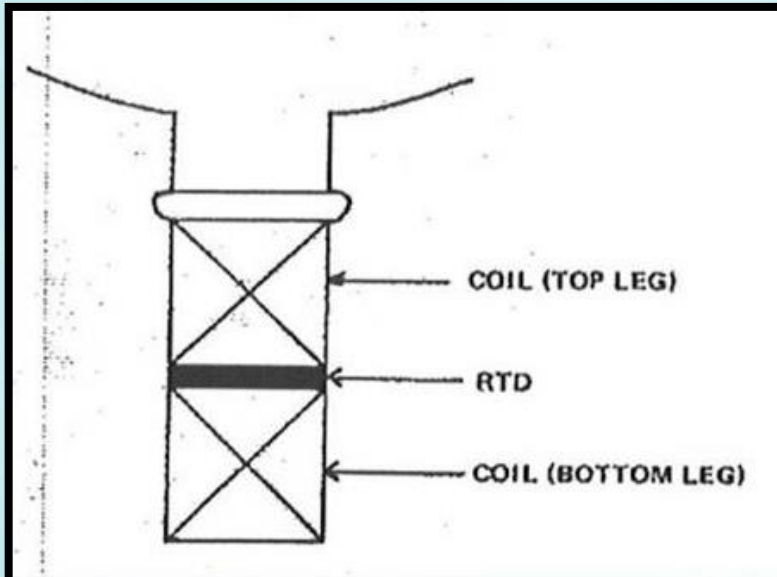


Motor Accessories – RTD's

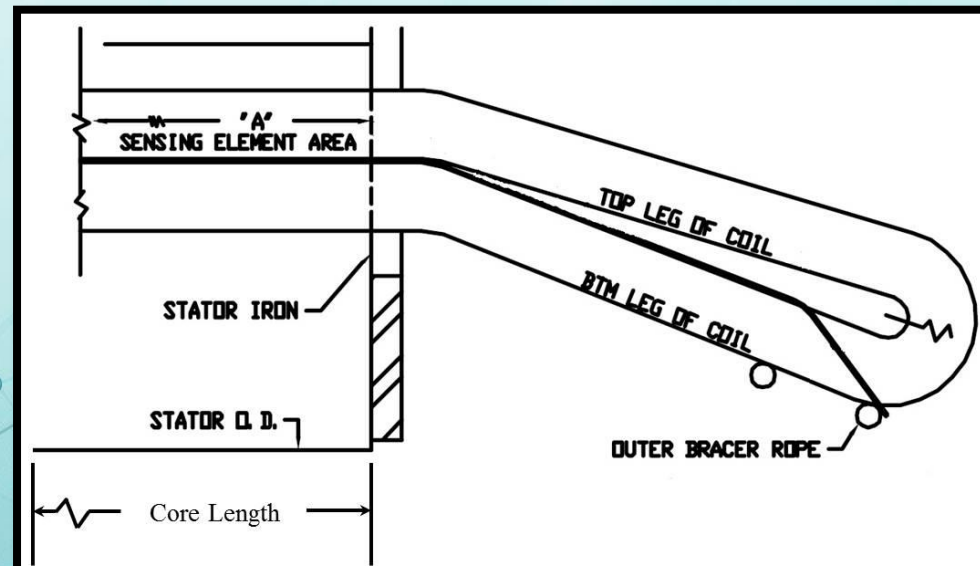
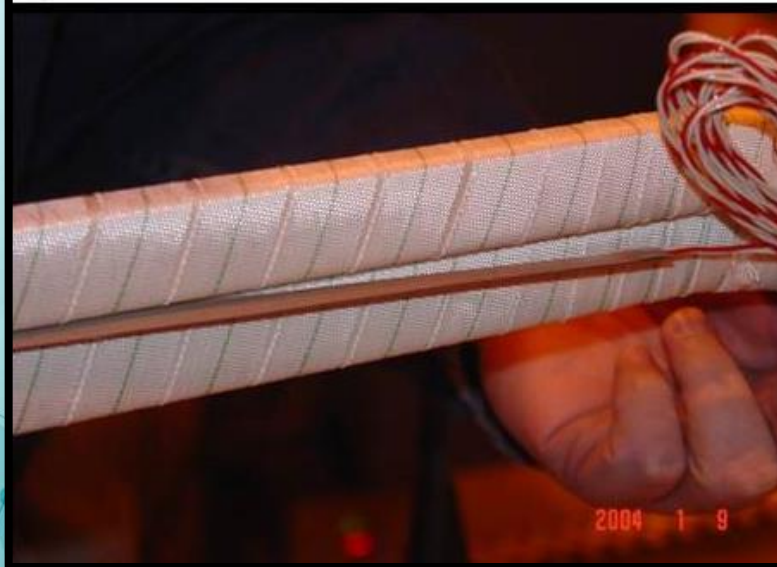
- Applications
 - Bearings - Probe type with tip sensitive area.
 - Windings - Inserted between the bottom and top coils in the slot
- Advantages
 - Capable of transmitting continuous temperature readings
 - Installed in the Hot-Spot region of the stator winding (between 2 coils), or directly contacting bearings.
 - Senses an average temperature
 - 200° C maximum operating temperature
- Disadvantages
 - External control required by customer
 - Fragile construction (New RTD is more flexible and forgiving)



Motor Accessories – RTD's

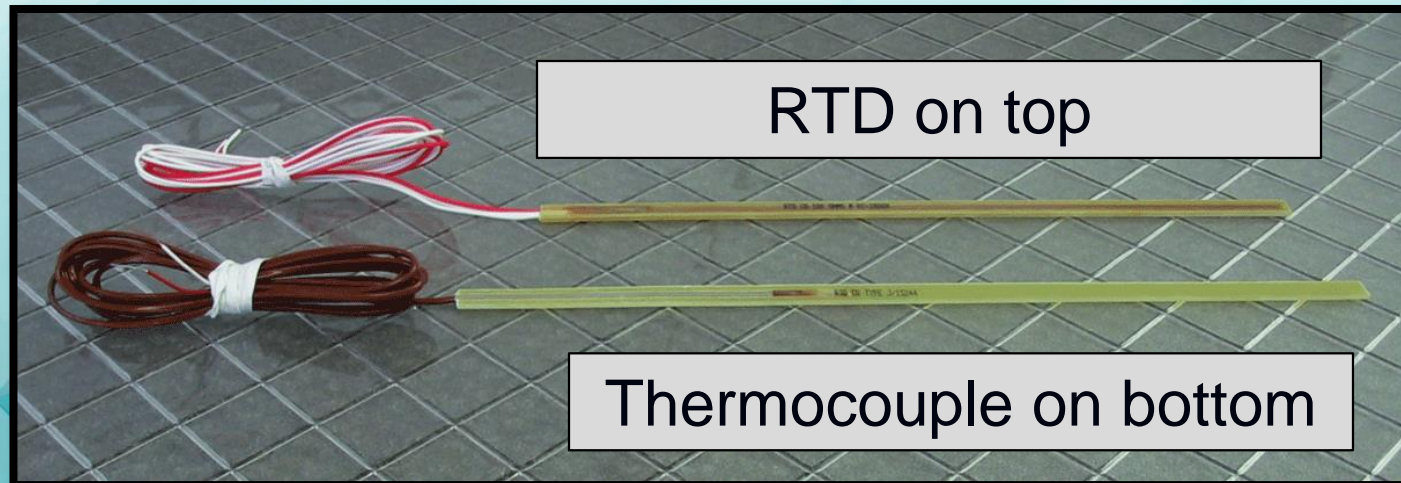


- RTD's inserted between top and bottom coil per NEMA
- All RTD's routed to common point on stator
- 1,2,3 per phase options available



Motor Accessories - Thermocouples

- Thermocouple (TC) (Temperature Detector)
 - Thermocouples are used to measure temperature in order to monitor and/or display the temperature reading. The sensing point of the TC is a junction of two (2) dissimilar metals that produces a small voltage (current) proportional to the temperature of the measured area. By knowing the rate of change of voltage with temperature, the TC can be used to continuously measure temperature
 - Types of TC's used at RSN
 - *Iron-constantan* (Type J) Most Common
 - Copper-constantan (Type T)
 - Chromel-constantan (Type E)
 - Chromel-alumel (Type K)



Motor Accessories - Thermistors

- Thermistor (PTC) (Temperature Switch on/off)
 - Thermistors are positive temperature coefficient devices that operate with a solid state relay. At normal temperatures, the resistance is relatively low. The resistance remains relatively constant up to a pre-determined temperature, depending on thermistor design. A rise in temperature above this pre-set limit causes the resistance to greatly increase very abruptly, thus tripping the relay.
 - Some common setpoints:
 - 155° C -class F insulation
 - 185° C -class H insulation



Motor Accessories - Thermistors

- Applications
 - Bearings - Probe type with tip sensitive area.
 - Windings - Inserted between the bottom and top coils in the slot. (Not recommended for Form Wound Stators. Slot configuration does not have allowable space, therefore thermistor must be taped to coil end away from the hot-spot of the stator.)
- Advantages
 - Rapid thermal response
 - Inexpensive thermal protection
 - 600 volt rated
- Disadvantages
 - External control required
 - Can not provide continuous temperature readings (on/off switch)

Motor Accessories - Thermostats

- Thermostat (Temperature Switch on/off)
 - Thermostats are bi-metallic snap switches. They use bi-metallic discs to operate a set of contacts. When heated the internal stresses of the bi-metal causes the disc to reverse its curvature with a snap action at a fixed non-adjustable temperature and open the electrical contacts. A decrease in the temperature below reset temperature of the disc relieves the internal stresses in the disc which returns the disc to its normal curvature and closes the contacts.

