Reinhold Environmental Ltd.

2009 APC Round Table & Expo Presentation

July 12-14, 2009, in The Woodlands, TX

ELECTROSTATIC PRECIPITATOR ELECTRODE DESIGN AND PERFORMANCE

ROBERT MASTROPIETRO

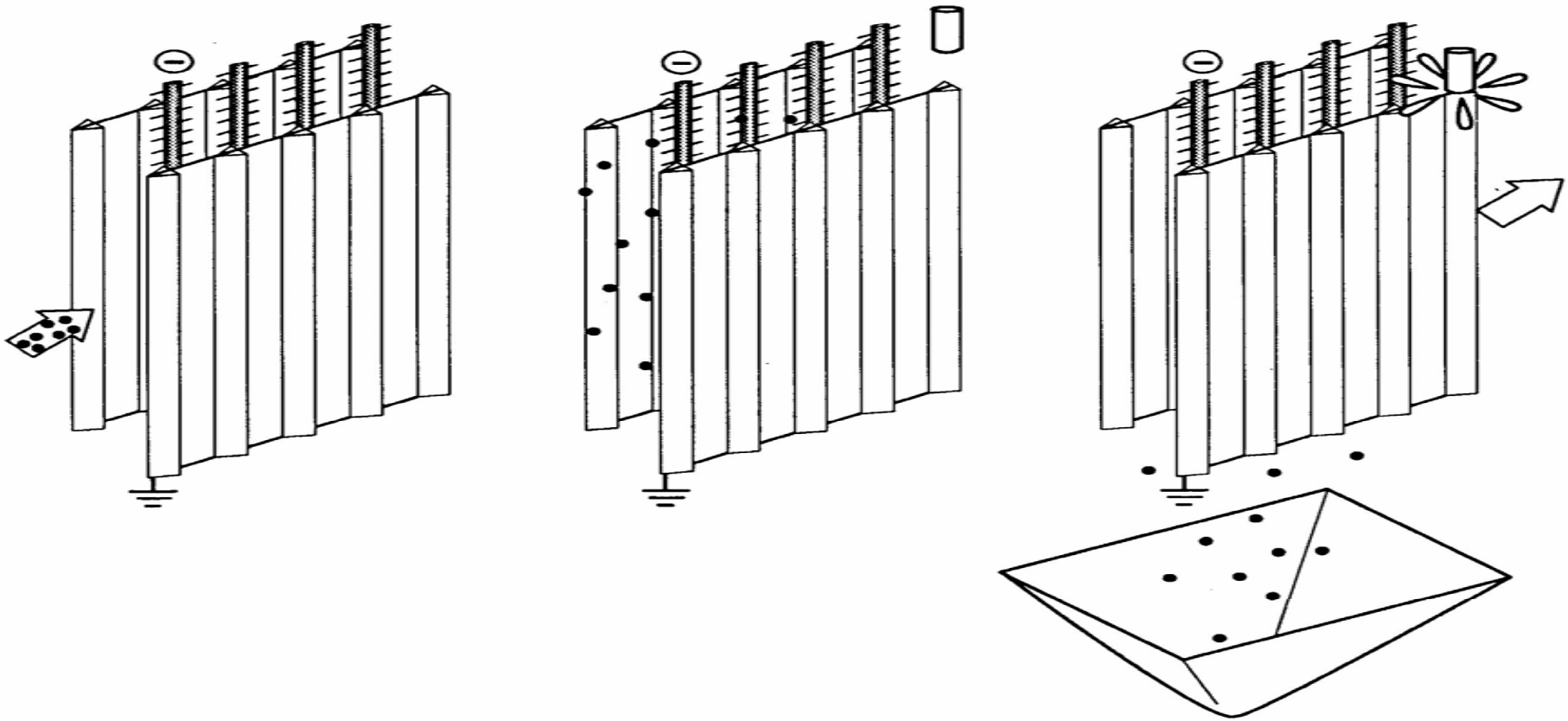
FIGURE 1

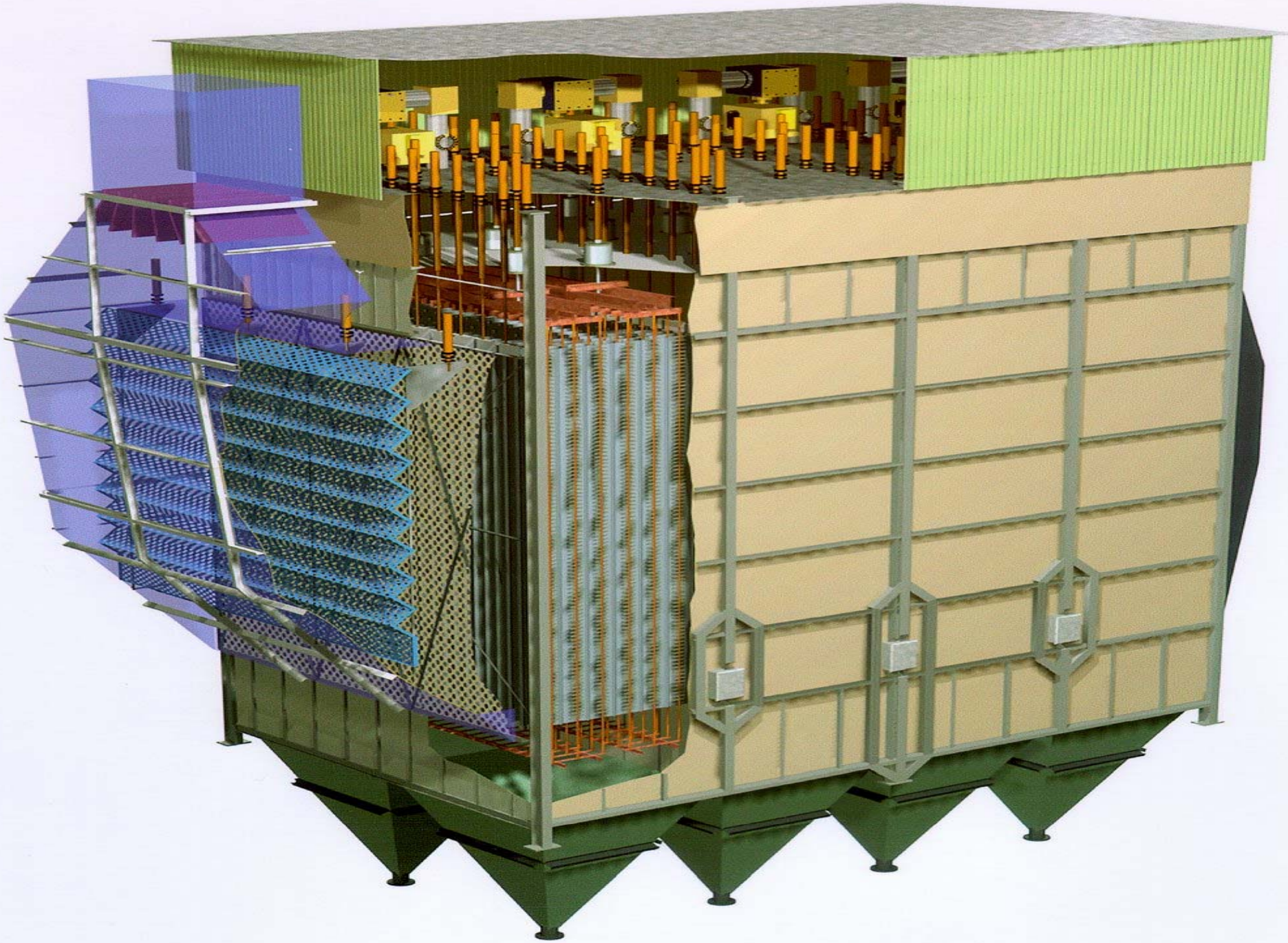
ESP Operating Principle

Particles suspended in a gas enter the precipitator; passing through ionized zones around high voltage electrodes. These high voltage electrodes, through a corona effect, emit negatively charged ions into the gases.

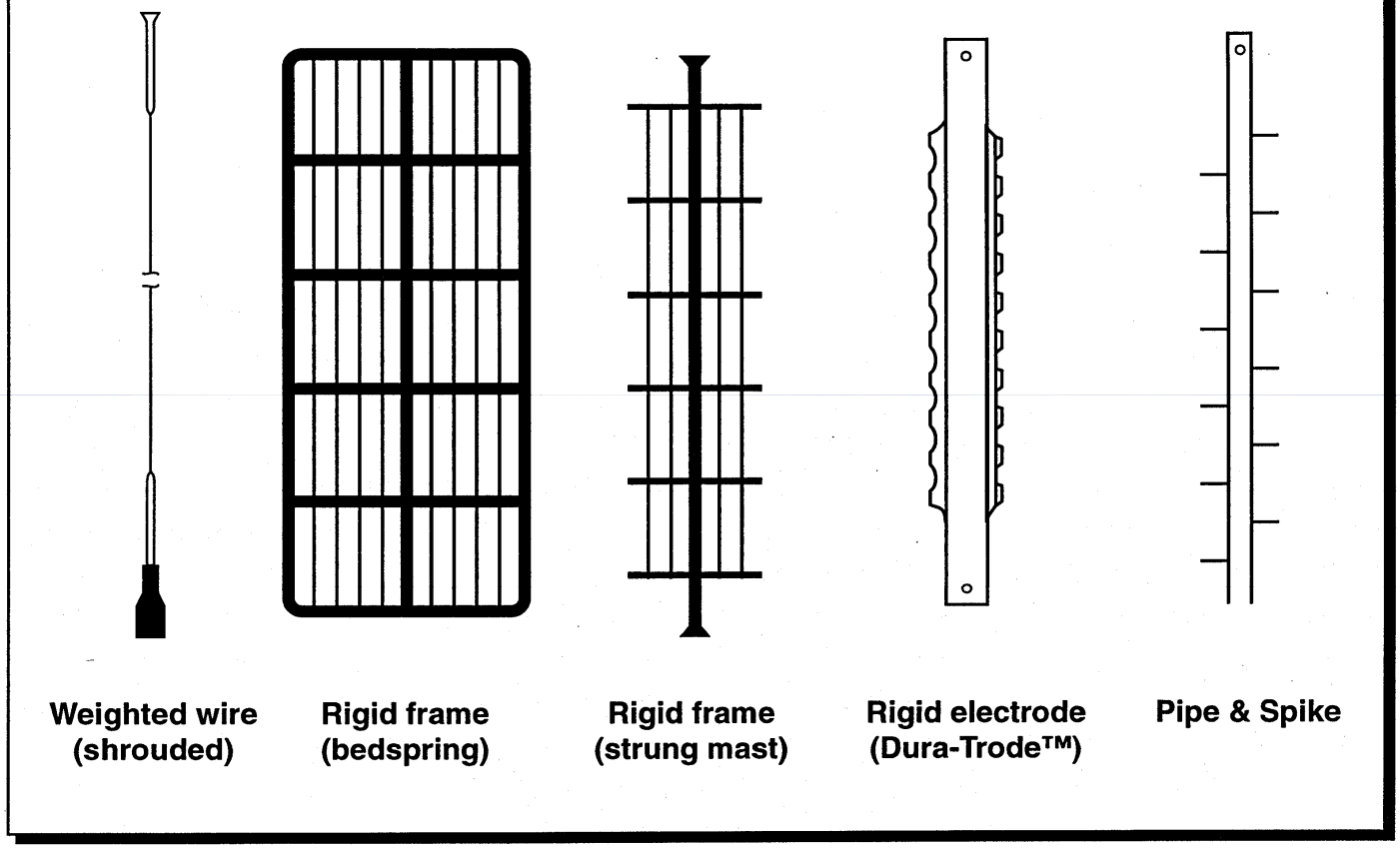
The negatively charged gas field around each electrode charges passing particulates, causing the particulates to migrate to the electrode of opposite polarity, the collector plates.

