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9303-68-373

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Document

Results of
QUALITATIVE TEST
Image Evaluation
Resolution

Prepared By R. McCarthy

Approved By R. Dyer.

JUN 3 - 1968

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QUALITATIVE TESTS

Image Evaluation

Resolution

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1.0 SCOPE

The Resolution tests were performed to determine the optical properties of the Slide Viewing System (SVS) as a function of magnification, field position, contrast, and anamorphism. Comparisons of these properties were made between the resolution at the dummy reticle and the resolution at the eyepiece using the interim eyepiece. A telescope will be used with the eyepiece to establish data that will not be "eye-limited". The results will be published as an addendum to this report. This report is an interim report and covers only the resolution testing following review and customer direction for additional testing. Results of all previous testing were reported in Itek-Customer meetings.

2.0 APPLICABLE DOCUMENTS

The Applicable Documents include:

2.1 SDR 154-2

2.2 TR 1429 A

2.3 SDR 151-8

2.4 344-68-063

2.5 344-68-063/B Add 1

3.0 TEST DESCRIPTION

Figure 1, of the test plan document number 344-68-063/B addendum 1, shows the test configuration. The Optical System was examined over the following field of Optical parameters listed below:

Step Magnification—High and Low.

Zoom Ratio—Low/Medium/High

Anamorph Ratio—1.1, 2.1, none

Field Position—(0, 0)
(X at + 0.5, + 1.0)
(Y at + 0.5, + 1.0)

Target Contrast—1.6 to 1 (Negative only)
6 to 1 (Negative only)

Color—White Light only

Positions—With the Eyepiece
At the dummy retical

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One hundred and twenty six data points were examined and the results of these readings is shown in Section 4.0 of this report.

Other Specifications and test criteria included.

a. All readings were made in H/V (horizontal/vertical).

b. Ophthalmic tests were made on each observer and the results can be found in Section 5.1 of this report. These tests were specified in SDR-151-8.

c. While the bench did not always include elements to represent the new beamsplitter and the intensity modulator, these were placed into the system towards the completion of the testing phase and at that time no degradation of resolution occurred either on axis or at the off-axis positions.

d. Two observers were used to record the data, with two other observers used for backup only.

→ e. All the testing was with the 4mm final exit pupil.

f. Readings for axial settings were optimized by centering the target and pointer with the microscope so that the limiting resolution group was near the optical axis, as was specified in SDR-151-8. *WHAT ABOUT OFF AXIS READINGS?*

4.0 TEST RESULTS

4.1 Resolution as a Function of Contrast

The following table relates resolution as a function of contrast. All the data was collected during the qualitative test with the exception of additional data using a 1000:1 contrast target.

The data in the table was taken using the interim eyepiece.