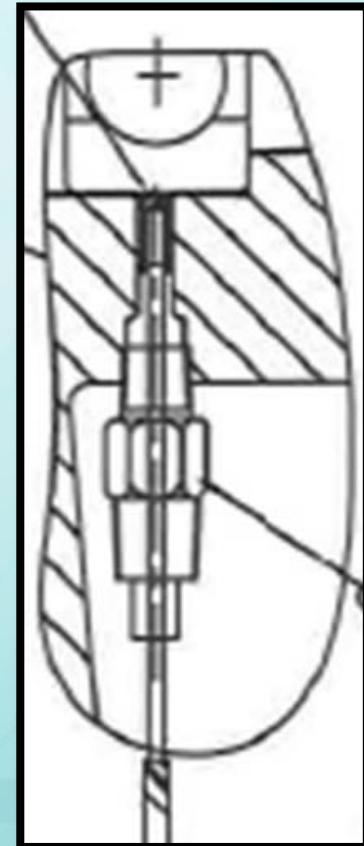
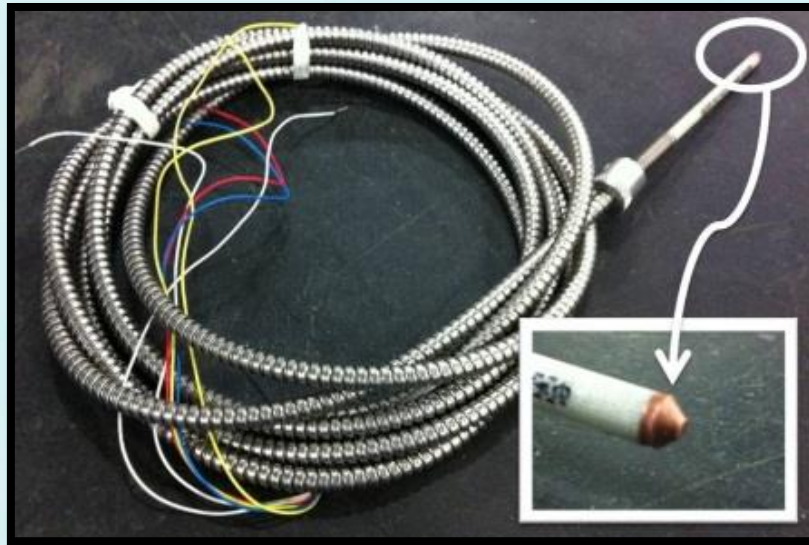


Motor Accessories - Thermostats

- Applications
 - Windings - Installed on the stator winding head. (The thermostats used are hermetically sealed and therefore can be used in hazardous areas.) Required on all DIV 1 motors
 - Setpoints 160°C, 140°C
- Advantages
 - Simple to install
 - Low cost
 - Can be wired to the customers holding coil circuit
 - 600 volt rated
- Disadvantages
 - Slow thermal response
 - Can not provide continuous temperature readings (on/off switch)
 - Not located in hot-spot areas of stator

Temperature Devices - Bearings

Motor Accessories – Bearing Probes



Motor Accessories – Bearing Probes



- Bayonet style probe installed into bracket using bayonet adapter
- RTD leads routed to conduit



Motor Accessories – Condulet Heads



- One condulet per bearing is standard
- Bearing RTD's may be routed to winding RTD box via flex conduit

Terminal Box Accessories

ACCESSORIES

Bus Bar / Standoff

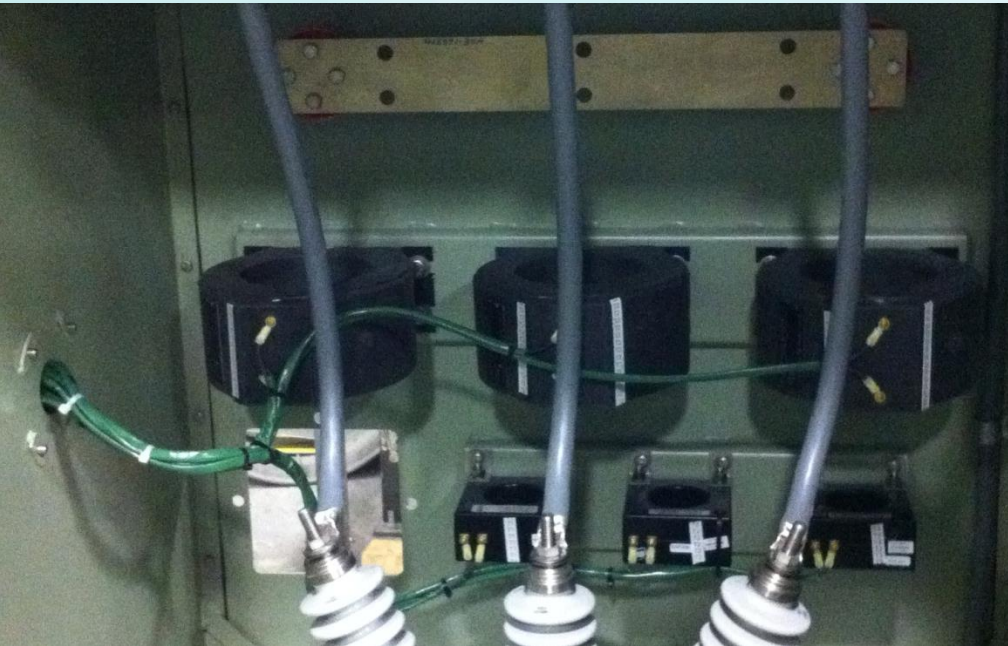


- Bus Bar
 - Used as connection point for motor power leads and customer supply leads
 - Silver plated copper is standard
 - Tin plated as option
- Standoff
 - Used to insulate Bus Bar from terminal box.
 - Two sizes available
 - $\leq 5\text{kv} = 3.50''$ tall
 - $> 5\text{kv} < 15\text{kv} = 6.00''$ tall

ACCESSORIES

Current Transformers

- Load CTs allow continuous monitoring of line current
- Self-Balancing differential CT's protection scheme



ACCESSORIES

Surge Protection

- Surge Capacitors

- Increase surge voltage rise time allowing voltage to distribute more evenly throughout the motor winding.

- Lightning Arrestors

- Limit magnitude of voltage spike by “Chopping” the voltage wave at a specific Level

