

REINHOLD ENVIRONMENTAL Ltd.



**2013 APC Round Table
& Expo Presentation**

July 8-9, 2013, in St. Louis, MO / Hosted by Ameren

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Photos of Precipitator Problems

Try to guess the root cause or what
the problem is.

John Walker Sr. Engineer Duke Energy

PCUG Roundtable
St.Louis-Host AMEREN
July 8, 2013

Hopper Fire



Hopper Fire

- RB Mill Inverted cone failure, allowed unburnt coal to enter the ESP hopper.





Center Guide Bolt Failure

- Fretting wore the bolt away.
- CE came into contact w/ DE when airflow increased.
- Temp repairs made 20' up.





Ground

- High hopper lifted the chain and flopped it into the CE when the hopper was cleared.





High Hopper/Clinker



- This is what you get when you have a high hopper and force the TR to stay on



Standoff Insulator crack

- Root cause...Old age?





Air Inleakage

- Photo of an expansion joint from inside the outlet nozzle.
- Fan Bias killed ESP performance.

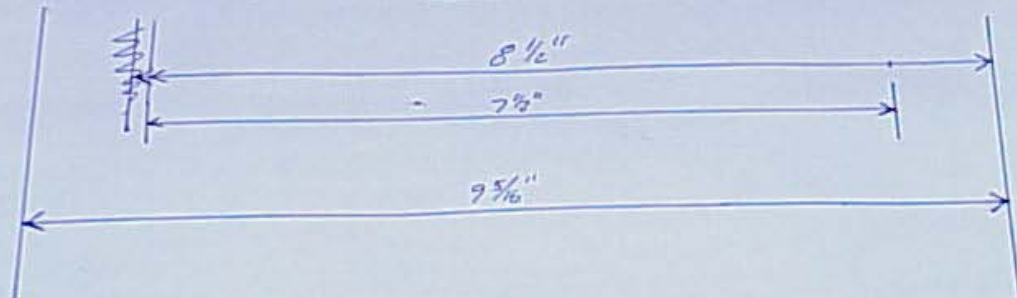




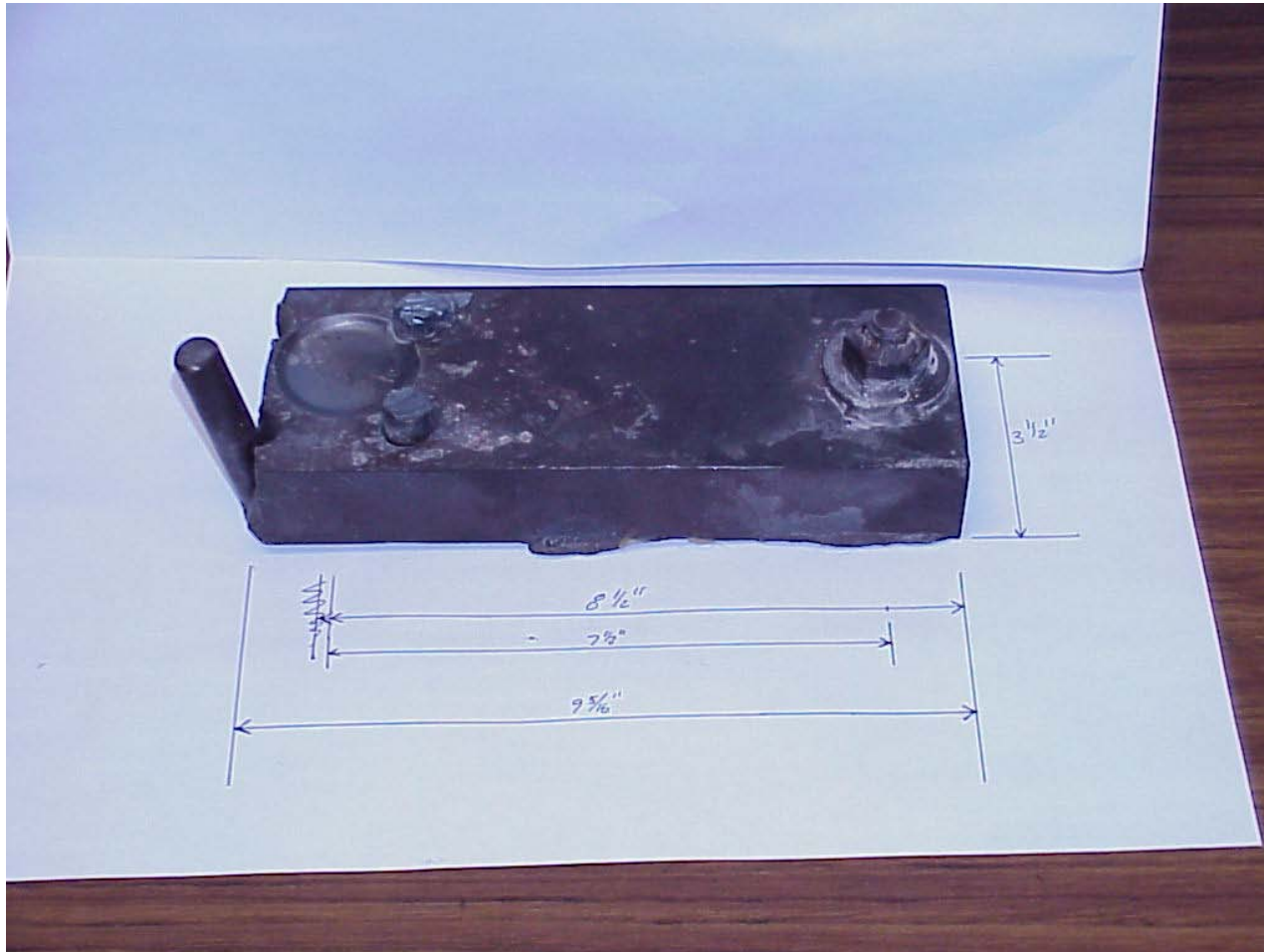
Reactor Cable Fault

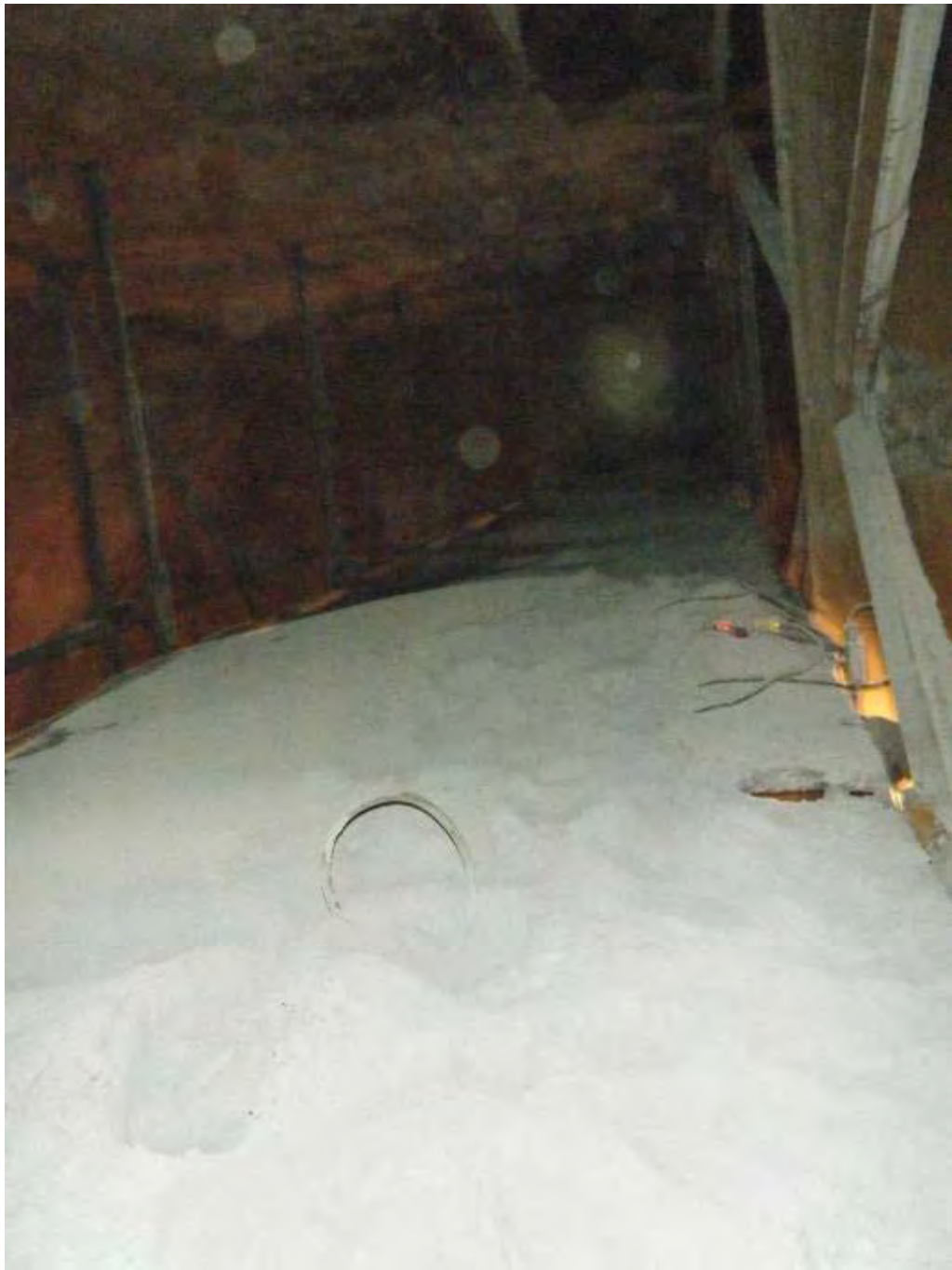






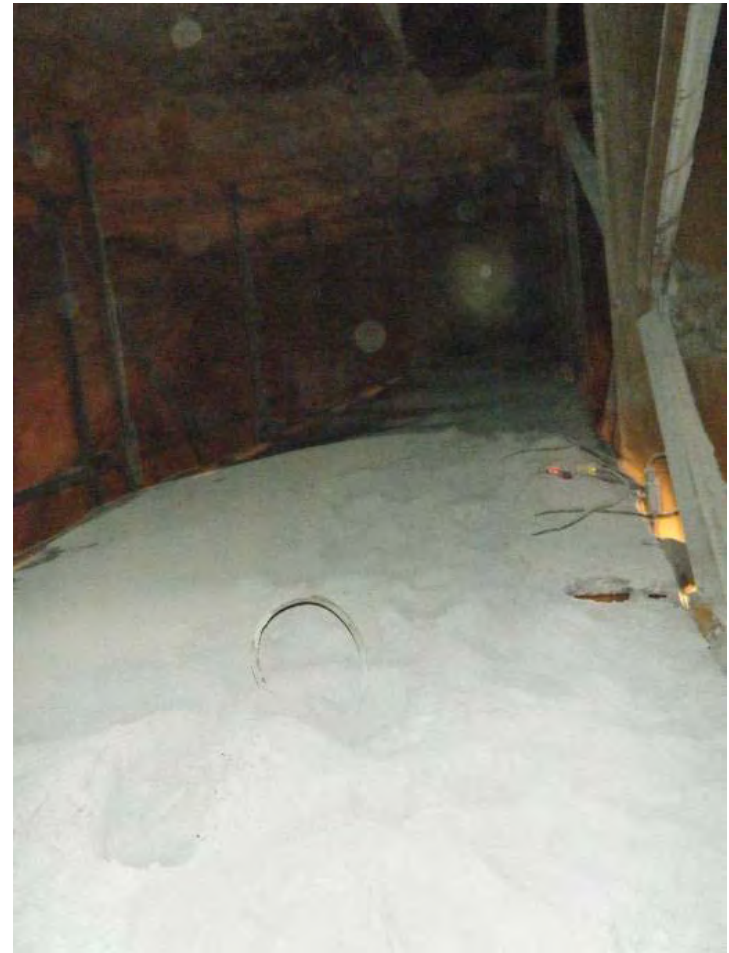
Rapper Anvil Beam Failure





Unbalanced Flow

- APH Turning vane: heavy ash on B-side, not on A-side.
- RC: New FGD-transition to the common ducts didn't account for structural steel, 0.7" pressure drop between A&B sides.



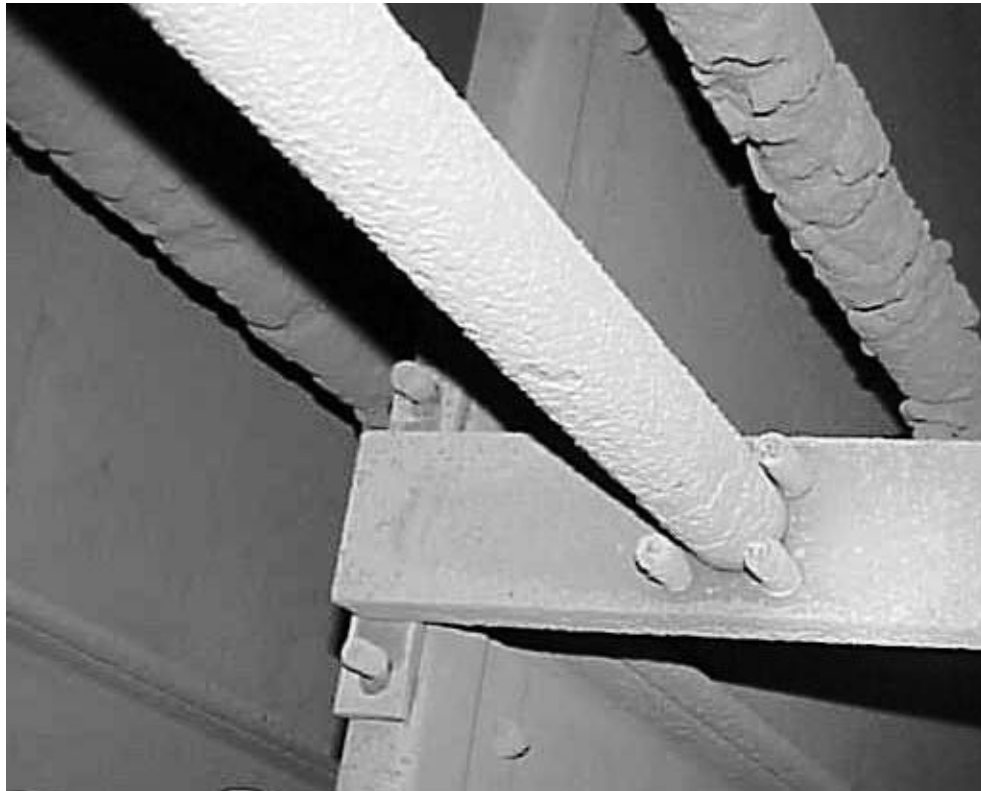




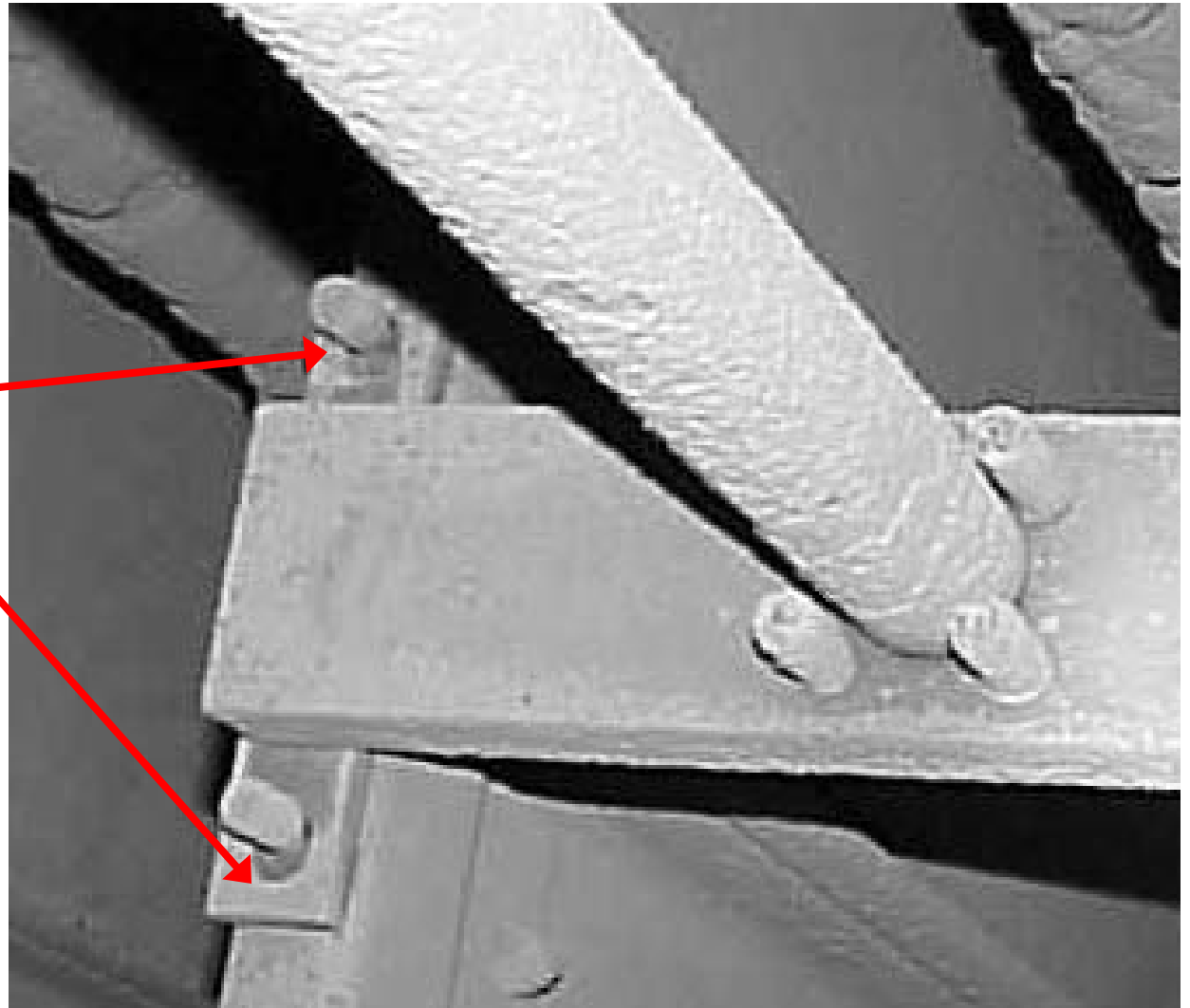
Single Anvil beam is rolling on it's plate support. The solution was to replace the anvil if necessary (due to wear) and add strut extensions to the adjoining plate.



