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SENSITOMETRIC CROSSOVER FOR 2485 IN BALLOON OBSERVATION ASTRONOMICAL PROGRAM

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Manned Spacecraft Center
Houston, Texas

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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SENSITOMETRIC CROSSOVER FOR 2485 IN BALLOON

OBSERVATION ASTRONOMICAL PROGRAM

This Report has been reviewed

and is approved.

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SENSITOMETRIC CROSSOVER FOR 2485 IN BALLOON OBSERVATION ASTRONOMICAL PROGRAM

Introduction:

The Photographic Technology Division was requested to provide processing support to the CREPE IV Project, a high-altitude balloon study of cosmic radiation. The film was delivered to PTD by the Principal Investigators, Larry Pinsky and Zack Osborne. Prior to that time, there had been no communication regarding film types or sizes.

Procedures:

The film was originally received at PTD in 12" x 12" sheets. Since it was desired to process the film with good sensitometric control, hand processing had to be ruled out, as did all machine processors able to accommodate this film size. It was therefore necessary to cut the film into 6" x 12" sheets in order to process the film in a Versamat or similar processor. This cutting was accomplished by the Principal Investigator.

Two thickness of film were used. One was a thick base film measuring 9.2 mils (0.0092 inches) total thickness. The other was a thin base film measuring 4.0 mils (0.004 inches) total thickness.

Initial tests on sample sheets of the thin base film run in the Versamat processor showed that it was too thin to transport dependably. The film was therefore spliced together in rolls, 64 sheets to a roll, using a heat splicer. In this way, only about 1/4 inch of each end of the imagery was masked by the splice.

Tests on samples of the thick base film showed that it also would not transport dependably in the Versamat. Splicing this film was impractical for several reasons. First, the thick base would create a greater tension on the splice when negotiating a machine turnaround. Second, the total thickness at the splice would be about 12 mils (0.012 inch), possibly causing damage to the Versamat.

An alternative processor, the GAF Transflo, was selected. This machine has no turnarounds; the film traverses a straight path through the processor.

Sensitometric Data:

All processing was done using Kodak's MX-641 developer. Using a control stock (2485-33-1) an H & D curve having maximum contrast without an appreciable increase in fog was obtained (Solid Curve, Figure 1). Sensitometric strips from the two emulsions used in the project were then run in the same machine configuration. The resulting sensitometric curves are shown in Figures 2 and 3. The upper and lower limits of the sensitometric response for all control film processed is shown by the dotted lines in Figure 1.

Results:

The processing of 1536 sheets of 6" x 12" film was accomplished, requiring approximately three months to complete.

Damage:

One sheet of the thin base film (#64-65) was lost in the splicing operation. Approximately 12 sheets of the thick base film were damaged or fogged due to processor problems.

None of the thick sheets can be considered a total data loss.

Anomalies:

Both thin and thick base films exhibited a very high fog level. Some of this fog is inherent in the film. The remainder is most likely accumulated from storage and the radiation environment during the balloon flight.

The thin base film exhibited numerous pinholes, streaks, and base irregularities. An examination of raw stock samples (unprocessed) showed these same defects, apparently due to manufacture.

Recommendations:

In an experiment of this size, more consideration should be given to the photographic processing aspect of the data reduction. It is highly desirable that the PTD Photo Science Office be consulted during the experiment planning stage, so that recommendations of film types, thicknesses, processing, etc. can be made.

The chief difficulty encountered in the processing of this film, and the reason for the unusually long time required for processing, was the nonstandard size and thickness of the materials used. In any future experiments, the following limitations should be observed.

1. Film sizes wider than 9 1/2" should not be used. This will eliminate the necessity of cutting the film.

2. Film thickness should be restricted to standard sizes, preferably between 4 and 7 mils.

3. If the experiment can be designed to use roll film, this will greatly simplify and speed the processing.

4. If the experimenter can tolerate the loss of about one inch on one end of each film sheet, this will simplify processing by allowing us to either round off the film corners or tape the film to a leader bullet.

5. Some of the raw stock should be examined in white light upon receipt from the manufacturer. In this way, film defects can be discovered before the experiment is run.