- Best protection when both are used

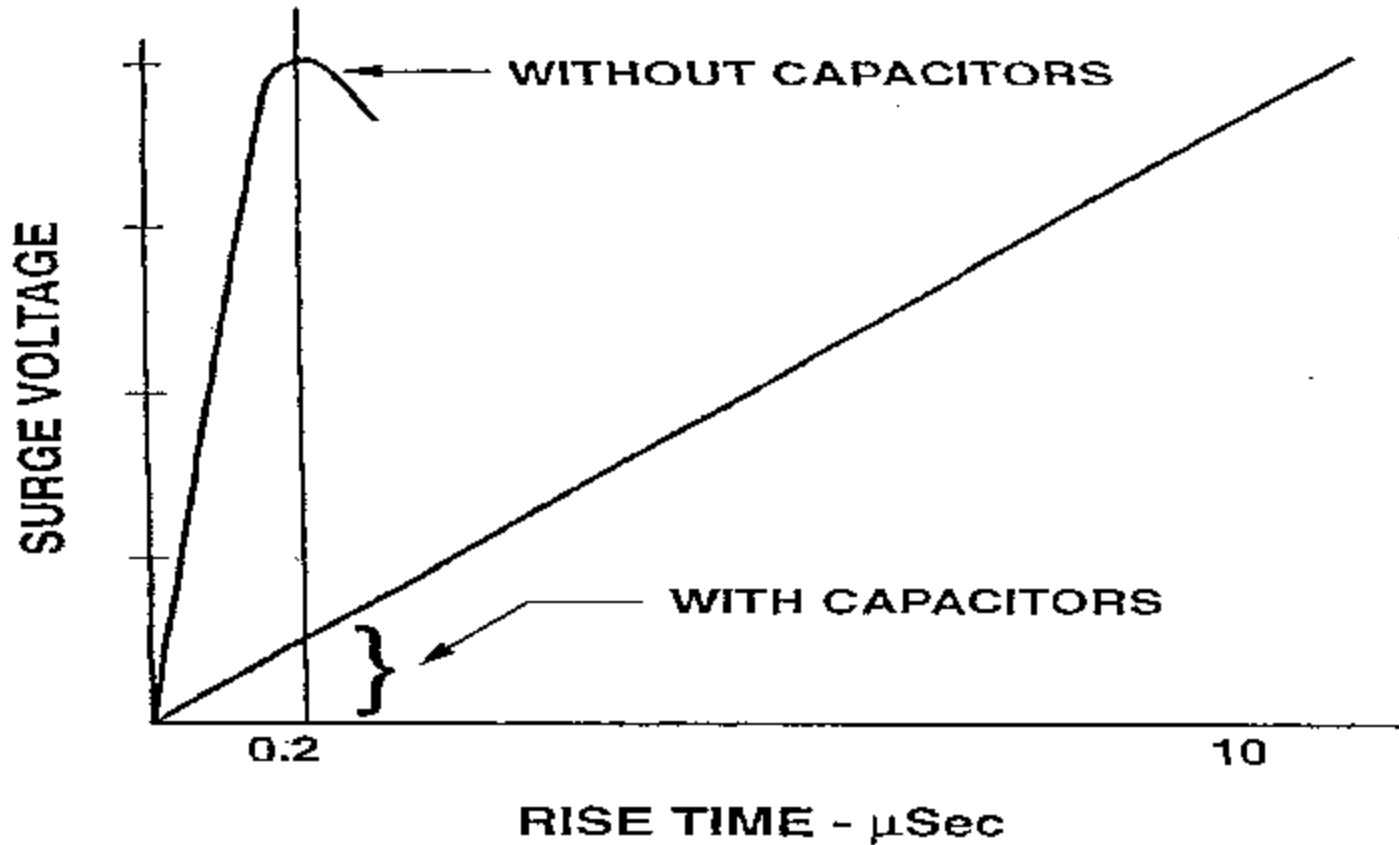
ACCESSORIES

Surge Capacitor



ACCESSORIES

Surge Capacitor



EFFECT OF CAPACITORS ON RISE TIME

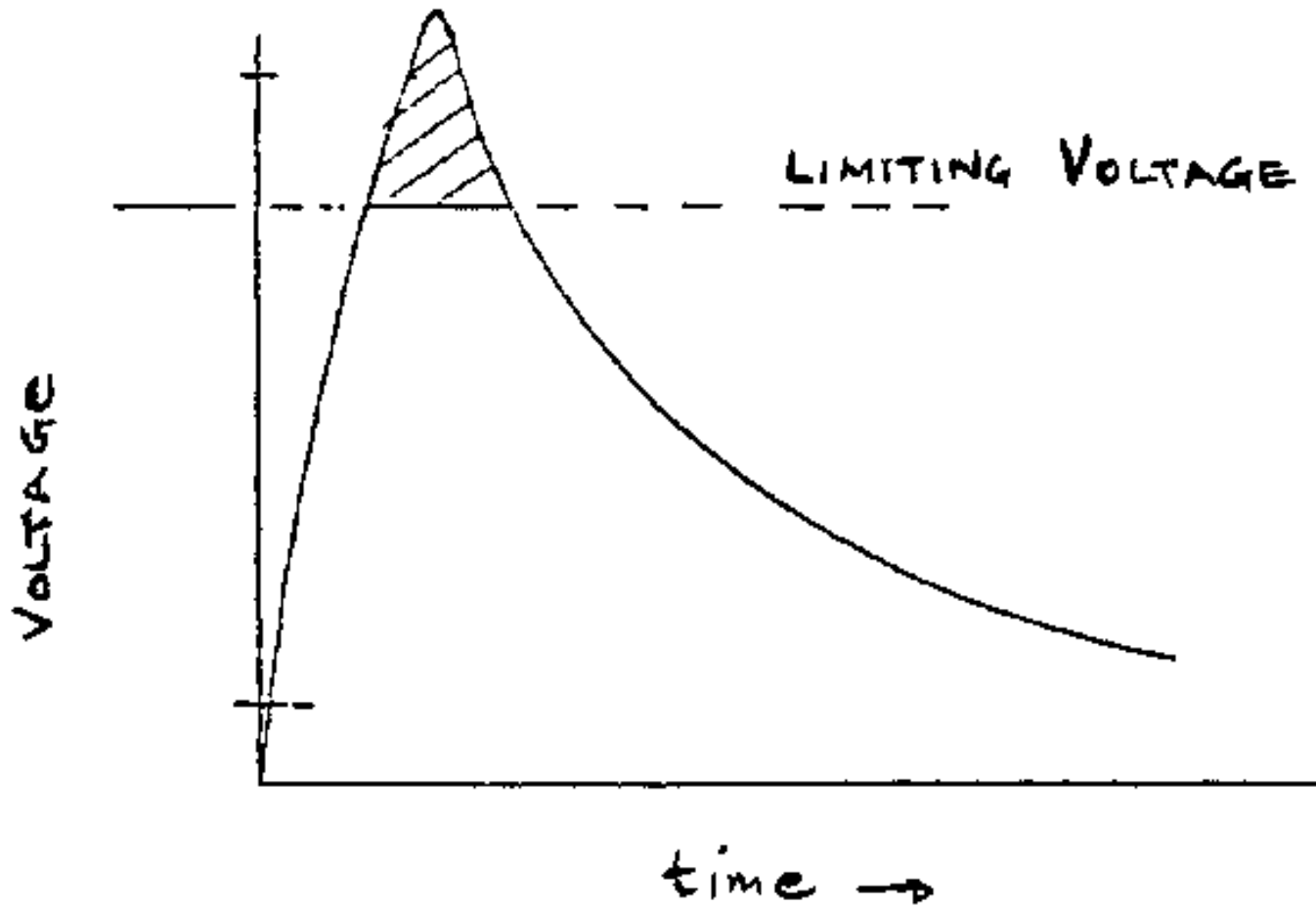
ACCESSORIES

Lightning Arrestors



ACCESSORIES

Lightning Arrestors



ACCESSORIES Mounted in Main Terminal Box



Standoff

Lightning Arrestor

Bus Bar

Neutral Bus

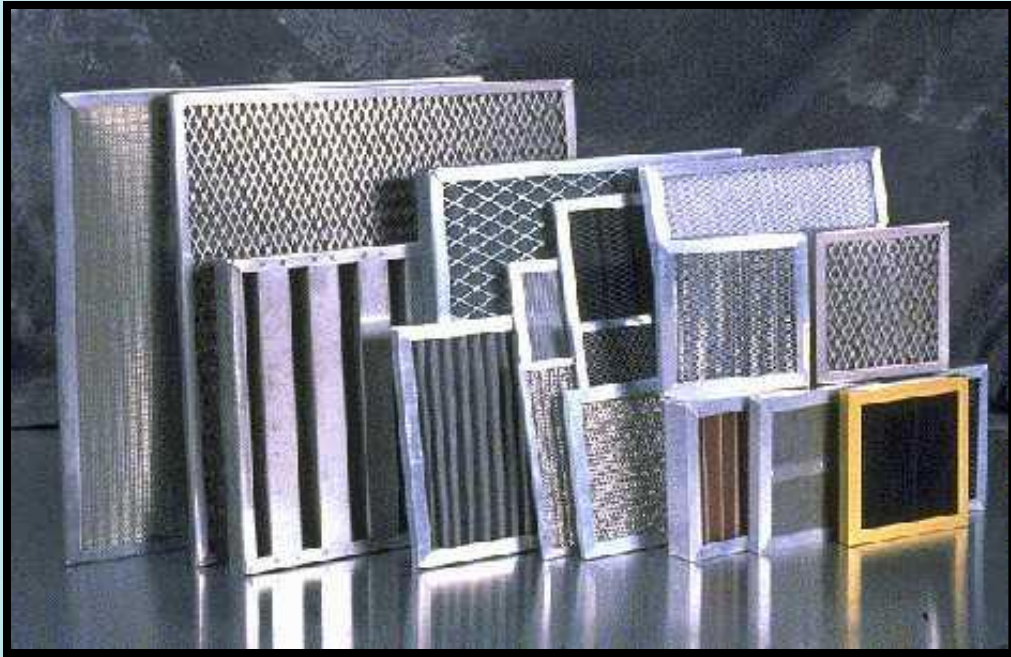
Current Transformer

CT Secondary Leads

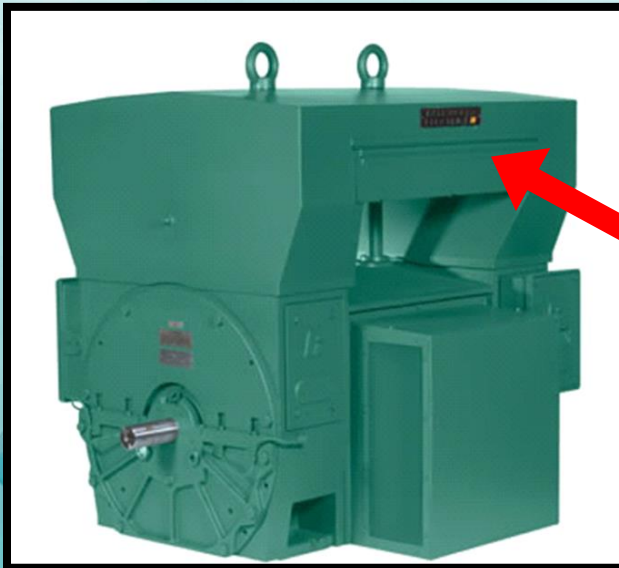
Surge Capacitor

Ground Pad

Motor Accessories - Filters

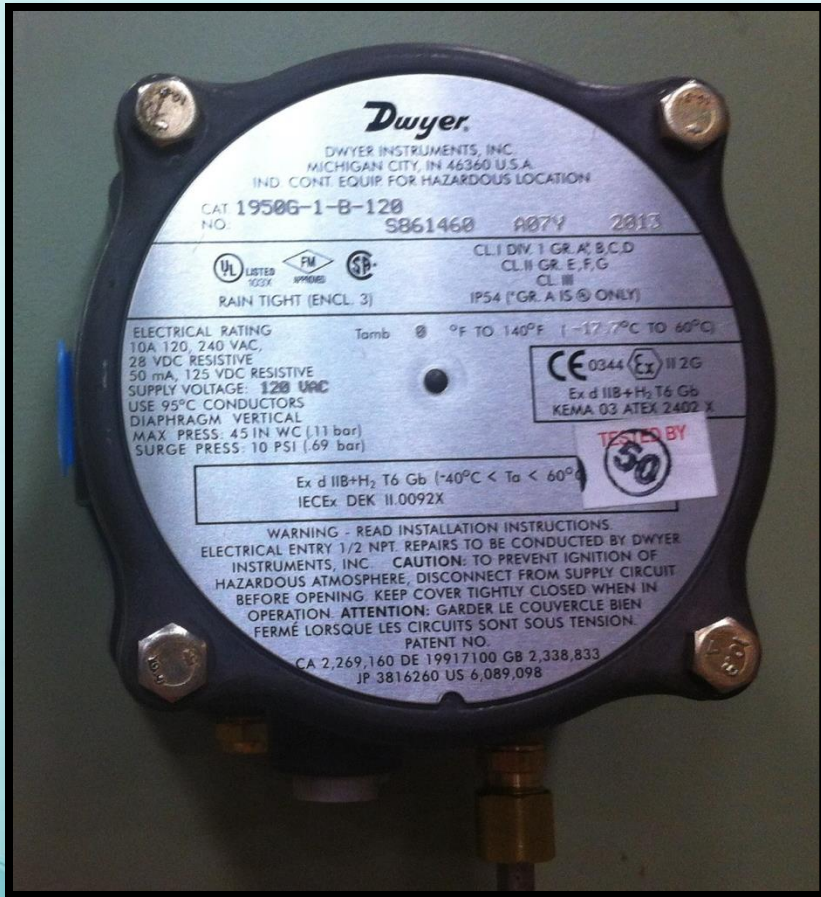


