GLOBAL ELECTRODEPOSITION TECHNOLOGY

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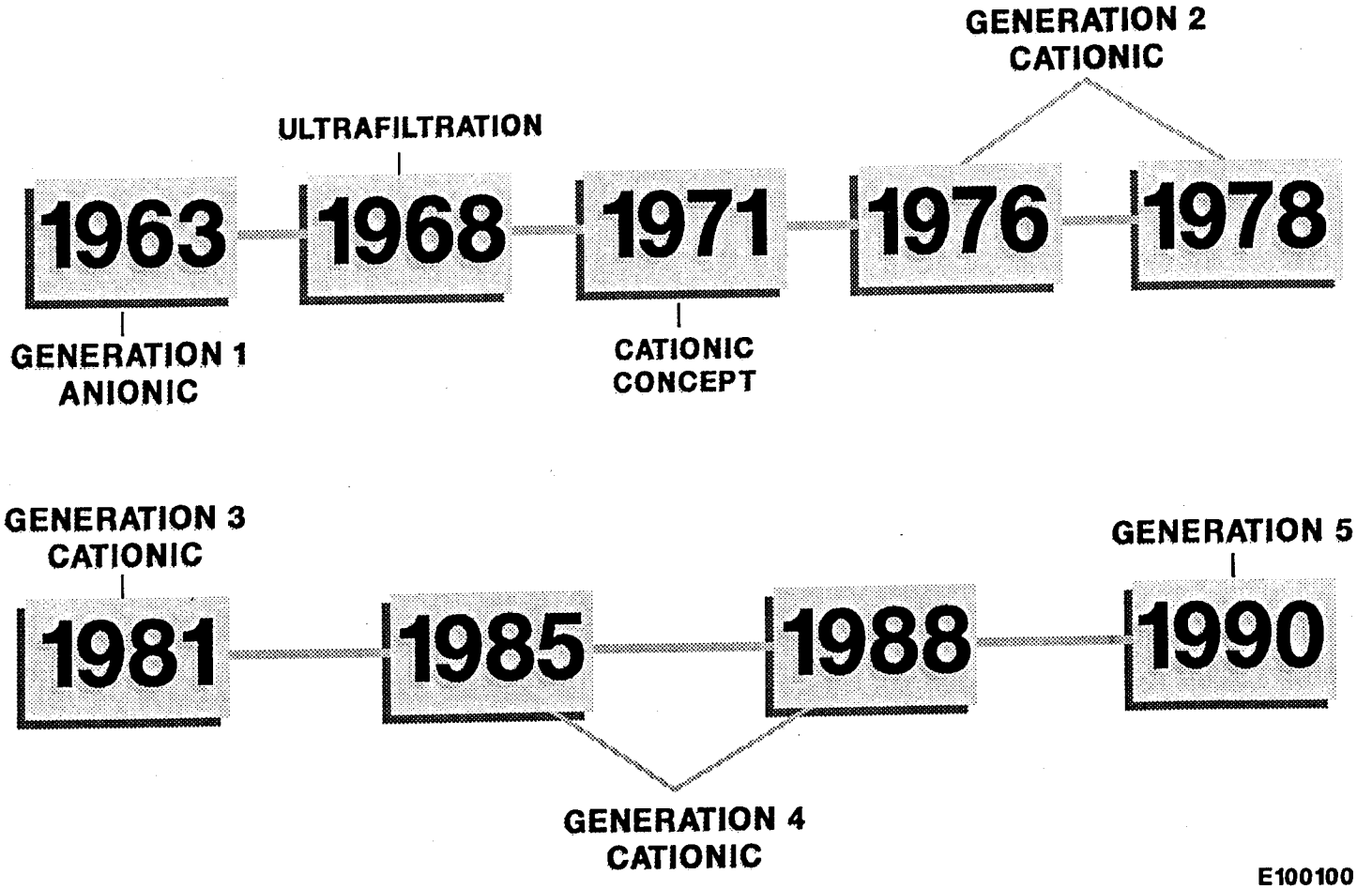
E100540

GLOBAL ELECTRODEPOSITION TECHNOLOGY

PPG AUTOMOTIVE ELECTRODEPOSITION MILESTONES



BACKGROUND OF ELECTROCOAT GENERATIONS

GENERATION	FEATURES	ADVANTAGES	INTRODUCTION
1	• ANIONIC ELECTROCOAT	• IMPROVED CORROSION RESISTANCE COMPARED TO DIP PRIMERS	1963
2	• FIRST CATIONIC ELECTROCOAT	• GREATLY IMPROVED CORROSION RESISTANCE COMPARED TO ANIONIC	1976
3	• HIGH BUILD (30-35μ) CATIONIC	• IMPROVED FILM SMOOTHNESS • IMPROVED CHIP RESISTANCE • REDUCED VOC	1981
4	• NEW CROSSLINKER TECHNOLOGY	• REDUCED FILM SHRINKAGE - IMPROVED APPLIED COSTS • NON-YELLOWING EFFECT ON TOPCOATS	1985
5	• NEW SOLUBILIZING ACID TECHNOLOGY • NEW SURFACE ACTIVE POLYMER TECHNOLOGY • REDUCED PIGMENT CONTENT	• IMPROVED THROWPOWER • REDUCED DIRT • LOWER APPLIED COST	1990
6	• LEAD FREE • REDUCED PIGMENT CONTENT	• IMPROVED ULTRAFILTER FLUX STABILITY • LOWER SPECIFIC GRAVITY	1995

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ELECTRODEPOSITION MILESTONE

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5 1985 1985 1985 1985 1985 1985 1

GENERATION 4

FILM THICKNESS	THROW POWER	V.O.C.	BAKE TEMPERATURE
30 MICRONS	30.5 CM	0.072 KG / L	173°C

IMPROVEMENTS:

- FUME YELLOWING
- V.O.C.
- TAR GENERATION
- APPLICATION EFFICIENCY
- FILM SMOOTHNESS

5 1985 1985 1985 1985 1985 1985 1

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5 1985 1985 1985 1985 1985 1985 1

