Best Practices for Maintaining AM Antenna Systems

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Typical AM Broadcast Engineer?

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AM Antenna System Critical Components

- Tower(s)
  - Base and Guy Insulators
  - Paint
  - Ground System
  - Unipole Kits
- Antenna Tuning Unit, Diplexer or Phasor Cabinet
  - Inductors, Fixed and Variable
  - RF Contactors
- Transmission Line(s)
  - Terminating Cable Clamps or Connectors
  - Dehydrators

Illustration of an AM Broadcast Transmission Facility

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TOWER MAINTENANCE

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Examples of Cracked Insulators

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Symptoms of Damaged Insulators

- Sudden change in transmitter reflected power where there is no apparent problem in the ATU
- Visible corona at a damaged guy insulator location
- Visible observation of an oil leak on the surface of a cracked base insulator
- Change in the measured drive impedance of the tower

TROUBLESHOOTING PRACTICES

- Observe the tower at night with full power and 1kHz continuous tone modulation to look for visible corona if the required transmitter match can be achieved
- Use a corona camera such as a CoroCam 504 to observe the tower during day or night operation
- Use binoculars to look for any indications of burning on the surface of the primary fiberglas insulators or have a tower rigger climb the tower to investigate.

EXAMPLES OF CORONA CAMERA IMAGERY

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How Not to Maintain Tower Paint

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Tower Paint Maintenance

- Be Sure All Legs of All Sections Are Welded Together With At Least a 0.5-1” Weld Joint
- Remove All Rust Using a Wire Brush, Remove All Residue, Apply Cold Galvanizing Paint Followed By a Primer Coat and Final Coat
- Paint Maintenance Schedule is Dependent on Observable Experience and Local Environmental Conditions
- We Recommend Rustoleum Tower Paint Products

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Tower Ground System Examples

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GROUND SYSTEM EXAMPLE WITHOUT GROUND SCREEN

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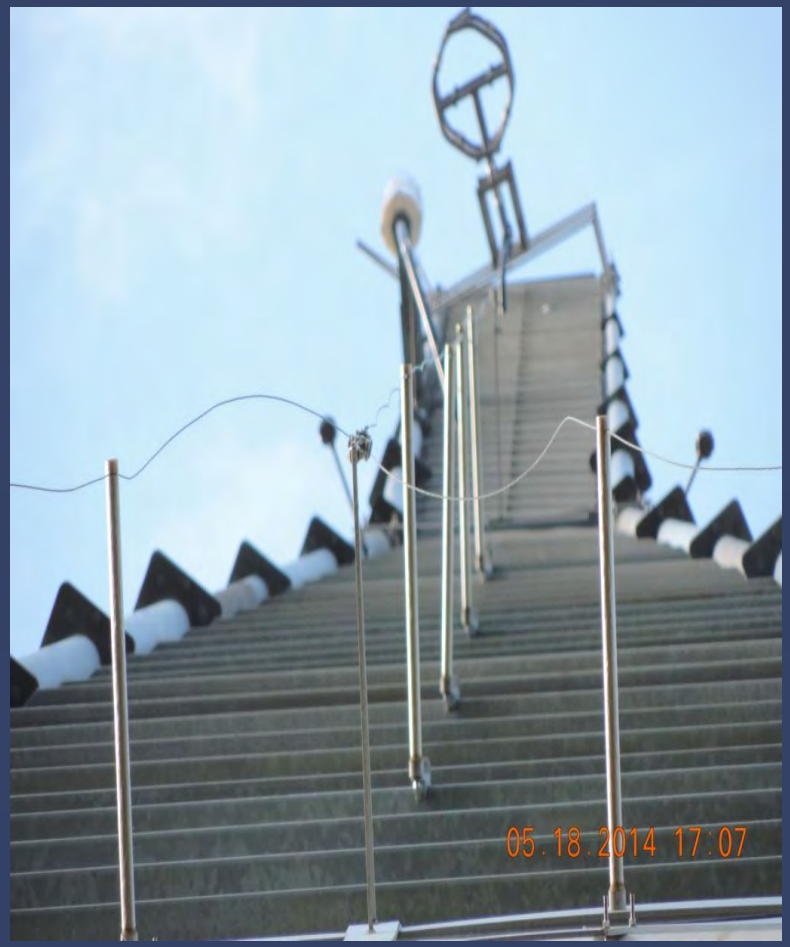
Ground System Maintenance

- Symptoms:
  - Reduction in pattern coverage
  - Tower impedance instability
- Maintenance Procedures
  - Measure resistance of ground system using a Megger. Should be < 2 ohms typically depending on the soil type
  - Use field intensity meter or differential radial detector to detect ground radials
  - Remove soil to expose radial to base perimeter strap silver solder joints. Repair as needed.
  - Repair broken radials as needed using silver solder or cad weld.