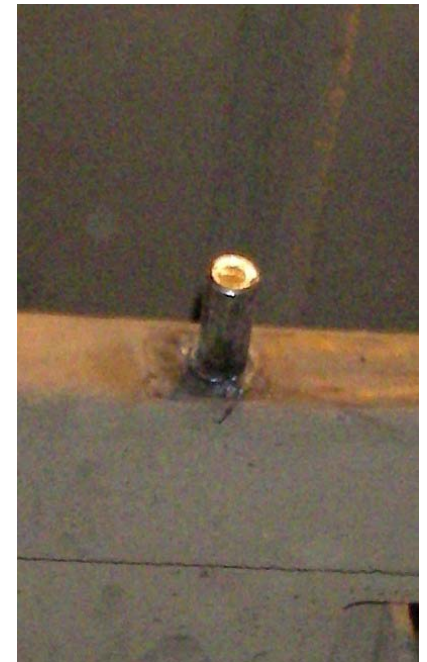
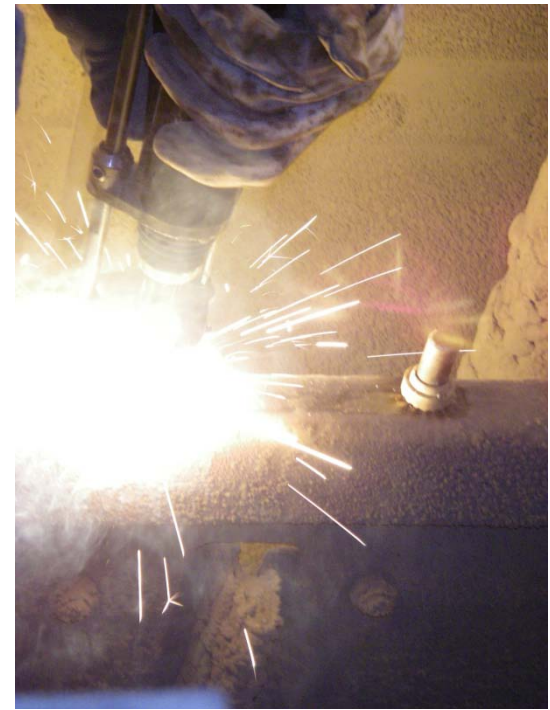
While we're on the anvil beams note how the positioning studs are worn



**Elongated
holes and in
some cases
the studs are
worn off**



We replaced the studs on the first row of rappers. These were the hardest hit rappers and the pins were in bad shape. We hired a specialty company to install them. Our on-site contractors removed the rappers and rapper shafts. All the new studs were installed in about a day.