GENERATION 4

ELECTRODEPOSITION PRIMER PRODUCTS

ED–4

ED–11

ED–12

ED–46

5 1985 1985 1985 1985 1995 1985 1

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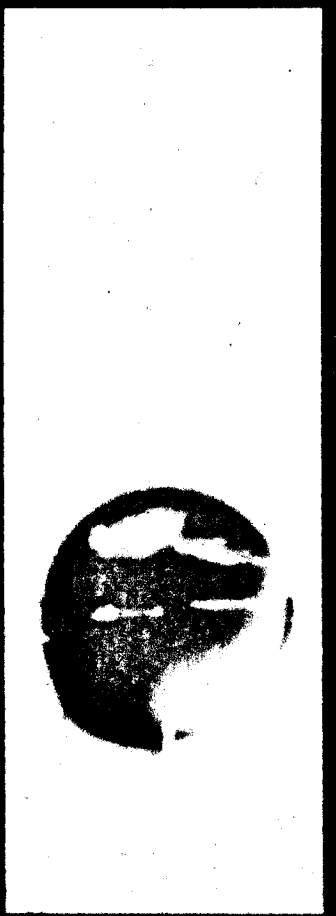
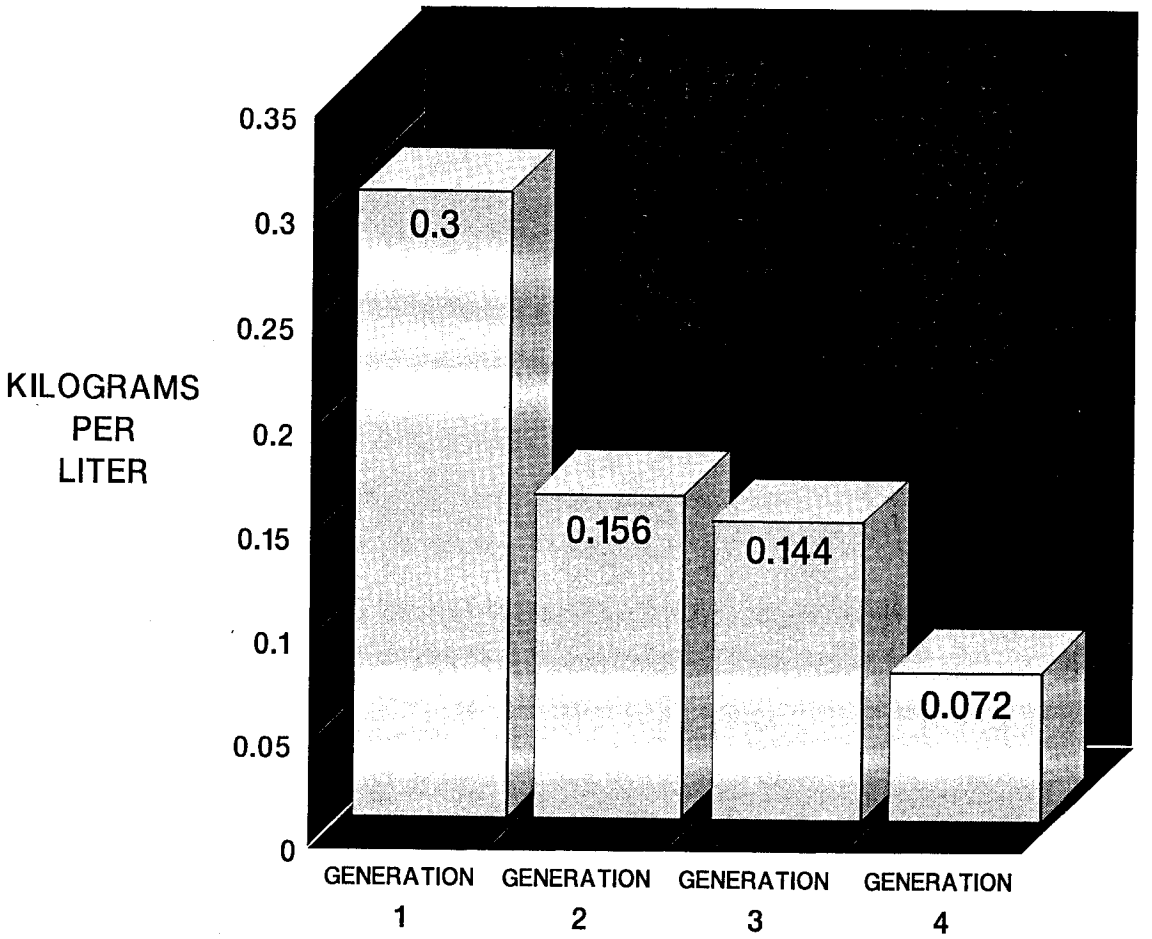
COMPARISON OF FUME YELLOWING

GENERATION 3



GENERATION 4

COMPARATIVE V.O.C. LEVELS



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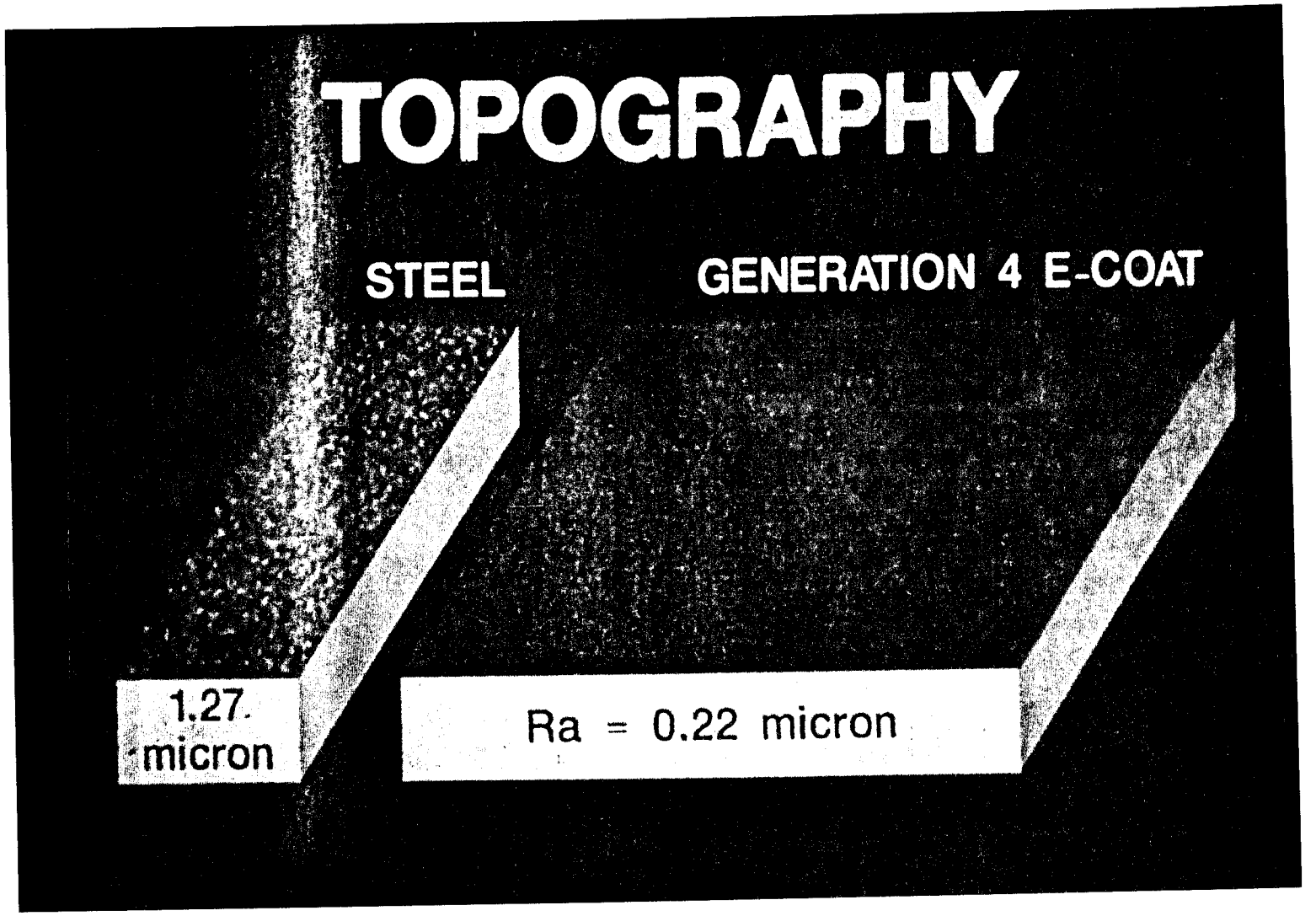
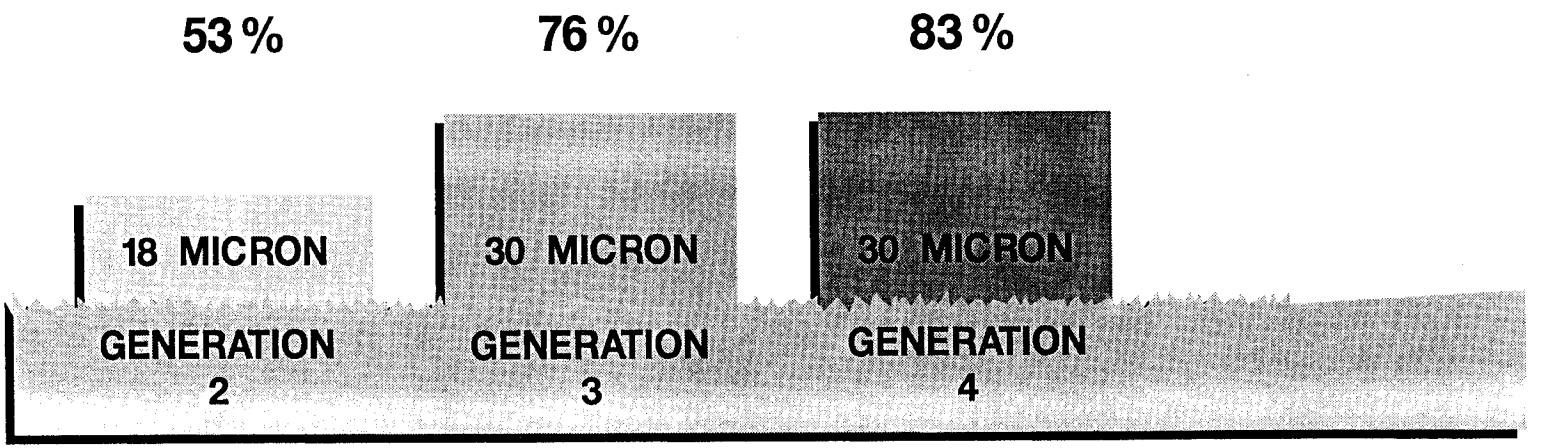