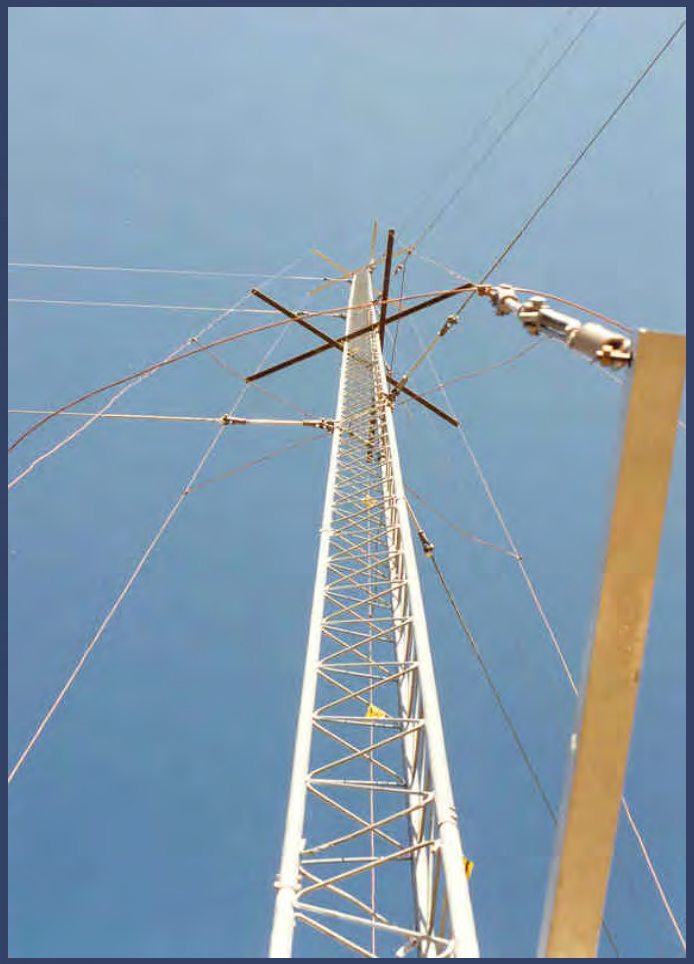
Improperly Maintained Unipole Kits



Tower Unipole Problems

- Symptom: Increased transmitter reflected power during or following a wind or ice storm is the typical scenario
- Visibly inspect the unipole kit to look for any loose or severed mechanical connections, particularly paying attention to the skirt to leg shorting stubs. Make the appropriate repairs.
- Inspect the standoff insulators for any signs of arcing or burning. Replace any damaged insulators
- Check the base commoning loop for tight mechanical connections
- Check the tension of the skirt kit conductors compared to the original installation setting and reset if necessary