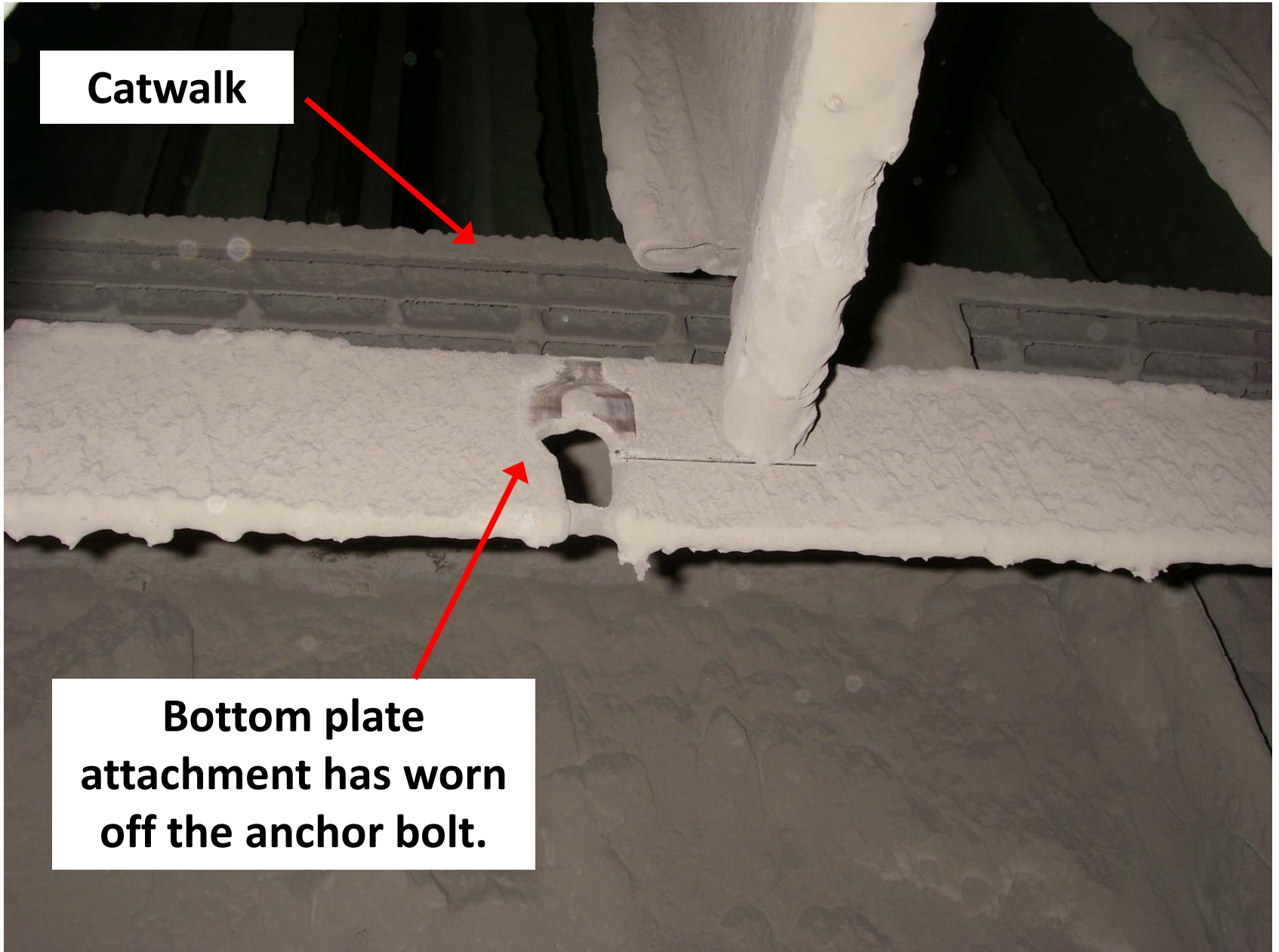
**RDE has slipped
off anchor bolt**

**Results in erratic spark
control/high sparking low
power**



Catwalk

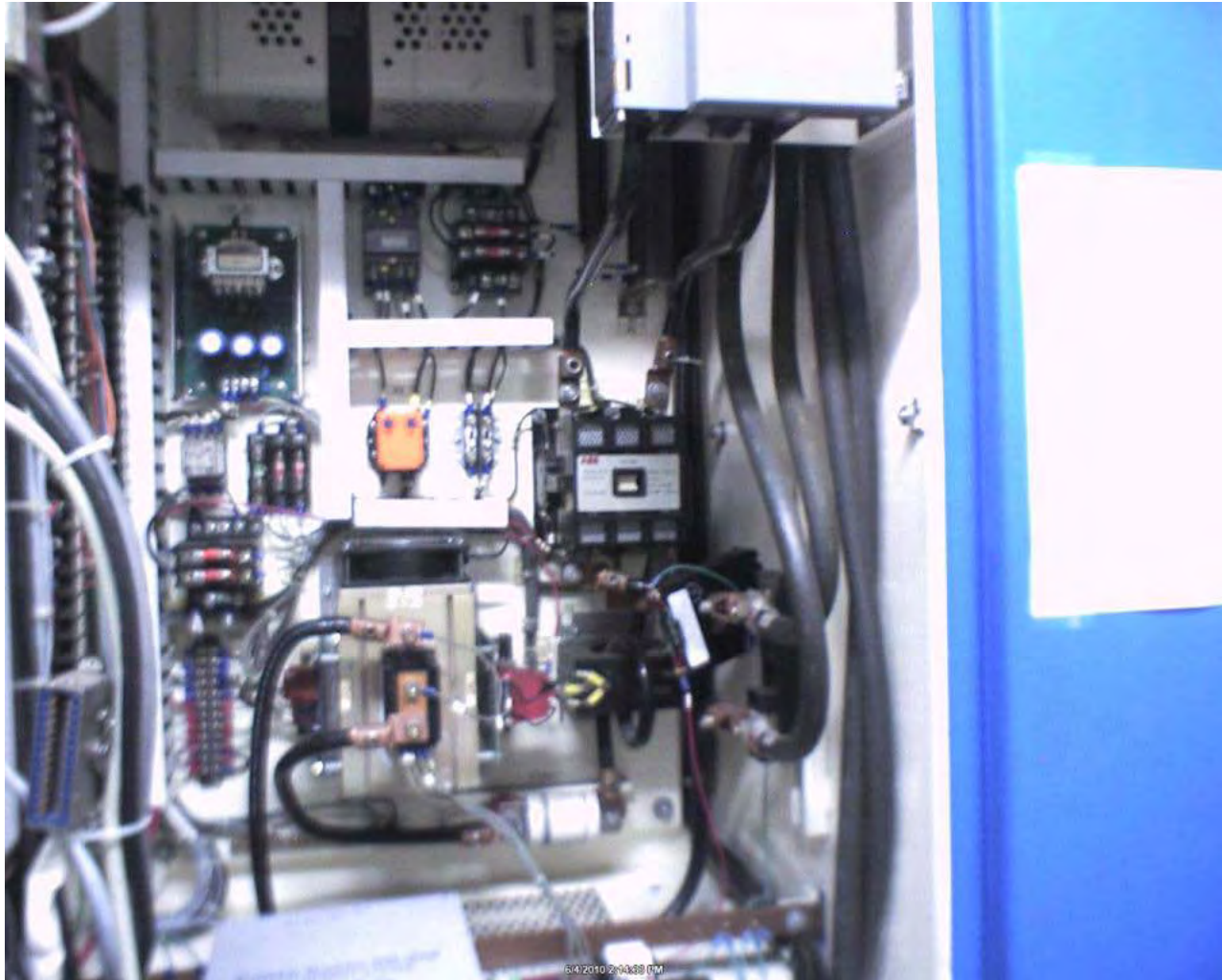
**Bottom plate
attachment has worn
off the anchor bolt.**





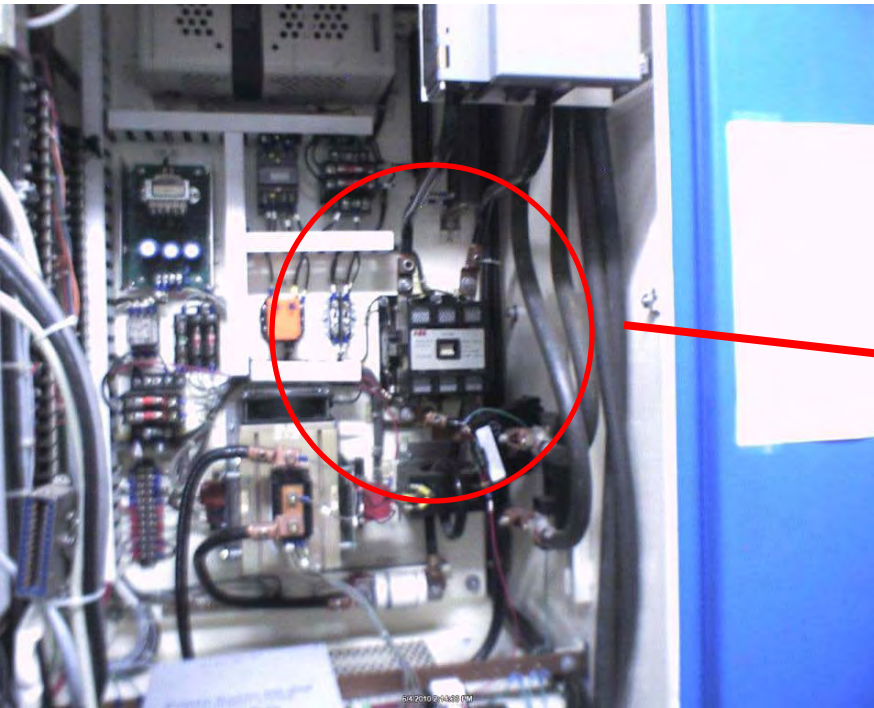
New blank bolt installed to anchor bottom of collector plate

You can't see the problem here



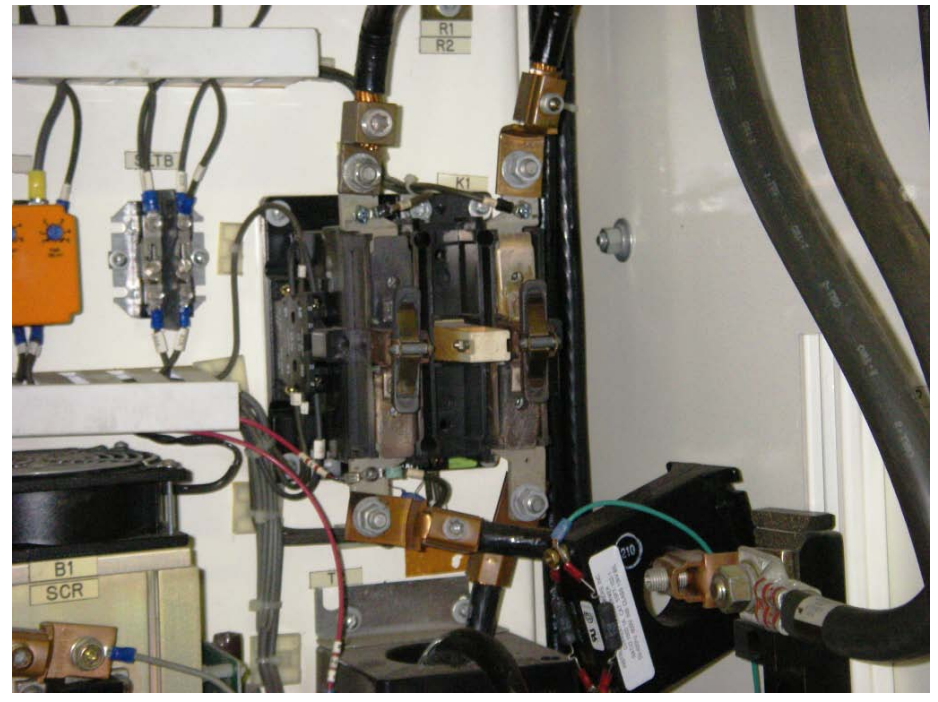
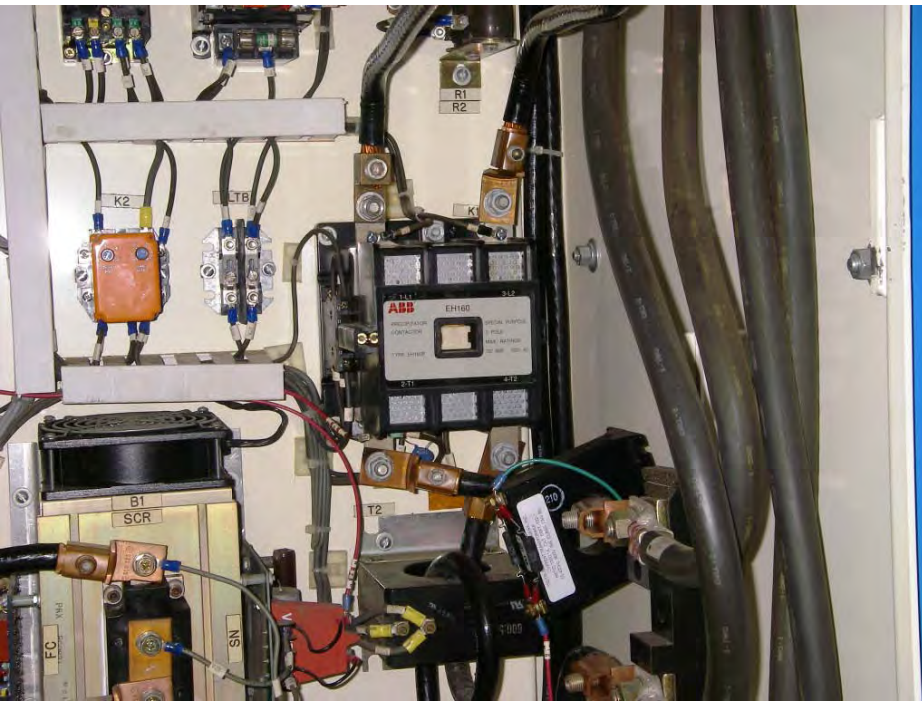
You have to see it at a different frequency of light