6. PTD should procure and calibrate the film to be used in order to ensure optimum film speed and fog level.

DATE 11/3/72 CONTROL # Fig. 1 TASK HT-64 PREPARED BY

FILM 2485 EMULSION # 33-1 MFG EK EXPIRATION DATE

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY			
SENSITOMETER	I-B	PROCESSOR	Versamat & Transflo	INSTRUMENT	MacBeth	SPEED (Avg. APS)	1930
ILLUMINANT	2850 °K	CHEMISTRY	MX-641	TYPE	TD217DR	D-MAX	Avg. 2.86
TIME	1/100 SEC.	SPEED	TANKS FPM	APERTURE SIZE	2 MM	GAMMA	Avg. 1.85
FILTER	1.60ND	TEMP °F	TIME	FILTER	Visual	BASE + FOG	Avg. 0.46

CHEMICAL ANALYSIS

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pH

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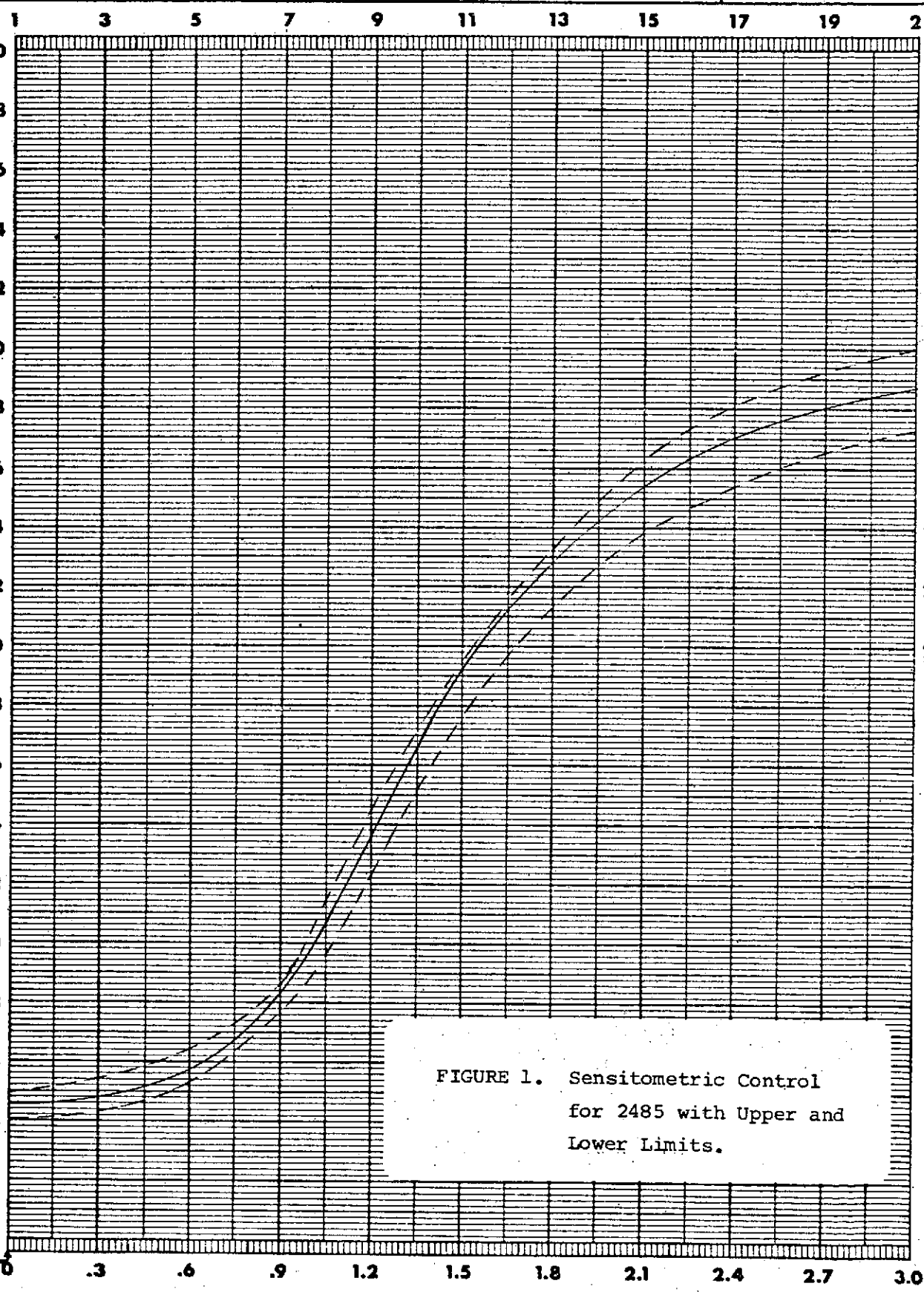

FIGURE 1. Sensitometric Control for 2485 with Upper and Lower Limits.