TOPOGRAPHY
STEEL
GENERATION 4 E-COAT
1.27 micron
Ra = 0.22 micron

LEVELING POWER



$$\% \text{ LEVELING} = \frac{\text{Ra STEEL} - \text{Ra FILM}}{\text{Ra STEEL}} \times 100$$

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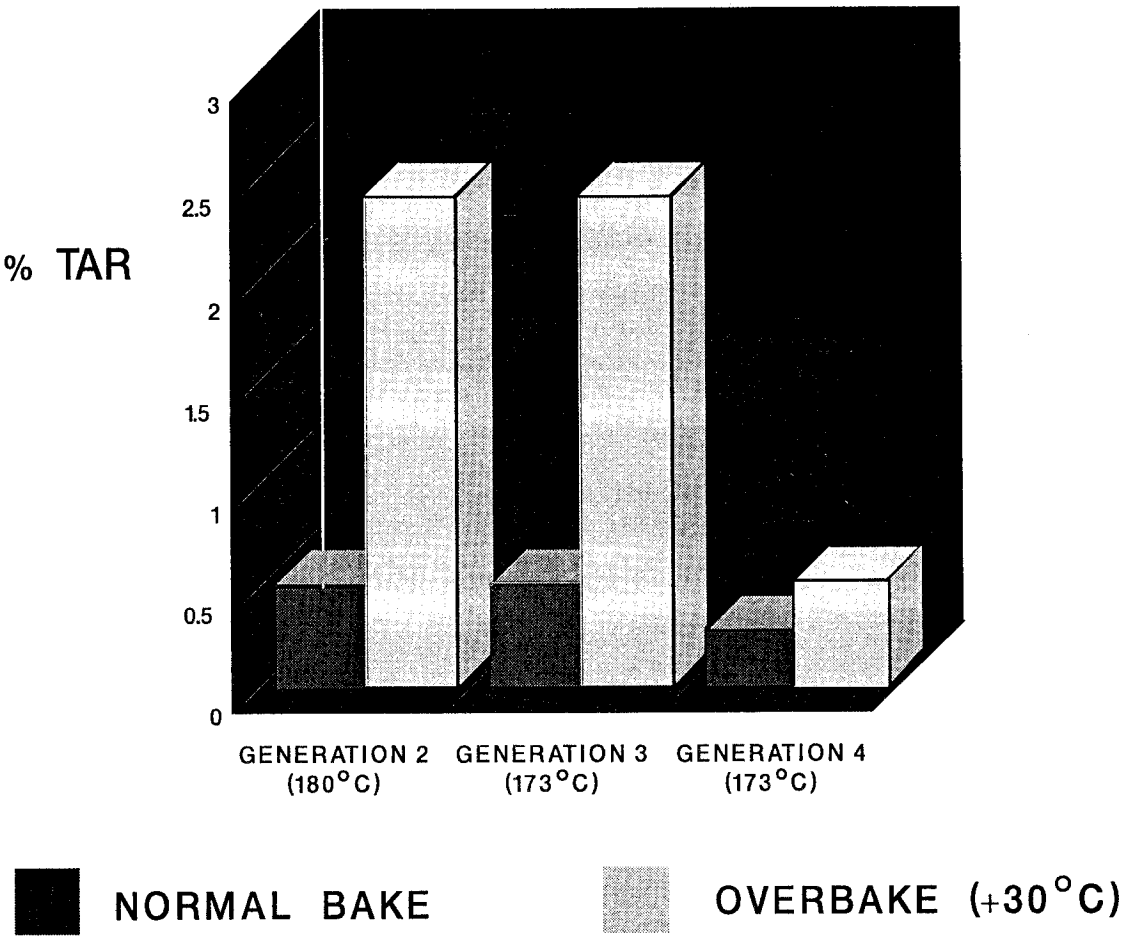
OVEN TAR GENERATION



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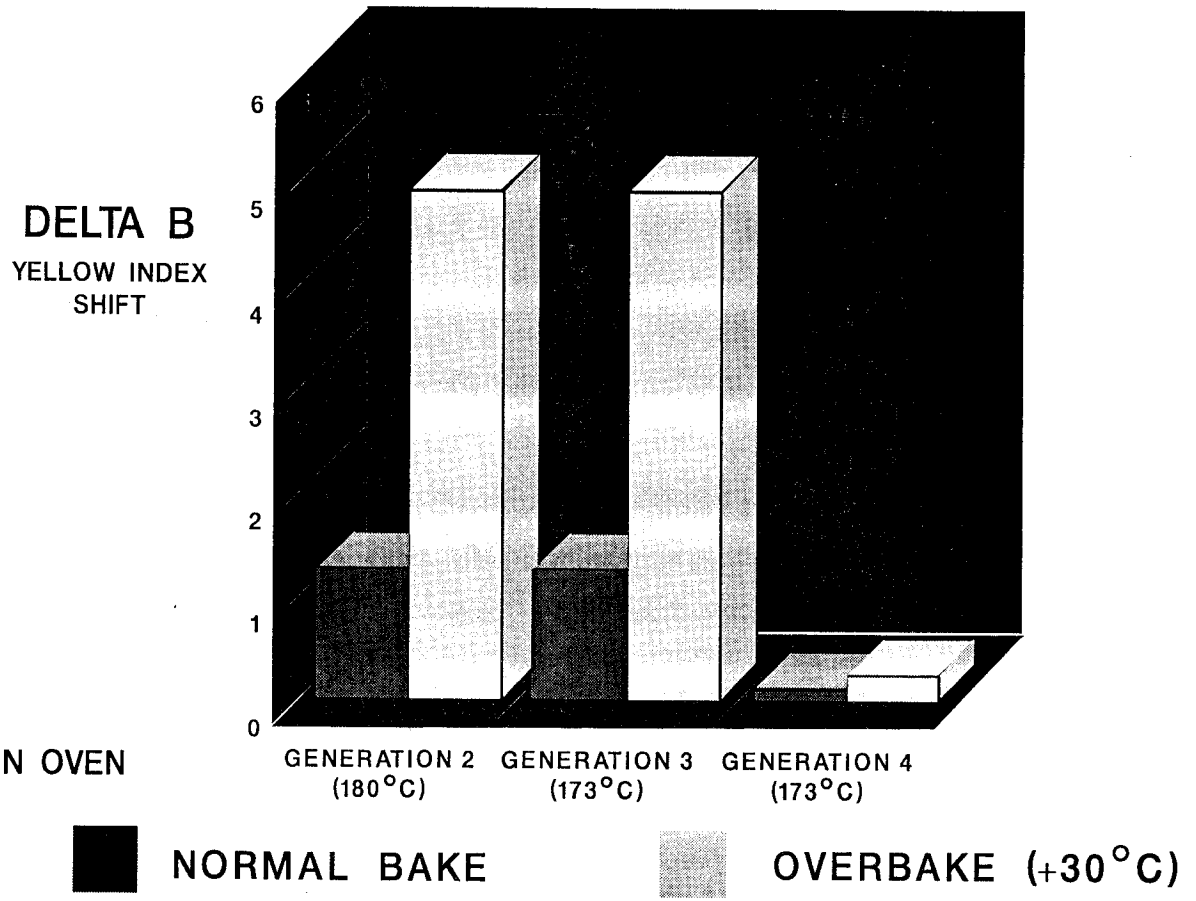
FOULED OVEN SIMULATION
REPAIR YELLOWING