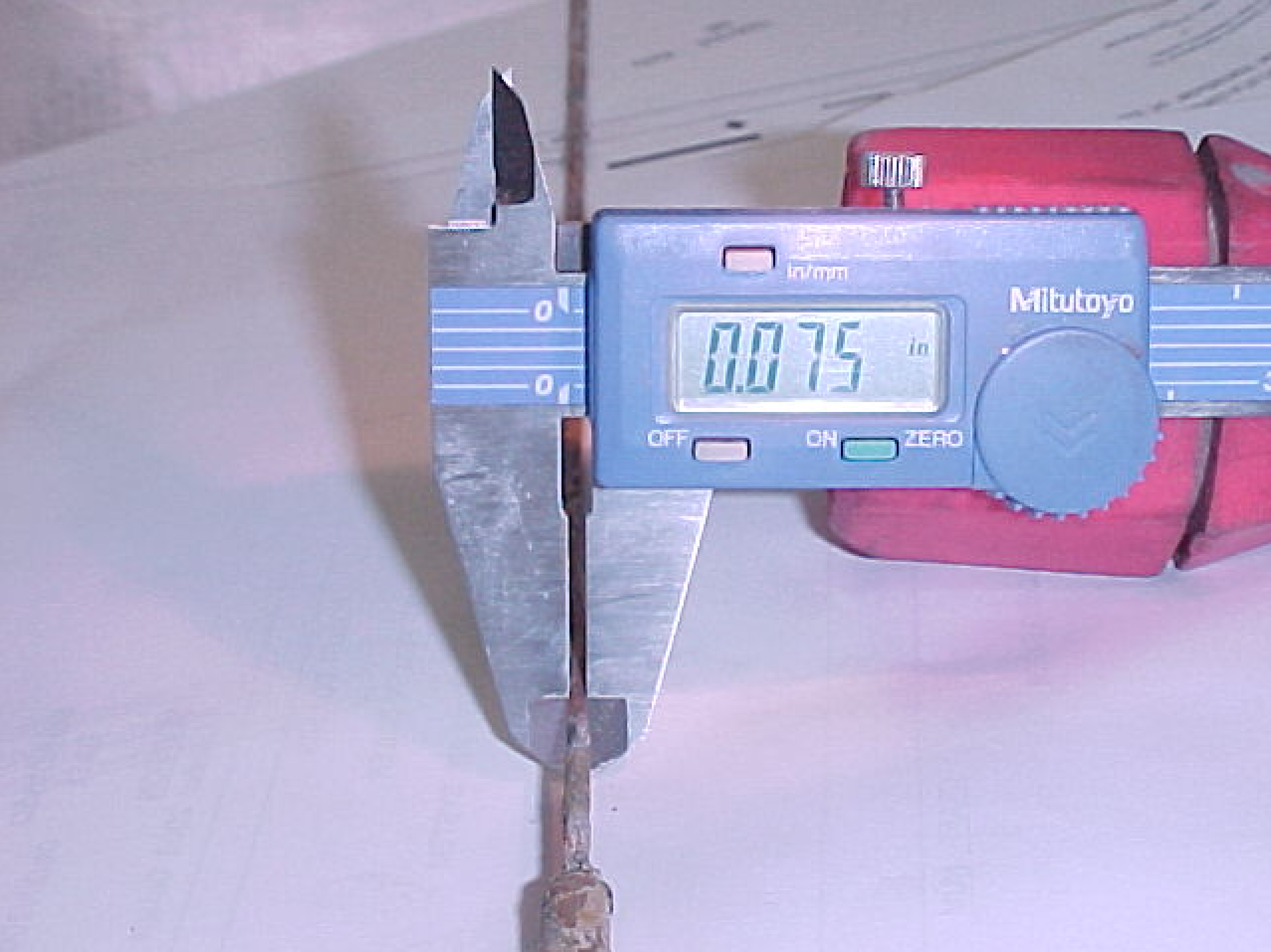
The charged particulates gather on the grounded collector plates. Rappers shake loose the agglomerate which falls into the collection hoppers for removal.



