Worldwide Pollution Control Association

IL Regional Technical Seminar

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How to Grade Your ESP

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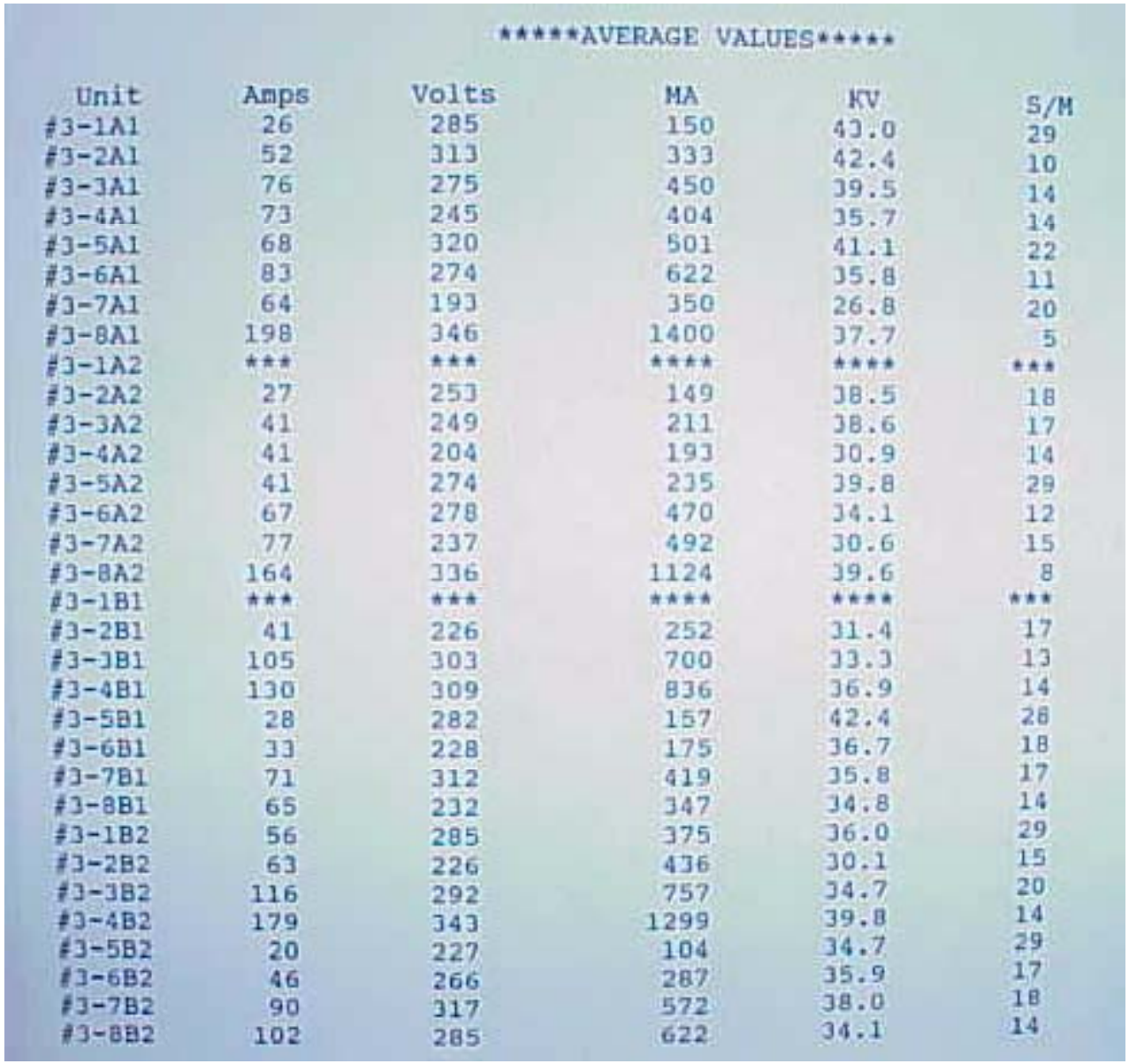
Applications Engineer

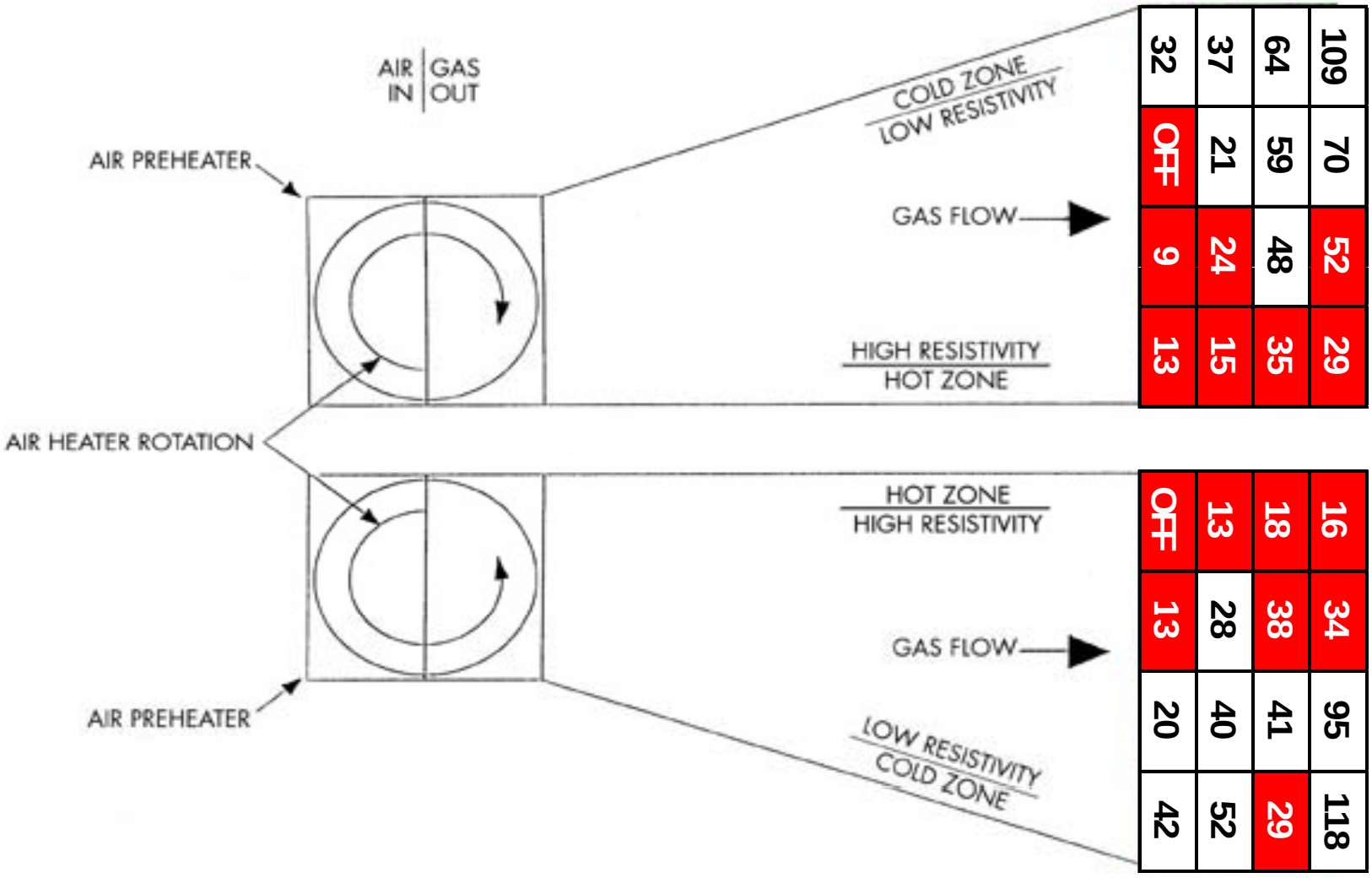
Does This ESP Have A Problem?