Properly Maintained Unipole Kits



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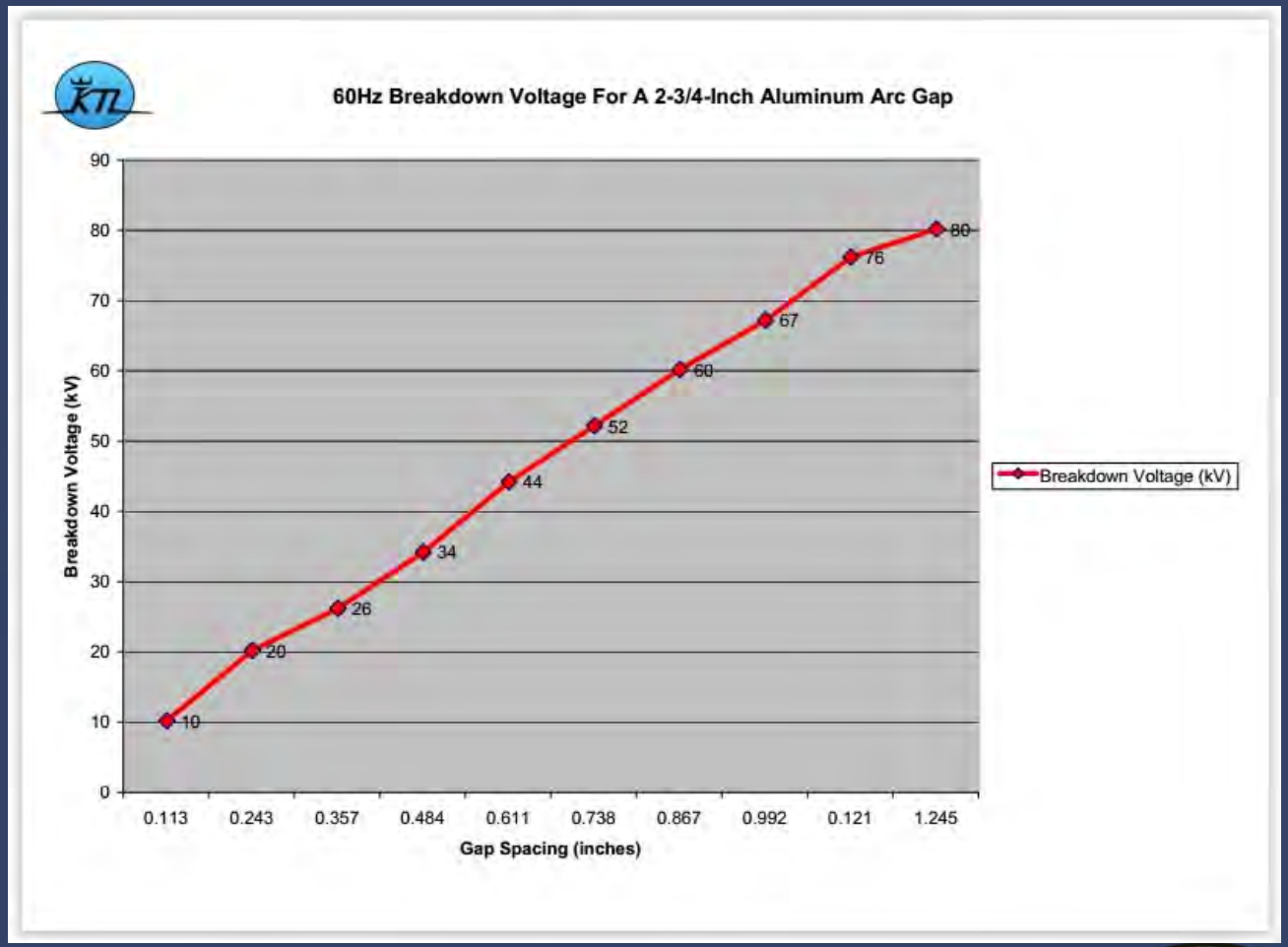
Tower Ball Gap Setting
Note: Multiply 60Hz Voltage by 0.6 to obtain the equivalent RF voltage.



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Setting a Tower Ball Gap

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Tower Maintenance Guidelines

- Guy and Base Insulators: Inspect six months and 12 months following initial installation. Annual inspection following first year of operation
- Tower Paint: Annual visible inspection with touch up as required
- Ground System: Inspect tower base silver solder joints and RF tower connection following first year of service followed by annual inspections following spring thaw
- Tower Plumb and Tension: Check after first year of operation. Repeat every five years.
- Unipole Kits: Check mechanical connections and skirt wire tensions after first year of operation. Repeat annually. Inspect insulators every three years.