Table 1

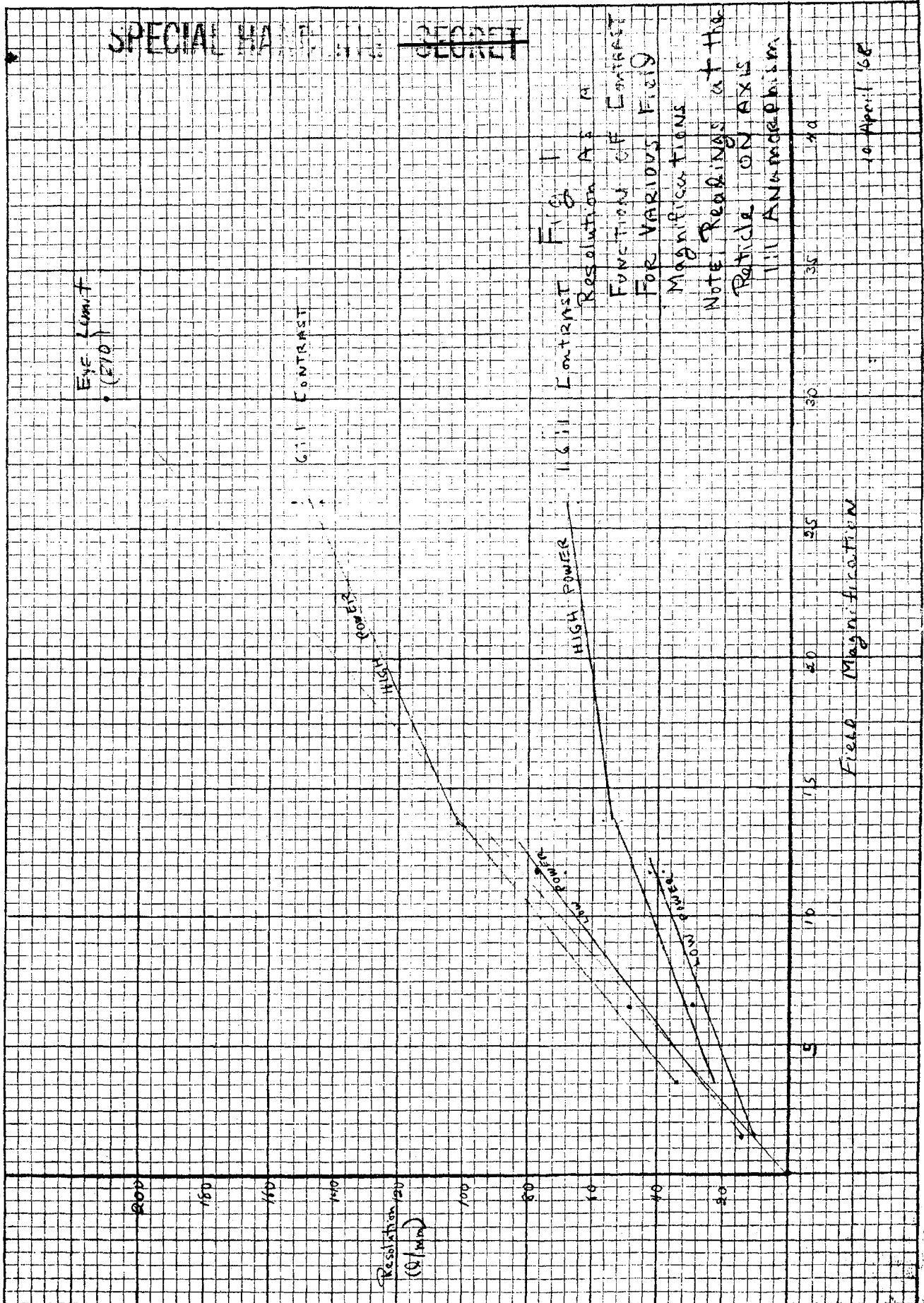
Mag.			1000:1*		6:1		1.6:1	
			on axis	Full-X	On axis	Full-X	On axis	Full-X
25.7	↑ High step- MAG ↓	H	228/203	203/181	153/144	136/144	128/128	
13.6		M	128/128	114/102	87/92	-----	72/72	-----
3.6		L	29/32	29/25	23/26	21/17	-----	-----
36.4/18.2		H	144/144	-----	114/114	121/161	82/92	-----
19.2/9.6		M	81/102	-----	61/64	-----	48/61	-----
5.1/2.6		L	23/25	-----	16/16	-----	-----	-----

*Resolutions are in lines per millimeter at film.

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Resolution $A \approx M$
 FUNCTION OF CONTRAST
 FOR VARIOUS FIELD
 Magnifications
 Note: Readings at the
 Particle ON AXIS
 III Annularorphism