*****AVERAGE VALUES*****

Unit	Amps	Volts	MA	KV	S/M
#3-1A1	26	285	150	43.0	29
#3-2A1	52	313	333	42.4	10
#3-3A1	76	275	450	39.5	14
#3-4A1	73	245	404	35.7	14
#3-5A1	68	320	501	41.1	22
#3-6A1	83	274	622	35.8	11
#3-7A1	64	193	350	26.8	20
#3-8A1	198	346	1400	37.7	5
#3-1A2	***	***	****	****	***
#3-2A2	27	253	149	38.5	18
#3-3A2	41	249	211	38.6	17
#3-4A2	41	204	193	30.9	14
#3-5A2	41	274	235	39.8	29
#3-6A2	67	278	470	34.1	12
#3-7A2	77	237	492	30.6	15
#3-8A2	164	336	1124	39.6	8
#3-1B1	***	***	****	****	***
#3-2B1	41	226	252	31.4	17
#3-3B1	105	303	700	33.3	13
#3-4B1	130	309	836	36.9	14
#3-5B1	28	282	157	42.4	28
#3-6B1	33	228	175	36.7	18
#3-7B1	71	312	419	35.8	17
#3-8B1	65	232	347	34.8	14
#3-1B2	56	285	375	36.0	29
#3-2B2	63	226	436	30.1	15
#3-3B2	116	292	757	34.7	20
#3-4B2	179	343	1299	39.8	14
#3-5B2	20	227	104	34.7	29
#3-6B2	46	266	287	35.9	17
#3-7B2	90	317	572	38.0	18
#3-8B2	102	285	622	34.1	14

How About When You Look At It This Way?



Does This ESP Have a Problem?

AVC	AMPS	VOLTS	mA	KV1	KV2	SPM
711	38	292	134	64.2	52.0	64
721	59	327	296	51.1	40.8	29
731	122	340	569	45.9	50.3	59
741	99	324	494	45.0	37.0	2
751	52	241	296	36.3	32.2	55
761	129	404	806	53.0	X	0
762	79	330	387	43.7	X	30
771	125	393	766	50.8	X	0
772	56	262	245	29.1	X	37
781	134	376	790	44.1	X	0
782	128	353	711	45.6	X	0

How About When You Look At It This Way?

WEST CHAMBER		T/R SET DESIGNATION		EAST CHAMBER
40 TO 60	43.6	X82	X81	48.4
	15.0	X72	X71	46.9
30 TO 40	23.7	X62	X61	49.4
	9.1	X51		9.1
20 TO 30	15.1	X41		15.1
	17.4	X31		17.4
10 TO 20	9.1	X21		9.1
	4.1	X11		4.1

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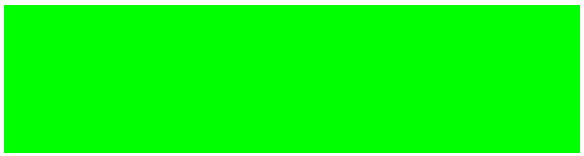
This Leads Us to...

How to Grade Your Precipitator

Very Good



Marginal

Poor

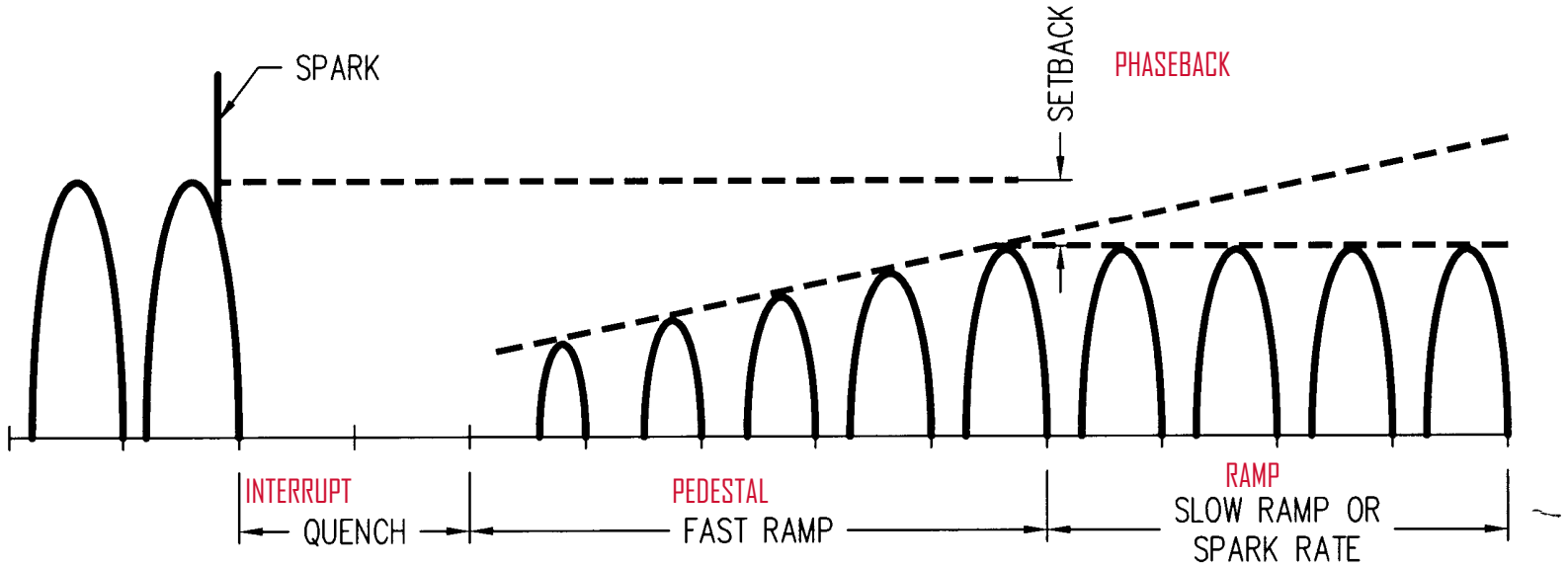
Step 1

- **If a T/R set is not sparking, then its AVC should be pushing that T/R set to one of its pre-set, *<u>healthy</u>* limits (volts, amps, KV, ma, or firing angle).**