Hot Contactor

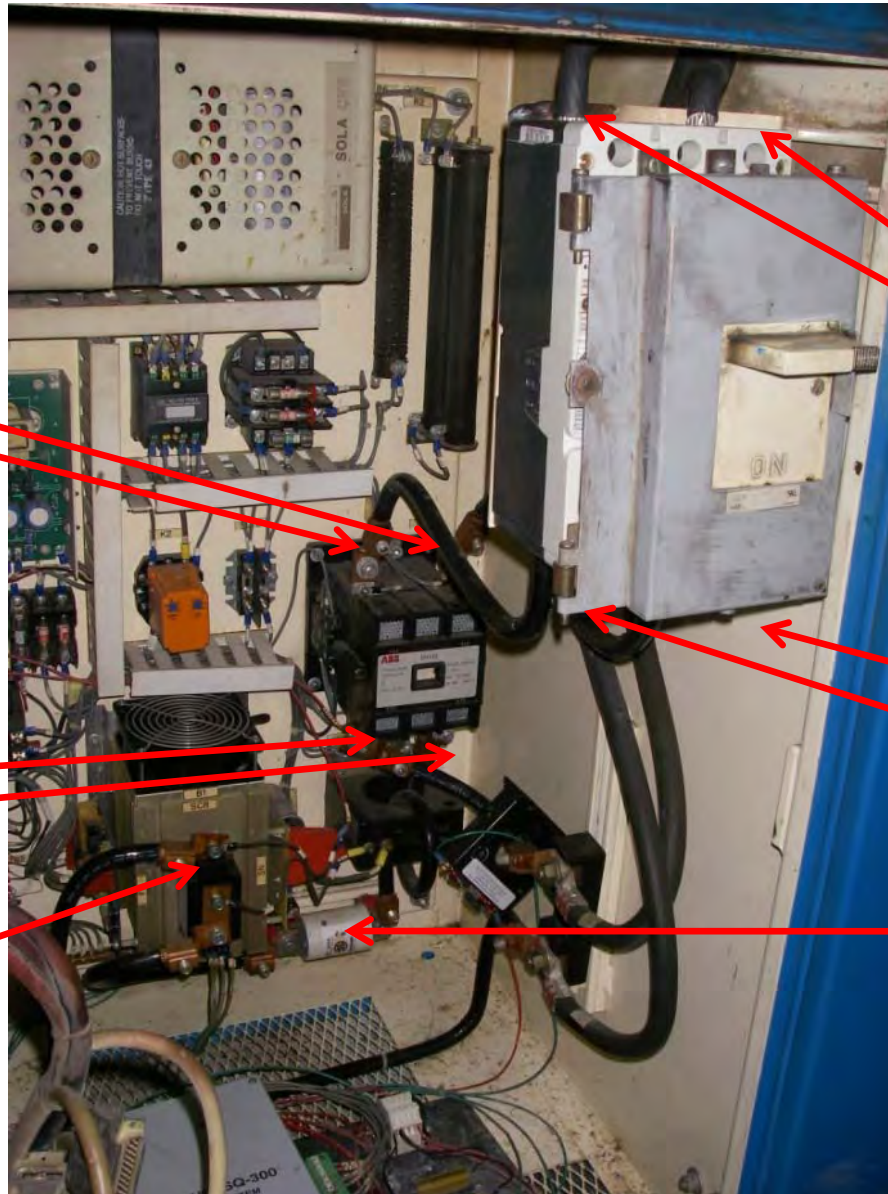


Thermal IR Camera Image





Temperature Checks in a T/R control cabinet



Check Contactor Connections

Check SCR Temperature

Check Breaker connections

Check Fuse Temperature

Note: A hot fuse will transfer it's heat to the contactor through the cable.

Unit 6 Precipitator Thermography Tabulation 11_5_08 - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins PL

Clipboard: Cut, Copy, Paste, Format Painter

Font: Calibri, 11, Bold, Italic, Underline, Text Color, Background Color

Alignment: Wrap Text, Merge & Center

Number: General, Currency, Percentage, Increase/Decrease Decimal

Styles: Conditional Formatting, Format as Table, Cell Styles

Cells: Insert, Delete, Format

Editing: AutoSum, Fill, Clear, Sort & Filter, Find & Select

B5

A B C D E F G H I J K L M N O P Q

1 **Unit 6 T/R set cabinet thermography data tabulation** *Air Load Conditions. Unit is off-line, T/R sets are maxed out except as noted.*

2 *(Note: This data follows extensive work done on 2/27/09)* *The temperatures will be higher than normal for several of these points.*

4 Date of data: 5/19/09 Time of data: 0730 to 0900

		Unit 6 must be off to fix		Outage Gray Zone		Unit 6 may be on to repair							
		Top of Breaker		Bottom of Breaker		Top of Contactor		Bottom of Contactor		Fuse	SCR		
T/R	Primary Amps	Control Limit	Left	Right	Left	Right	Left	Right	Left	Right			Comment
1A-1	163	Pri I	112	130	122	96	140	155	142	144	160	135	Spark limited
2A-1	163	Pri I	150	148	155	154	161	170	145	165	184	113	Clean contactor contacts, tighten connections.
3A-1	174	KV/PRI I	130	130	130	130	130	138	128	130	160	130	
4A-1	212	SCR	136	138	147	142	153	154	142	143	165	120	Check Connections on Contactor.
1A-2	163	Pri I	145	167	146	147	148	152	122	137	155	111	Clean and tighten connection.
2A-2	163	Pri I	144	153	146	150	147	156	127	136	147	114	
3A-2	150	Pri I	160	137	155	127	123	120	110	111	145	105	Breaker left side contact is hot. Try to access and clean. Replace breaker if possible.
4A-2	60	SCR BAD	109	107	100	101	100	101	90	95	91		Control has low PRI I limit. SCR is bad and operates at Half wave.