Field Magnification

10 April '68

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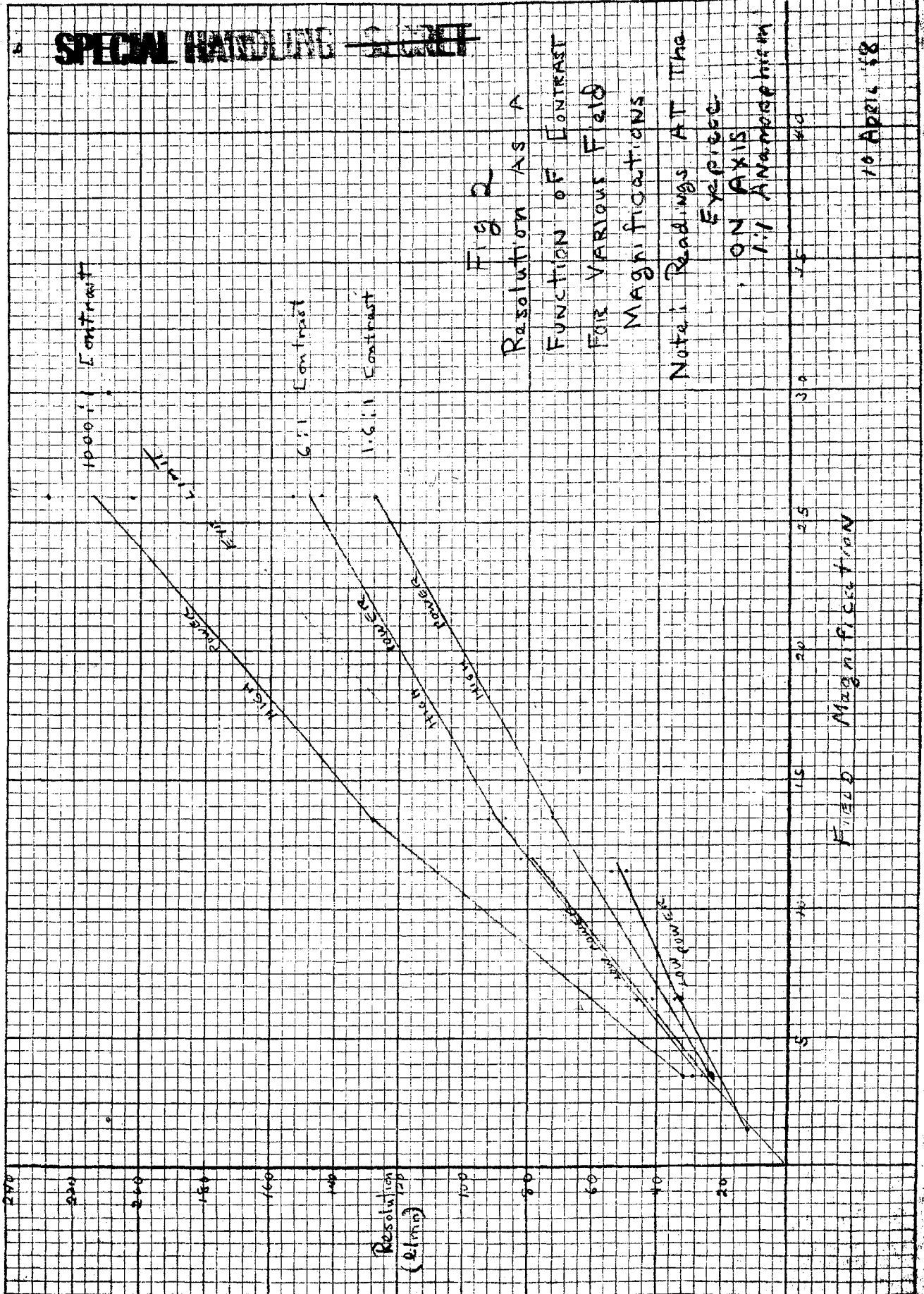


Fig 2

Resolution AS A
 FUNCTION OF CONTRAST
 FOR VARIOUS FIELD
 MAGNIFICATIONS

Note: Readings AT THE
 EYE PIECE
 ON AXIS
 1:1 ANAMORPHISM

FIELD MAGNIFICATION

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Resolution as a function of contrast is plotted below (Fig. 1 and Fig. 2) for field Magnification, on axis, 1:1 Anamorphism only, and for both the reticle and eyepiece location. The eye limit defined as 7 l/mm for 1 X is given at 30X as $30(7) = 210$ l/mm and shown on each chart for reference. A slight fall off in resolutions at the edge of the field does occur but is not contrast dependent. Therefore, no comparison of the resolution in the field as a function of contrast has been made.

An analysis was performed showing critical areas of astigmatic differences between the horizontal and vertical readings. Some of these were individual differences and have been eliminated from the following chart. (see Table 2) As shown on the chart most of these differences are due to positioning the target off axis in the field. The on axis readings at 1.6 to one are a direct effect of the low contrast target. Possible explanations for this effect include:

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TABLE?

a. A defect of the target, as would occur in the processing of the target or, an effect of low contrast targets on the visual process.

b. It should be noted here that the effect of the Anamorphs in producing any astigmatic difference is negligible and not substantiated by the data summarized in Table 2. It does not appear to produce any more astigmatism at 2:1 than 1:1.