- Types of filters
 - Galvanized Steel
 - Stainless Steel
 - Aluminum
- Where Used
 - WP-II
 - Force Vent



Filter Location

Motor Accessories – Pressure Switch



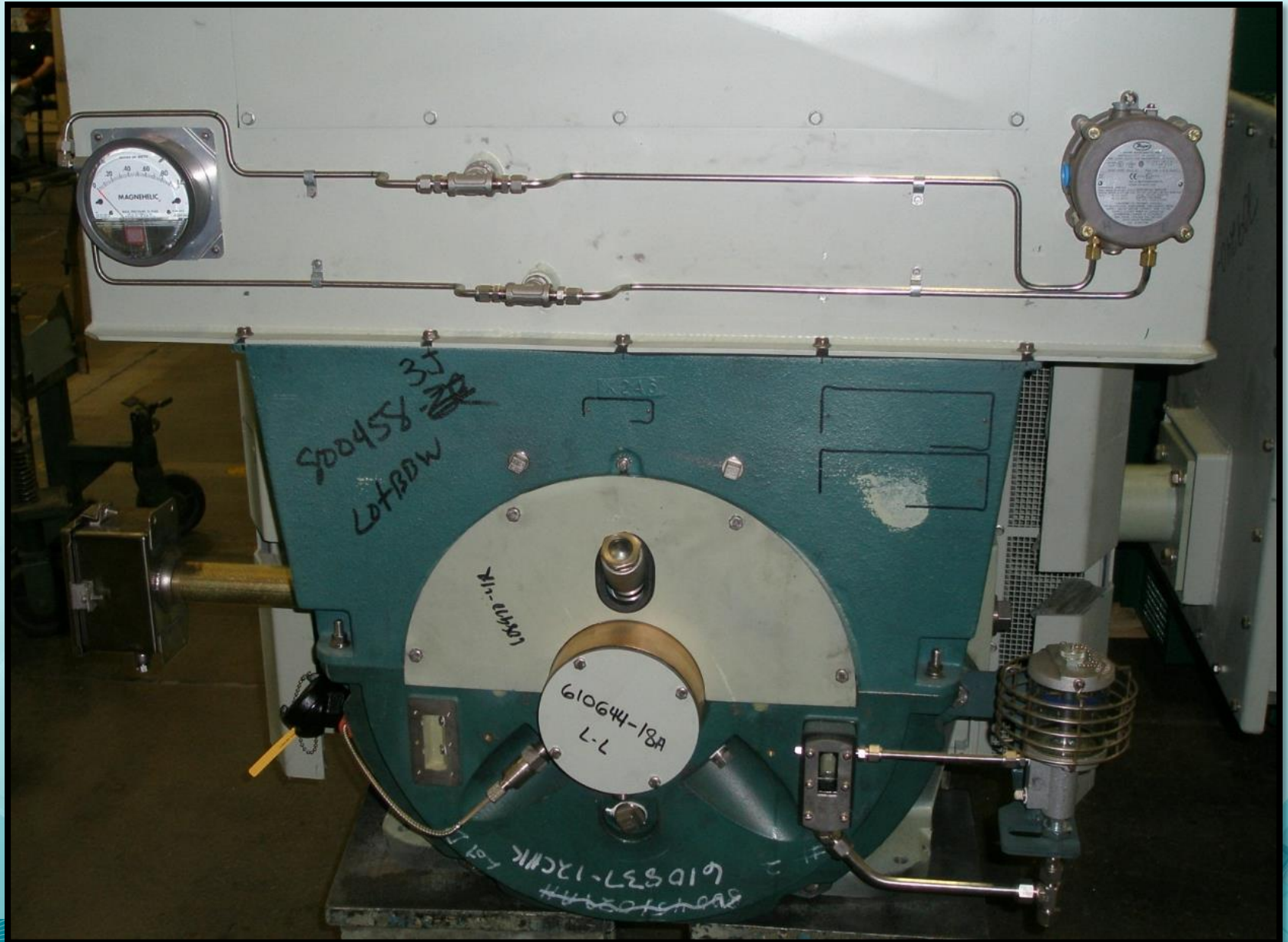
- Used to monitor filter condition for WPII motors
- Used to monitor air inlet condition for TEBC motors
 - Rain-tight for outdoor use, and are UL listed for use in hazardous locations
 - Supply Voltage
 - 24 VDC
 - 120 VAC
 - 240VAC

Motor Accessories – Pressure Gage



- Used to provide a visual monitor of filter condition for WP11 motors
- Used to provide a visual monitor of air inlet condition for TEBC motors