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ELECTRODEPOSITION MILESTONE

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INTRODUCTION TO

FIFTH GENERATION TECHNOLOGY

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FIFTH GENERATION ELECTROCOAT

PURPOSE

TO REPORT ON THE ADVANTAGES AND PROPERTIES OF 5TH GENERATION CATIONIC ELECTROCOAT

CONCEPT

	FEATURE	QUALITY IMPROVEMENT	ADDED BENEFIT
1	NEW SOLUBILIZING ACID	IMPROVED THROWPOWER	EXTERIOR FILM BUILD CAN BE REDUCED (POTENTIAL LOWER COST / VEHICLE)
2	NEW SURFACE ACTIVE POLYMER TECHNOLOGY TO CONTROL FILM RHEOLOGY	IMPROVED CRATER AND CONTAMINATION RESISTANCE	ABLE TO REDUCE PIGMENT CONTENT
3	REDUCED PIGMENT CONTENT	REDUCED DIRT DUE TO SETTLING	LOWER COST / SOLID KG OF ED AS WELL AS POTENTIAL LOWER COST / VEHICLE

➡ RESULT IS IMPROVED QUALITY AT LOWER COST

COMMERCIALIZATION

CURRENTLY THERE ARE 60 AUTOMOTIVE BODY TANKS USING 5TH GENERATION ELECTROCOAT IN NORTH AMERICA EUROPE, AND AUSTRALIA.
AUTOMAKERS USING 5TH GENERATION ARE:

CHRYSLER
FORD
GENERAL MOTORS
MAZDA
MITSUBISHI (DIAMOND STAR MOTORS)
NISSAN
PEUGEOT
ROVER
TOYOTA

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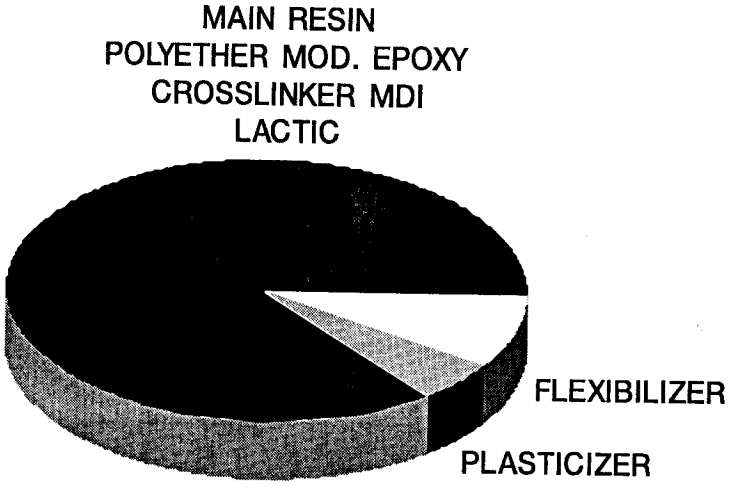
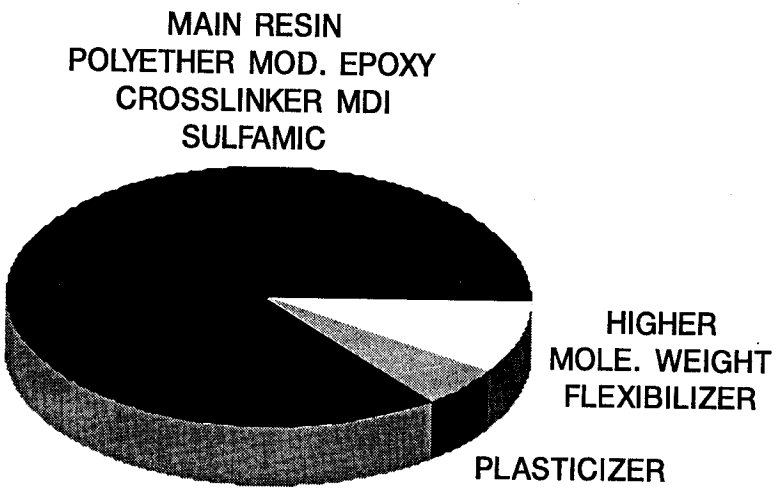
GENERATION 4



GENERATION 5



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COMPOSITION COMPARISON

RESIN	GENERATION 4	GENERATION 5
MAIN RESIN	POLYETHER MODIFIED EPOXY RESIN	←
SUBRESIN	SPECIAL LINEAR AMINE–MODIFIED RESIN	←
FLOW CONTROL	–	ADDITIVE A
CROSSLINKER	AROMATIC	←

PASTE	GENERATION 4	GENERATION 5
GRIND RESIN	85 % RESIN A 15 % RESIN B	100 % RESIN B
MAIN PIGMENT	PIGMENT A	←
EXTENDER PIGMENT	NA	PIGMENT B
BLACK PIGMENT	PIGMENT C	←
LEAD PIGMENT	PIGMENT D	←
CATALYTIC PIGMENT	PIGMENT E	←

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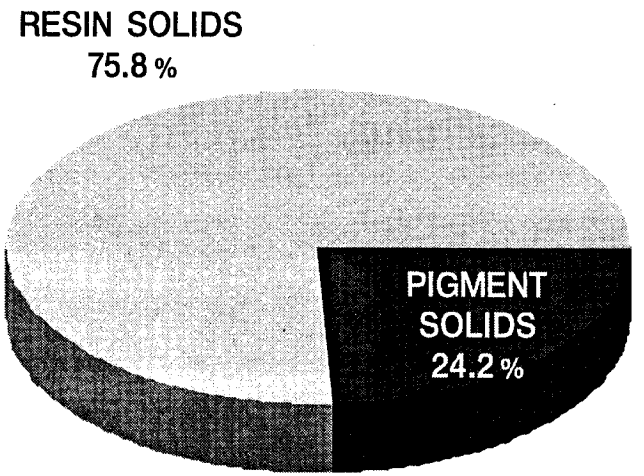
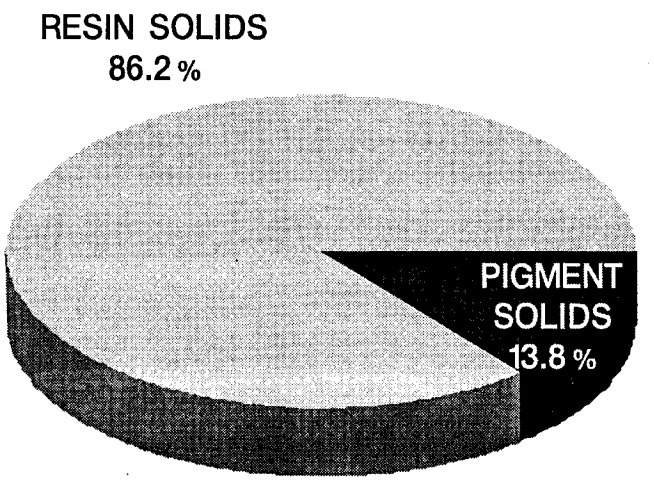
NON–VOLATILE DISTRIBUTION

GENERATION 4



GENERATION 5



E100395

Transition to Fifth Generation

Improvement

Reduced Sedimentation Velocity

Reduced Filter Consumption

Reduced Dirt Generation
(i.e. Pigment Flocculation)
Reduced Sludging

Explanation

Film rheology (cratering) is controlled organically reducing the importance of inert pigment.

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Transition to Fifth Generation

Improvement

Reduced Specific Gravity (1.47 - 1.35)

Explanation

Reduced Pigment Content in Film

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REDUCED PIGMENT CONTENT

SINCE FILM RHEOLOGY IS CONTROLLED BY A NEW SURFACE ACTIVE POLYMER TECHNOLOGY, PIGMENT CONTENT IS REDUCED.