4.2 The Anamorphs and Resolution

The remaining resolution vrs, magnification data are given below. Only the 6:1 contrast data is shown. For the 1.6:1 data refer to the test matrix in the appendix of this report. Comments on the result of each chart are given below.

Fig. 3 Anamorphs 1:1 on axis.

Fig. 4 Anamorphs 1:1 Full "X" field.

The term full "X" field refers to the 1.0X on the test Matrix. The resolution drops slightly but not critically at the edge of the field. The increased resolution in the high power at the dummy reticle is believed to be due to the fact that the observers were looking at a vignetted image and the edge effects, enhanced the resolution reading.

Fig. 5 Anamorphs 1:1 full "Y" field. The full "Y" field refers to the 1.0 Y on the test matrix. The curve is similar to the full "X" field without the error at the edge of the field as mentioned above.

Fig. 6 Without Anamorphs on axis. There is little change here from the on axis condition with the Anamorphs at 1:1.

9303 IMAGE EVALUATION TESTS - RESOLUTION

a. TITLE: AT "DUMMY" RETICLE WITH EYEPIECE b. REF. c. SPECIAL CONDITIONS:

STEP CHANGE	ANAMORPH PW	ZOOM SETTING	6:1			1.6:1			6:1			1.6:1			BENCH MODE		
			0.0	0.5X	1.0X	0.0	0.5X	1.0X	0.0	0.5X	1.0X	0.0	0.5X	1.0X		CONTRAST	
LOW POWER	11.7	H															
	6.4	M	X														
	11.6	L															
	16.5	H		X													
	9.1	M	X														
	12.3	L															
	11.7	H															
	6.4	M	X														
	11.6	L															
	12.5	H															
	13.6	M	X														
	3.6	L															
	15.2	H		X													
	13.2	M	X														
	15.9	L															
	2.9	H															
	12.5	M															
	13.4	L															
	3.6	H															

d. TEST EQUIPMENT
 NAME _____
 INITIAL CONDITION _____
 CONFIGURATION _____
 TARGET _____
 e. COMMENTS _____
 f. OBSERVER _____
 DATE _____
 TIME _____
 TEMP _____ °F

NOTES: (1) MEASUREMENTS WILL BE REPEATED AT THREE (3) RADIAL FIELD POSITIONS (H), AXIAL (O), & FULL FIELD (O). X HORIZONTAL TO RIGHT, Y VERTICAL UP.
 (2) THE THREE (3) BASIC ZOOM LENS FOCAL LENGTH SETTINGS CORRESPOND TO MINIMUM MAGNIFICATION (L), MAXIMUM MAGNIFICATION WHEN RETROFIT ZOOM EYEPIECE IS USED (M), & MAXIMUM MAGNIFICATION WHEN INTERIM EYEPIECE IS USED (H). SPECIFIC FOCAL LENGTH VALUES ARE TO BE CALIBRATED.
 (3) READINGS ARE RECORDED: HORIZONTAL BAR/VERTICAL BAR.

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Fig. 7 Without Anamorphs, Full X field. In comparison with the full "X" field and anamorphs at 1:1, the resolution is reduced by taking the anamorphs out of the system, (at the full X field and dummy reticle position). At the eyepiece however the resolution is slightly enhanced.

Fig. 8 Without Anamorphs, full Y field. The resolution is reduced by taking the anamorph out of the system at the full Y field at the dummy reticle for high power. At low power relay it is about the same and in some places slightly higher with the anamorph out of the system. No readings were made at the eyepiece.

Fig. 9 Anamorphs 2.1 on axis. At the dummy reticle the resolution is greatly reduced in the horizontal direction, while in the vertical direction the resolution is approximately the same as the 1:1 condition axis or the no anamorph condition on axis.

Fig. 10 Anamorphs 2.1 on axis at the eyepiece. The reduction in resolution from the other on axis curves is in the horizontal direction while in the vertical direction the resolution is the same.