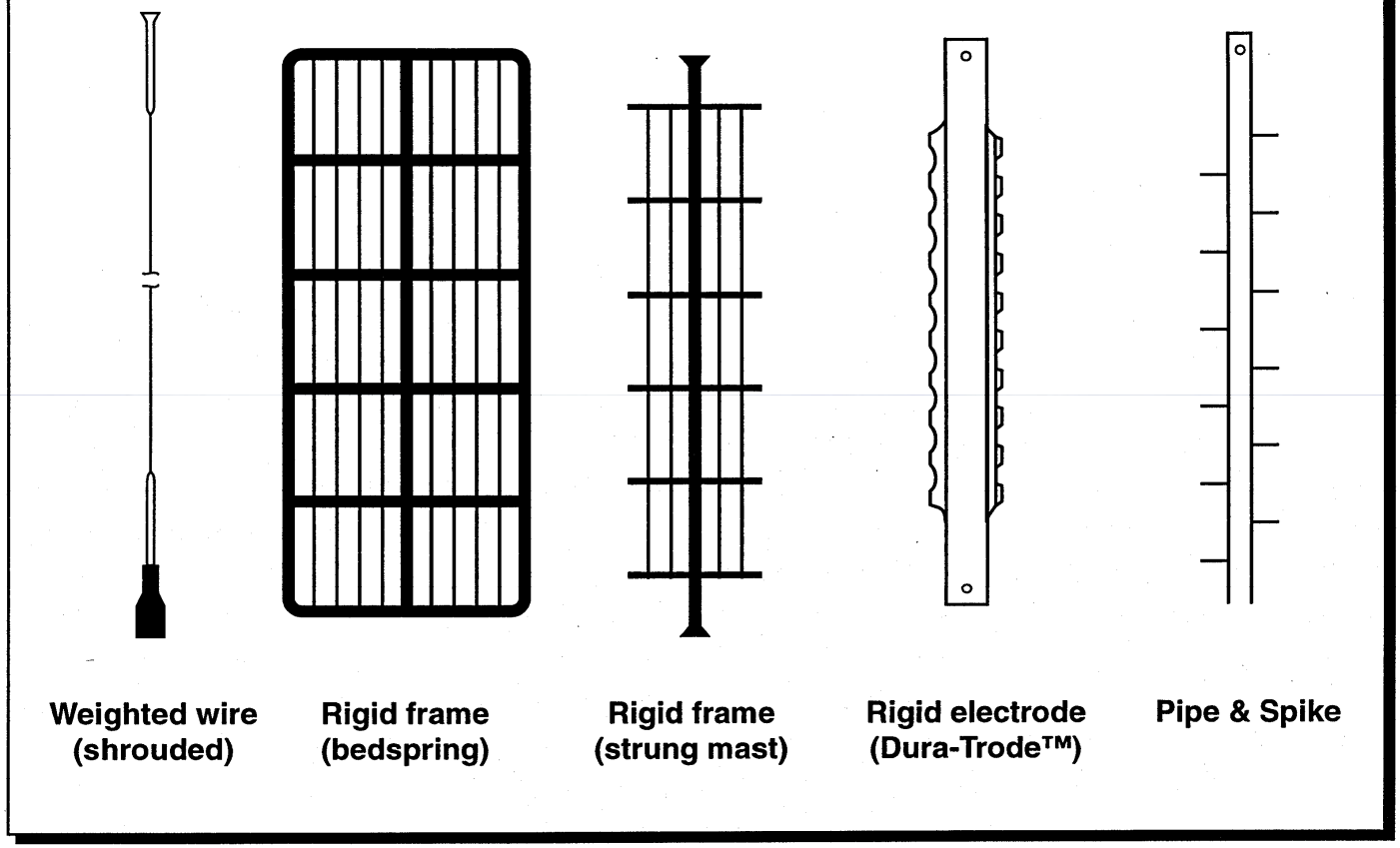


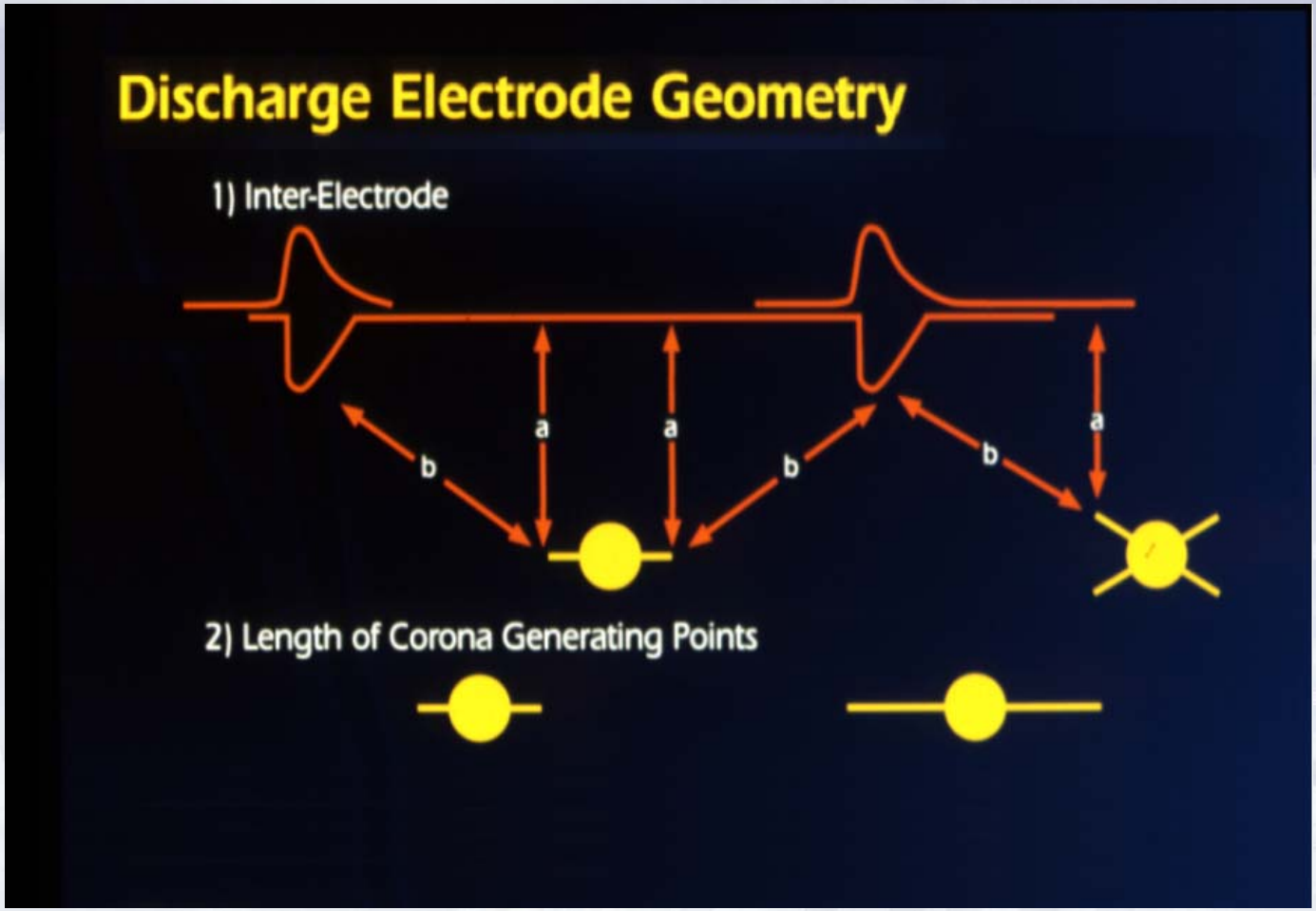
Discharge Electrode Types

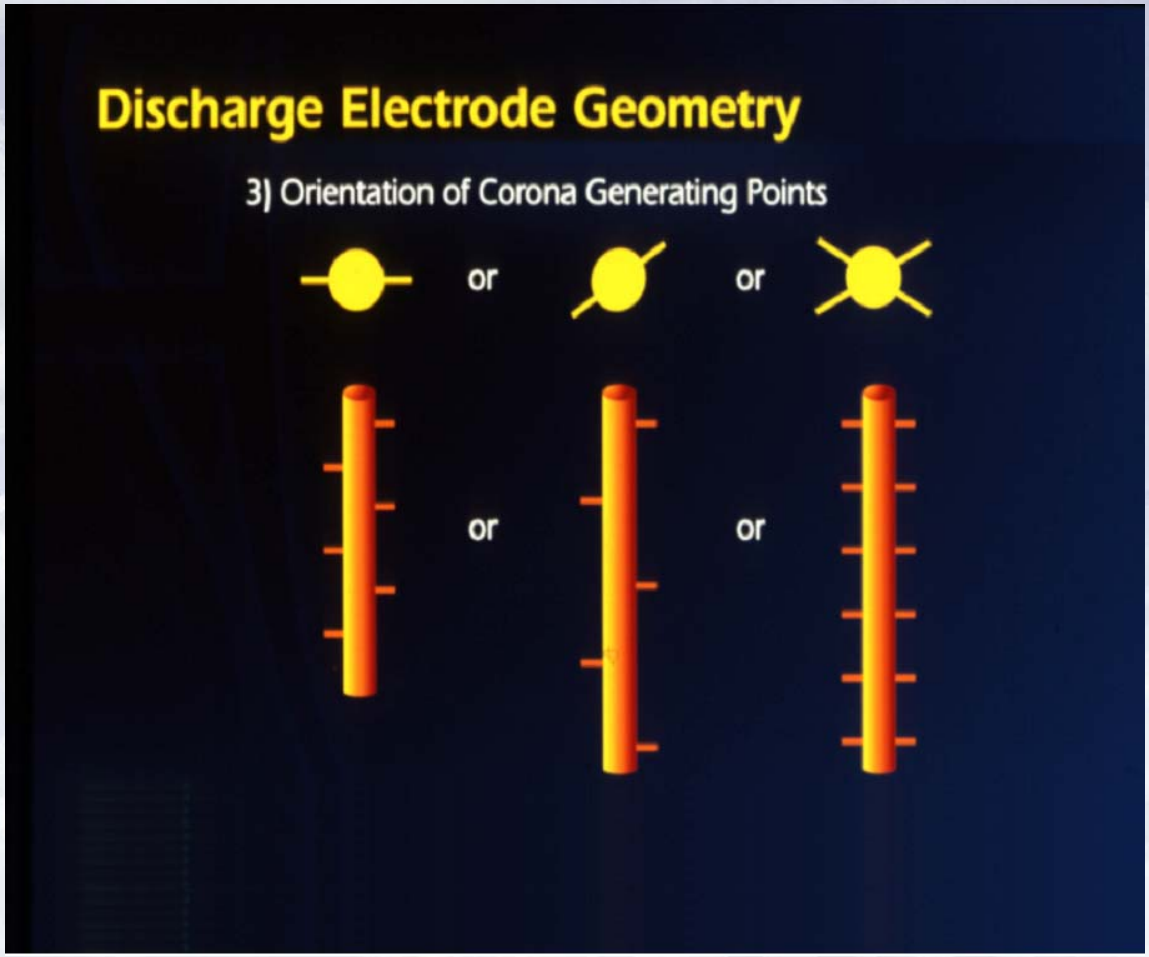


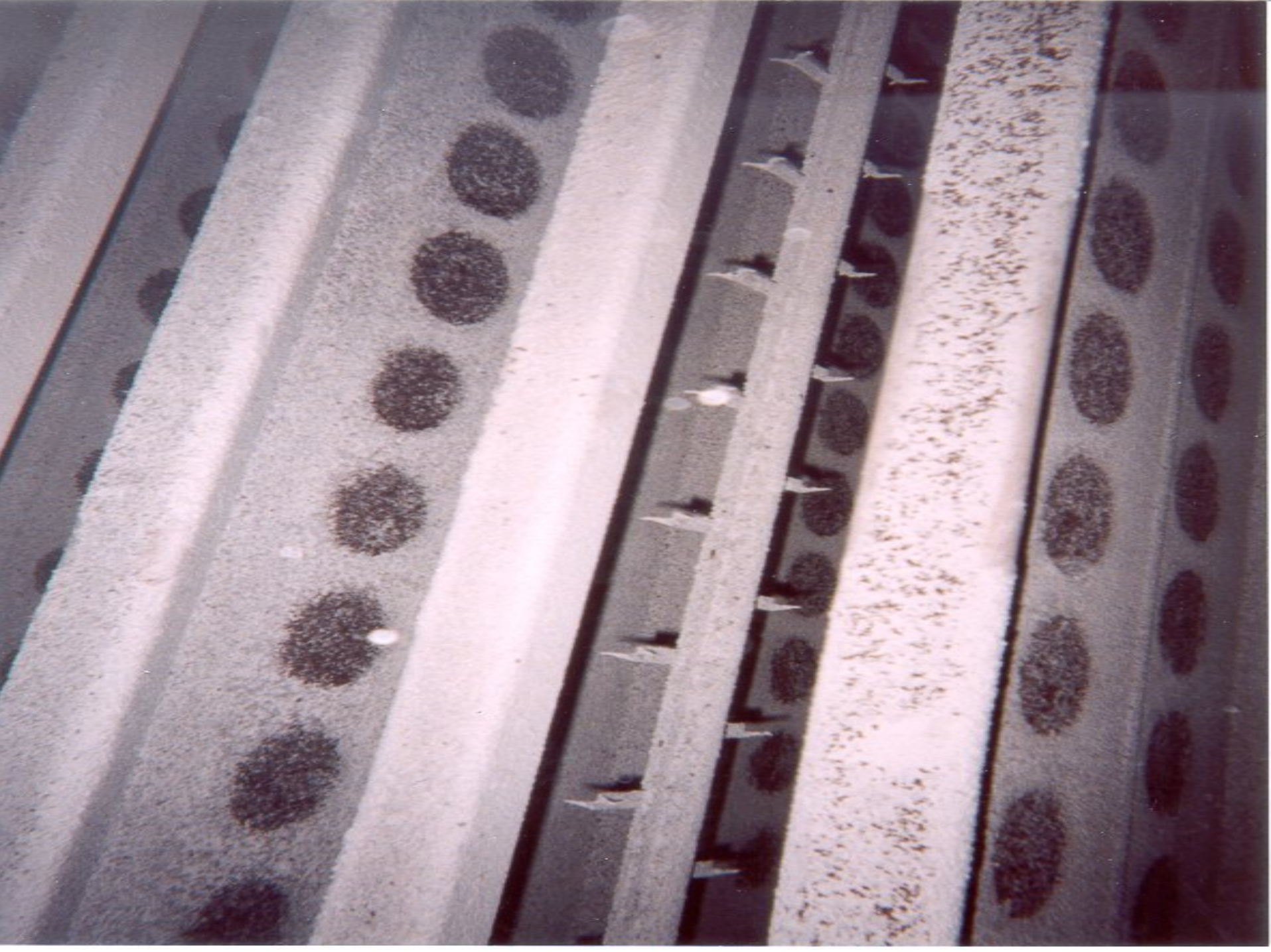

in/mm
Mitutoyo
0.075 in
OFF
ON
ZERO

Discharge Electrode Types

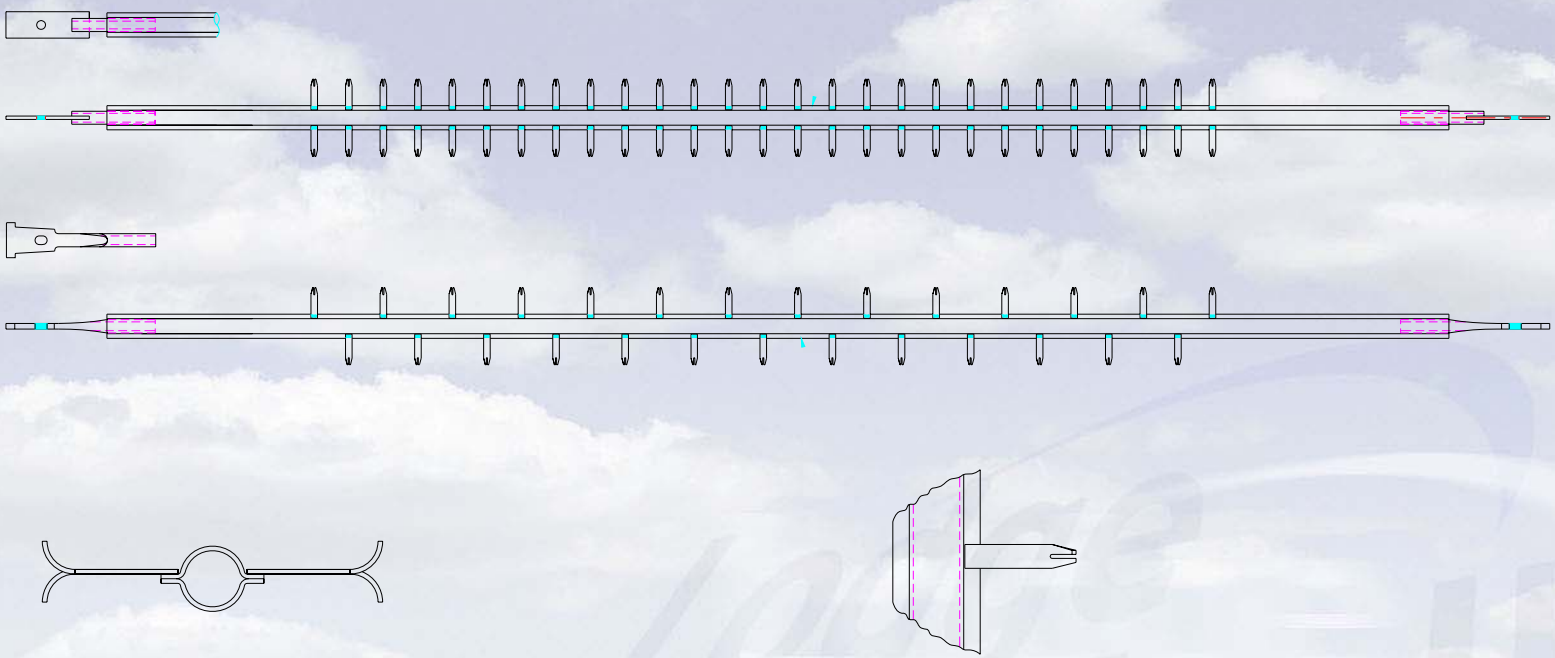



Discharge Electrode Geometry
1) Inter-Electrode
a
a
a
b
b
b
2) Length of Corona Generating Points

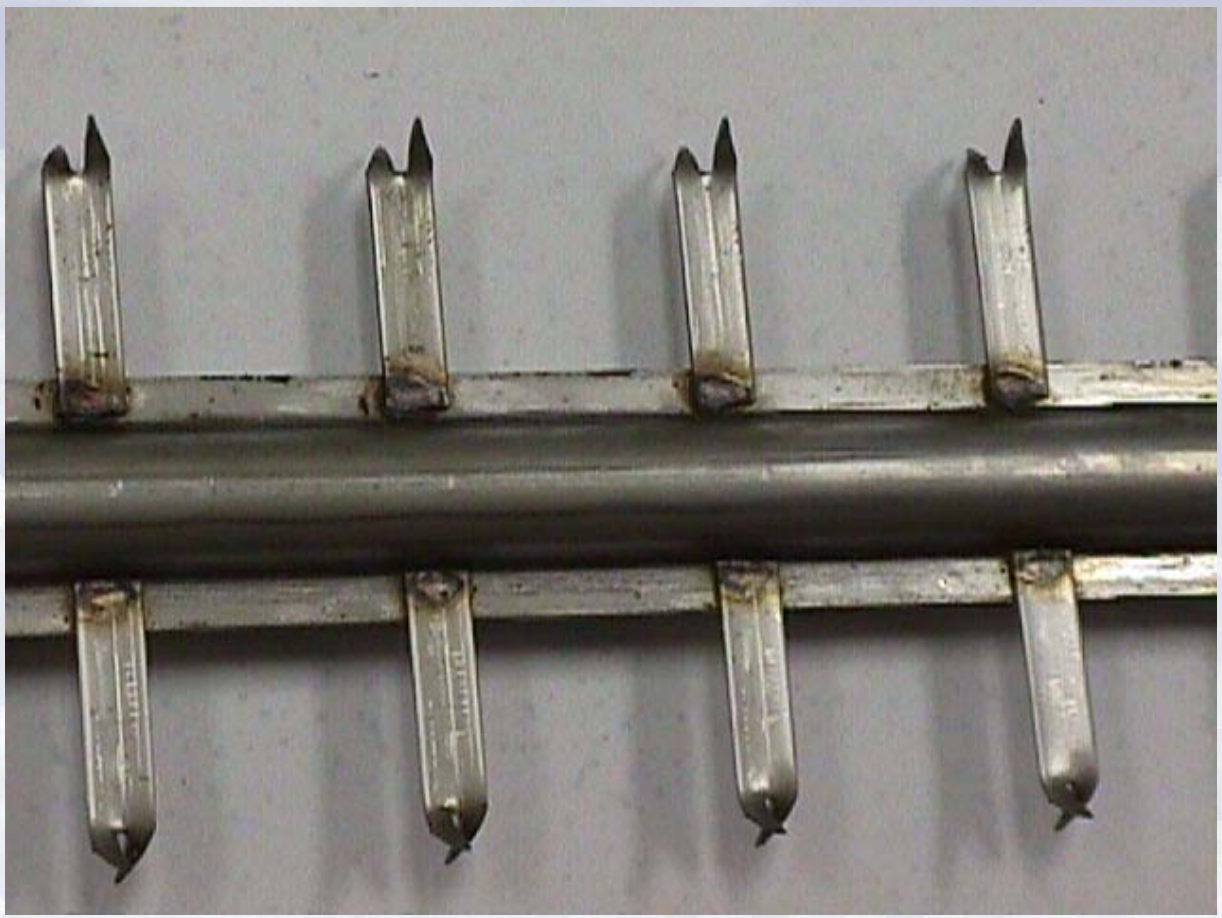

Discharge Electrode Geometry
3) Orientation of Corona Generating Points
or
or
or
or