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DATE 11-3-72 CONTROL # Fig. 2 Thin Base TASK HT-64 PREPARED BY

FILM 2485 EMULSION # 116-02-01 MFG EK EXPIRATION DATE

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY			
SENSITOMETER	I-B	PROCESSOR	Versamat 11C-M	INSTRUMENT	MacBeth	SPEED (AFS)	843
ILLUMINANT	2850 °K	CHEMISTRY	MX-641	TYPE	TD217DR	D-MAX	1.74
TIME	1/100 SEC.	SPEED	2 TANKS 4 FPM	APERTURE SIZE	2 MM	GAMMA	0.83
FILTER	1.60ND	TEMP °F	85 TIME	FILTER	Visual	BASE + FOG	0.68

CHEMICAL ANALYSIS

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pH

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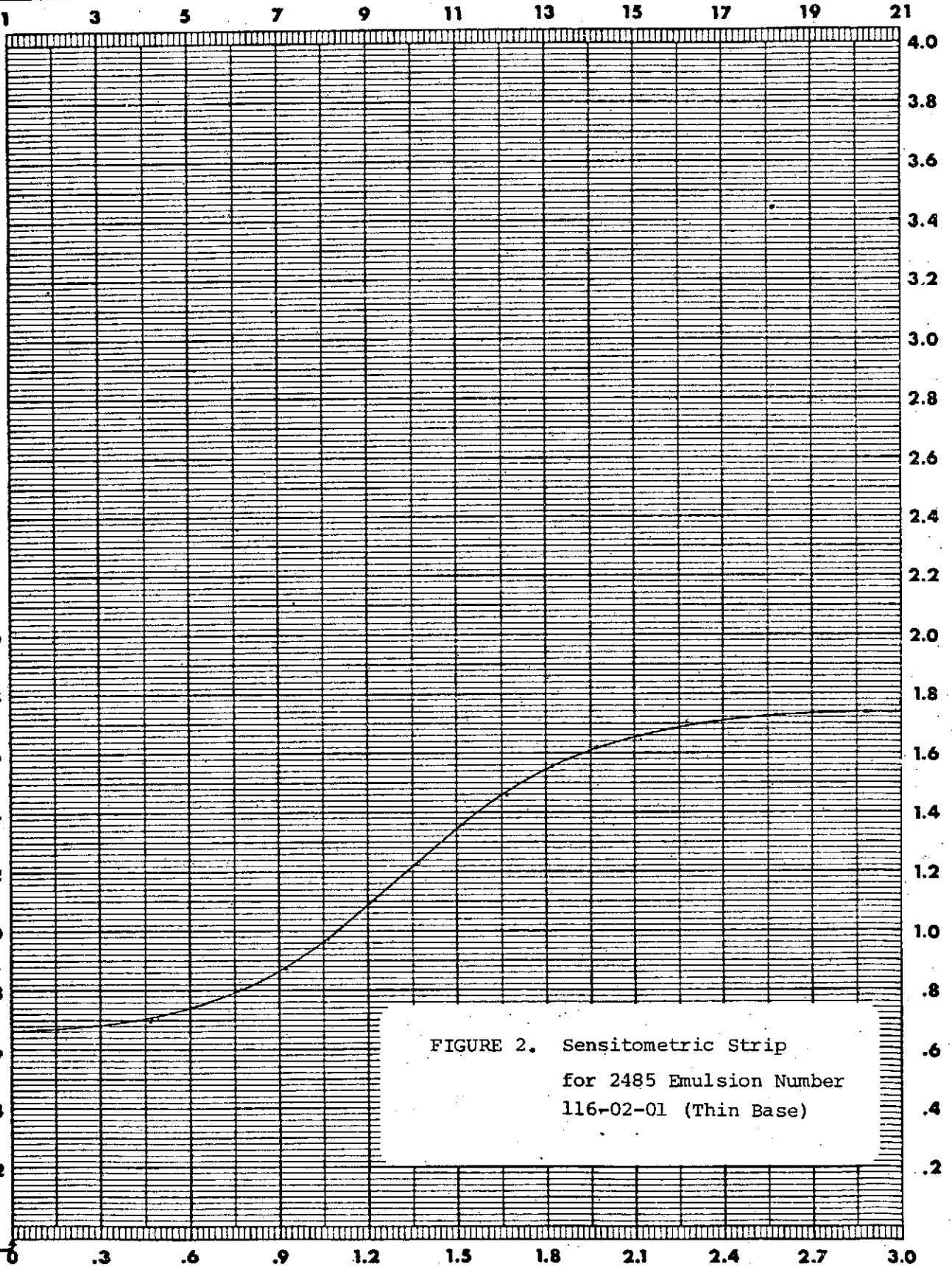

FIGURE 2. Sensitometric Strip for 2485 Emulsion Number 116-02-01 (Thin Base)

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DATE 11/3/72 CONTROL # Fig. 3 Thick Base TASK HT-64 PREPARED BY