		GENERATION 4				GENERATION 5			
PWC		24.0 %				14.0 %			
OIL COMPATABILITY (CRATERING)		O				O			
SECONDARY DRIP PROPERTIES		O				O			
WATER SPOT RESISTANCE	2 MICROMHOS / cm	ED	O	T / C	O	ED	O	T / C	O
	200 MICROMHOS / cm		△		O		O⁻		O
CONTAMINATION TO CHEMICAL TREATMENT SURFACE	2 MICROMHOS / cm	ED	O	T / C	O	ED	O	T / C	O
	50 MICROMHOS / cm		O⁻		O		O		O
	200 MICROMHOS / cm		△		O		O⁻		O
APPEARANCE (Ra)		0.22				0.22			
FILM SPECIFIC GRAVITY		1.47				1.35			

- GENERATION 5 HAS NO ADVERSE EFFECT ON CRATERING OR CONTAMINATION RESISTANCE OR APPEARANCE

- GENERATION 5 HAS LOWER FILM SPECIFIC GRAVITY RESULTING IN POTENTIAL REDUCED USAGE AND LOWER COST / VEHICLE

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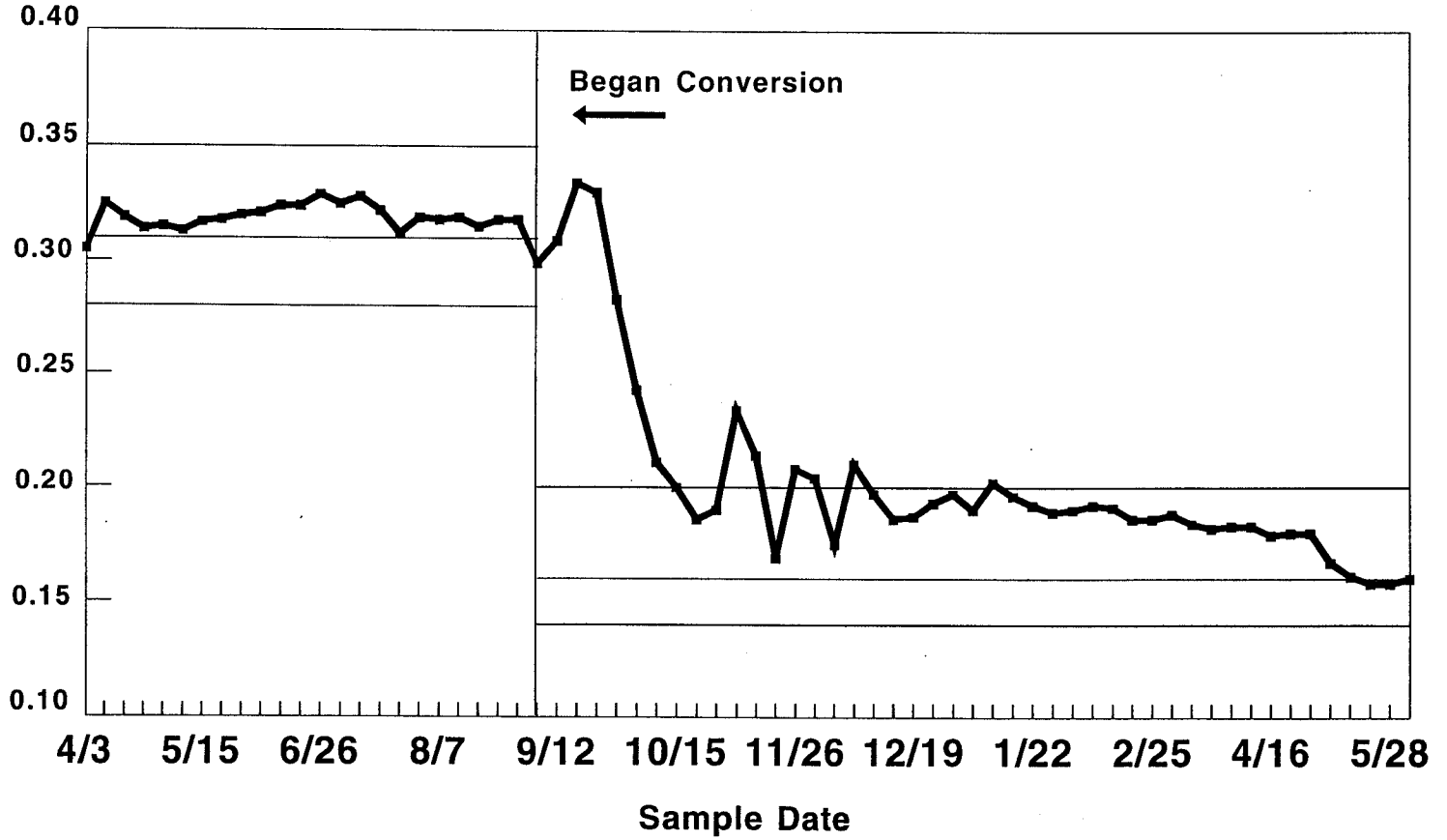
TANK A BATH P/B