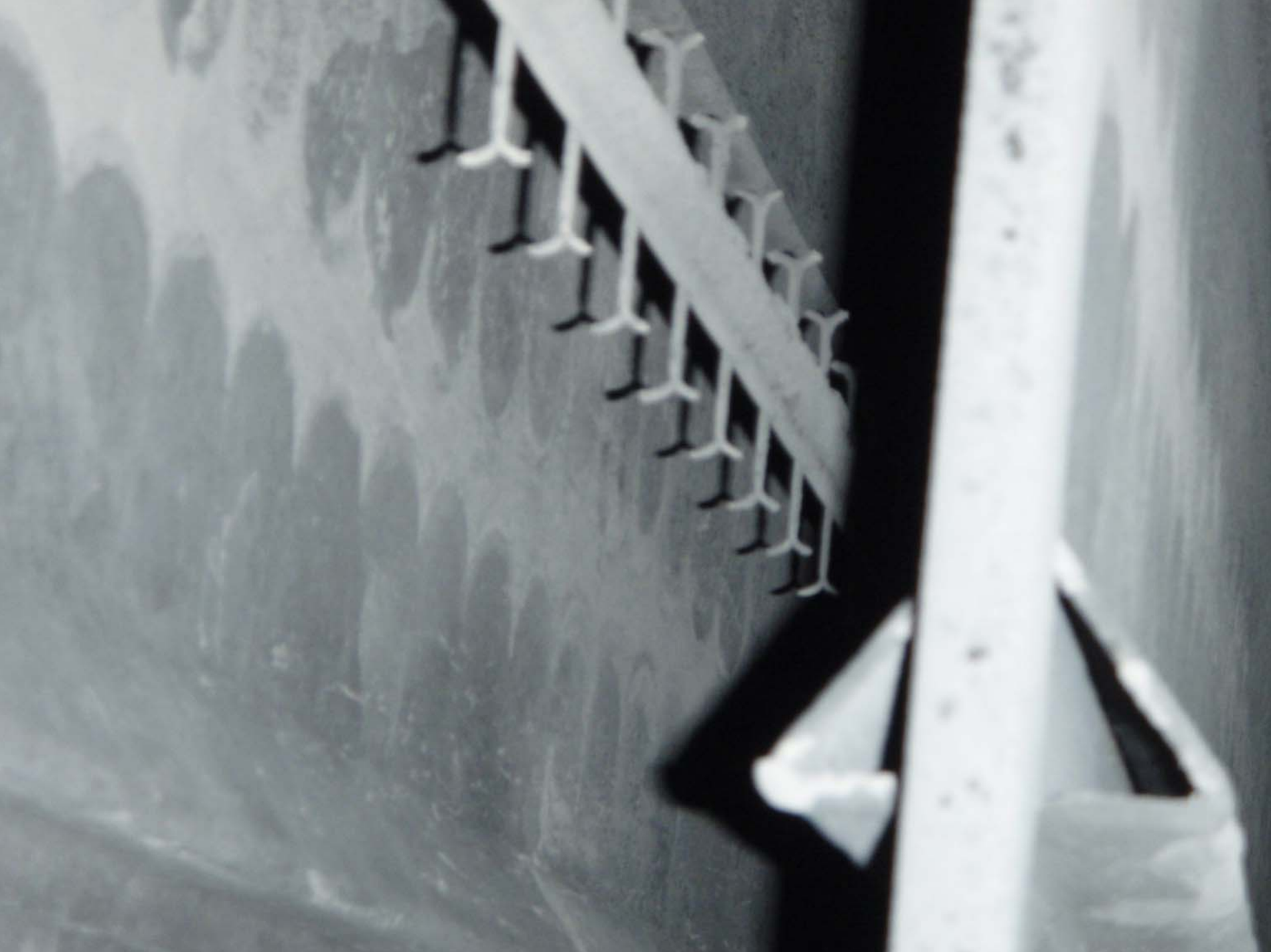


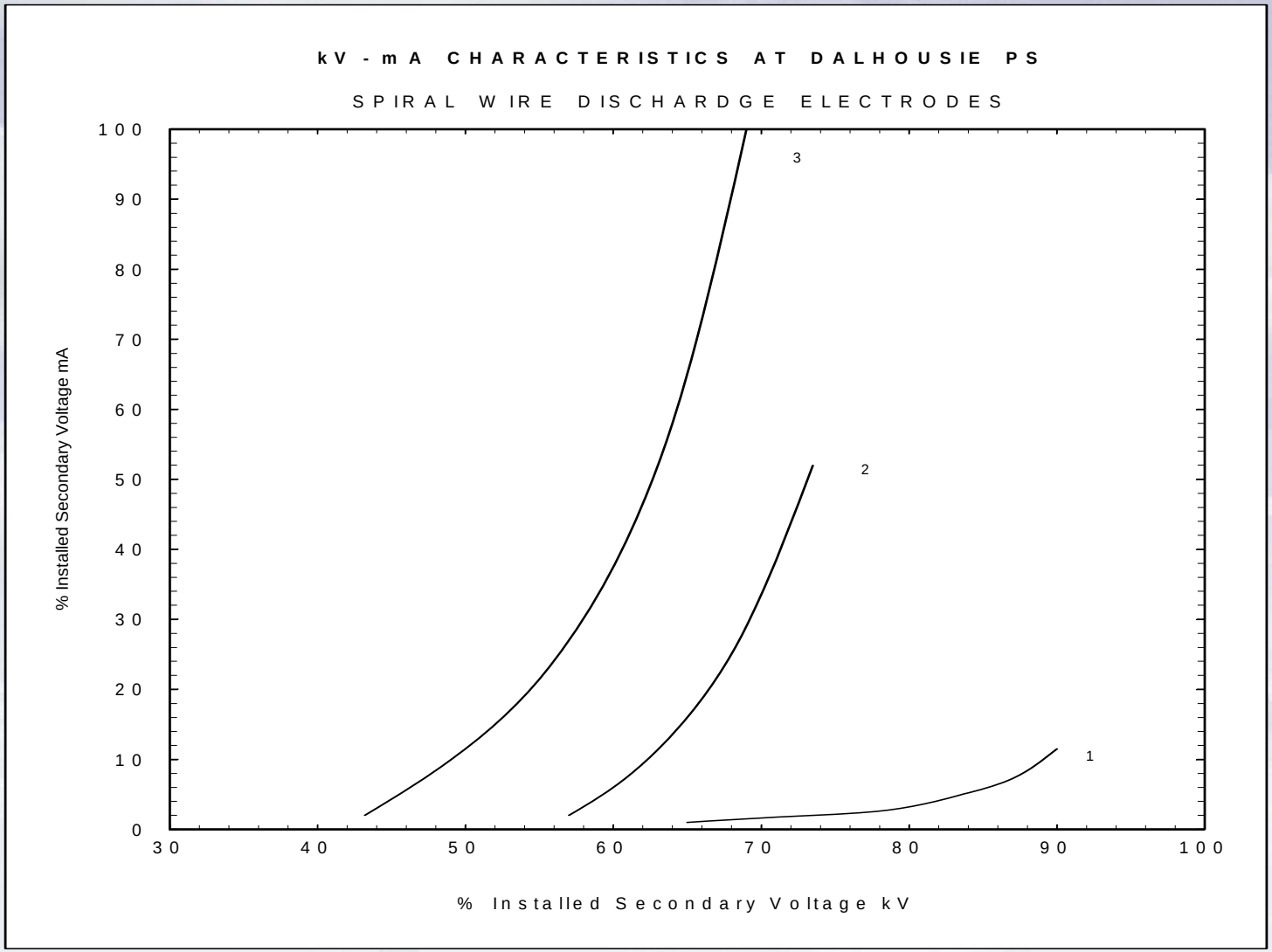
Aggressive & Staggered Profiles



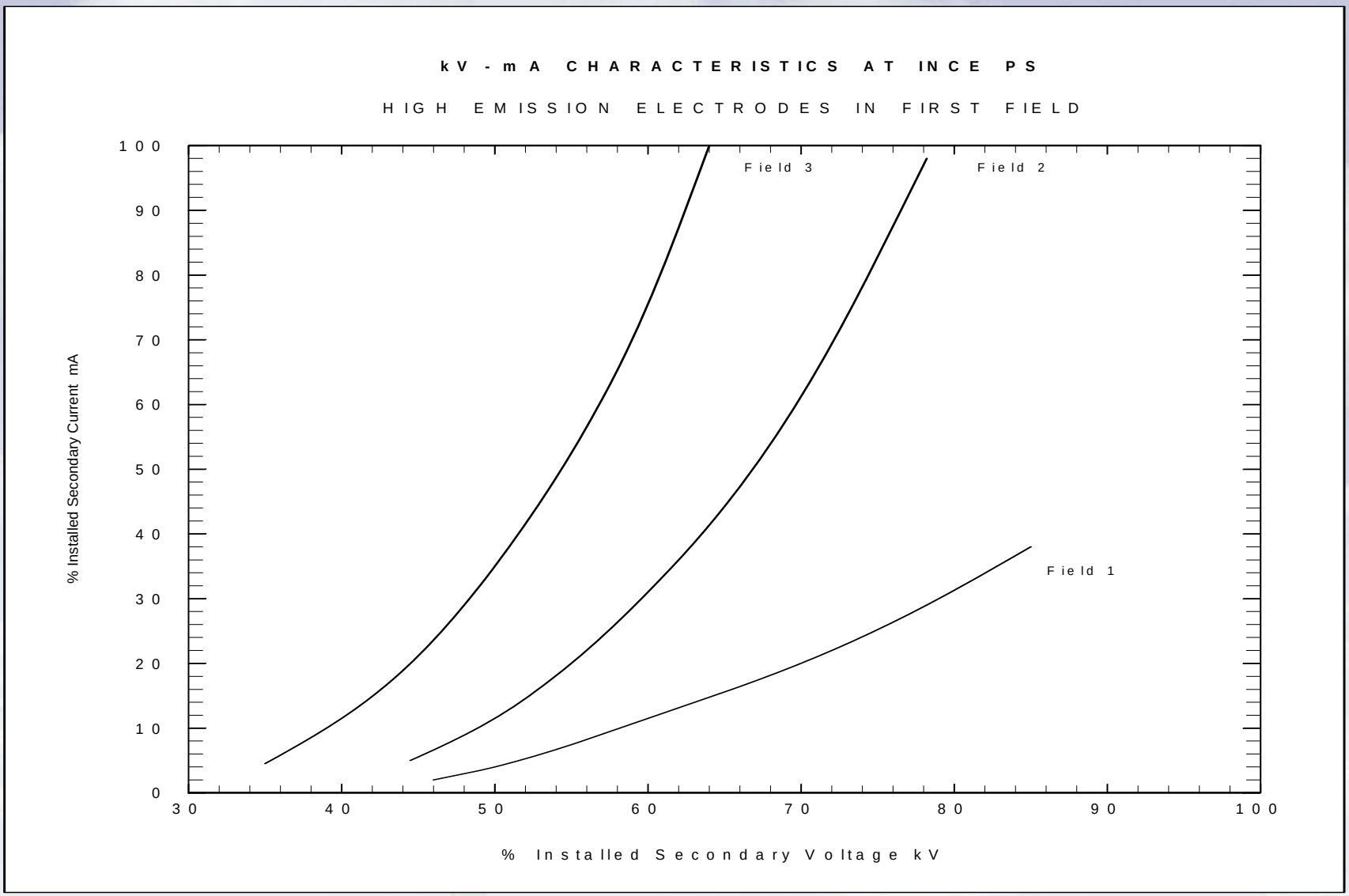
Aggressive SEI/ELEX RDE



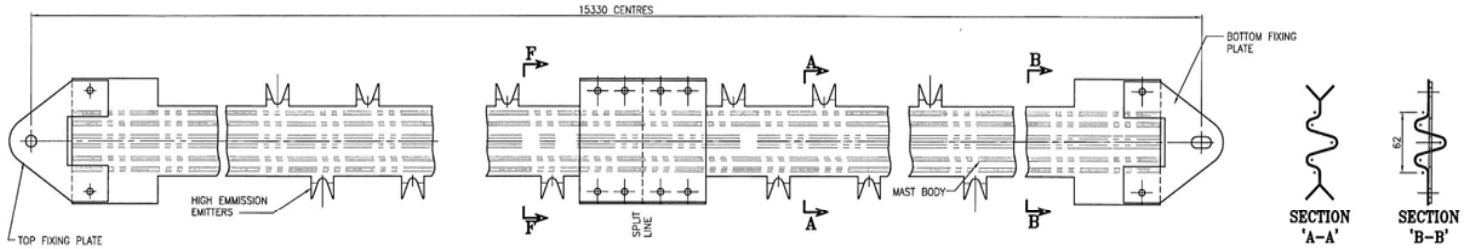



kV - mA CHARACTERISTICS AT DALHOUSIE PS
SPIRAL WIRE DISCHARDGE ELECTRODES
% Installed Secondary Voltage mA
100
90
80
70
60
50
40
30
20
10
0
30
40
50
60
70
80
90
100
% Installed Secondary Voltage kV
3
2
1

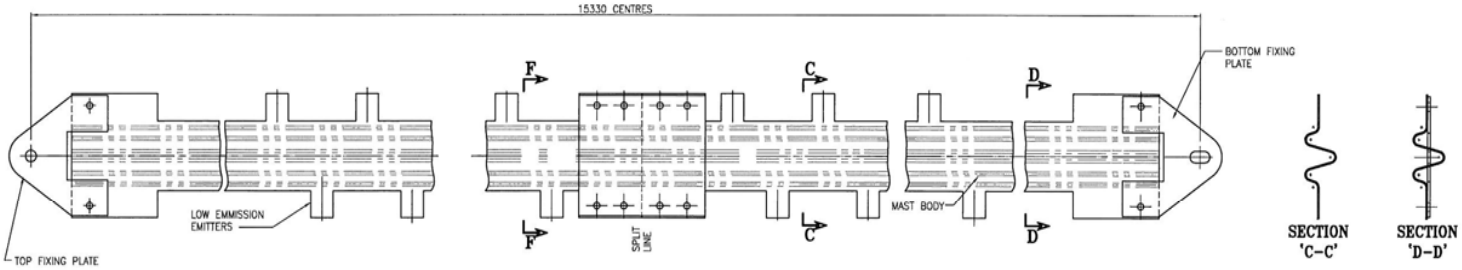
High and Standard Emission Electrodes


kV - mA CHARACTERISTICS AT INCE PS
HIGH EMISSION ELECTRODES IN FIRST FIELD
% Installed Secondary Current mA
100
90
80
70
60
50
40
30
20
10
0
30
40
50
60
70
80
90
100
Field 3
Field 2
Field 1
% Installed Secondary Voltage kV

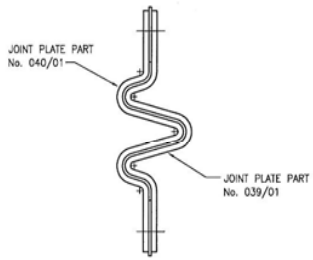
THIS DRAWING IS FIRST ANGLE



HIGH EMMISSION DISCHARGE ELECTRODE



LOW EMMISSION DISCHARGE ELECTRODE



TYPICAL ENLARGED SECTION 'F-F' SPLIT JOINT DETAIL

DETAILS OF HIGH EMMISSION EMITTER

DETAILS OF LOW EMMISSION EMITTER

REV			
	DRAWN	CHECKED	APPROVED
MODIFICATIONS			

LODGE COTTRELL LIMITED
21 GEORGE STREET BIRMINGHAM B3 1QQ

SCALE	1:2.5		CHD	MJG	21.11.08
DRN.	FWE	20.11.08	APP.D	ND	25.11.08

ASSEMBLY AND DETAILS OF STRIP DISCHARGE ELECTRODES 'W' TYPE DE

DRG.No. RD.06030/015 REV.