Motor Accessories – Pressure Switch and Gage

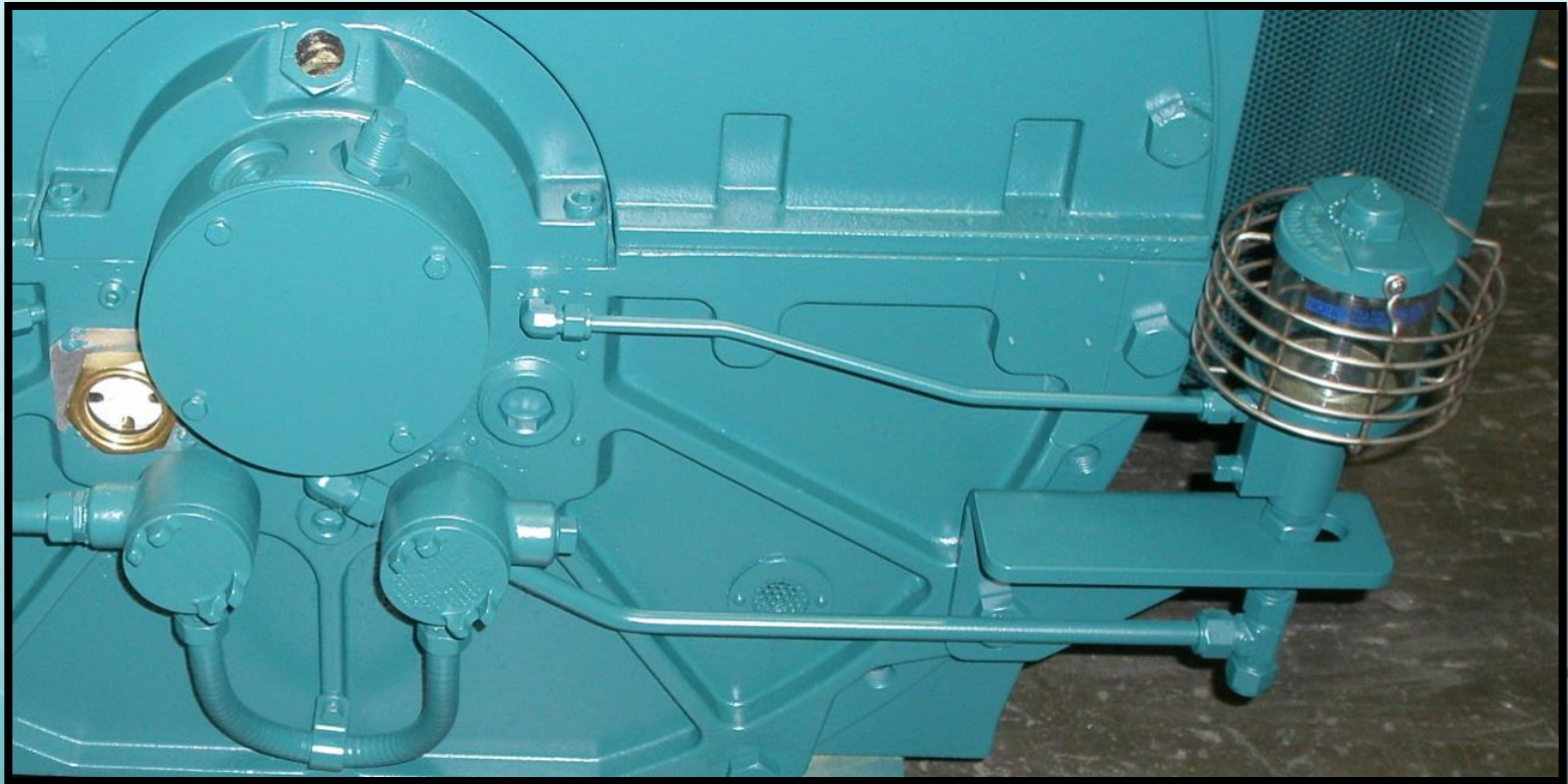


Motor Accessories – Leak Detector

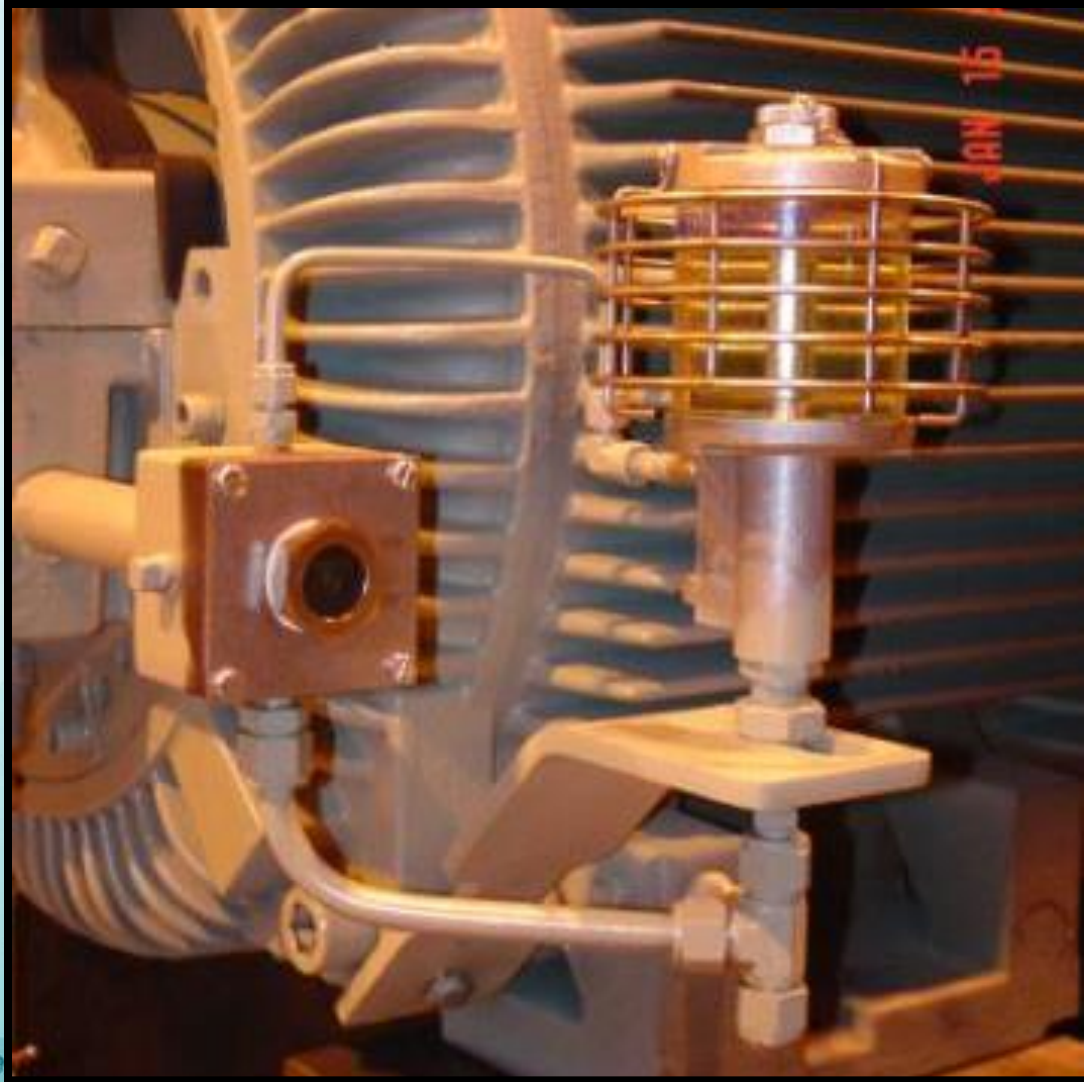


Motor Accessories - Oilers

- Constant level oilers are used to maintain a fixed level in a oil lubricated sump.
- When the liquid in the bearing recedes due to bearing consumption, the liquid seal on the inside of the oiler is temporarily broken. This allows air from the air intake to enter the oiler reservoir, releasing the oil until a seal and proper level are again established.