04/01/90 TO 06/21/91



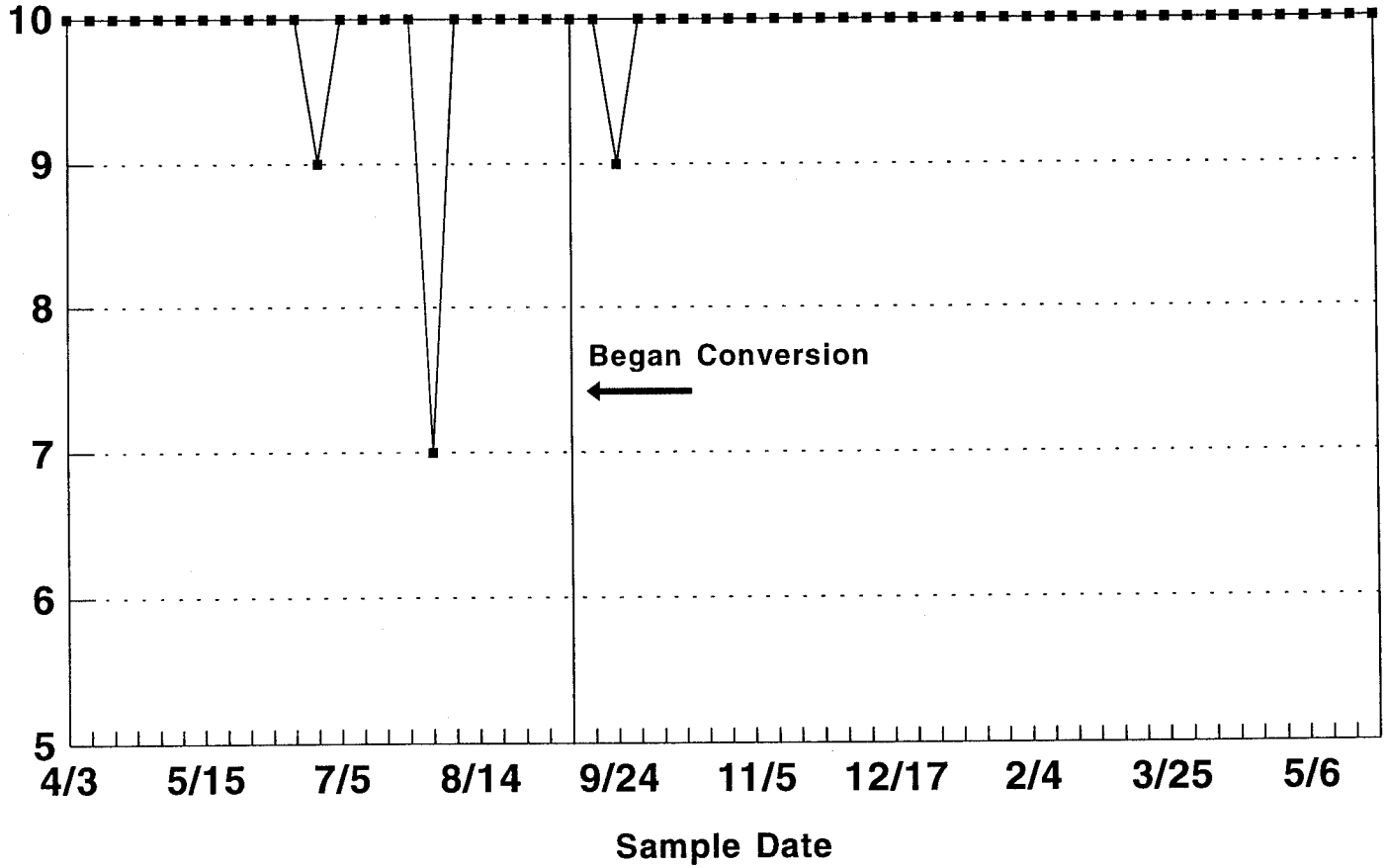
tankapb

E100271

TANK A CRATER RATING

04/01/90 TO 06/21/91

LABORATORY EVALUATION

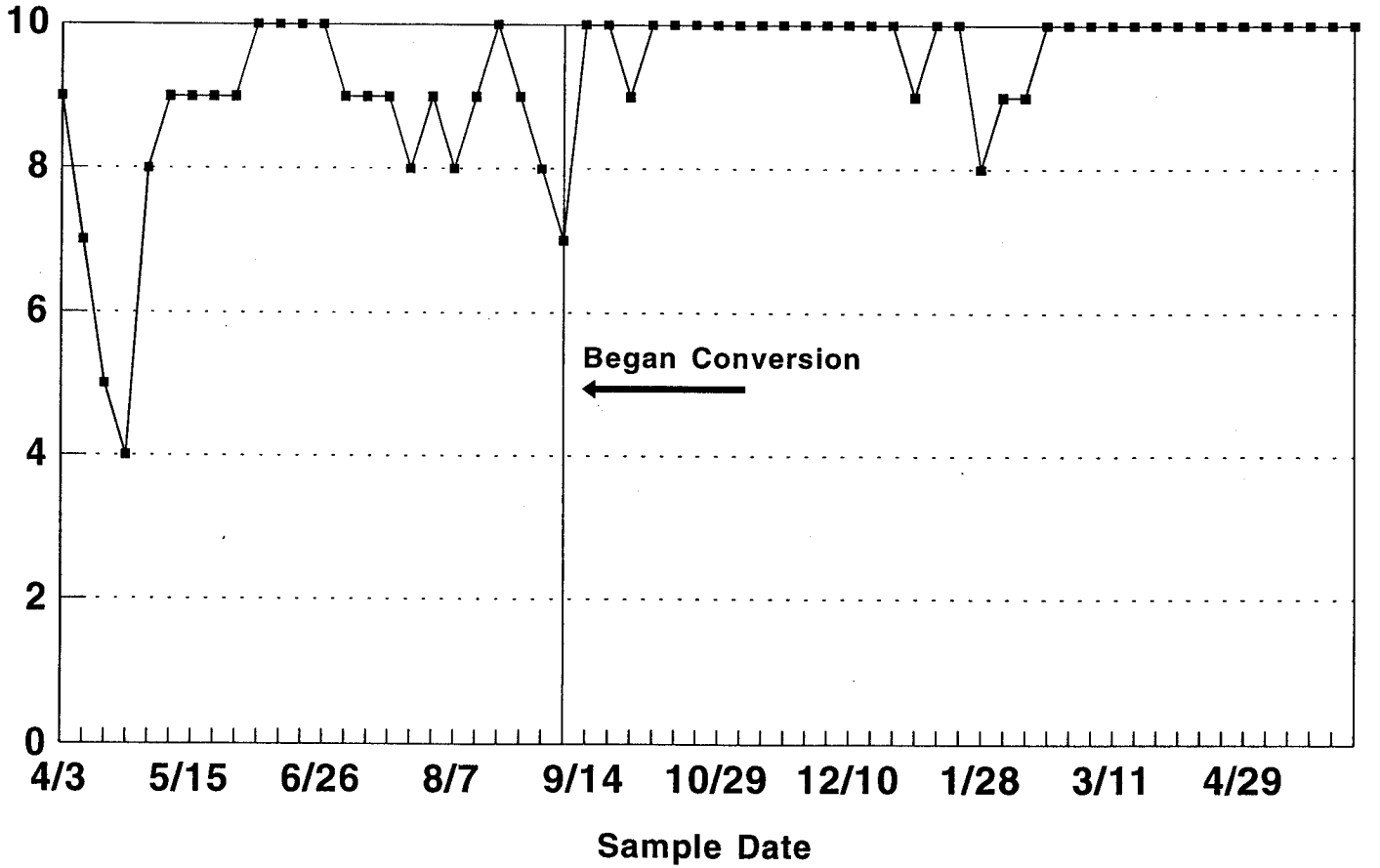


tankactr

E100272

TANK A HORIZONTAL PANEL

04/01/90 TO 06/21/91
LABORATORY EVALUATION



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Transition to Fifth Generation

Patented Improvement

Improved Throwpower

Anode Passivation

Reduced Bacteria Growth

Reduced BOD/COD

Explanation

Sulfamic Acid Neutralization. Influences "Application Properties" only; not film properties. The counterion never becomes part of the film.

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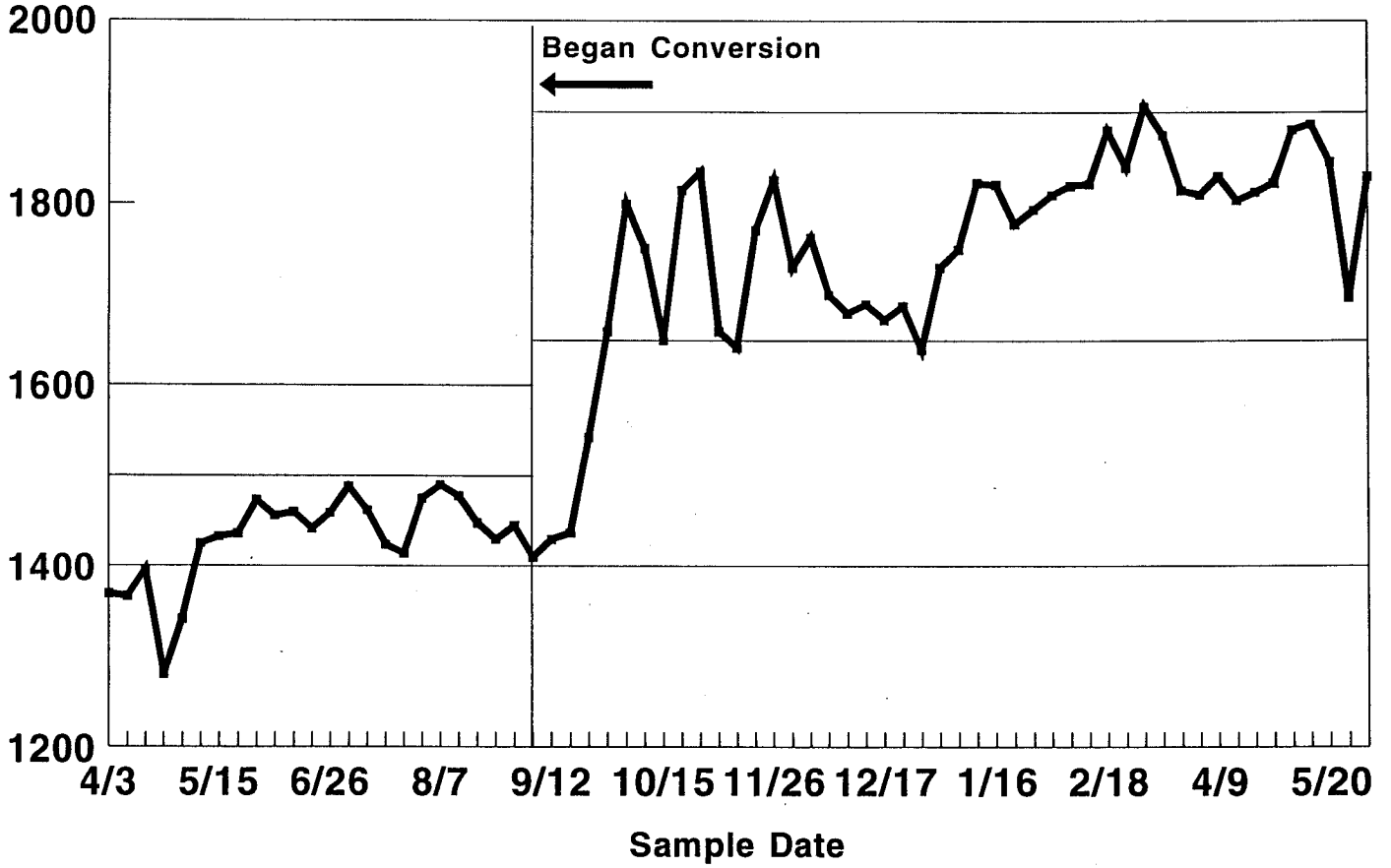
TANK A BATH CONDUCTIVITY