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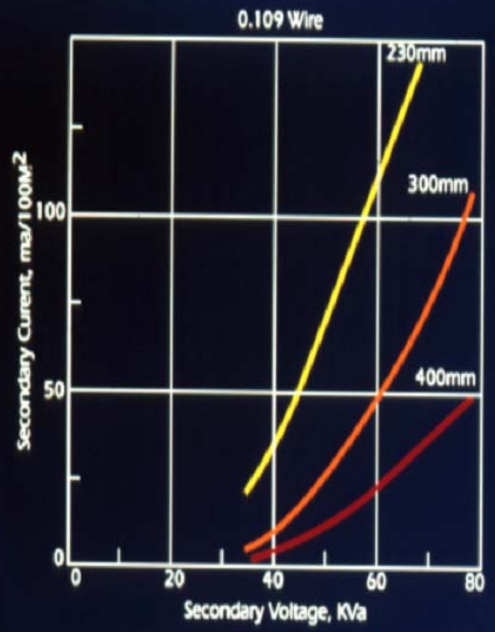
Air-Load Voltage-Current Curves



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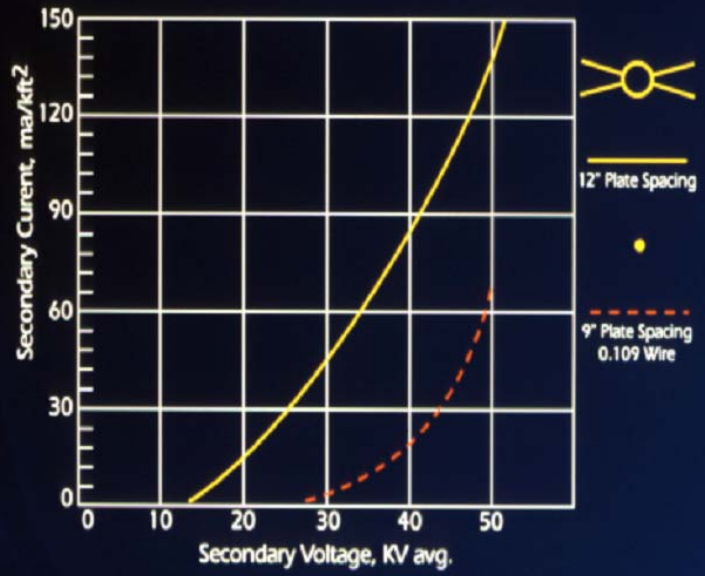
Electrostatic Precipitator Air Load Data

Pipe & Spike at 12" Spacing vs. 0.109" Wire at 9" Spacing



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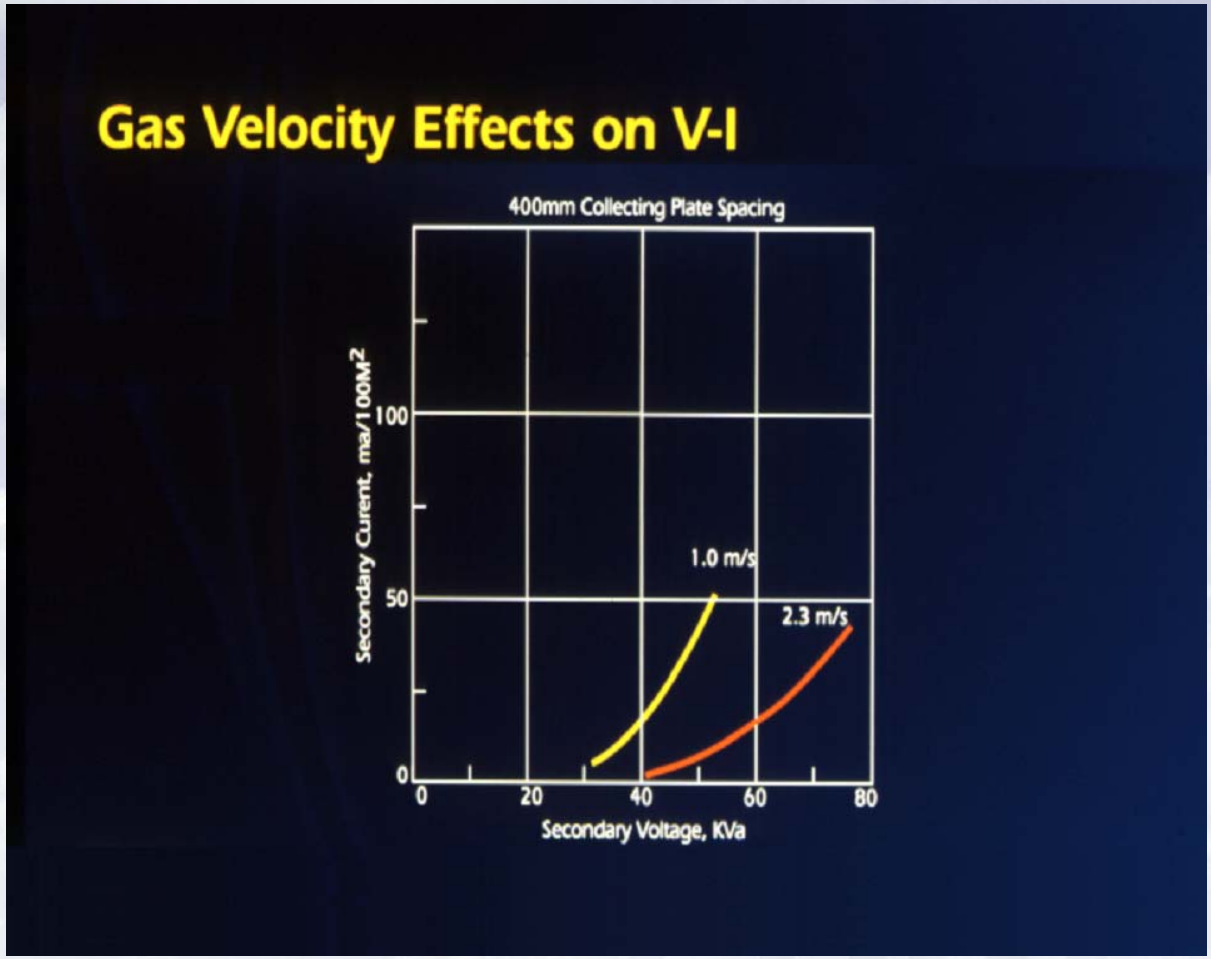
Gas Velocity Effects on V-I



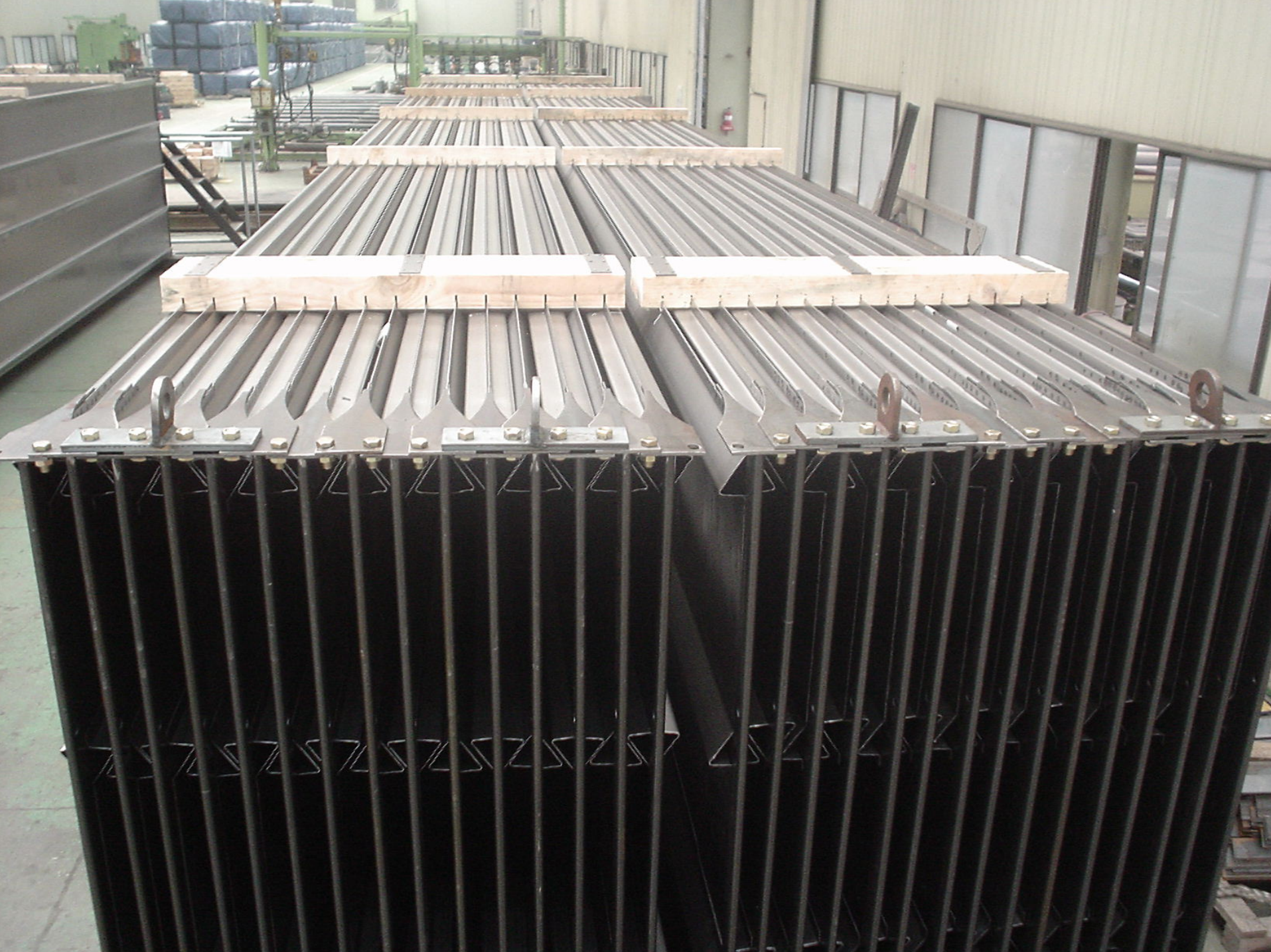
SUMMARY

Discharge electrode design can be modified to adjust for;

- dust loading, particle size, resistivity, etc.
- collecting plate spacing
- ESP gas velocity
- installed T-R voltage capacity
- dust stickiness (rapping density and type)
- gas temperature (flue gas density)

Discharge electrode design has reached to point where it is done by calculation, rather than by pilot plant study


#29



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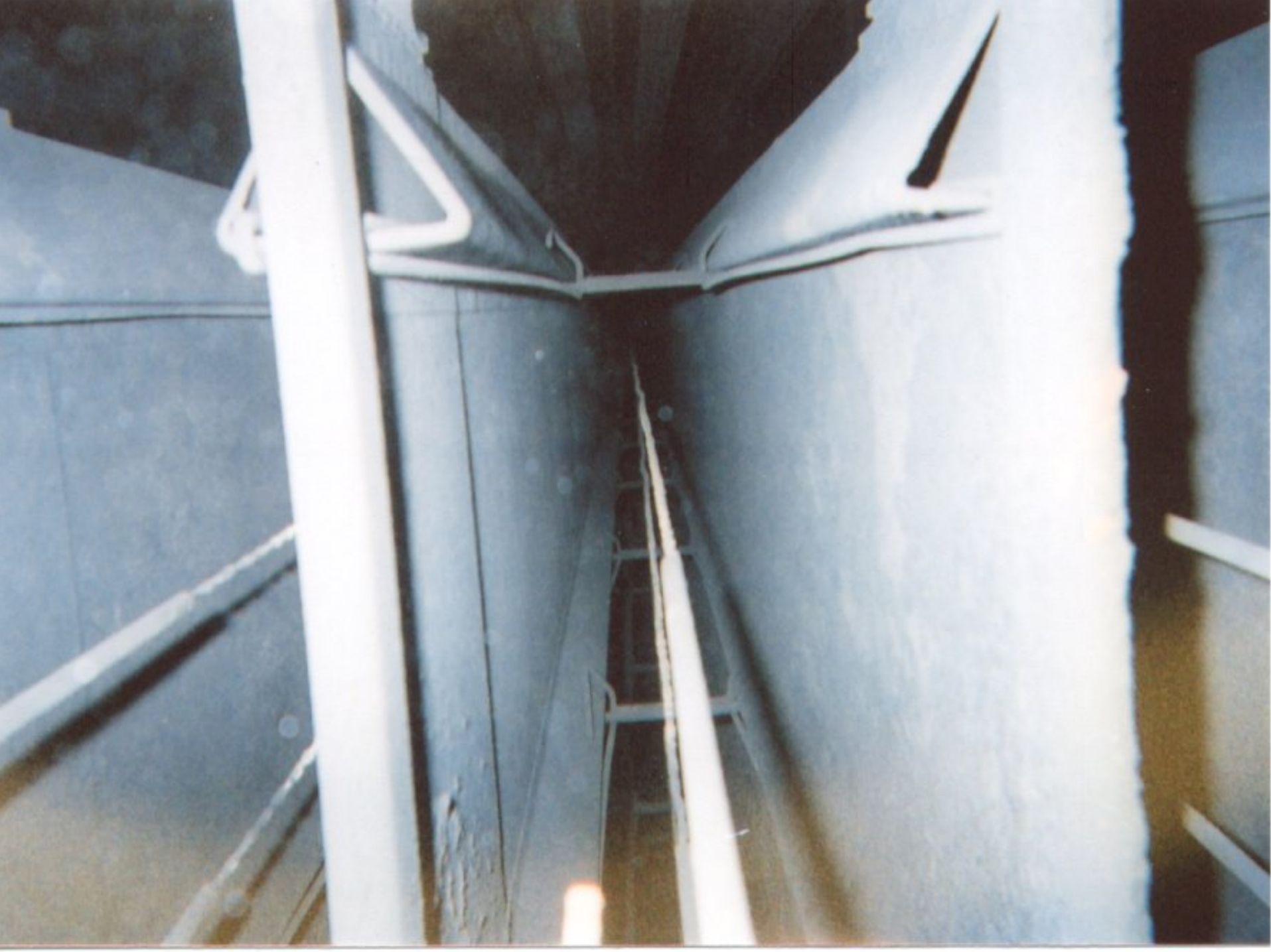
TYPICAL LIFE OF ELECTROSTATIC PRECIPITATOR INTERNALS