Motor Accessories - Oilers



Oil-Rite® 9oz. with protective cage

Motor Accessories - Oilers



Trico Opto-Matic and Sight Glass
Gage

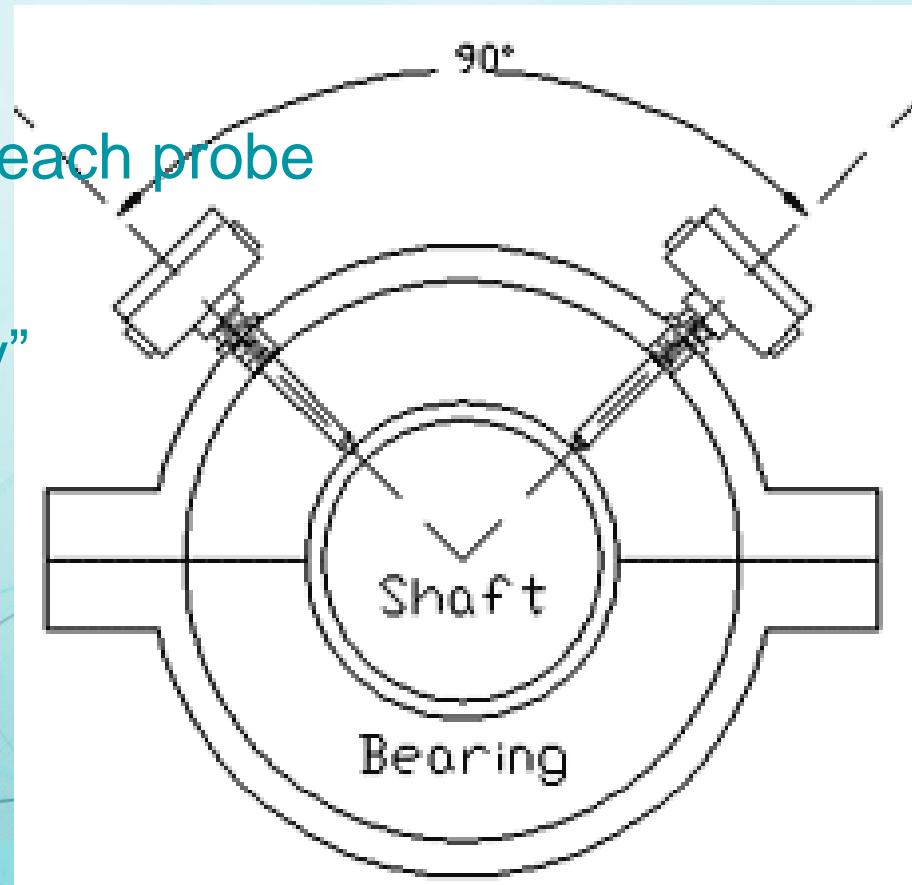
Motor Accessories – Proximity Probes

- Typical Proximity Transducer System

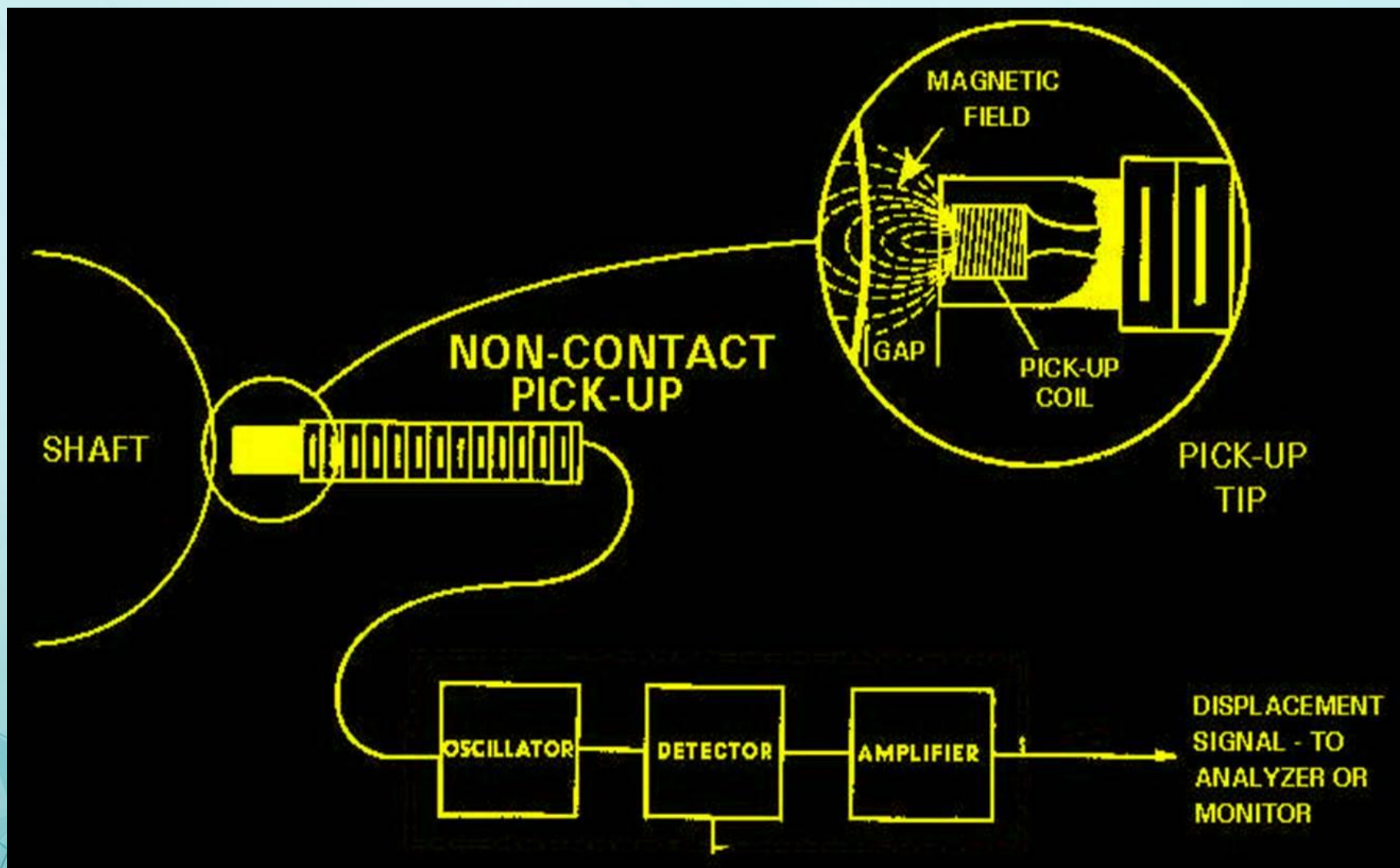


Motor Accessories – Proximity Probes

- Proximity Probes and Proximity Probes
 - Measures shaft displacement relative to bearing housing
 - Usually able to monitor and trend condition
 - Sleeve bearing motors only
 - Proximity Probes are required for each probe
 - Two probes per bearing
 - May specify “Provisions only”



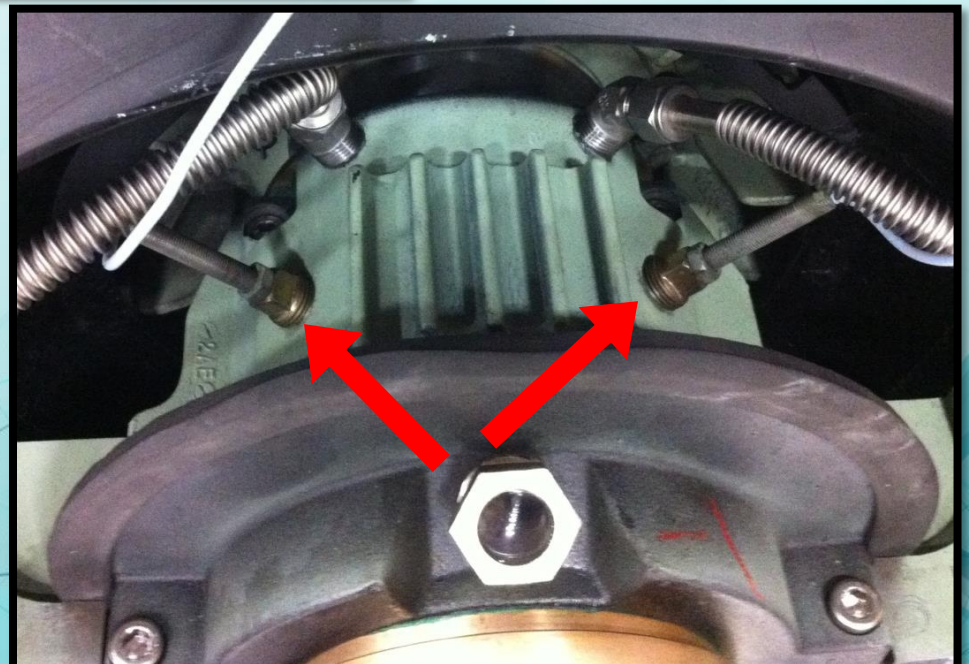
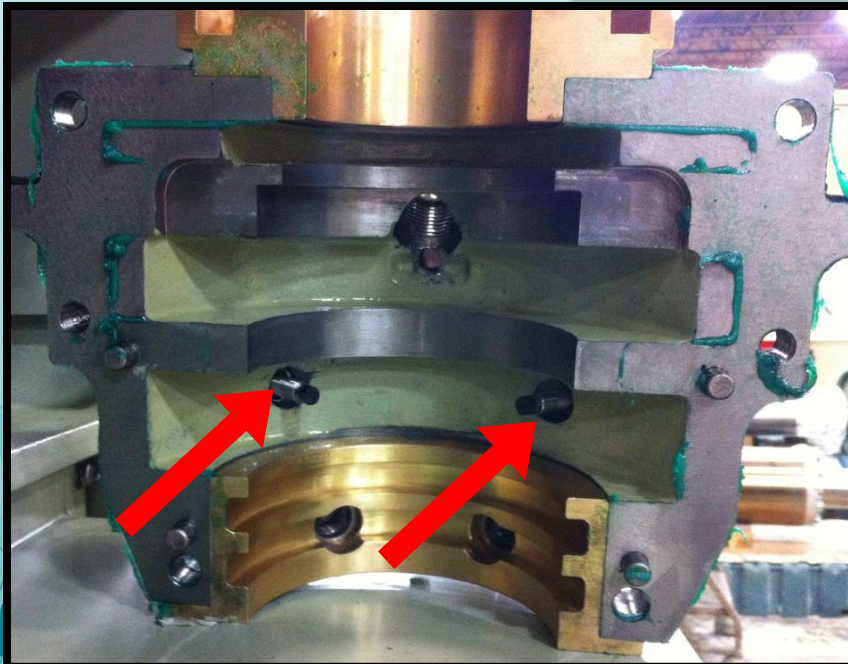
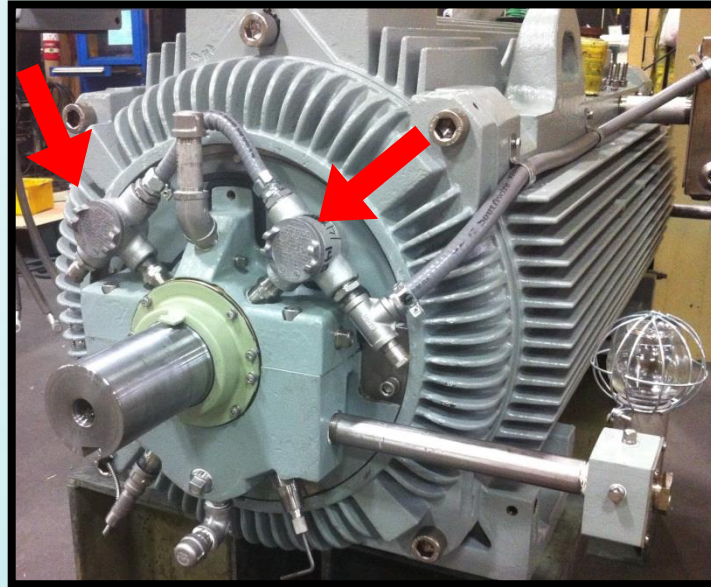
Motor Accessories— Proximity Probes



Motor Accessories– Proximity Probes

- Proximity probe detects three things
 - Movement of surface of shaft due to vibration (purpose)
 - Mechanical runout of probe target surface
 - Electrical runout of probe target surface
- Slow roll test to measure accuracy of reading
 - Run motor at approximately 200 to 300 RPM to eliminate the vibration component
 - Readings at this condition are attributed to electrical runout