The AVC Has Two Jobs to Execute

1. **Control the amount of sparking in the ESP**

AVC Spark Response – Discussed Later



AVC Spark Limited – Doing It's Job

The AVC Has Two Jobs to Execute

2.) In the absence of sparking, push the T/R set to it's limit(s)

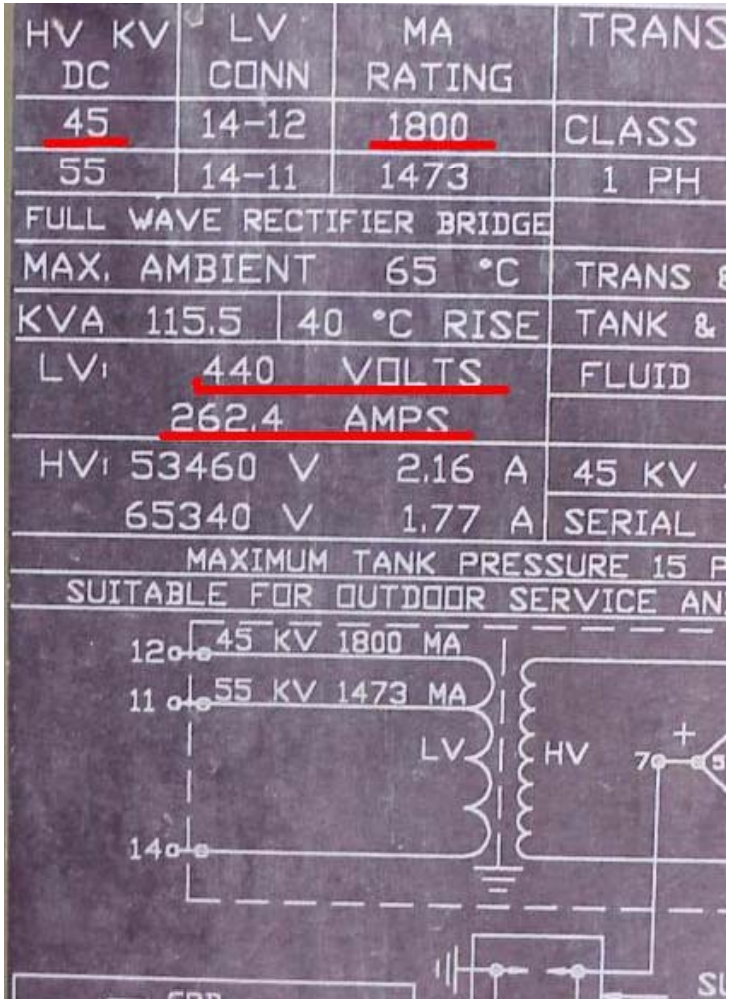
T-R Current Limited Without Sparking

What is Meant by "Healthy Limits?"

- **Primary or Secondary Limit is not healthy when accompanied by a Primary Voltage level < 90 VAC or a Secondary level < 12KV. It usually indicates a short circuit.**
- **Secondary Voltage Limit is not healthy when there is very little Secondary Current. It usually indicates an open circuit.**
- **Neither condition is aiding in particle capture**

Again, know the ratings of the T/R sets on the ESP being reviewed.

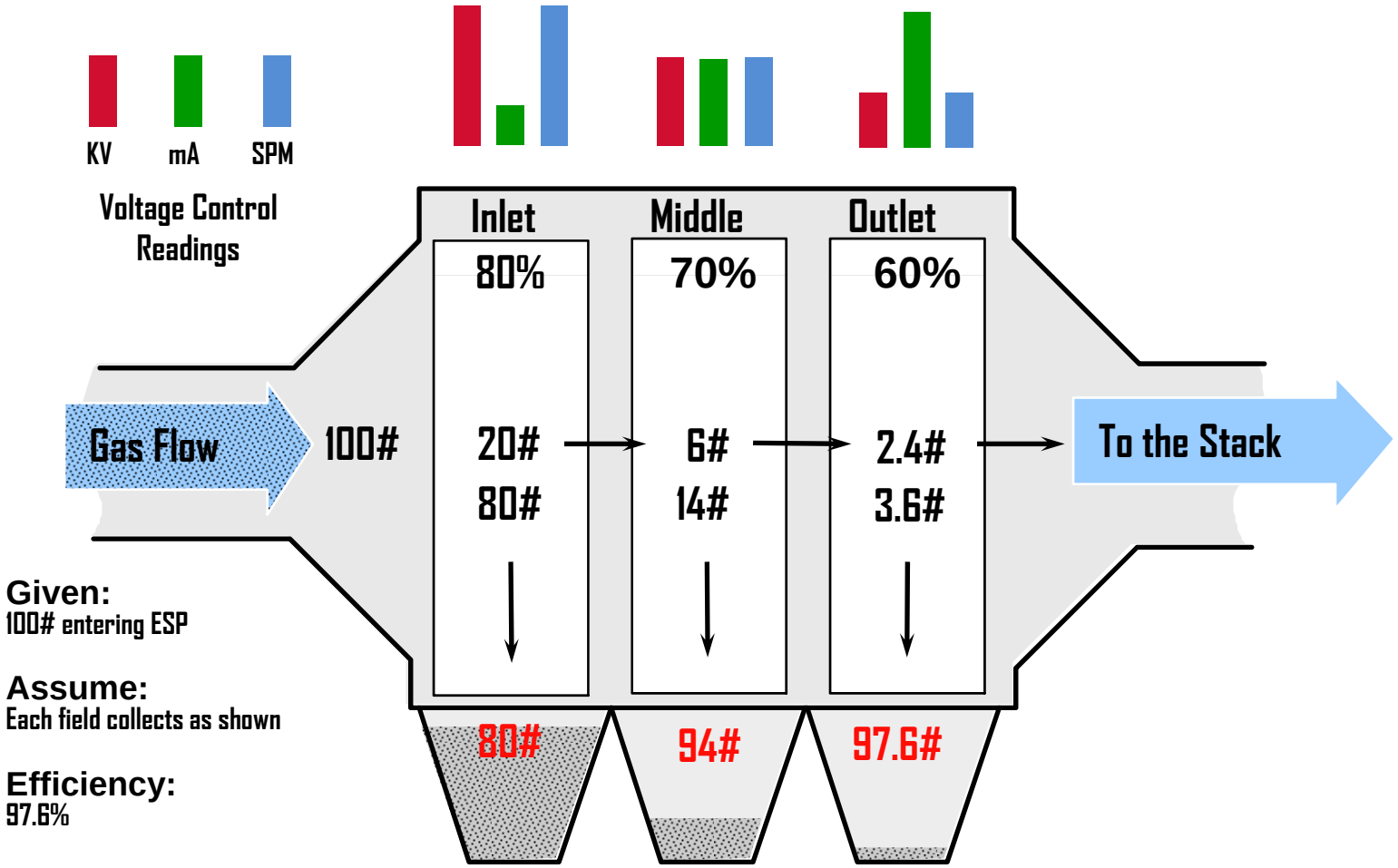
Walk up to the roof of the ESP and look at the nameplate on the T/R set