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ATU'S, DIPLEXERS AND PHASOR CABINETS

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THE CONSEQUENCES OF TOTAL NEGLECT

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PROPER ATU/DIPLEXER MAINTENANCE

- Replace the door seal gasket annually in the case of outdoor installation
- Be sure that the meter window is kept intact to prevent bird intrusion
- Be sure that all ventilation openings are designed to prevent “critter” intrusion
- Every three months check all standoff insulators bowl insulators and replace any cracked units
- Every six months check the J-plug spring clips to assure a tight fit of the shorting bar. If necessary compress the spring clips together using vice grips
- Annually check the input cable clamp assemblies to look for any signs of tracking between the inner and outer conductor due to dust accumulation on the foam dielectric
- Every three months check inductor clips for proper tightness
- Every six months check all hardware connections

Proper Phasor Cabinet Maintenance

- After the first month of operation check the front and rear cabinet access doors for any signs of arcing around the door frames. Tighten door latches if necessary and add straps between cabinet frame and door.
- Every three months inspect the fixed and variable inductors for any signs of overheating. Clean and repair the inductors as appropriate.
- Every six months check the front panel drive shaft couplings for each front-panel-controlled component for any signs of arcing or any slippage and repair accordingly
- Annually check all standoff insulators for any cracks and replace accordingly

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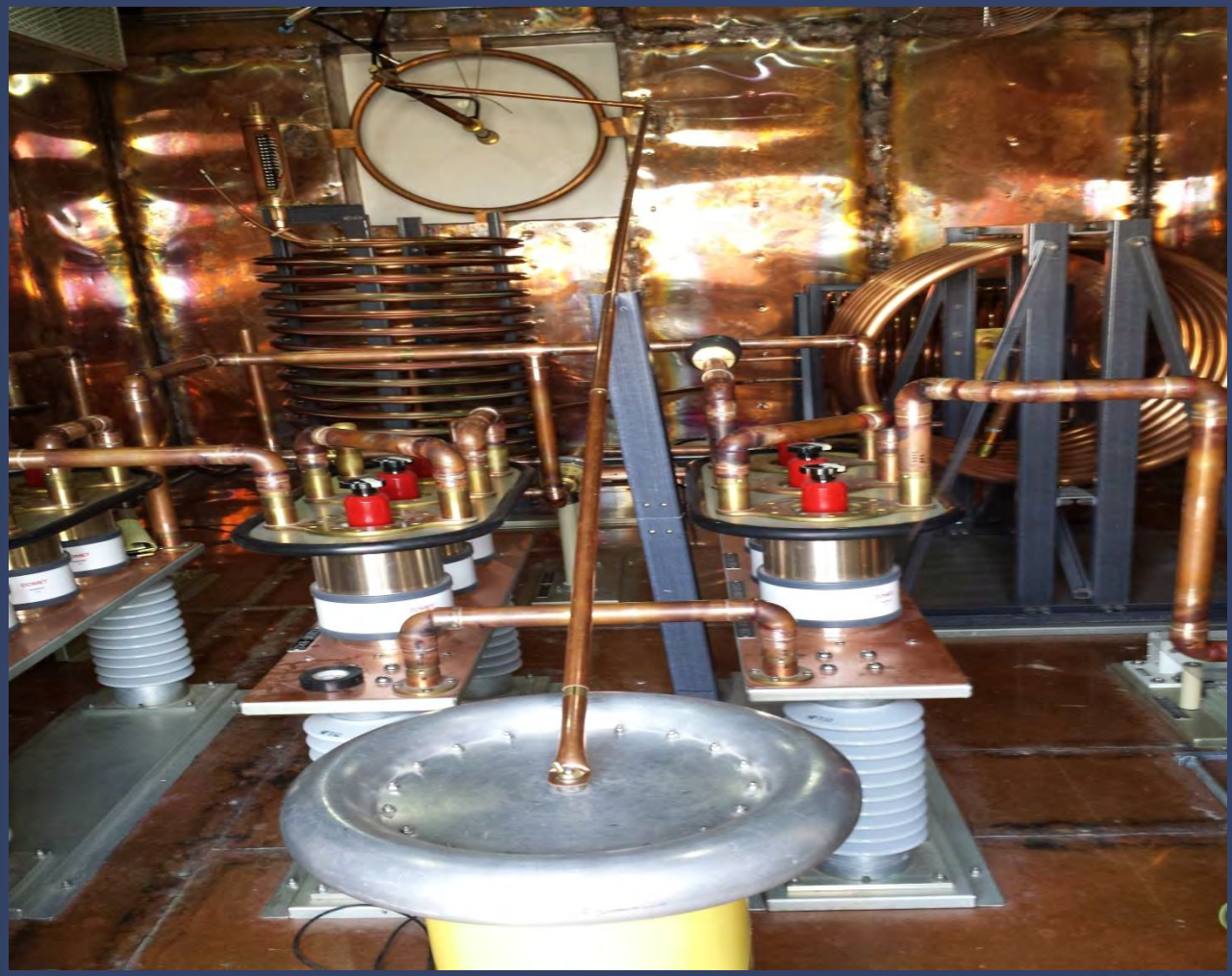
DIAGNOSTIC TOOLS