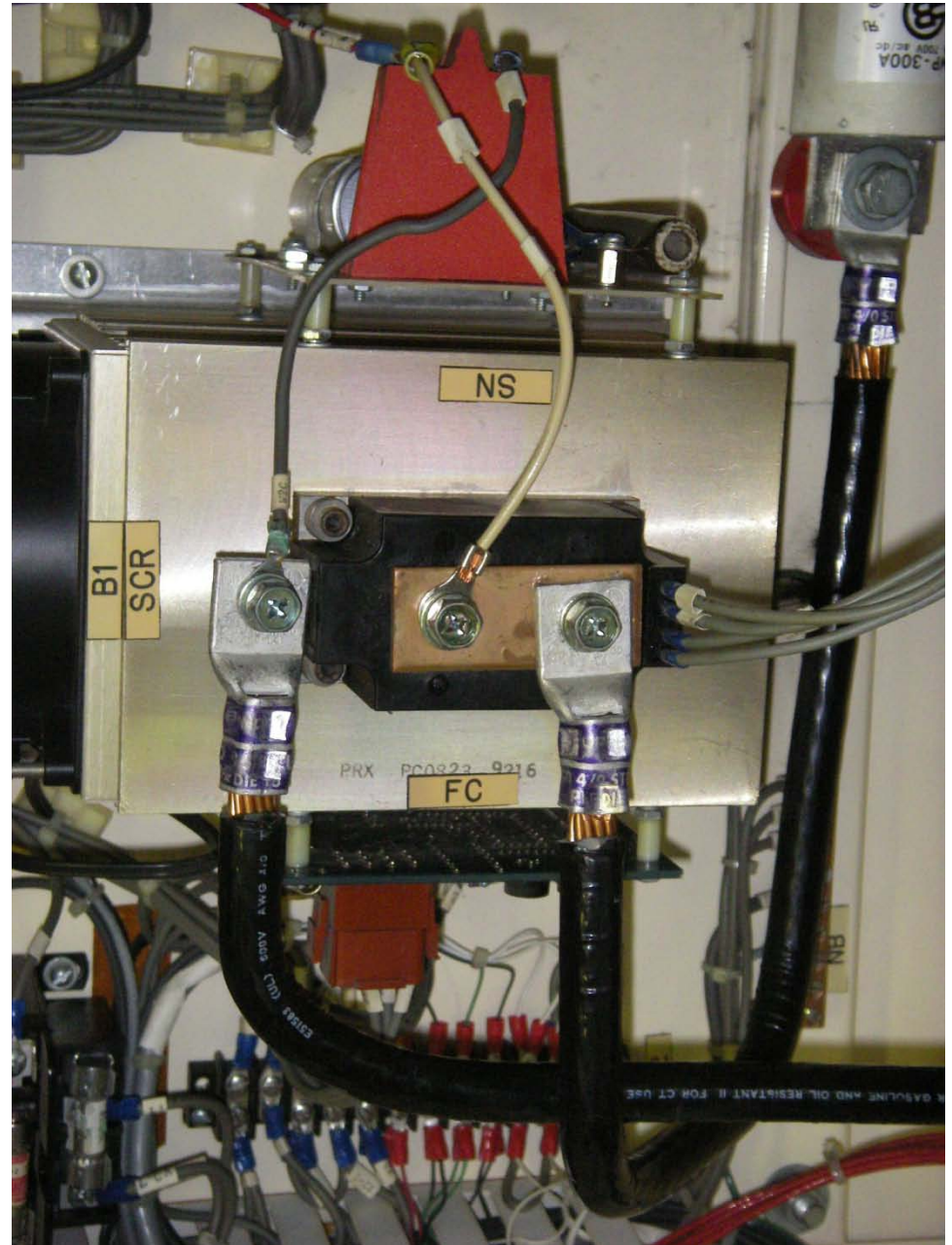
12 13 14 15 16

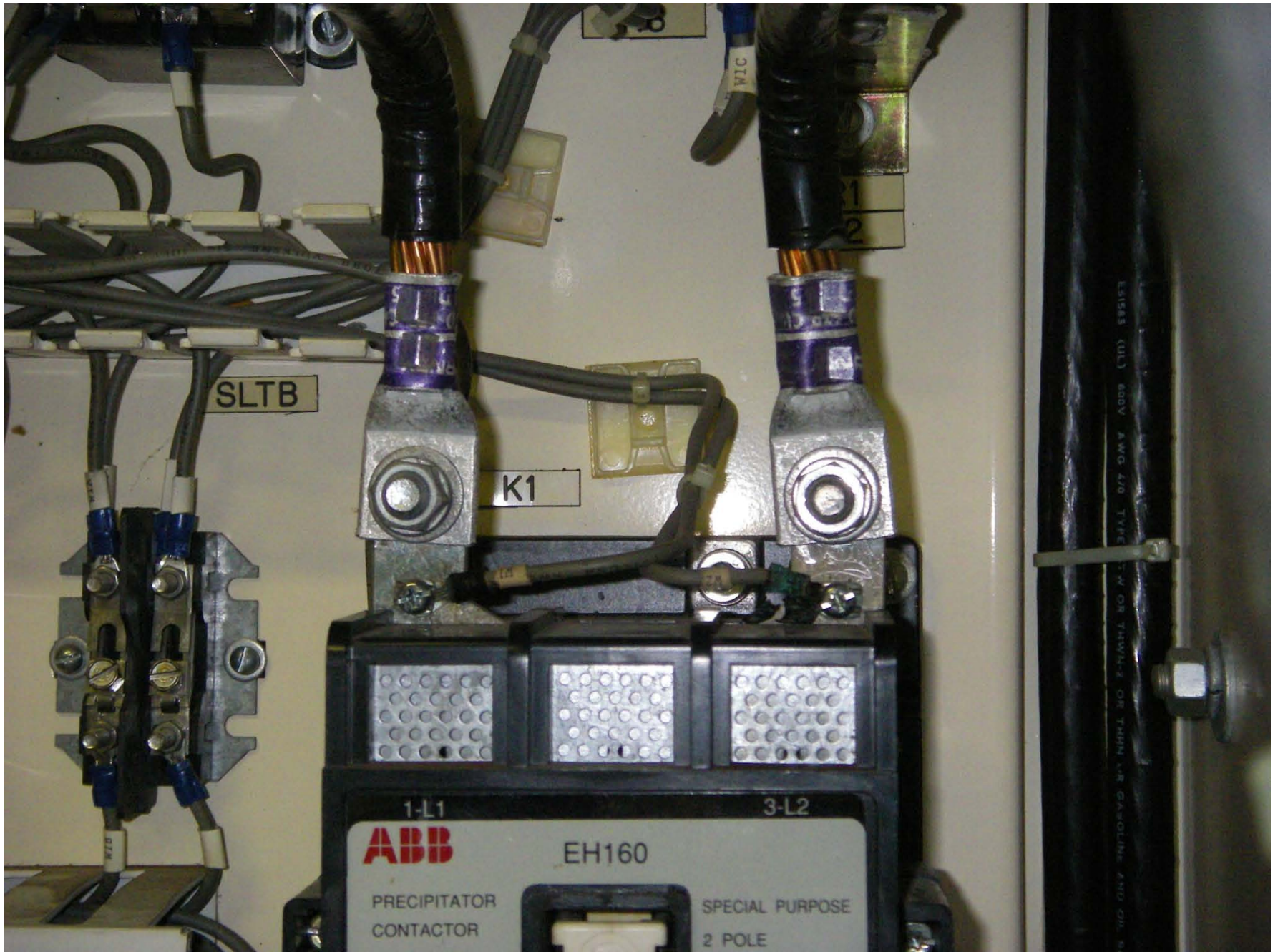
12_9_08 3_02_09 3_03_09 5_9_09 5_19_09 Sheet1

Select destination and press ENTER or choose Paste

Start Office C... 3 Micr... Home - ... 3 Micr... TR Perf ... 2 Micr... Desktop 100% 95% 3:57 PM

All mechanical power cable connections were replaced by compression connections. This reduced the heating problems considerably.