Step 2

2. Each succeeding field of a precipitator should have the same or higher precipitator current (mA), or better put, current density than the preceding field.

Incremental Collection Efficiency and Secondary Operating Conditions



Given:
100# entering ESP

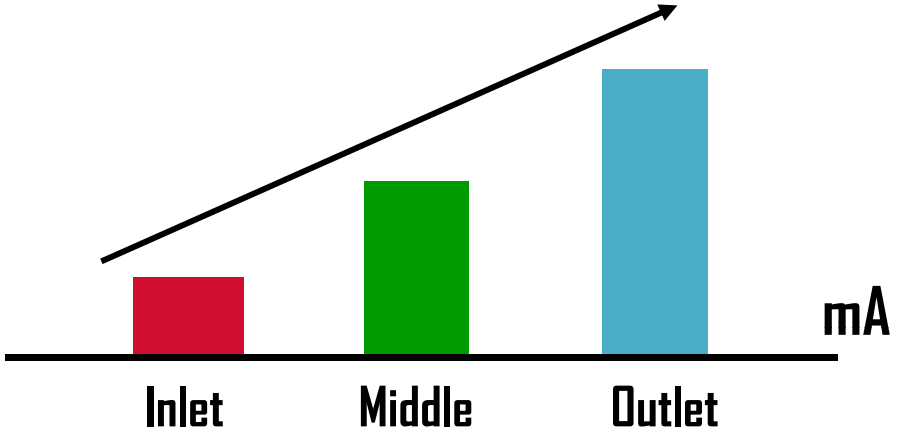
Assume:
Each field collects as shown

Efficiency:
97.6%

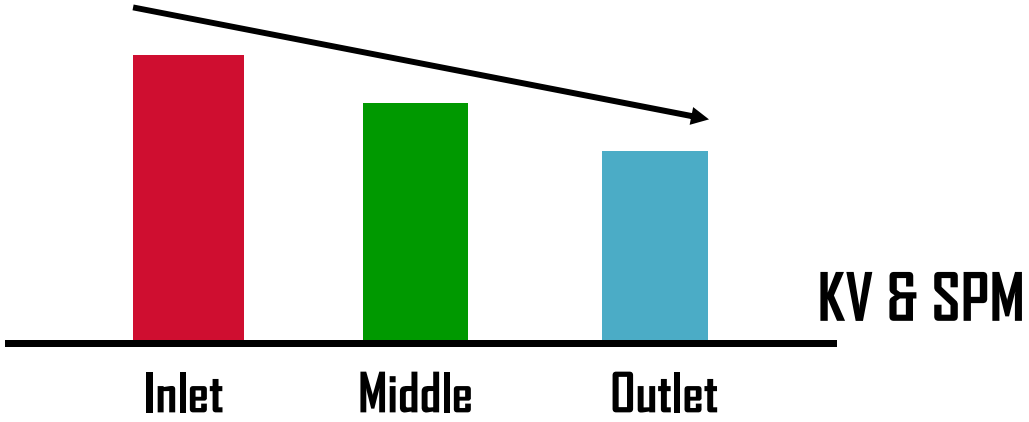
Values shown are to represent relationship only…not necessarily actual conditions

Space Charge Effects on Meters

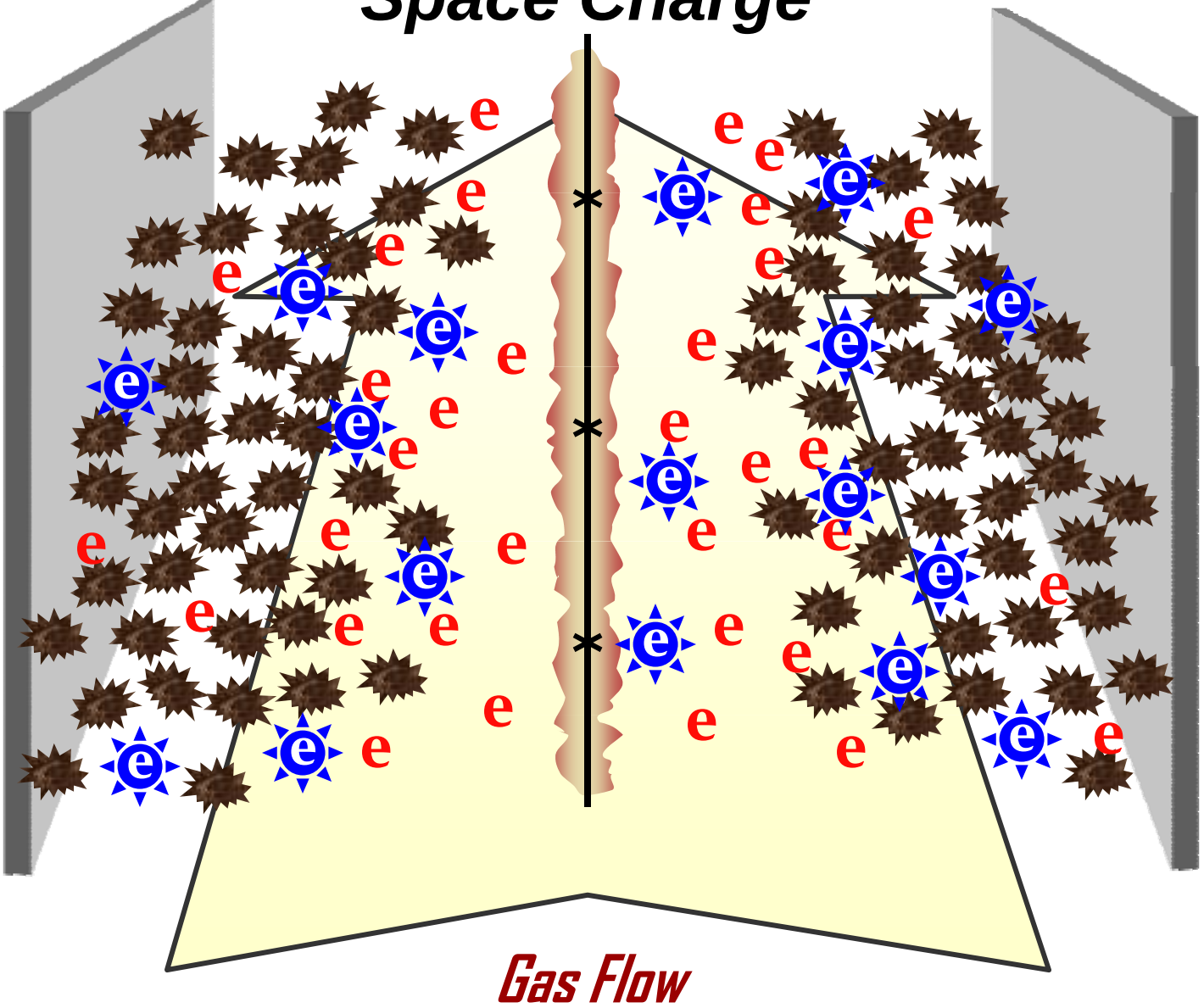
Always look for this trend...