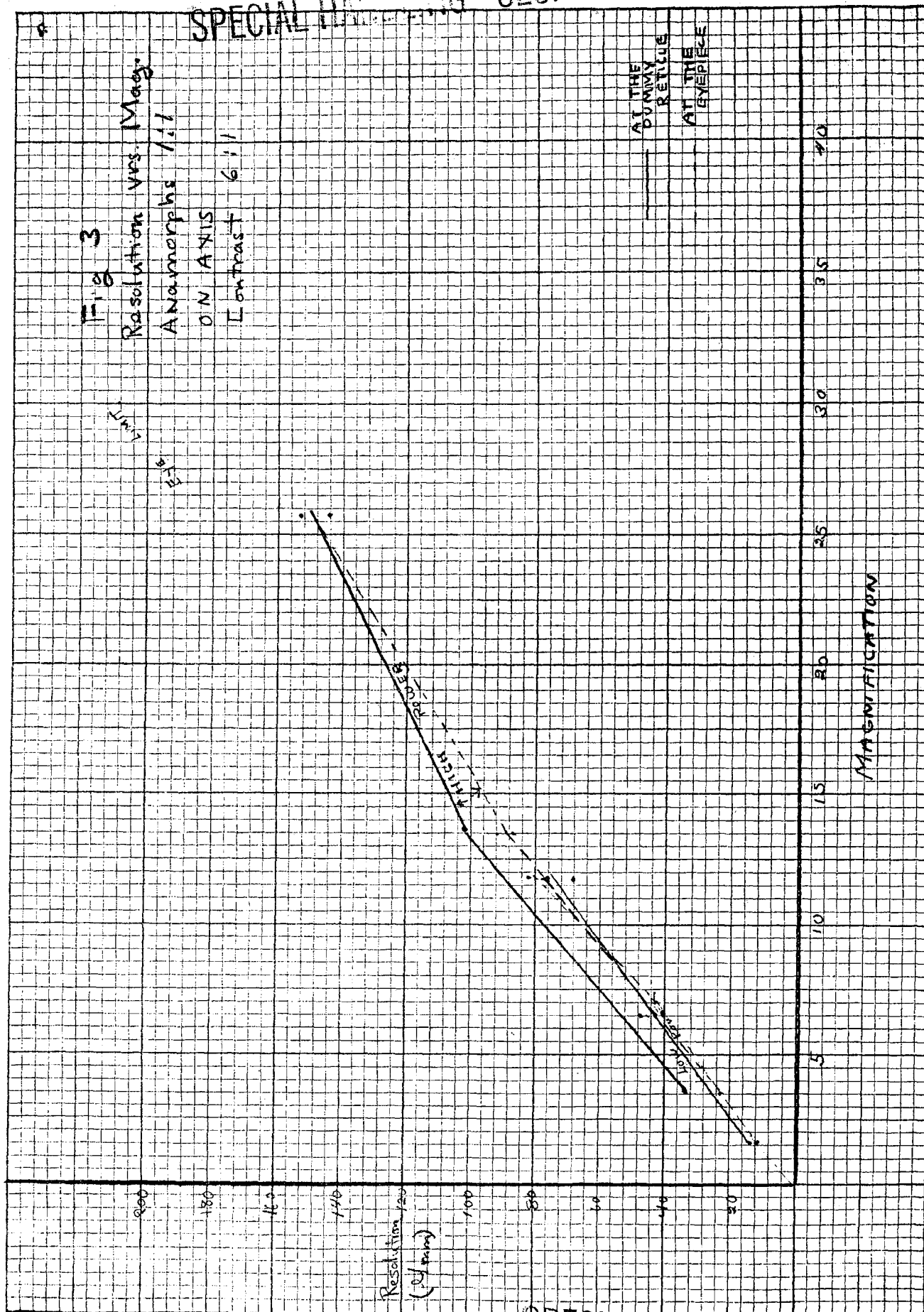
Fig. 11 Anamorph 2.1, Full X position. (a) the Horizontal resolution for both the eyepiece and dummy reticle is greatly reduced. (b) The vertical resolution for both the eyepiece and dummy reticle is greatly enhanced.