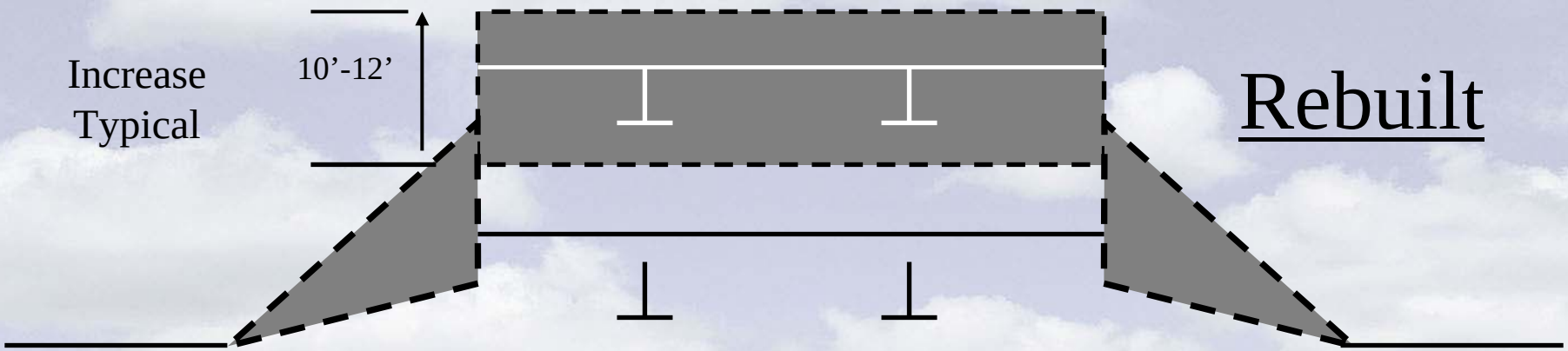
Recovery Boiler, Wet Bottom	**4-15 Years**
Recovery Boiler, Drag Bottom	**10-20 Years**
Oil Fired Boiler, High Sulfur Oil	**20-25 Years**
Coal Fired Boiler, High Sulfur Coal	**25-30 Years**
Coal Fired Boiler, Low Sulfur Coal	**30-40 Years**
Combination Boiler, Woodwaste Only	**30-40 Years**



ESP COLLECTING PLATE HEIGHT TRENDS

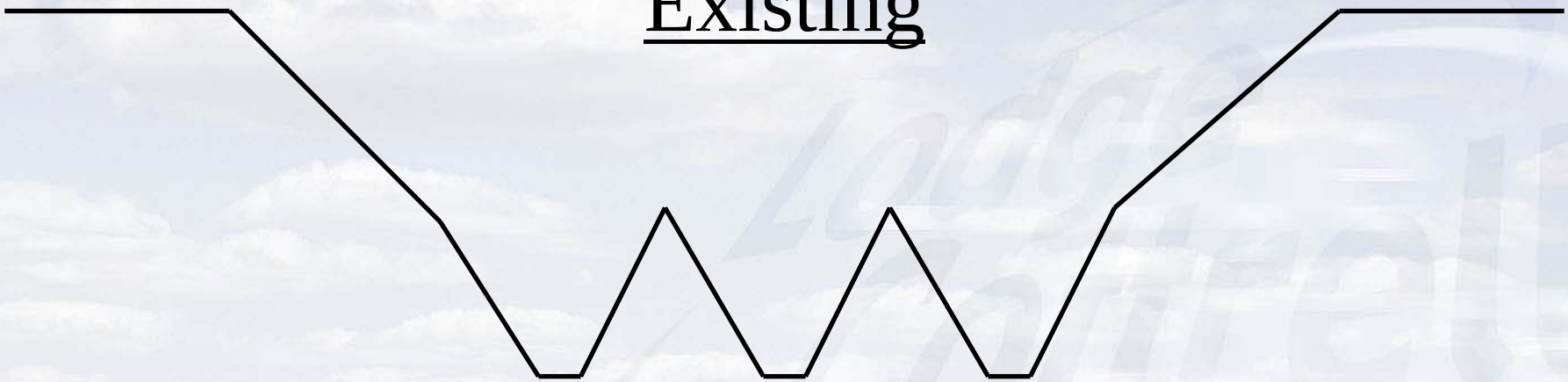
Year	Collecting Plate Height, Feet
1940's	17-20
1950's	17-24
1960's	24-30
1970's	24-36
1980's	24-48
1990-Present	24-50