Decreasing KV and SPM from inlet to outlet is not quite as evident



Space Charge



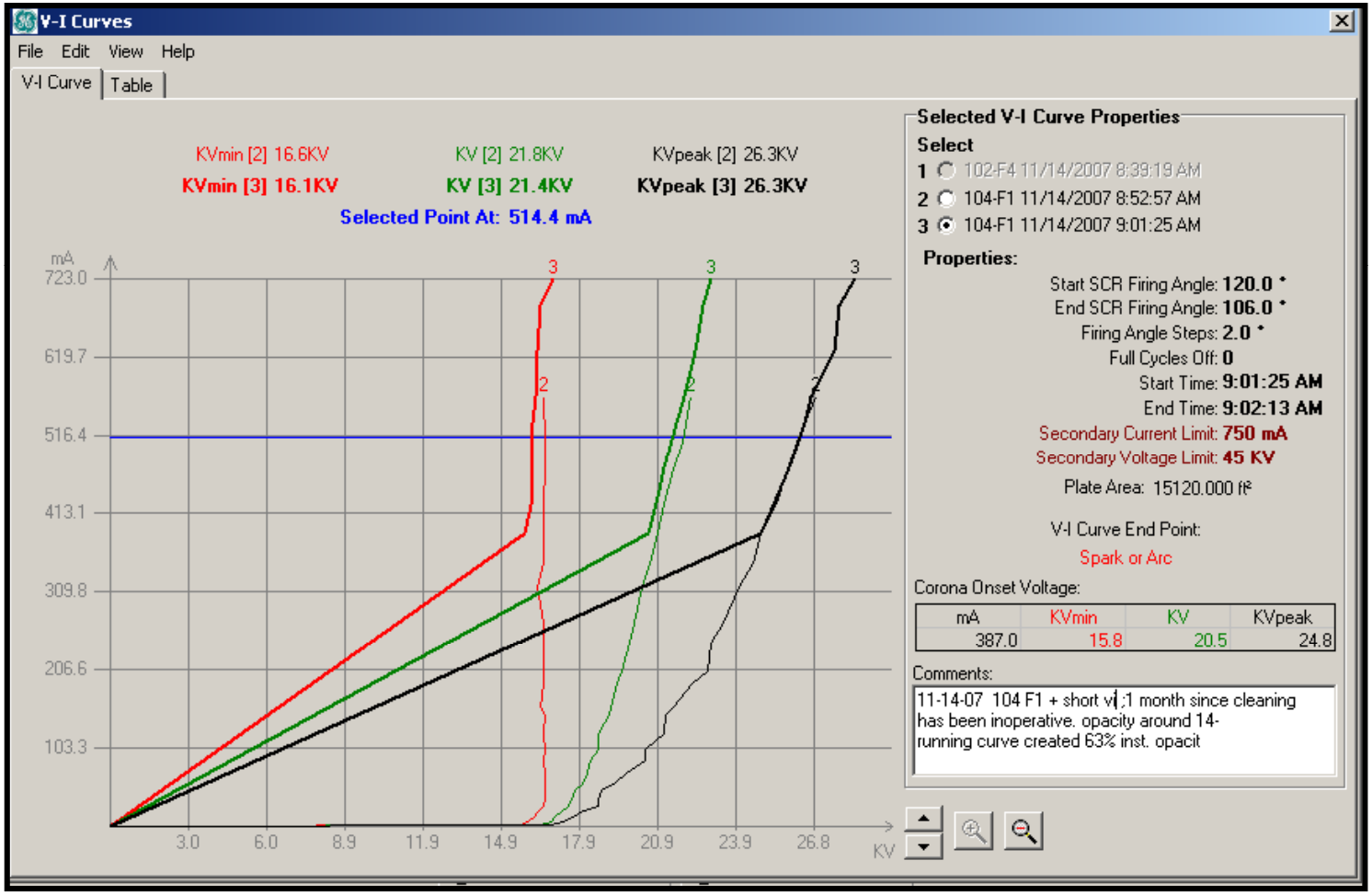
Step 3

3. If the dust is not highly resistive, then outlet fields usually run at full current and little or no sparking.

Wouldn't Hurt to Run a Couple of Quick V-I Curves

These are quick tests for resistivity. A full curve may be prohibitive because of opacity spiking caused by backing a set down to corona onset.
Be careful!