04/01/90 TO 06/21/91



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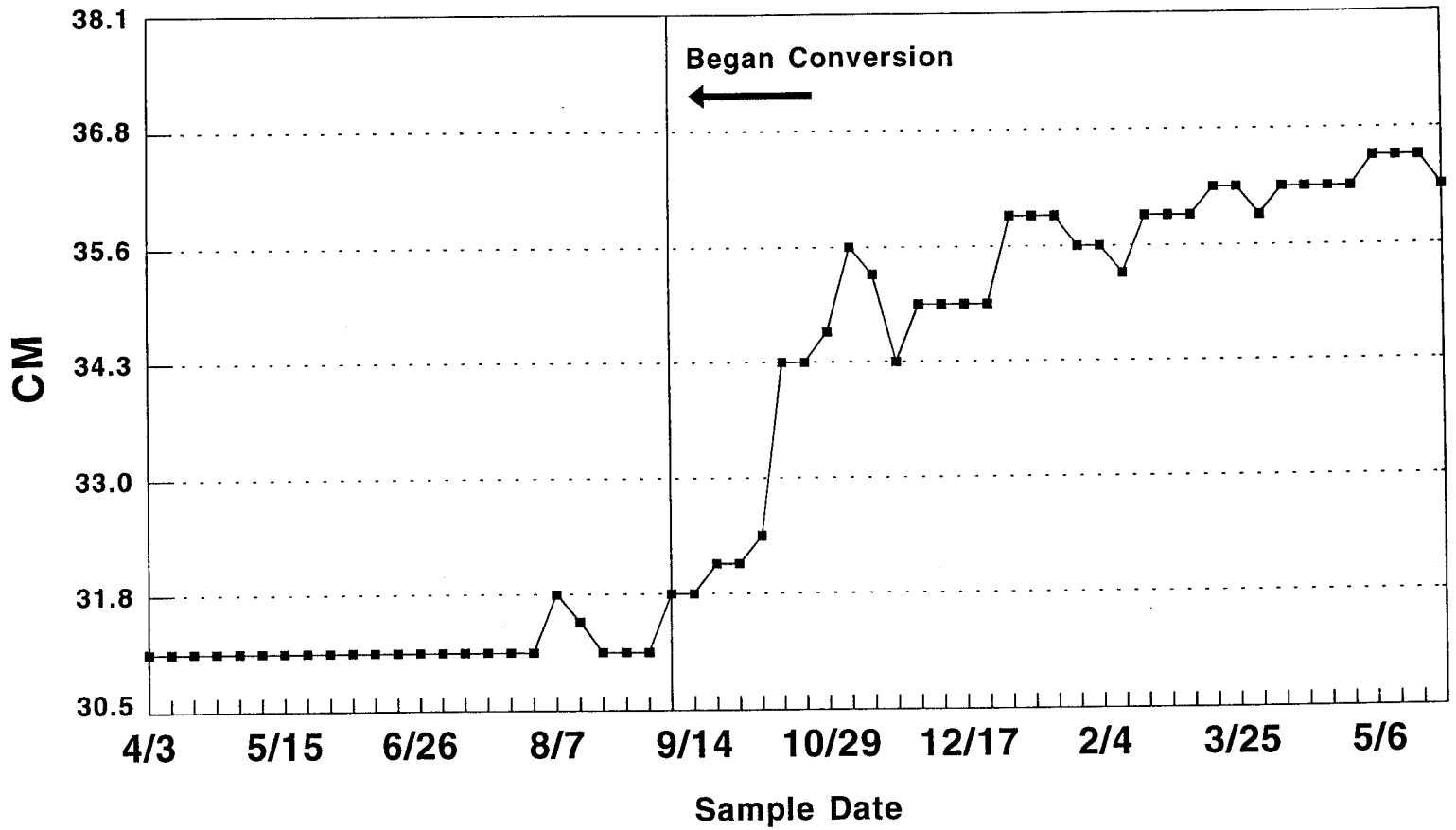
TANK A THROW POWER

04/01/90 TO 06/21/91

LABORATORY EVALUATION



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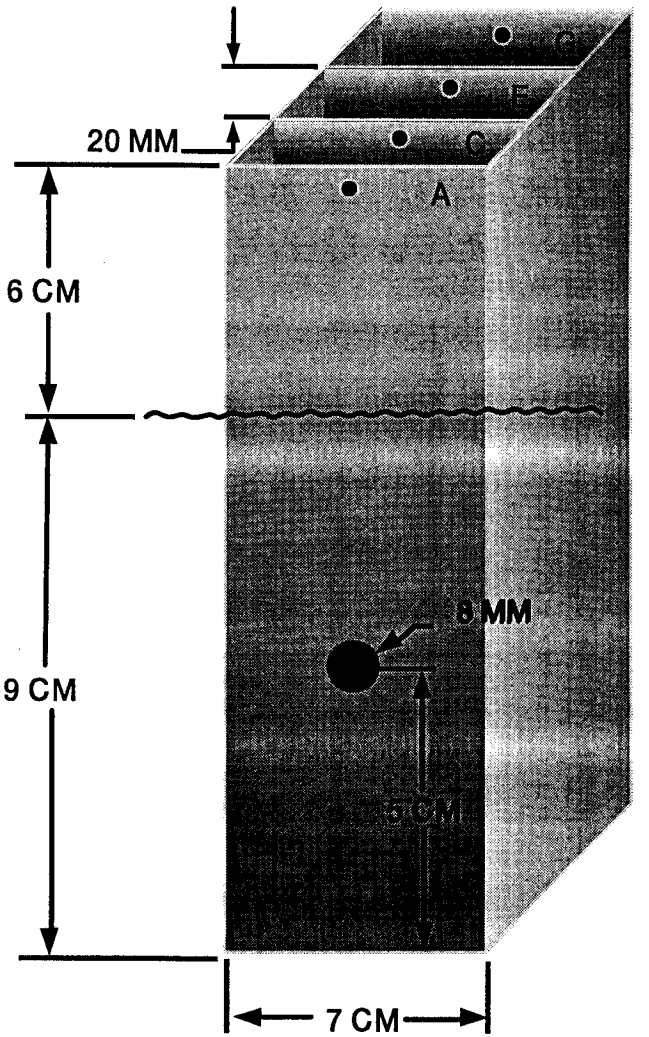
BOX THROW POWER TEST APPARATUS