- Check for hot spots due to loose connections or over current conditions or cracked insulators using a handheld thermal sensor with laser pointer or using an infrared imager
- Use a HiPot AC voltage tester to check network nodal voltages, output feedthrough peak voltage capacity or capacitor breakdown
- Use a HiPot tester and Corona Camera to detect corona due to metal burs or sharp RF buss points in a network

TYPICAL HIPOT TEST SETUP



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Inductors

Routinely Check:

- Fixed Inductors
  - Clip Contact
  - Routing of Strap
- Variable Inductors
  - Wheel Contact/Spring Tension
  - Condition of End Finger Contacts
- All
  - Signs of Heating or Arcing
    - Pitting or Discoloration
  - General Conditions
    - Dirt, Residue, Nests, Corrosion

Recommended Cleaning Method for Inductors

- Dip the complete inductor assembly in TARNAX

Variable Inductor Cleaning Procedure

- Dip the complete assembly in TARNAX
- Remove the end plate that does not include the variable contact
- Remove the center shaft
- Remove the wheel assembly from the shaft
- Wipe off the Conducto Lube lubricant with a clean cotton cloth
- Apply new thin layer of Conducto Lube to the shaft
- Re-assemble the inductor

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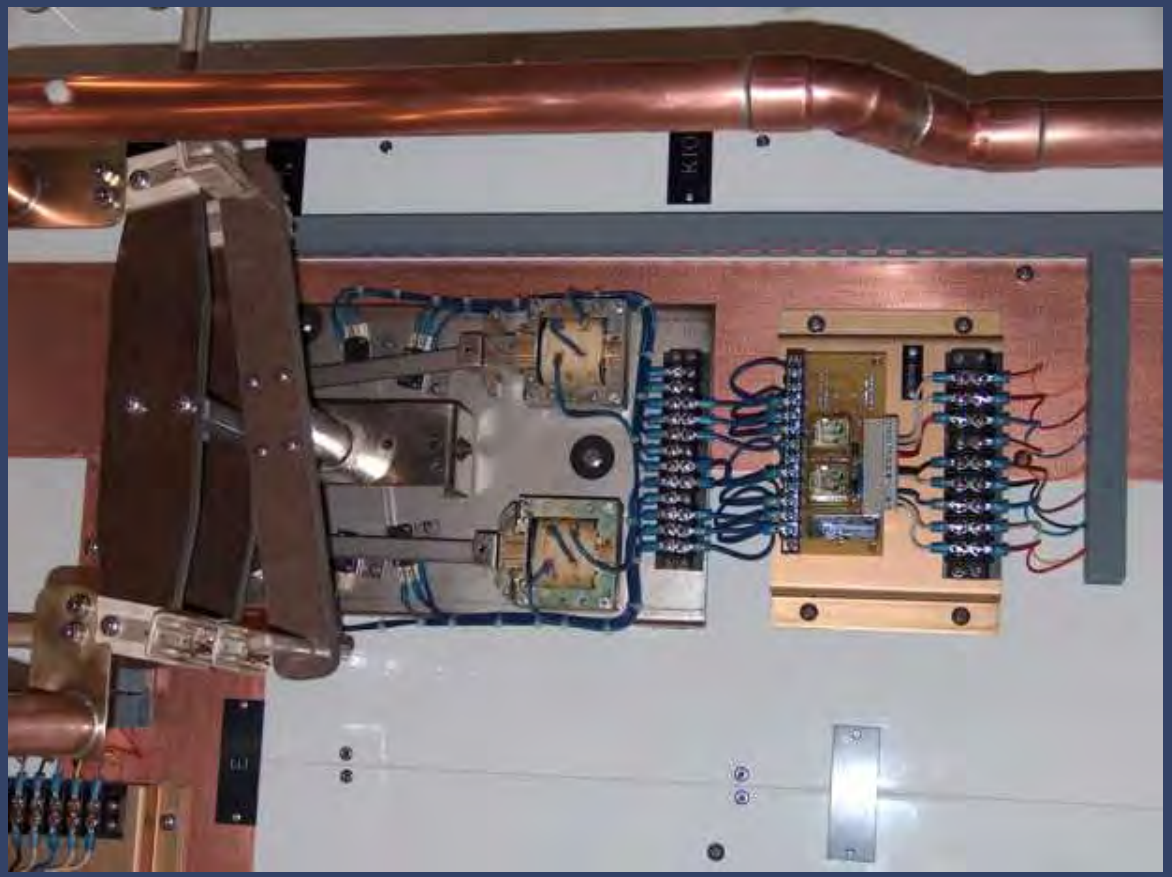
RF Contactors