Motor Accessories – Proximity Probes



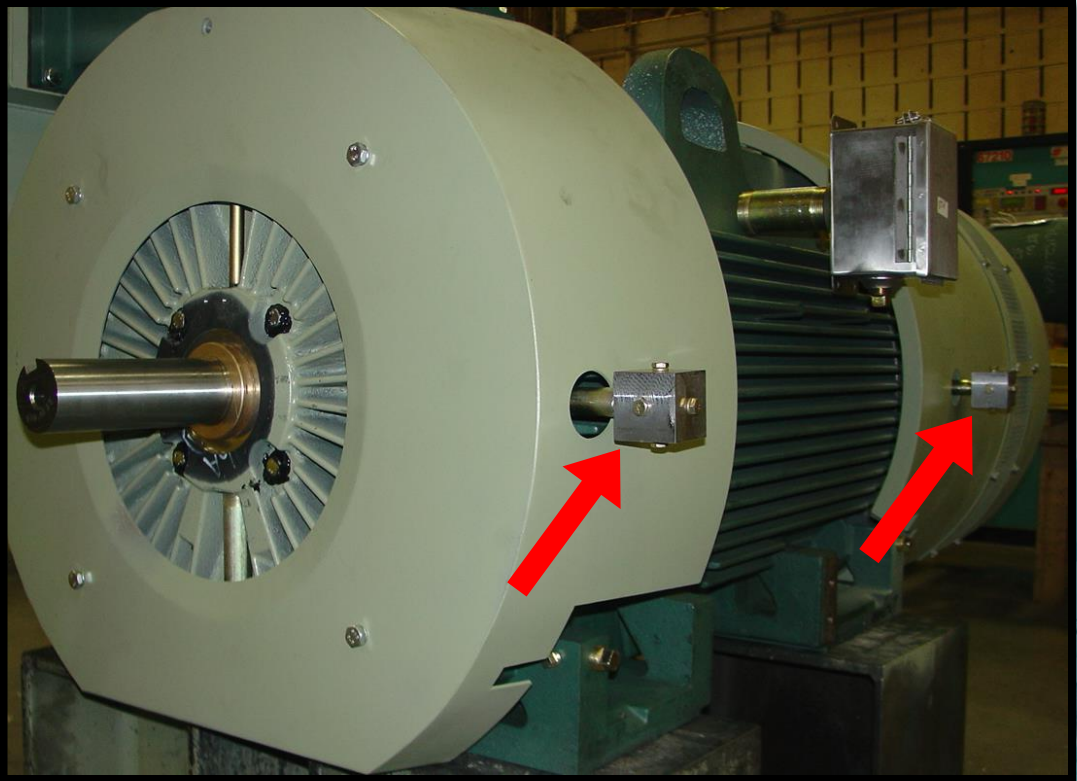
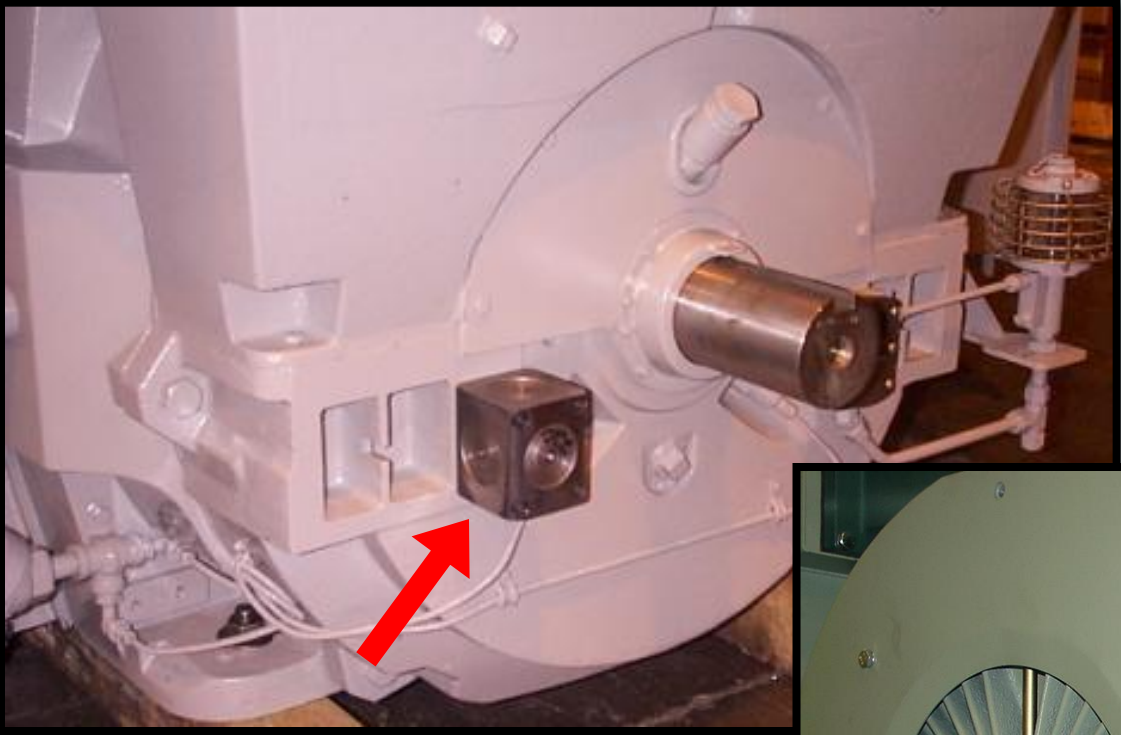
Motor Accessories – Velocity Transducers



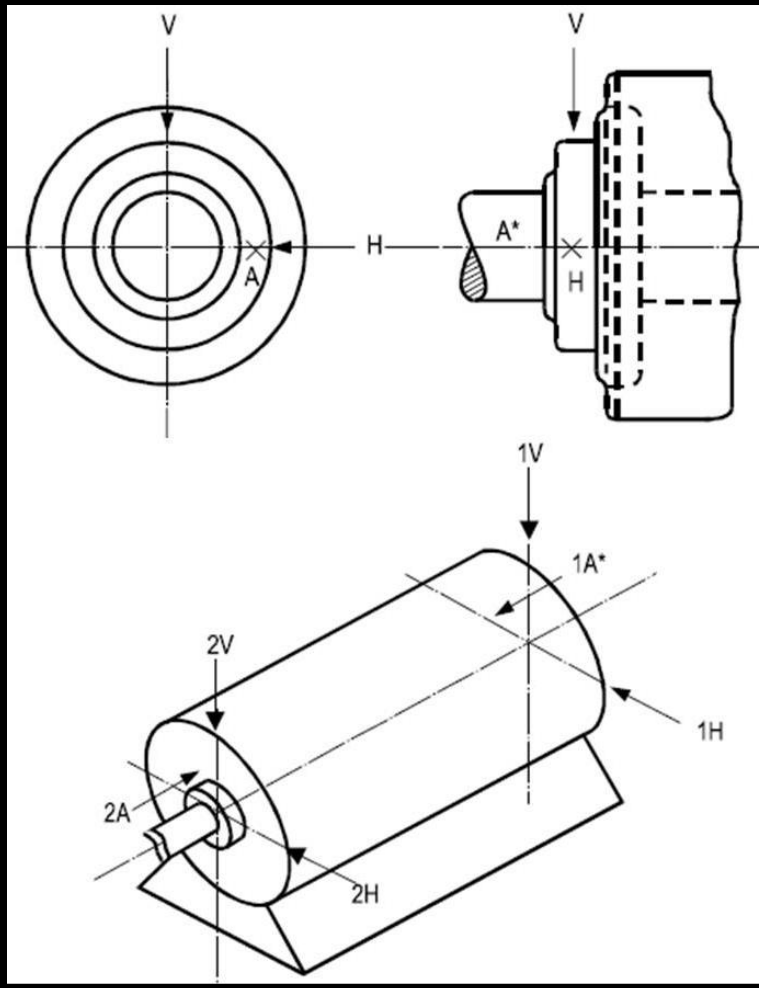
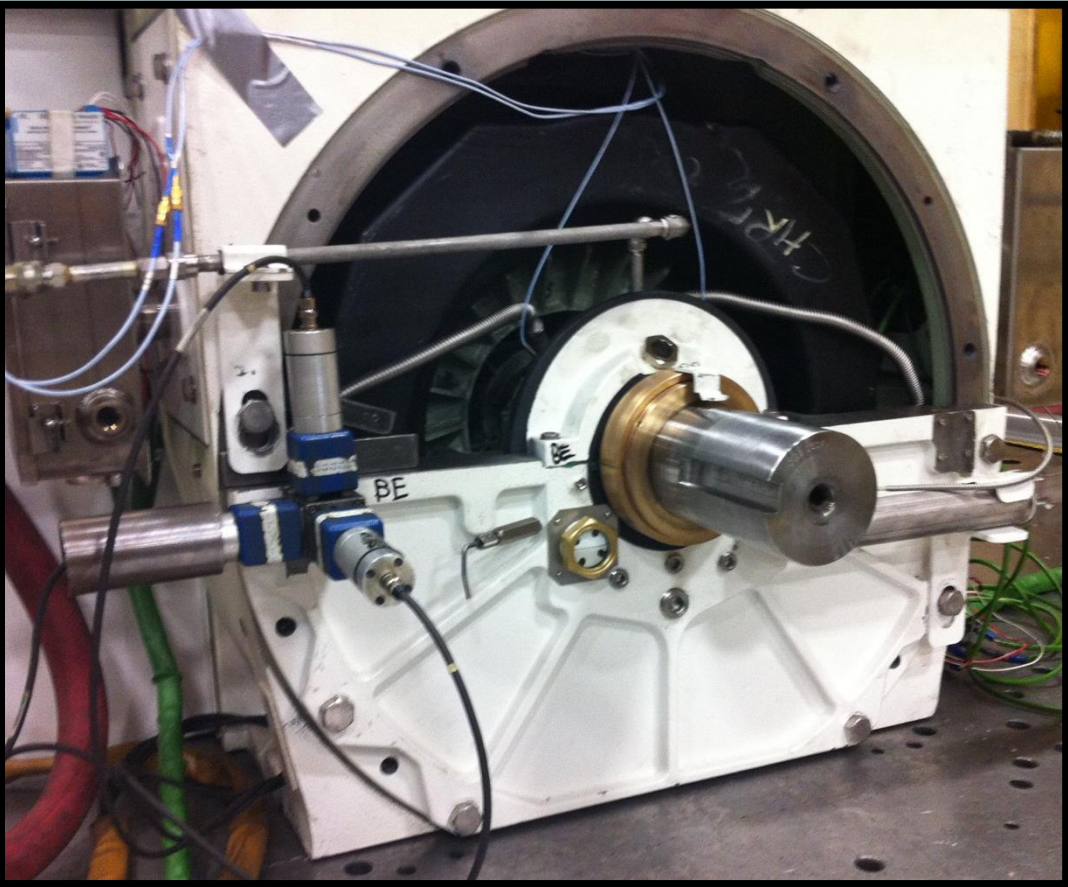
- Velocity Transducer