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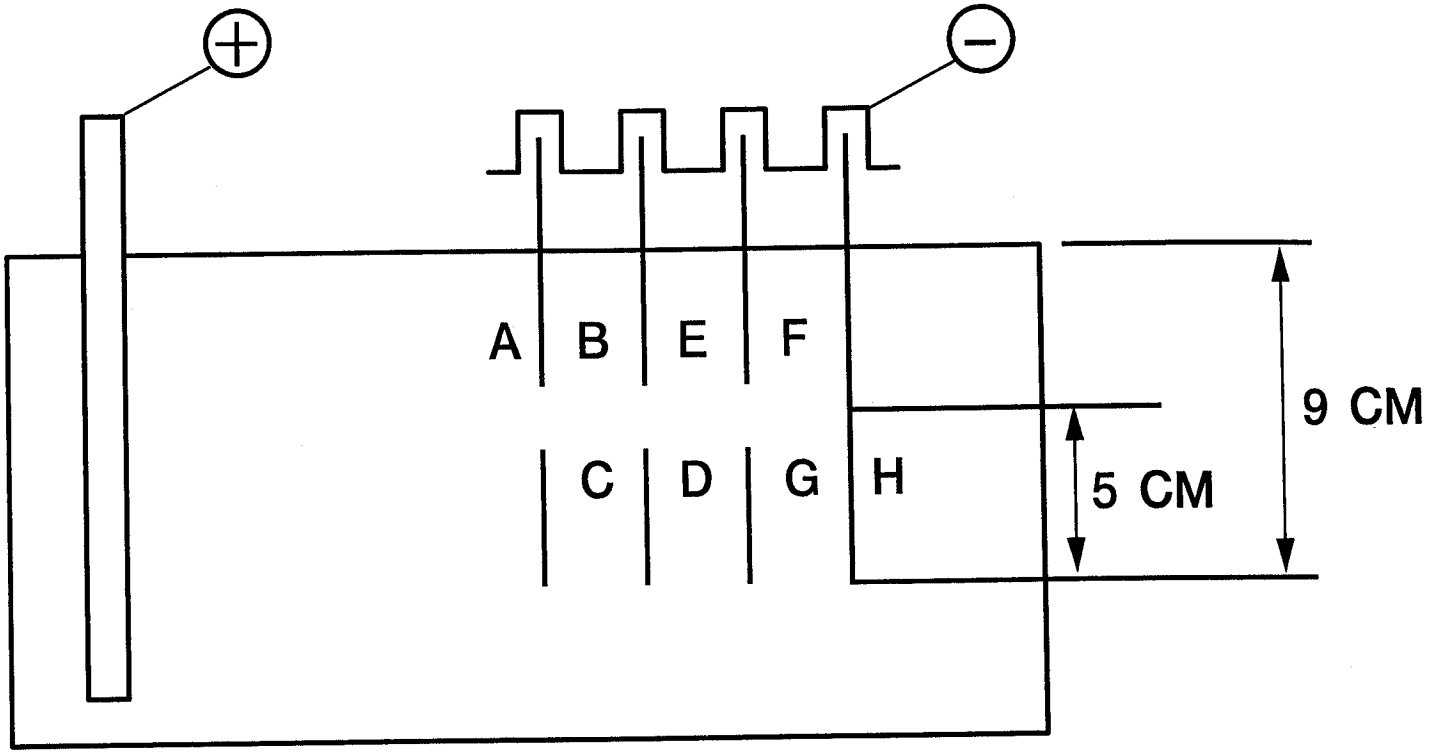
BOX THROW POWER TEST



TEST PANELS ARE SEALED WITH
INSULATION TAPE

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IMPROVED THROWPOWER – BOX THROWPOWER

	GENERATION 4			GENERATION 5		
COATING TEMP.	30°C			30°C		
COATING VOLTAGE	200V	250V	300V	200V	250V	300V
A FACE FILM BUILD (μ)	19	29	42	20	26	37
B	8	14	22	12	16	24
C	7	14	22	14	19	25
D	5	9	15	10	16	21
E	5	9	15	9	14	18
F	4	8	11	8	11	16
G	5	9	11	8	12	16
H	18	30	41	19	25	36
G (–)WITH A AT 25– / COATING VOLTAGE	7.6 μ / 230V			11.3 μ / 240V		

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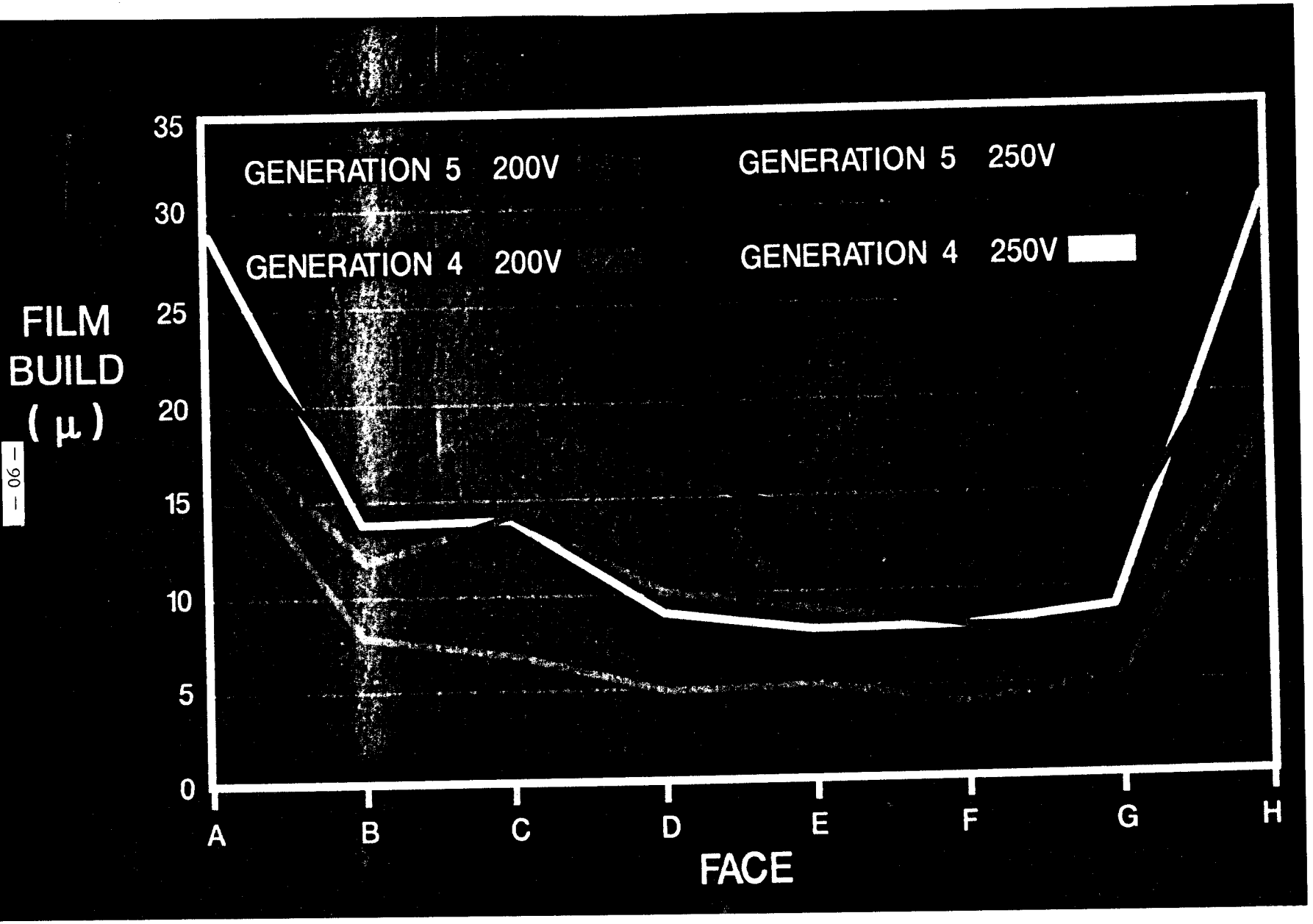
GENERATION 5 200V
GENERATION 5 250V
GENERATION 4 200V
GENERATION 4 250V
FILM BUILD (μ)
35
30
25
20
15
10
5
0
A
B
C
D
E
F
G
H
FACE