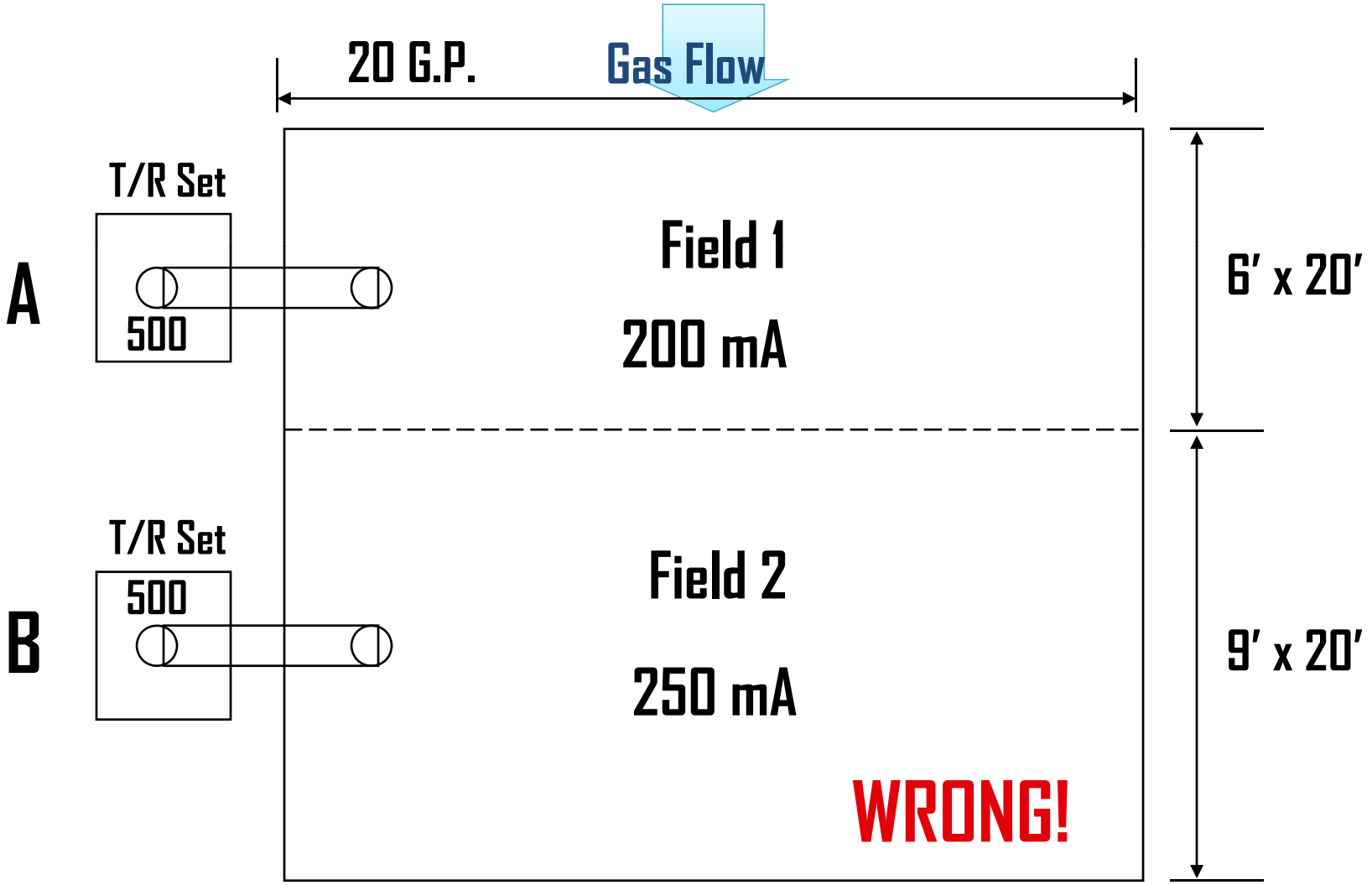
Curve 2 is the full VI Curve, Curve 3 is a "Quick – Curve"



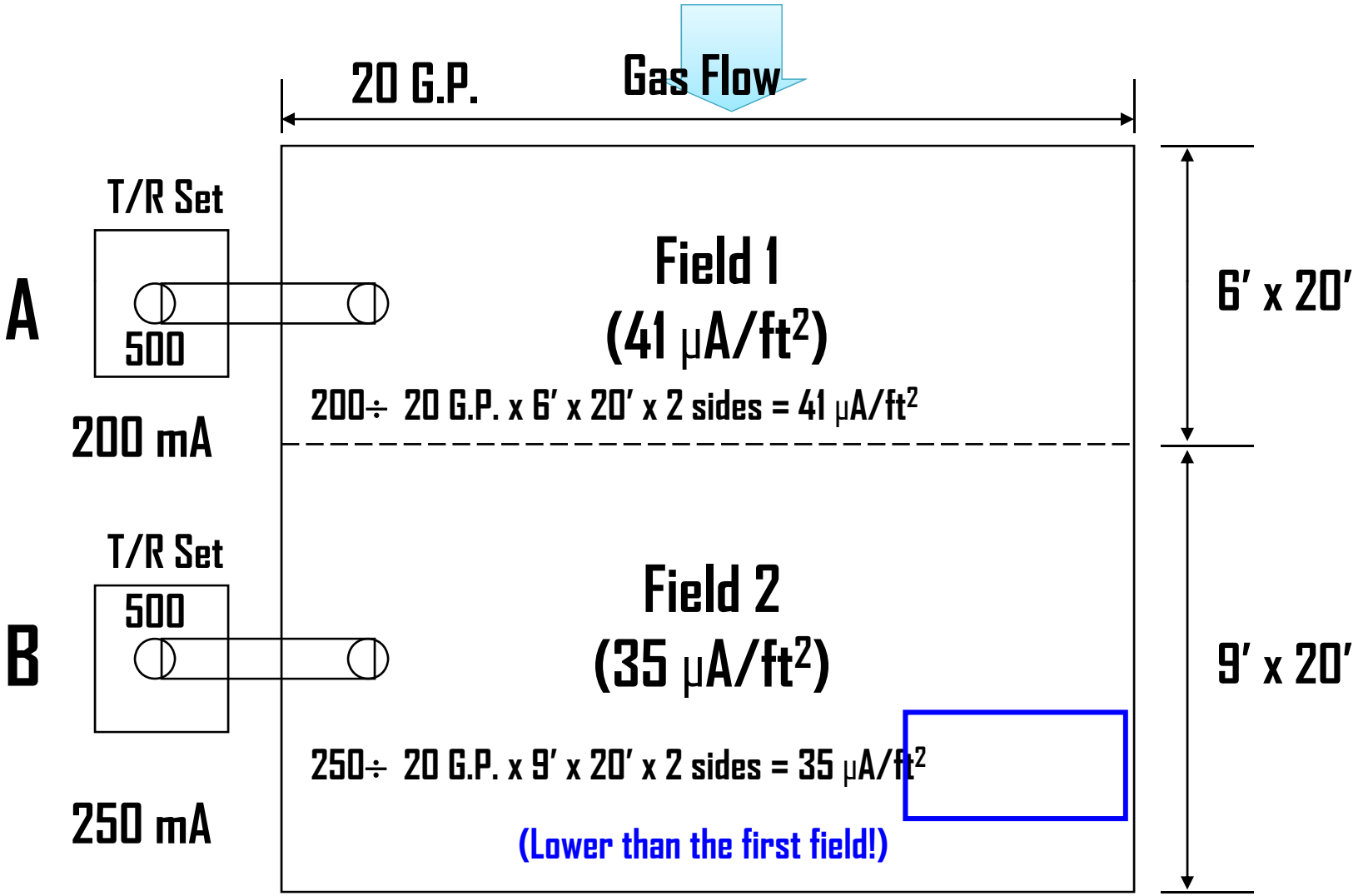
Step 5

5. Current densities are the best tool to check for dust resistivity and to GRADE successive fields' ESP current (mA) values.