- Routinely Check:
  - Freedom of Movement
    - Bar Freely Swings
    - Sluggish Solenoid Action
  - Signs of Heating or Arcing
    - Pitting or Discoloration
  - General Conditions
    - Dirt, Residue, Nests
  - Tighten Hardware

Installation With Slave (Pilot) Relay Panel



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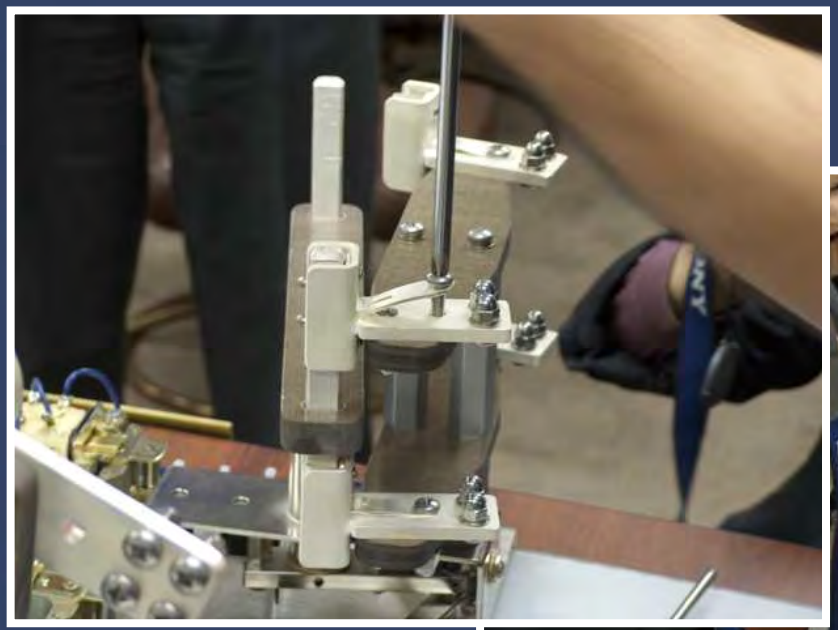
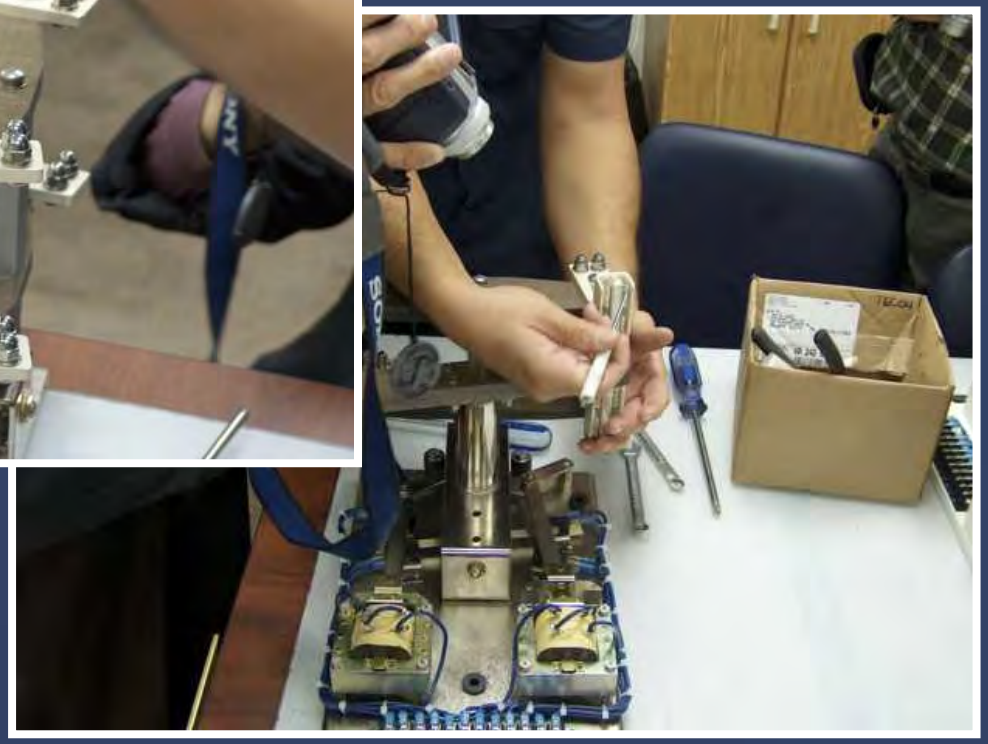
Finger Stock Installation And Adjustment