SLTB

K1

1-L1
ABB

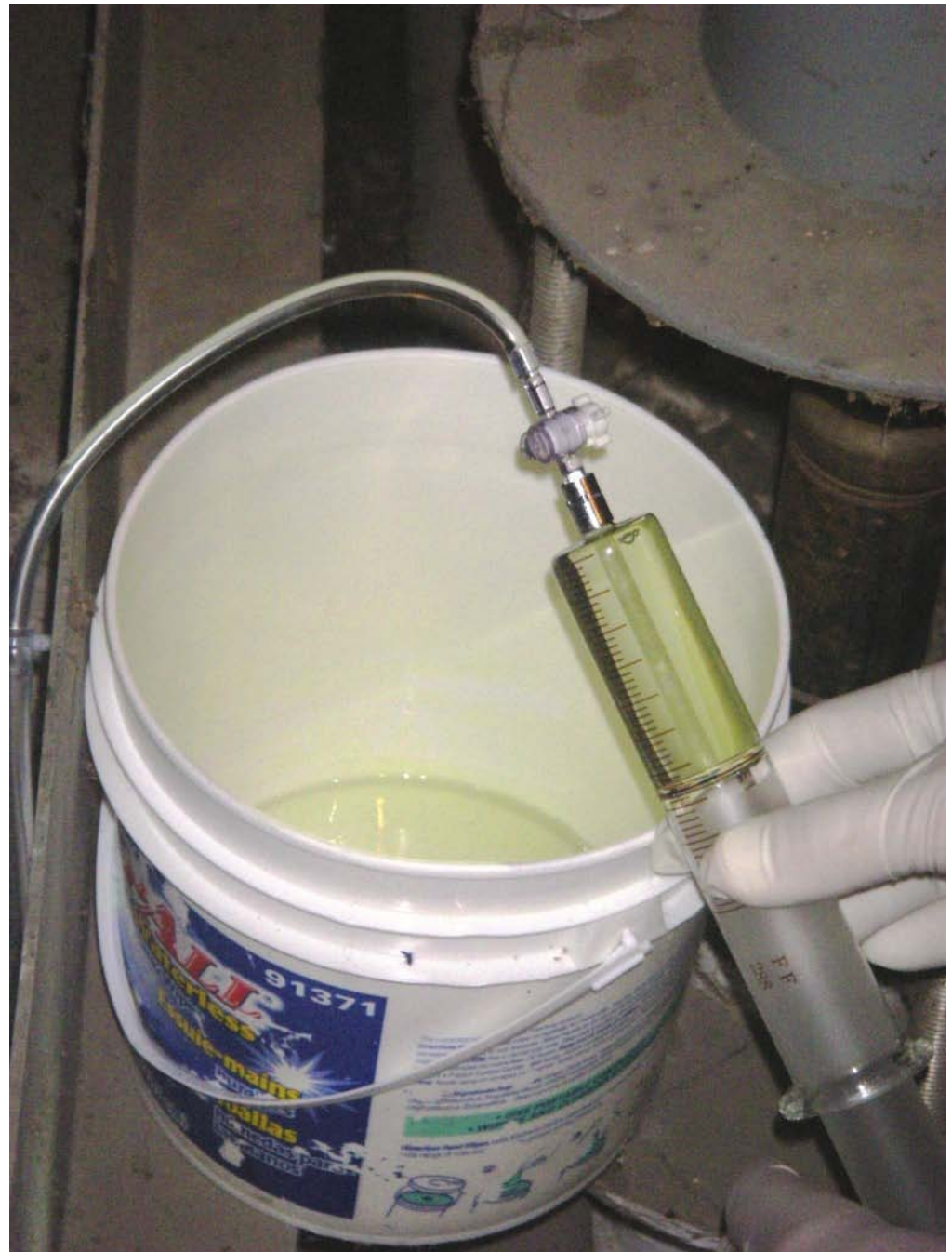
EH160

PRECIPITATOR
CONTACTOR

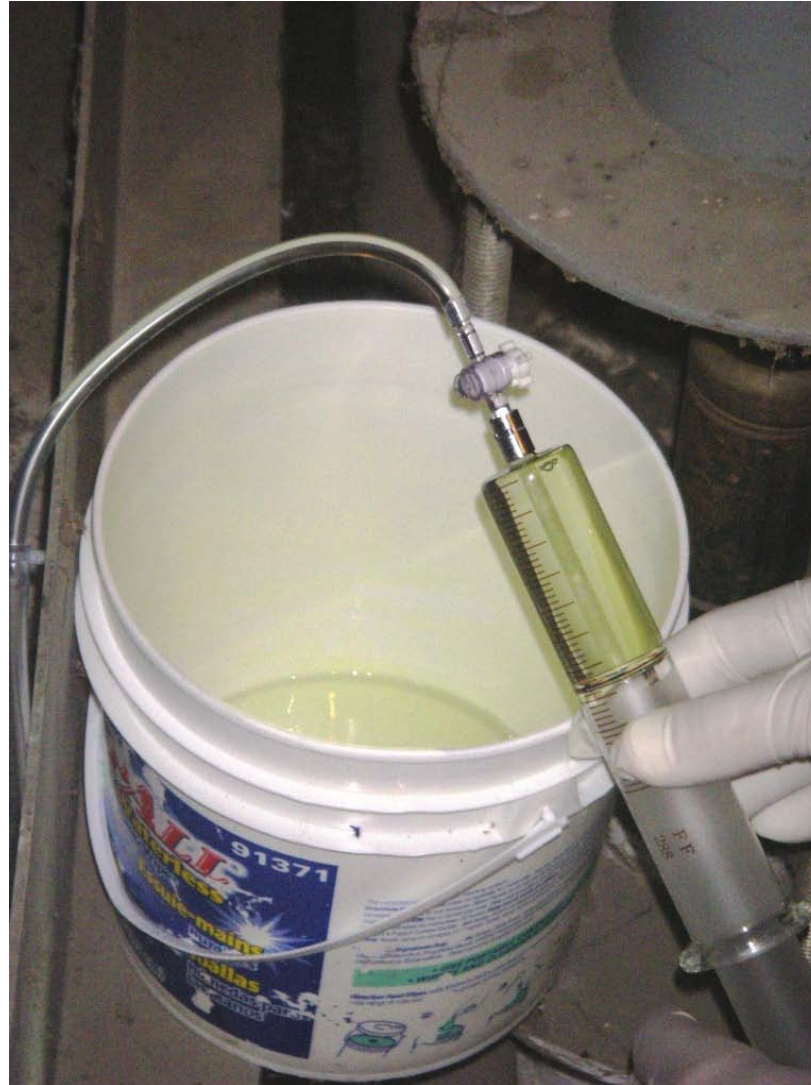
3-L2
SPECIAL PURPOSE
2 POLE

ES1583 (UL) 600V AWG 4/0 TYPE TW OR THWN-2 OR THHN OR GASOLINE AND OIL

**Is this T/R set
oil good or
bad?**



Too see what's in your oil you need to
test it



DGA Testing-Dissolved Gas Analysis

Insulating Fluid Analysis

WABASH RIVER GEN STA 3 Phase (PS266XTR64B2TR MAIN TK)

Equipment ID	PS266XTR64B2TR	Manufacturer	NWL	Owner	PSI Energy
Apparatus Type	MAIN TK	Serial No	921000	Location	WABASH RIVER GEN STA
Fluid Type	OIL	Year Mfg		Designation	3 Phase
Fluid Cap.		Model/Type		Description	
Analysis Rules	DXOILTRN	kV Rating		Preservation	
		MVA Rating		Cooling	

Gas Analysis	01/19/2007	ppm/day	12/14/2006	10/04/2006	09/19/2006	07/26/2006	Limits
Sample No	FF271		FF265	AA231	169363	FF284	
Fluid Temp C	30		58	40	23	70	
Hydrogen (H2)	259	5.36 Abnormal ++	66	<5	47	47	< 100
Methane (CH4)	1165	27.14 Very High ++	188	1	132	113	< 120
Ethane (C2H6)	298	6.72 Very High ++	56	19	51	42	< 65
Ethylene (C2H4)	4575	106.39 Very High ++	745	122	332	280	< 50
Acetylene (C2H2)	173	4.28 Very High ++	19	1	5	3	< 5
Carbon Monoxide (CO)	143	1.83	77	28	593	507	< 350
Carbon Dioxide (CO2)	6788	-1.31 High	6835	4884	15774	6622	< 2500
Oxygen (O2)	14934		10250	3628	2096	7993	
Nitrogen (N2)	28966		19000	4771	49826	37369	
TDCG (ppm)	6613	151.72 Very High ++	1151	171	1160	992	< 720
Equivalent TCG (%)	2.81		1.01	0.39	1.07	1.15	
Total Gas (%)	57301.000		37236.000	13454.000	68856.000	52976.000	
CO2/CO	47.47		88.77	174.43	26.60	13.06	
O2/N2	0.52		0.54	0.76	0.04	0.21	
Water	5		8	25	3	24	< 50
Water Saturation	5		4	20	5	7	
Equipment Condition	4		4	1	2	2	

Result	THERMAL	Port or Tank	BOT MAIN	Test Lab	QUEENSGATE
Interval (days)	30	Sampled by	TJ	Test Date	01/27/2007
Gas Std	OILTRN IEEE DG	Reason	NORMAL	Lab Ref No	

Gas Analysis Remarks

* The high gas generation rate (++) may indicate an active fault. The Rogers method suggests a high-temperature thermal fault (> 700 C). Exercise extreme caution. Consider servicing or inspection.

Report Date 01/31/2007

Transformer Oil Analyst 3.3

Trend the Gases

Trend gases of interest: Acetylene, Ethylene, Ethane, Ethylene, Hydrogen, CO and CO₂. Water and TDCG (Total Dissolved Combustible Gases) should be watched too. IF these numbers begin showing up in trends, watch the T/R set if the trend is at a slow rate. A fast rate may warrant removal from service immediately.

DGA History

Location: WABASH RIVER GEN STA
Equipment: PS266XTR64B2TR
Manufacturer: NWL
Apprtype: MAIN TK
Next DGA: 2/19/2010

Acetylene increasing.



There are 8 Gas Samples

H ₂	CH ₄	C ₂ H ₆	C ₂ H ₆ /CH ₄	C ₂ H ₄	C ₂ H ₂	CO	CO ₂	CO ₂ /CO	O ₂	N ₂	TOTAL GAS	WATER	EQUIP COND	TEST DATE	SAMPLE DATE	LAB
47	113	42	0.4	280	3	507	6622	13.1	7993	37369	52976	24.18	2	8/9/2006	7/26/2006	QUEENSGATE
47	132	51	0.4	332	5	593	15774	26.6	2096	49826	68856	3	2	9/20/2006	9/19/2006	ACTIINDPLS
0	1	19	19.0	122	1	28	4884	174.4	3628	4771	13454	24.52	1	10/19/2006	10/4/2006	QUEENSGATE
66	188	56	0.3	745	19	77	6835	88.8	10250	19000	37236	8.25	4	1/9/2007	12/14/2006	QUEENSGATE
259	1165	298	0.3	4575	173	145	6788	47.5	14934	28966	57301	4.52	4	1/27/2007	1/19/2007	QUEENSGATE
441	2074	389	0.2	7640	224	151	11862	78.6	15727	52516	91024	11	4	2/12/2007	2/12/2007	ACTIINDPLS
148	26	11	0.4	24	13	1026	13010	12.7	1616	95956	111830	57	2	9/24/2009	9/23/2009	ACTIINDPLS
140	27	12	0.4	25	13	1025	15808	15.4	1162	93075	111267	50	1	10/23/2009	10/22/2009	ACTIINDPLS