Based on what we learned in Step 3, this ESP is OK. However, that would be…..



Current Density



Current Density

1. **Enables A true comparison of ESP current for T/R sets not energizing the same square feet of collecting plates.**
2. **Generally accepted values for low and high resistivity dust, can aid in troubleshooting.**

I. Current Densities
(for very conductive dust)

- **In general, typical range of values for current density for a four field American ESP**

Field Number	Current Density ($\mu A/ft^2$)
1	10-20
2	20-30
3	30-50
4	50-70

I. Current Densities
(for conductive dust)

- **In general, typical range of values for current density for a four field European ESP where T-R sets may not be sized to provide more than 40μA/ft2**

Field Number	Current Density ($\mu A/ft^2$)
1	10-20
2	20-30
3	30-40
4	30-40

Converting to Densities We Get:

1299	836	622	347	MILLIAMP	193	404	1124	1400
757	700	572	419		211	450	492	350
436	252	287	175		149	333	470	622
375	OFF	104	157		OFF	150	235	501

109	70	52	29	DENSITY	16	34	95	118
64	59	48	35		18	38	41	29
37	21	24	15		13	28	40	52
32	OFF	9	13		OFF	13	20	42

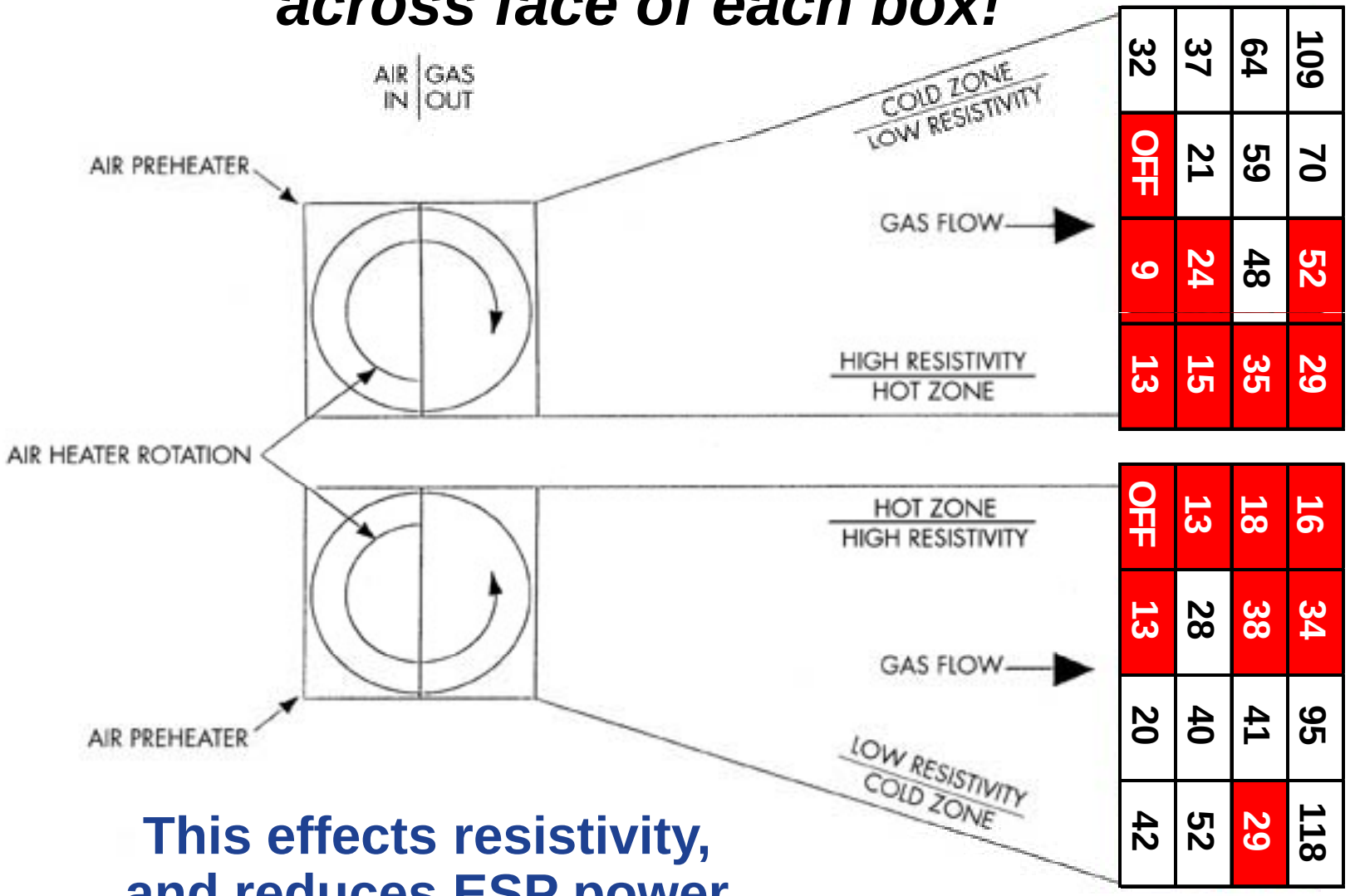
Evaluating Densities We Get:

1299	836	622	347	MILLIAMP	193	404	1124	1400
757	700	572	419		211	450	492	350
436	252	287	175		149	333	470	622
375	OFF	104	157		OFF	150	235	501

109	70	52	29	60 - 80	16	34	95	118
64	59	48	35	40 - 60	18	38	41	29
37	21	24	15	25 - 40	13	28	40	52
32	OFF	9	13	15 -25	OFF	13	20	42

There appears to be a pattern here. Why?

Air-Preheaters produce 60⁰ temperature difference across face of each box!