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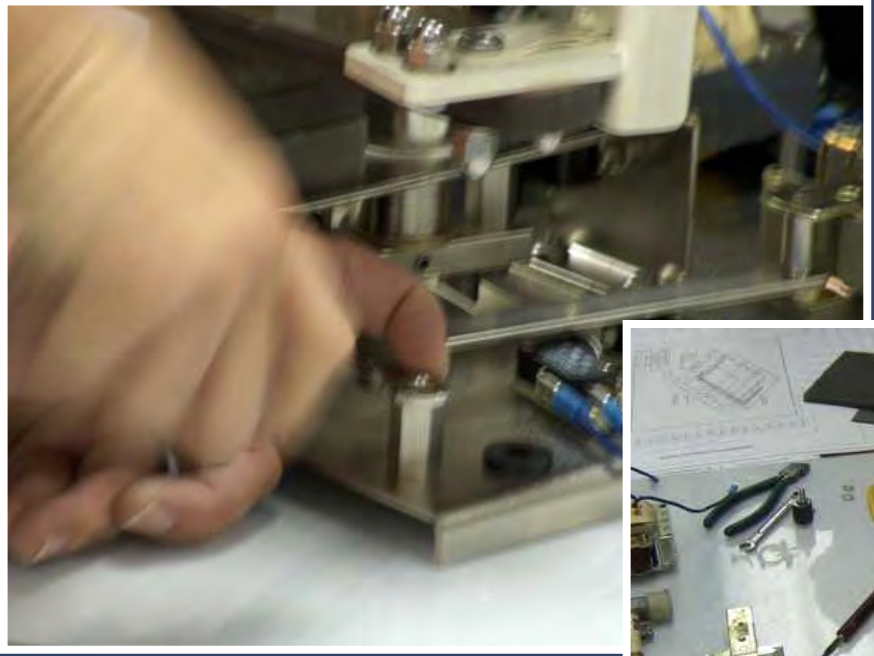
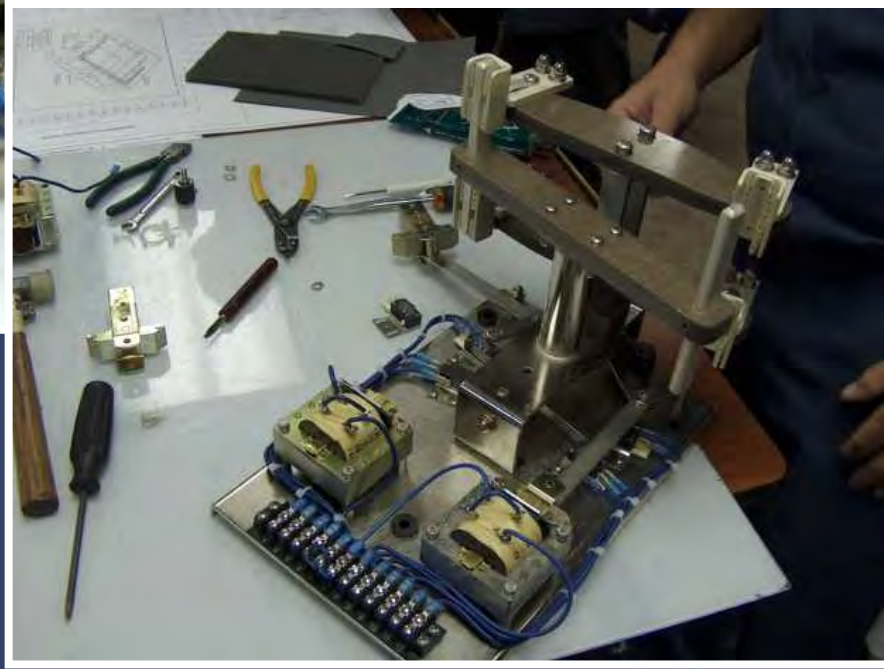
Removal of Solenoid Plunger