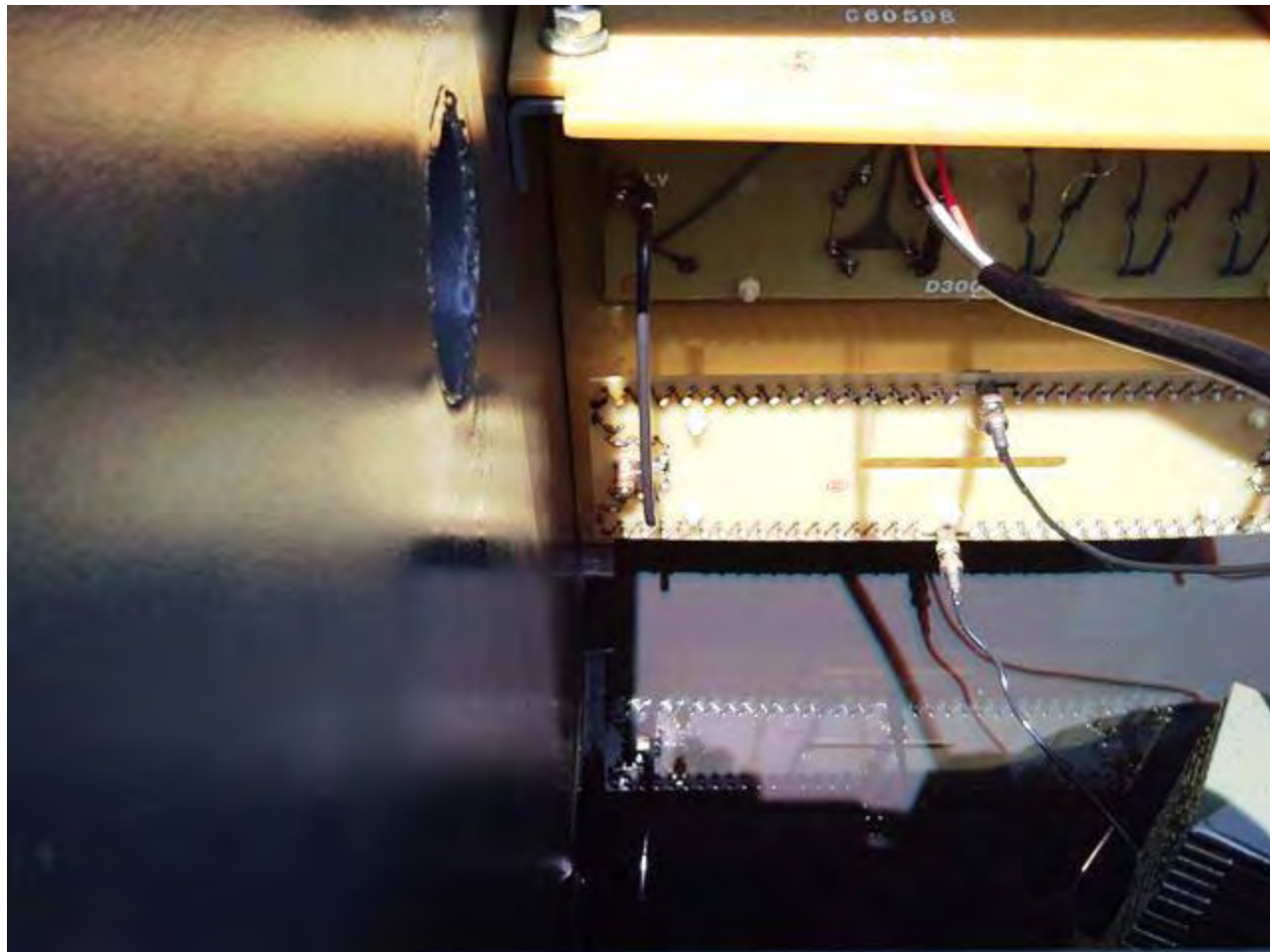
NOTE: NORMAL

Gas Key

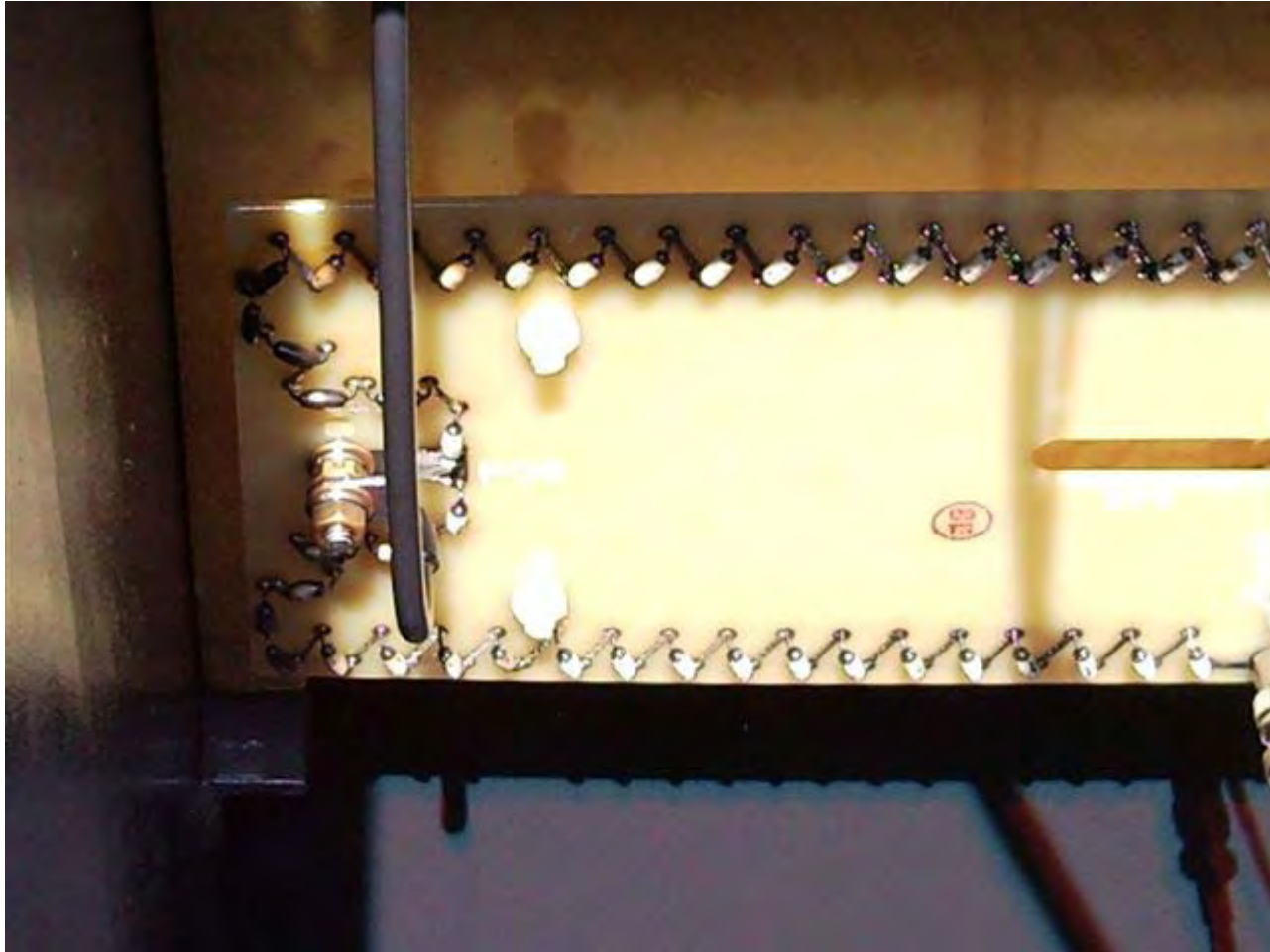
H ₂ - HYDROGEN	CH ₄ - METHANE	C ₂ H ₆ - ETHANE	C ₂ H ₄ - ETHYLENE
C ₂ H ₂ - ACETYLENE	CO ₂ - CARBON DIOXIDE	O ₂ - OXYGEN	N ₂ - NITROGEN
CO ₂ /CO Ratio Less Than 10 - Investigate		C ₂ H ₆ /CH ₄ Greater Than 1 - Investigate	

The following show some components of a T/R set that are failing and causing flammable gas readings via DGA testing. You can catch some of these before they cost you an expensive repair. Other common causes not illustrated are HV Choke coil and High Voltage Dividing Resistor.

LV Exit Lead, Barrier or Boot



Burned Diodes



LV Exit Lead, Burned Paper Sleeve





Worn Collector Electrode (plate)





HV Rapper shaft insulation failure

**These are made of
fiberglass to insulate
the grounded rapper
hammer from the HV
Electrode frame.**





2013/04/15

Crock Insulator Failure





Air Preheater basket failure







Every Industry has it's challenges. The root cause for this may have been cattle bumping the foundation or something.....