- Measures bearing housing velocity
- Usually able to monitor & trend motor condition
- Ball and sleeve bearing motors

Motor Accessories – Velocity Transducers

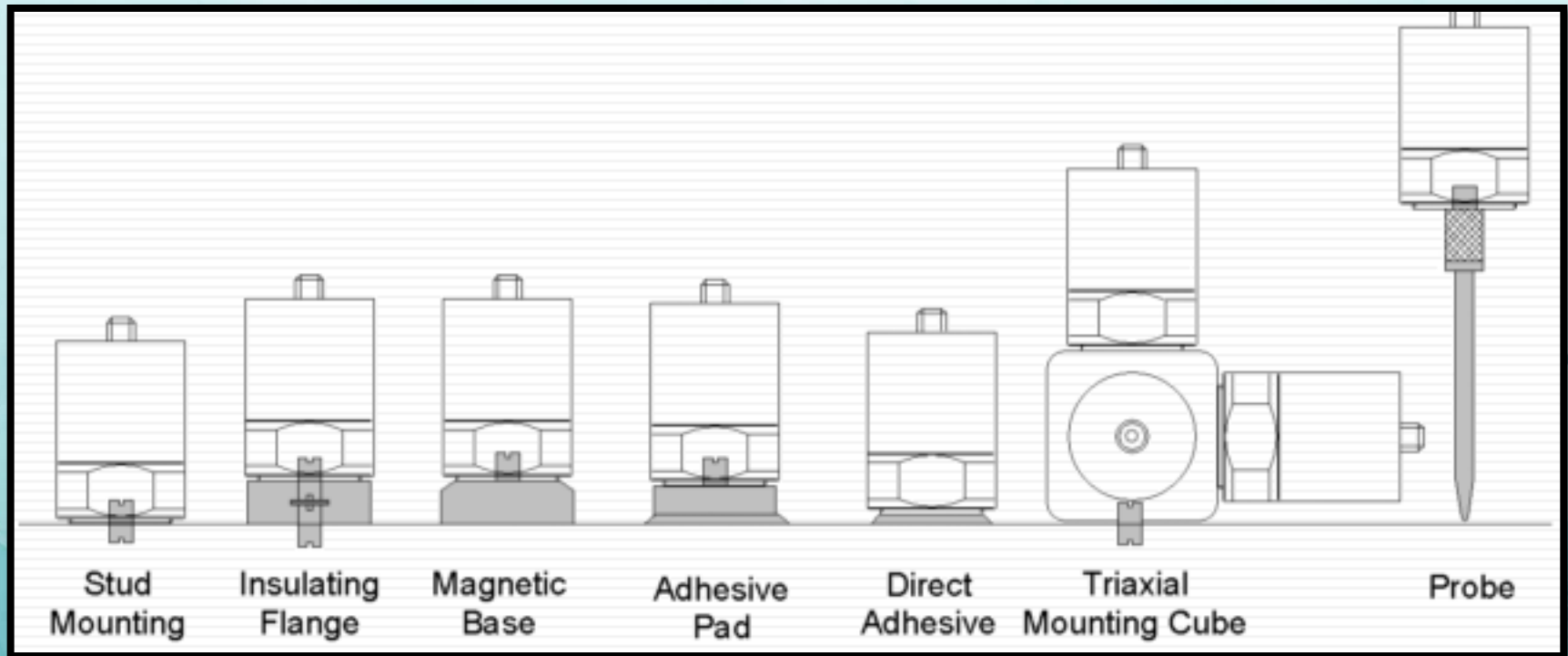


Motor Accessories – Velocity Transducers

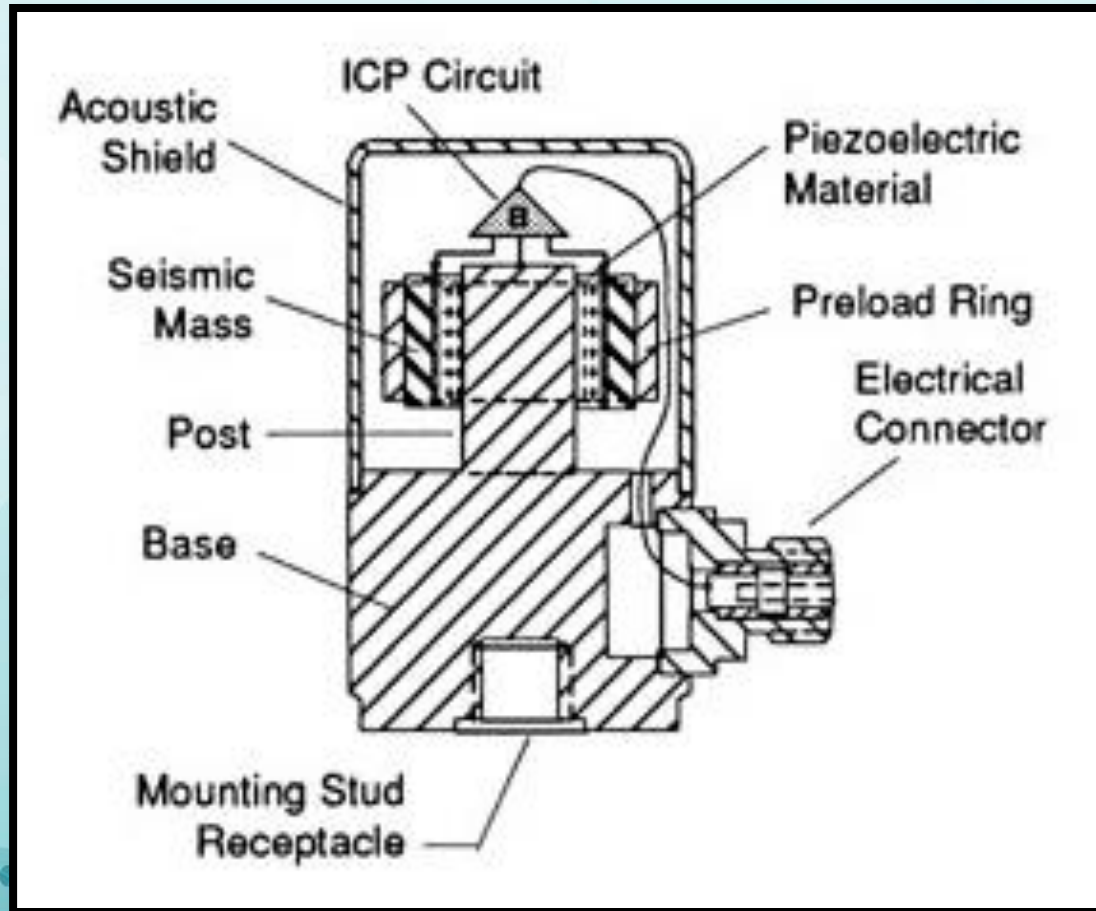


Motor Accessories – Accelerometers

- Accelerometers have many different features
 - Various mounting methods
 - Smaller than velocity transducers
 - No moving parts
 - Wide frequency detection range



Motor Accessories – Accelerometers



Motor Accessories – Vibration Switch



Motor Accessories - Encoders

- Encoders
 - Commonly used are incremental encoders
 - Can be hollow shaft or shafted.



- Will indicate speed of shaft
- Used for feedback into drives for VFD operation

- What are the two types of motor space heater?
- RTD stands for _____ Temperature Detector
- Where are lightning arrestors typically mounted (if used)?
- What are the two most common types of pressure sensors?

- Replaceable and Coilhead
- Resistance
- Terminal box
- Pressure Switch, Pressure Gauge