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RF CONTACTOR MAINTENANCE SCHEDULE

RF contactor	Maintenance Interval	Procedure
A. Spring Fingers	6 Months	1. Inspect spring finger contact surfaces and corresponding contact bar surfaces for any residue accumulation or signs of pitting. In the event of residue build up clean the surfaces with a clean cloth and apply a thin coating of Dow Corning No.4 lubricating compound on the contact bar surfaces. 2. If necessary adjust the spring fingers to maximize the contact surface with the contact bar using a small flat blade screw driver and needle nose pliers.
B. Contact holders	Annually	1. Verify contact bar is a centered in the contact holder. Adjust the contact holder as needed by loosening the acorn nut adjusting and re-tightening.
C. Linkage Hardware	6 Months	1. Visibly inspect pivot pin and C-ring hardware for unimpeded mechanical operation. Replace C-ring if necessary.

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RF CONTACTOR MAINTENANCE SCHEDULE

D. Fixed and moveable Insulated bars	6 Months	1.	Visibly inspect surfaces for any signs of carbonized arc paths. Using a sharp knife dig out and remove any black surface tracks. If necessary replace the insulated bar.
E. Moveable bar operation	6 Months	1.	Check mechanical movement of moveable bar to confirm contact bar is properly seating in the contact holder in both positions. Adjust the spring tension screws accessible between the two solenoid or on the rear of the contactor to yield desired operation.
F. Solenoids	6 Months	1. 2. 3.	Check solenoids for any signs of overheating. Check terminal block wiring to solenoids for proper tightness. Check AC voltage jumper solder connections.
G. Micro-switches	6 Months	1.	Confirm switch position to be such that the switch depression blade is against the switch body in each contactor position.

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D. Fixed and moveable Insulated bars	6 Months	1. Visibly inspect surfaces for any signs of carbonized arc paths. Using a sharp knife dig out and remove any black surface tracks. If necessary replace the insulated bar.
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TRANSMISSION LINE MAINTENANCE

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Connectors and Terminations

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Connector Maintenance

- Every 6 months clean the exposed insulated surfaces with isopropyl alcohol. More frequent cleaning may be required depending on the level of dust and particulates in the air
- Annually check the mechanical connections to the center conductor and to ground for proper tightness
- Check air dielectric connectors for pressure leaks by applying soapy water around the base of the connector and around the flange. Replace O rings where appropriate.

RFS Model APD-72-C Dehydrator

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Dehydrator Maintenance

- Visibly inspect the compressor air inlet filter monthly. Remove, wash in solvent, dry and replace as needed.
- Check the humidity indicator monthly and if it is displaying a pink color indicating high humidity remove the plastic tube from the rear of the dehydrator and let it run for up to 30 minutes until the color changes to blue indicating low humidity.
- In the event of a pressure leak check all possible mechanical connections between the output port of the dehydrator and the last connector on the transmission line with soapy water to locate the leak. Make the necessary repairs and re-check.

MAINTENANCE SUPPORT

- THE KINTRONIC LABS MANUFACTURING STAFF ARE AVAILABLE 7:30AM-4:00PM M-F FOR CONSULTATION. YOU MAY CONTACT US BY EMAIL AT KTL@KINTRONIC.COM, BY PHONE AT 423-878-3141 OR BY FAX AT 423-878-4224