FILM 2485 EMULSION # 116-03-01 MFG EK EXPIRATION DATE

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY			
SENSITOMETER	I-B	PROCESSOR	Versamat 11C-M	INSTRUMENT	MacBeth	SPEED (AFS)	1219 / 2.47
ILLUMINANT	2850 °K	CHEMISTRY	MX-641	TYPE	TD217DR	D-MAX	
TIME	1/100 SEC.	SPEED 2	TANKS 4 FPM	APERTURE SIZE	2 MM	GAMMA	1.64
FILTER	1.60ND	TEMP °F 85	TIME	FILTER	Visual	BASE + FOG	0.36

CHEMICAL ANALYSIS

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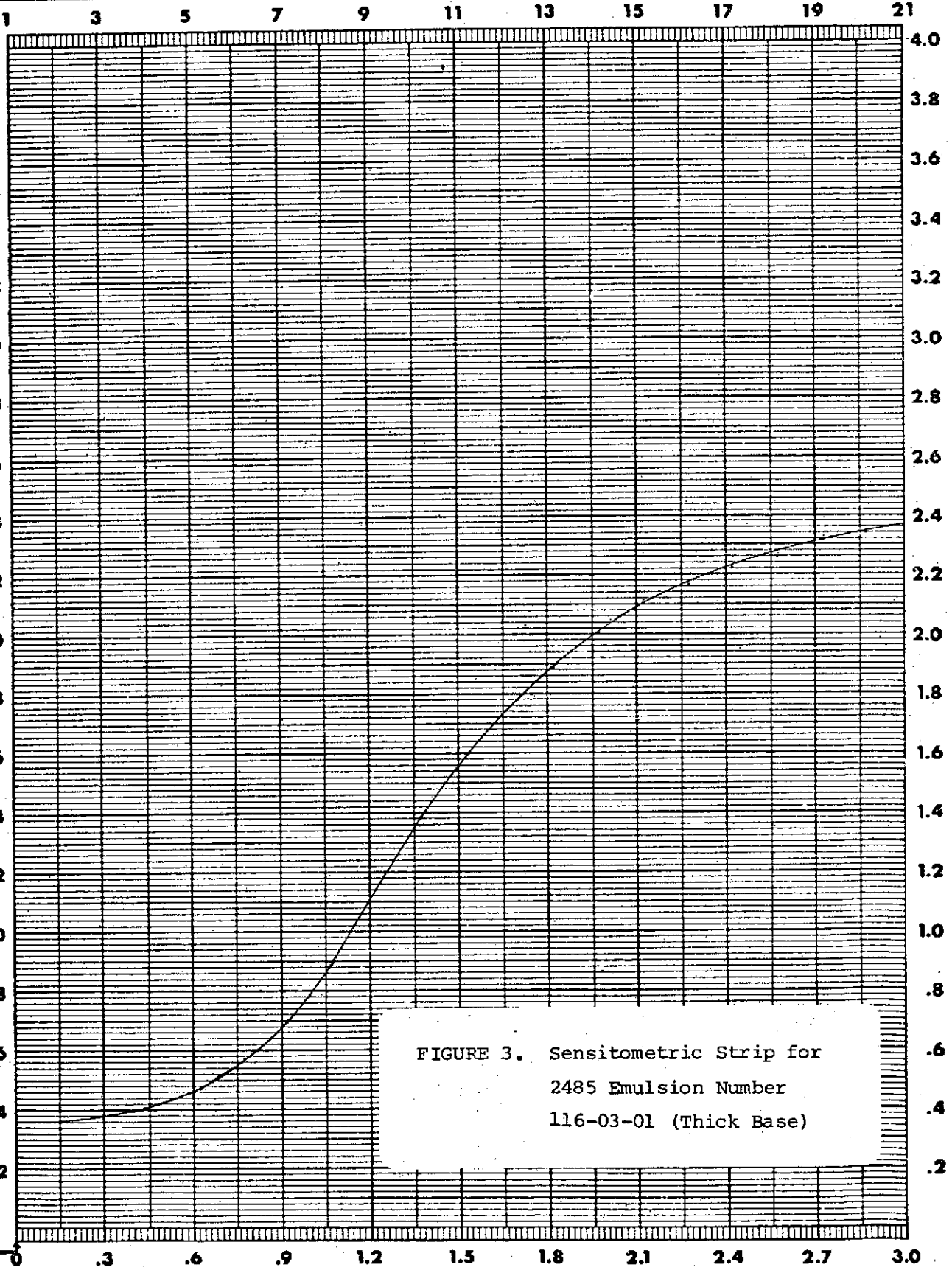

FIGURE 3. Sensitometric Strip for 2485 Emulsion Number 116-03-01 (Thick Base)

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