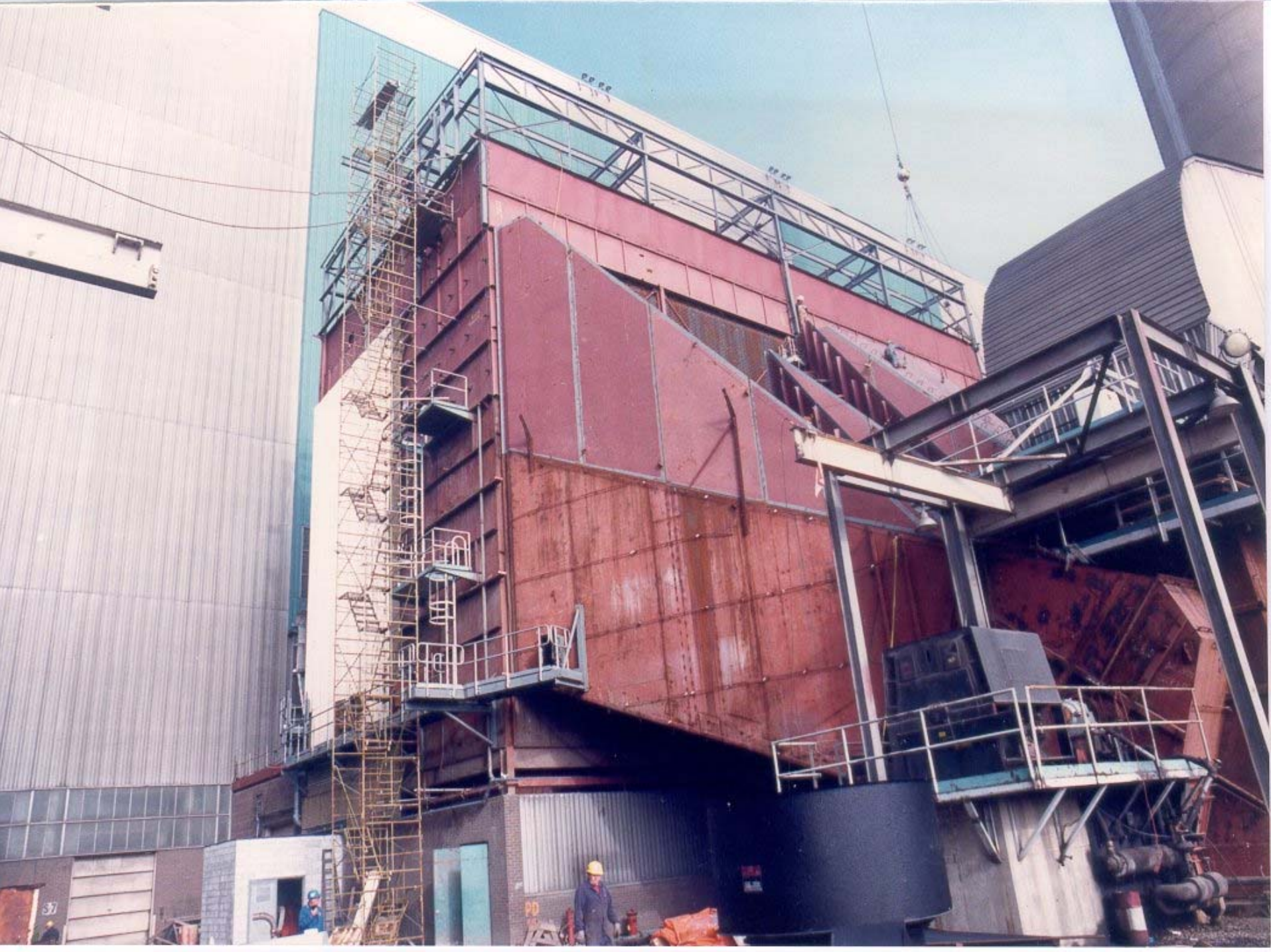
ESP Enlargement By Increased Height

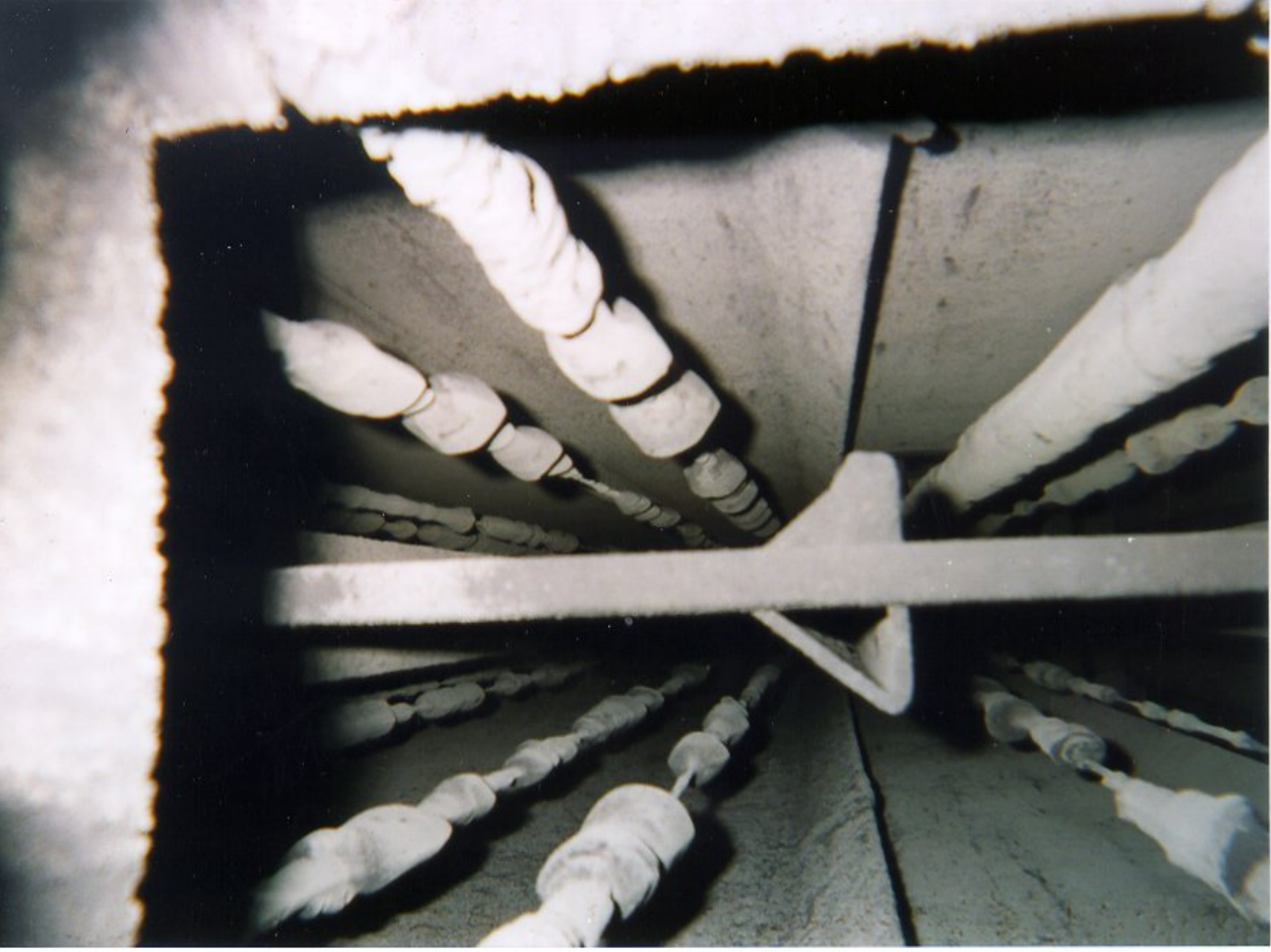


Rebuilt

Existing

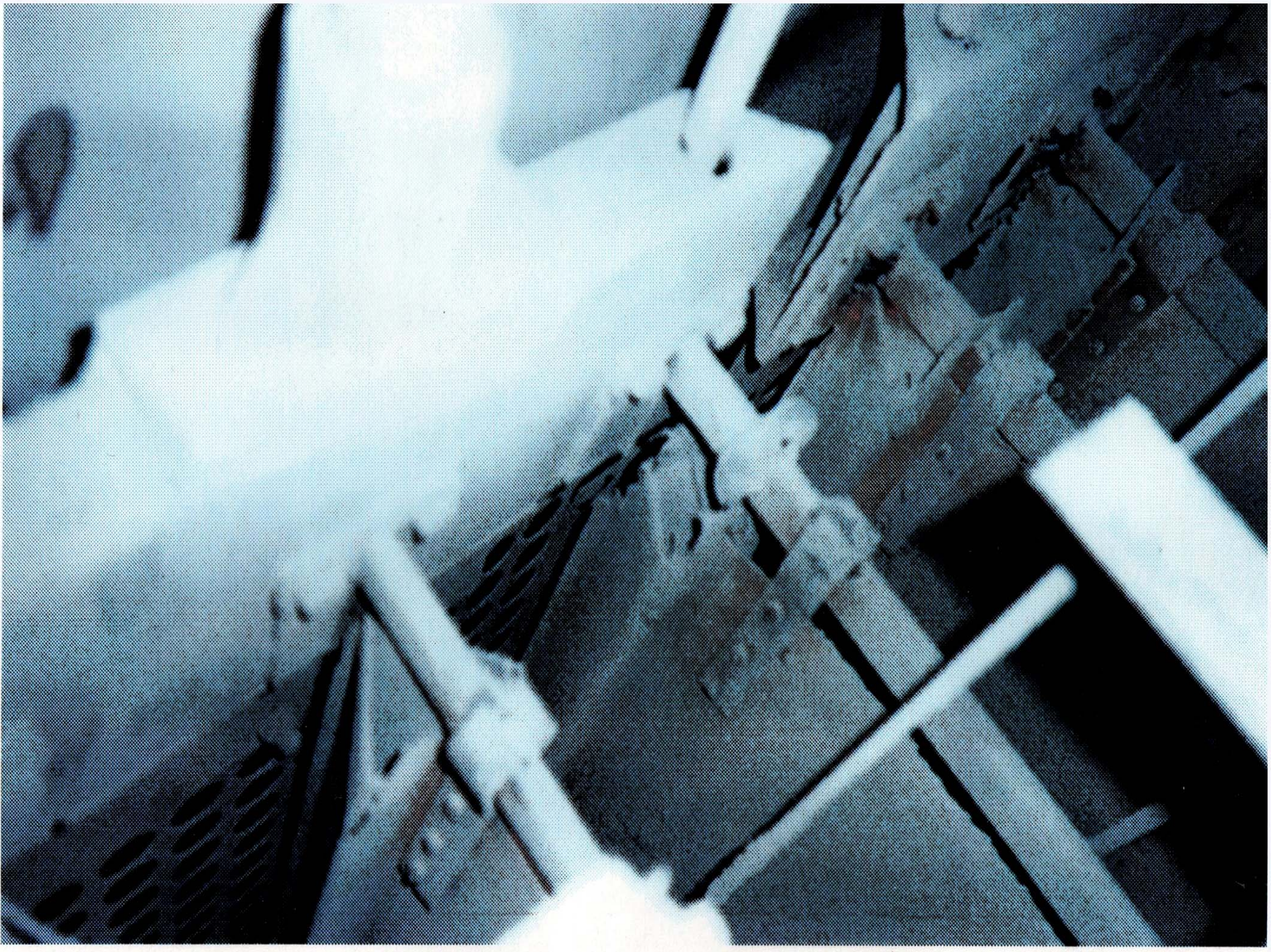




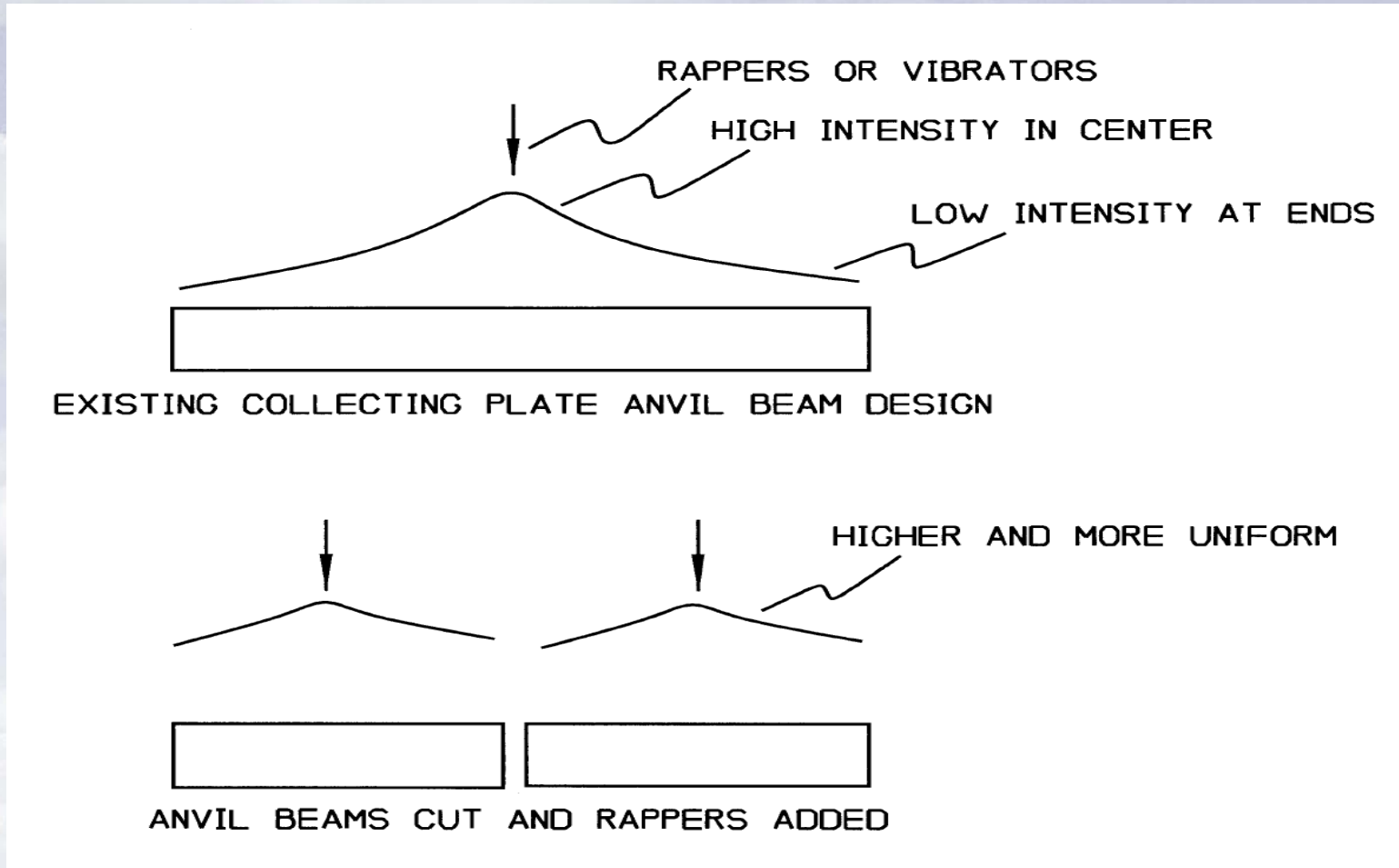


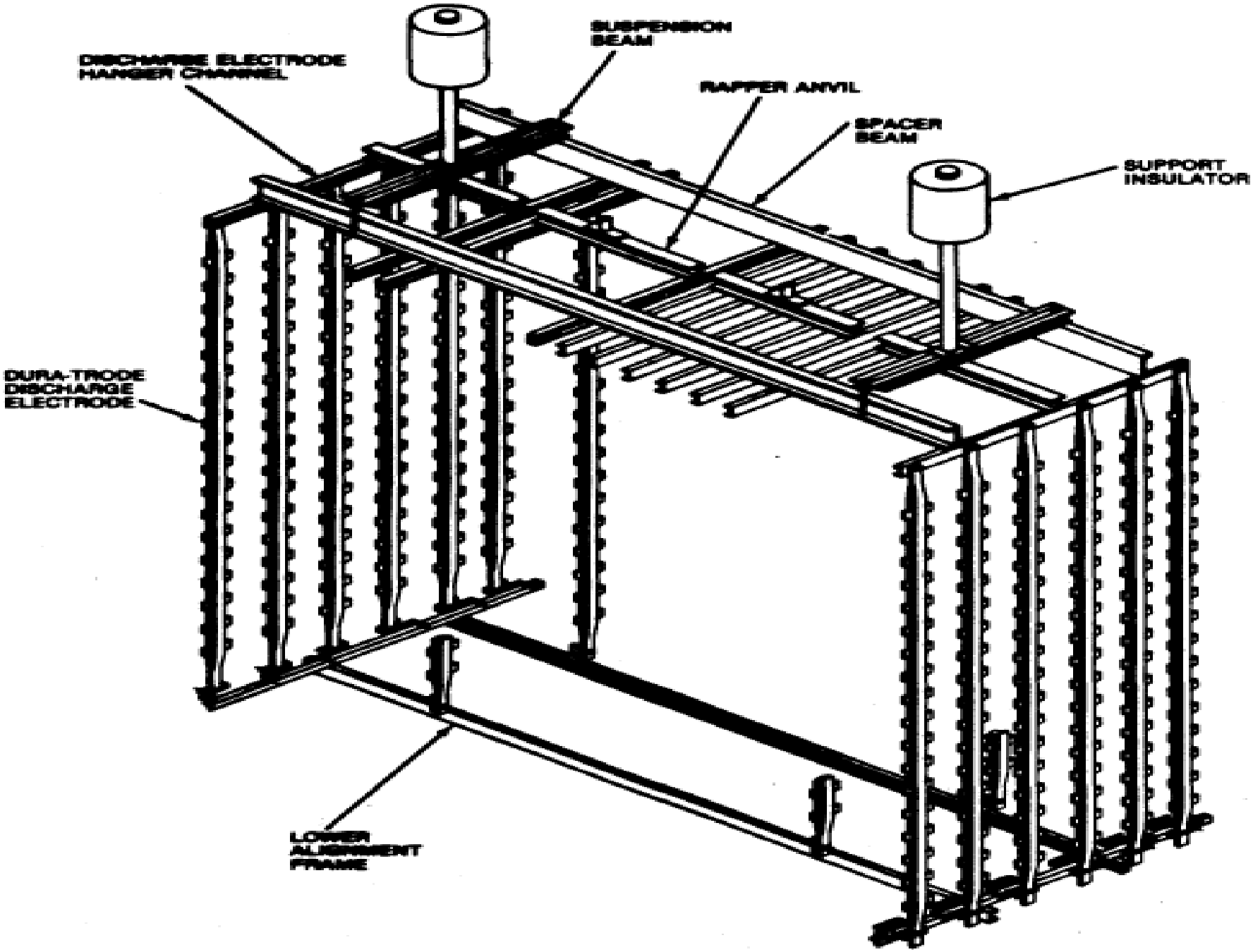
EVALUATION OF ELECTRODE BUILD-UP THICKNESS

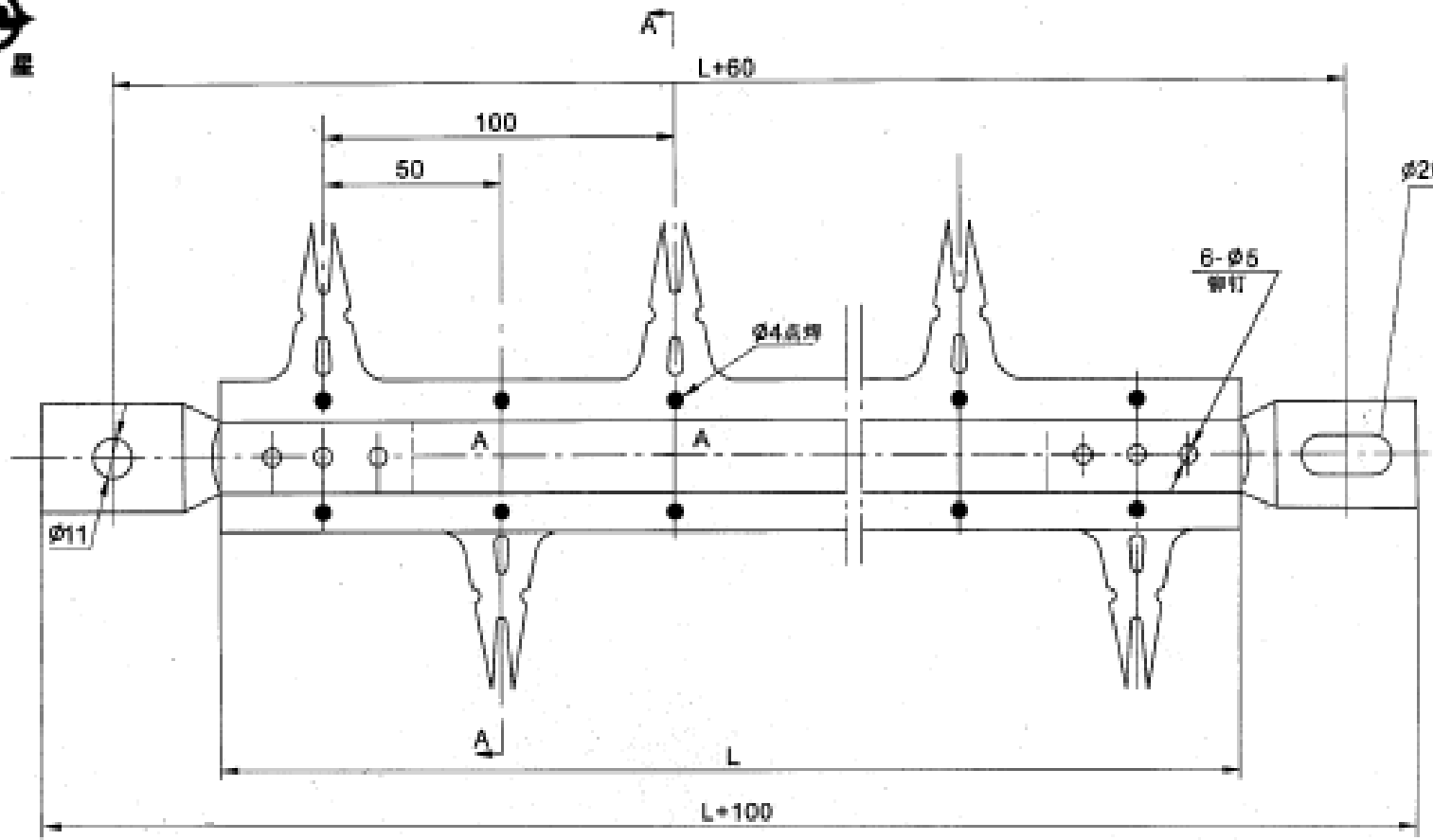
	Discharge Electrode	Collecting Electrode
Typical Dust Thickness	1/8”	1/4”
High Dust Build-up (Adjust rapping cycles)	1/4”	1/2”
Severe Dust Build-up (Change rapping design)	1/2”	1”