32	37	64	109
OFF	21	59	70
9	24	48	52
13	15	35	29

OFF	13	18	16
13	28	38	34
20	40	41	95
42	52	29	118

This effects resistivity, and reduces ESP power

What GRADE Would You Give This One?

WEST CHAMBER		T/R SET DESIGNATION		EAST CHAMBER
40 TO 60	43.6	X82	X81	48.4
	15.0	X72	X71	46.9
30 TO 40	23.7	X62	X61	49.4
	9.1	X51		9.1
20 TO 30	15.1	X41		15.1
	17.4	X31		17.4
10 TO 20	9.1	X21		9.1
	4.1	X11		4.1

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With Just Numbers, We Were Nowhere.

Time = Thu 1998/03/05 2:11pm Page 1 of 3

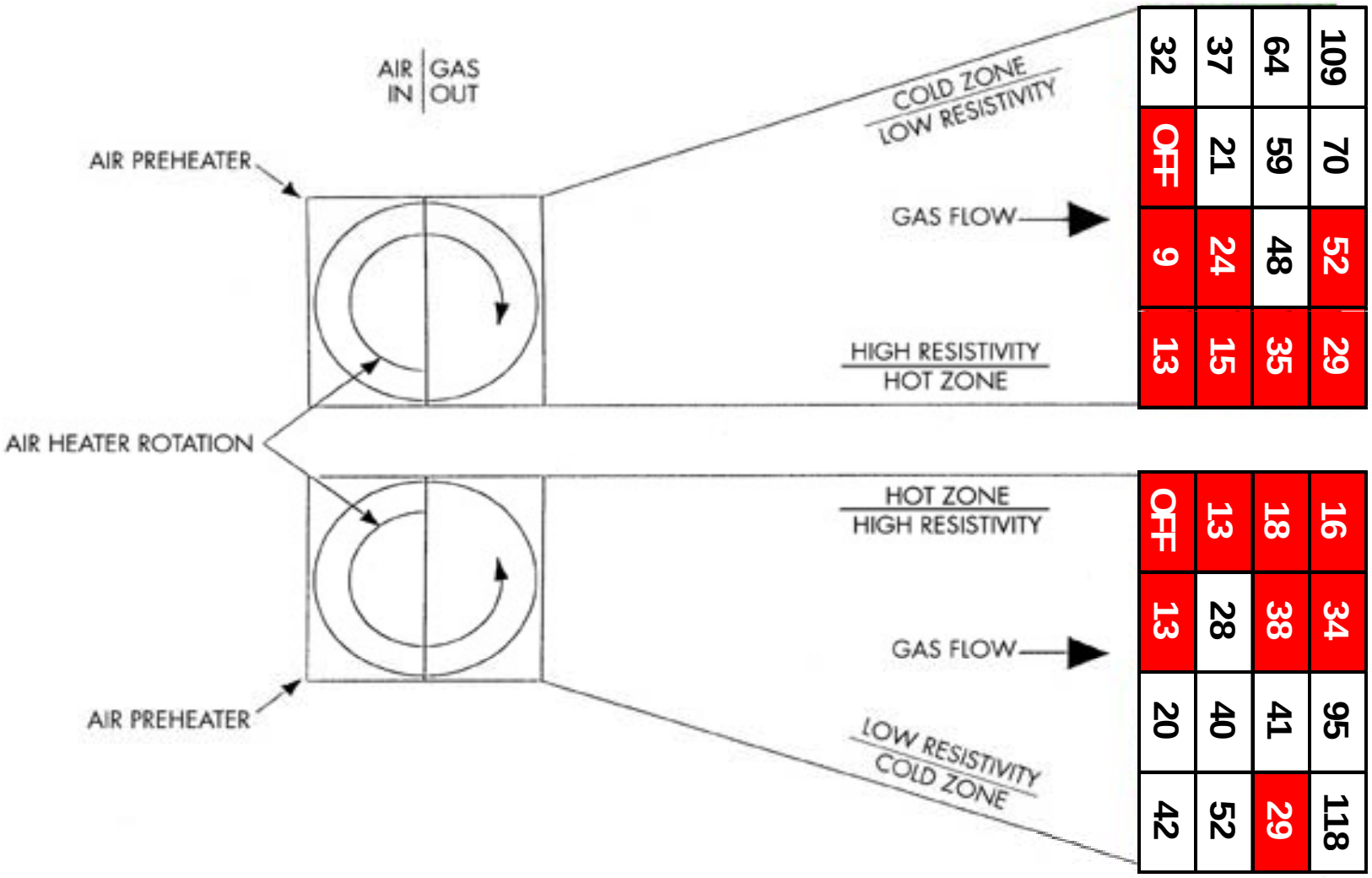
PrecipTech, Inc.
Power Guard Management System
DAC Version 2.9014
SQ-300 AVC

*******Supplemental Printout*******

*****CURRENT VALUES*****

Unit	Amps	Volts	MA	KV	S/M	Status
#3-1A1	22	254	126	39.2	28	Running
#3-2A1	58	346	379	45.0	11	Running
#3-3A1	60	248	324	37.5	11	Running
#3-4A1	76	252	415	36.1	11	Running
#3-5A1	83	357	652	44.5	25	Running
#3-6A1	115	334	909	41.4	11	Running
#3-7A1	59	185	312	25.9	20	Running
#3-8A1	215	365	1517	39.7	1	Running
#3-1A2	***	***	****	****	***	No Response
#3-2A2	16	194	71	33.2	14	Running
#3-3A2	35	236	166	38.1	12	Running
#3-4A2	37	207	173	31.9	14	Running
#3-5A2	39	265	217	39.6	27	Running
#3-6A2	60	263	375	33.3	15	Running
#3-7A2	55	210	308	26.6	16	Running
#3-8A2	144	312	924	38.1	6	Running
#3-1B1	***	***	****	****	***	No Response
#3-2B1	36	217	213	30.6	18	Running
#3-3B1	165	399	1229	42.2	13	Running
#3-4B1	84	206	782	30.4	15	Running
#3-5B1	26	266	150	39.7	27	Running
#3-6B1	23	200	102	35.3	17	Running
#3-7B1	115	377	758	41.3	17	Running
#3-8B1	76	249	415	36.0	14	Running
#3-1B2	55	276	355	35.1	30	Running
#3-2B2	49	207	296	28.1	22	Running
#3-3B2	112	291	719	34.8	18	Running
#3-4B2	192	373	1339	41.6	14	Running
#3-5B2	12	173	55	29.7	30	Running
#3-6B2	97	373	687	44.7	14	Running
#3-7B2	111	345	743	38.1	18	Running
#3-8B2	79	251	438	31.2	15	Running

But with a Grading System, We Can Plan a Strategy.



Questions?

Thank you.