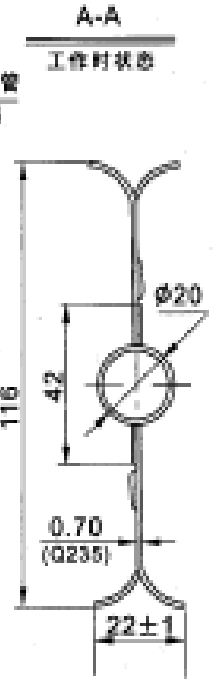


SPLITTING COLLECTING PLATE RAPPER ANVIL BEAMS TO MAKE RAPPING ENERGY GREATER AND MORE UNINFORM




DISCHARGE ELECTRODE HANGER CHANNEL
SUSPENSION BEAM
RAPPER ANVIL
SPACER BEAM
SUPPORT INSULATOR
DURA-TRODE DISCHARGE ELECTRODE
LOWER ALIGNMENT FRAME





注：

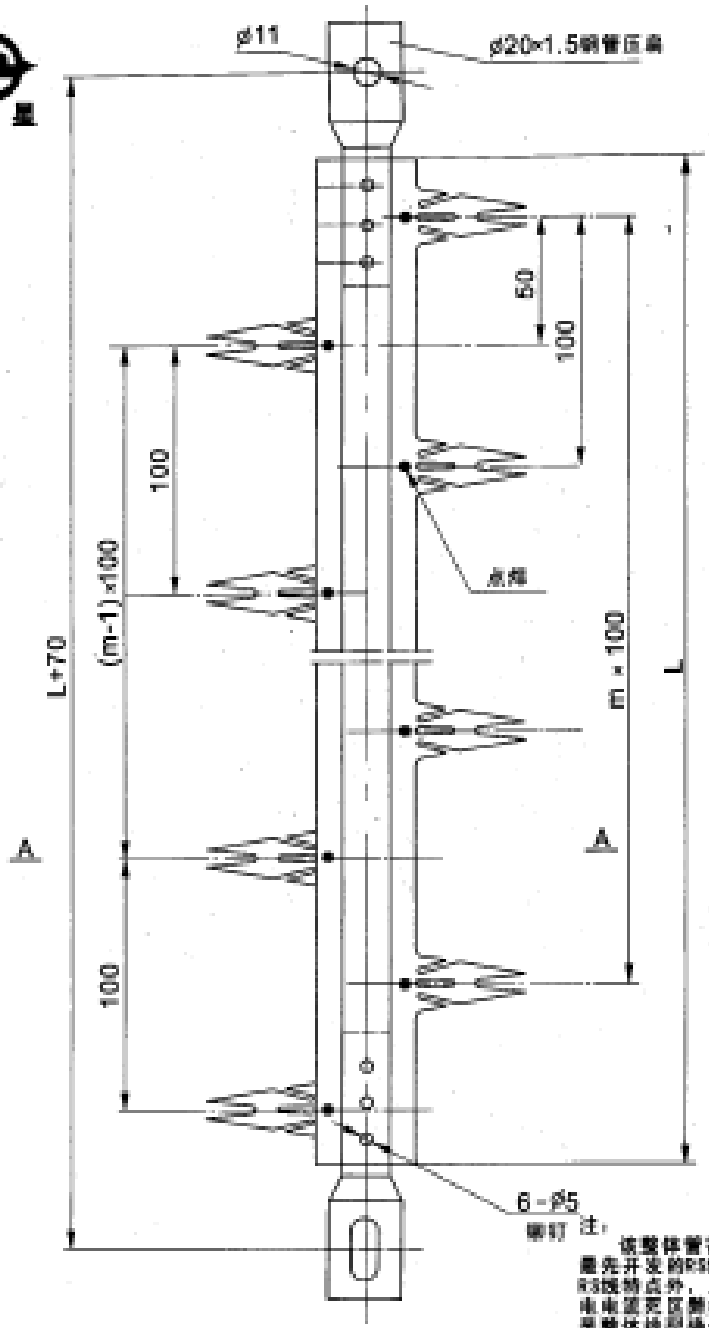
该线是我厂在85年最新开发的整体芒刺线，已广泛用于各类工矿企业的电除尘器上，命名RS线，具有强度的特好，不会断线，放电电流大等特点。

我厂首创中间半圆管与芒刺为整体型结构，克服了RS线运行振打过程中被刺损象，两端头用无缝管压扁铆钉连接方式使线更牢固。

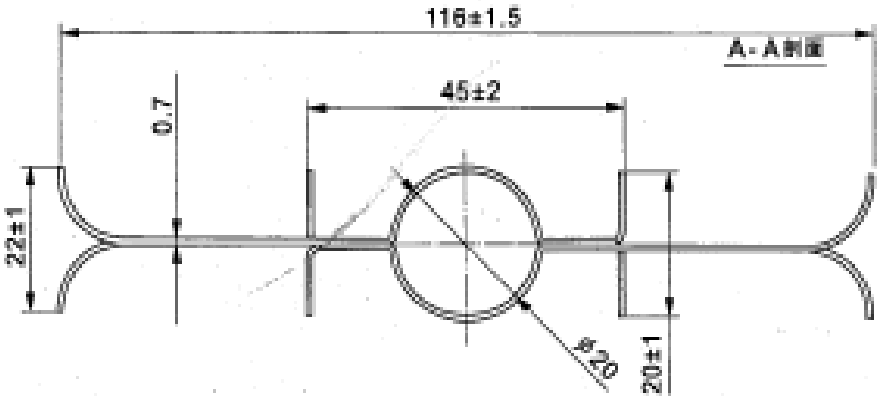
技术要求：

1. 按国家行业标准JB5913的要求。
2. 图中尺寸L应根据用户电除尘器规格自定。

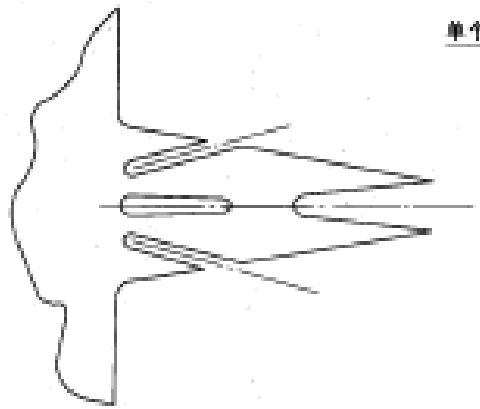
设计	杨锦寿	97.11	材料名称	重量	比例	整体管状芒刺线
制图	杨锦寿	97.11	Q235镀本钢带（1×0.8）			
工艺	管金龙	97.12				
审批	李玉成	97.12	共 1 张 第 1 张	图号	SG15	
昆山市城北电除尘设备厂						



成形状态



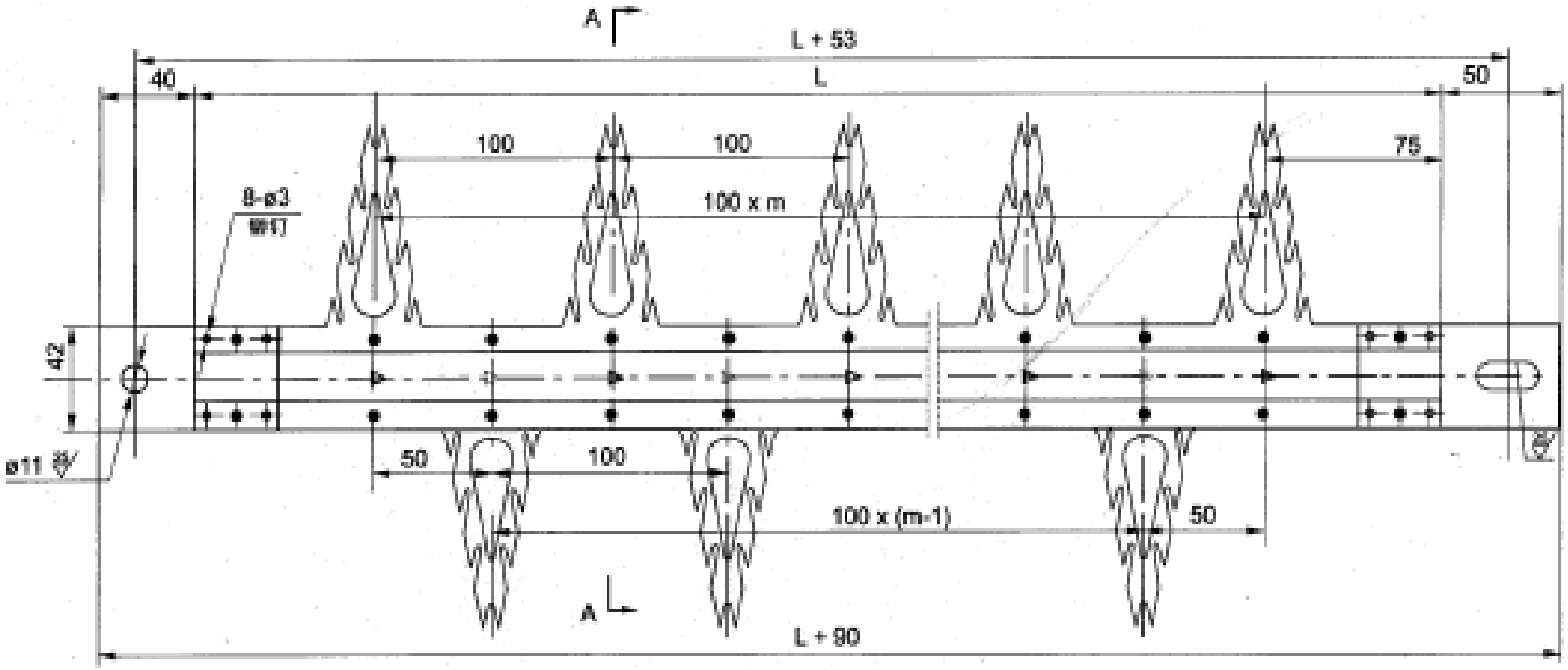
单个齿形

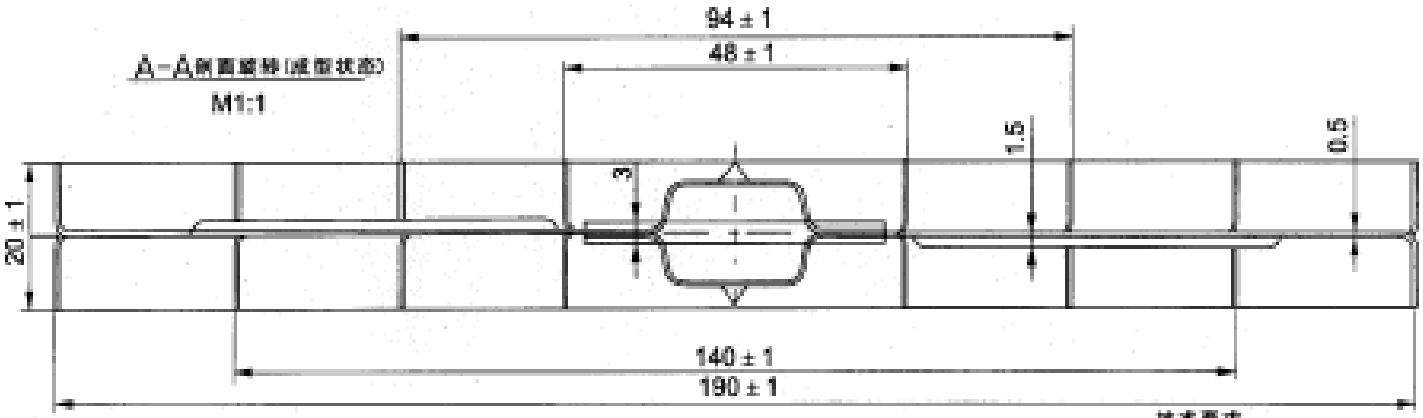


技术要求：
1. 按国家行业标准JB5813的要求。
2. 图中L及n尺寸应根据用户电除尘器规格自定。

注：
该整体管芒刺线在瑞士依来克斯公司最先开发的RS线基础上改进成型，除具有RS线特点外，且克服了RS线半圆管中刺拉伸中部完区断裂，增加了电流密度，由于是整体线型确保在进行振打过程永不掉刺的目的。

设计	杨绵寿	97.11	材料名称	重量	比例	改进型整体管状芒刺线
制图	杨绵寿	97.11	Q235A(t=0.5)			
工艺	管金龙	97.12	不锈钢			
审批	李玉成	97.12	共 1 张	第 1 张	图号	SG16
昆山市城北电除尘设备厂						





技术要求：
1. 按国家行业标准JB5913的要求。
2. 图中L、m尺寸应根据用户电除尘器规格自定。

注：
该线是我厂与上海冶矿厂、梅山钢厂共同在试验研究基础上开发的十齿方管芒刺线，使方管中间又出刺，克服了管中间电流死区弊病，用于钢厂烧结机电除尘器上，通过实践投入运行。使原每个电场电流仅100毫安左右增加到300毫安以上，大大提高了电流强度，除尘效率明显上升。

设计	杨绪寿	97.11	材料名称	重量	比例	十齿方管整体芒刺线
制图	杨绪寿	97.11	Q235(δ=0.7)板 不锈钢(δ=0.5)			
工艺	曾金龙	97.12				
审批	李玉成	97.12	共 1 张 第 1 张		图号	SG19

昆山市城北电除尘设备厂