Fig. 12 Anamorph 2.1 Full Y Position. The horizontal resolution both at the dummy reticle and at the eyepiece is reduced while for the vertical it is enhanced.

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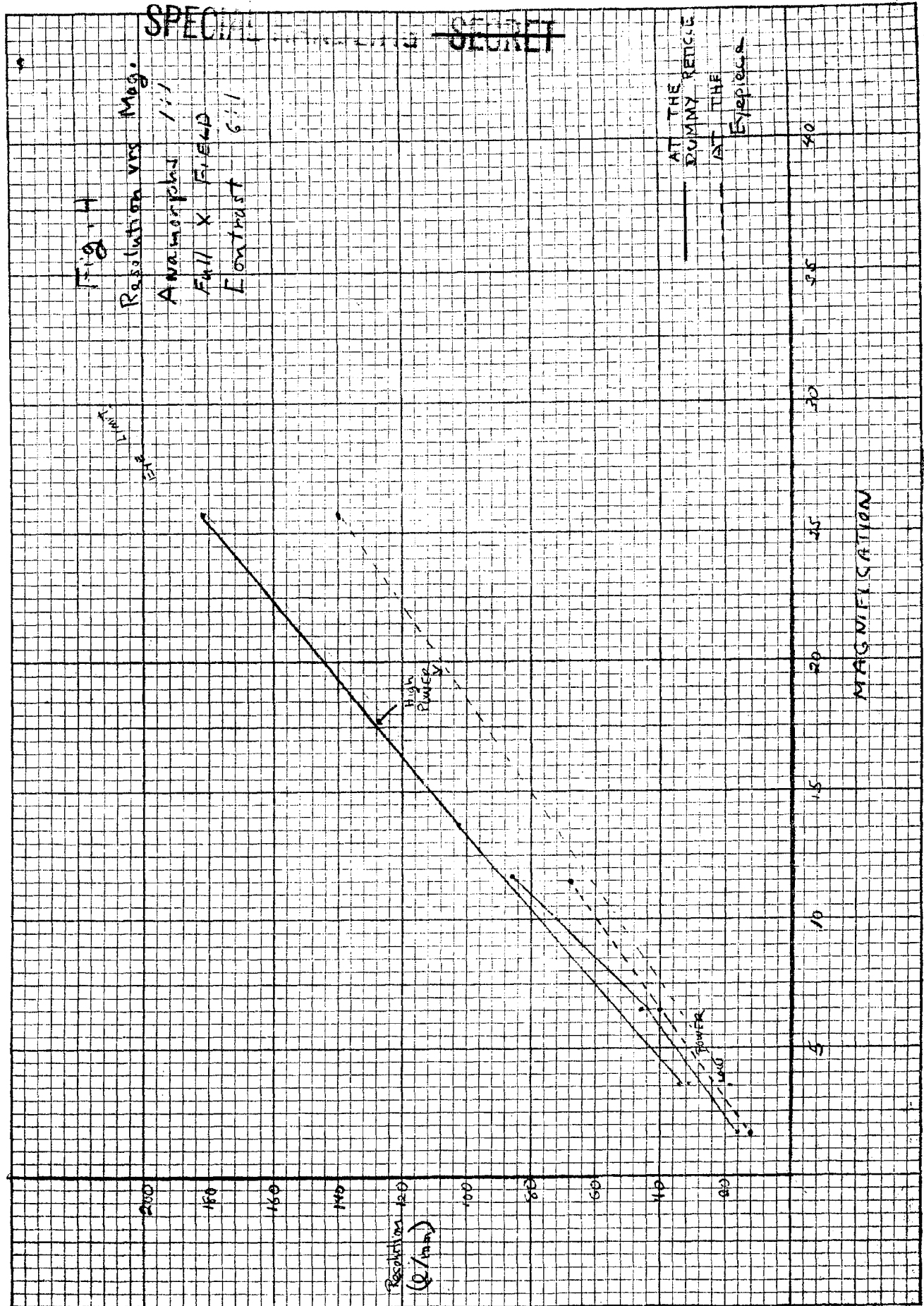
Fig 3
Resolution vs Magnification
Anamorphs 1:1
ON AXIS
Contrast 6:1

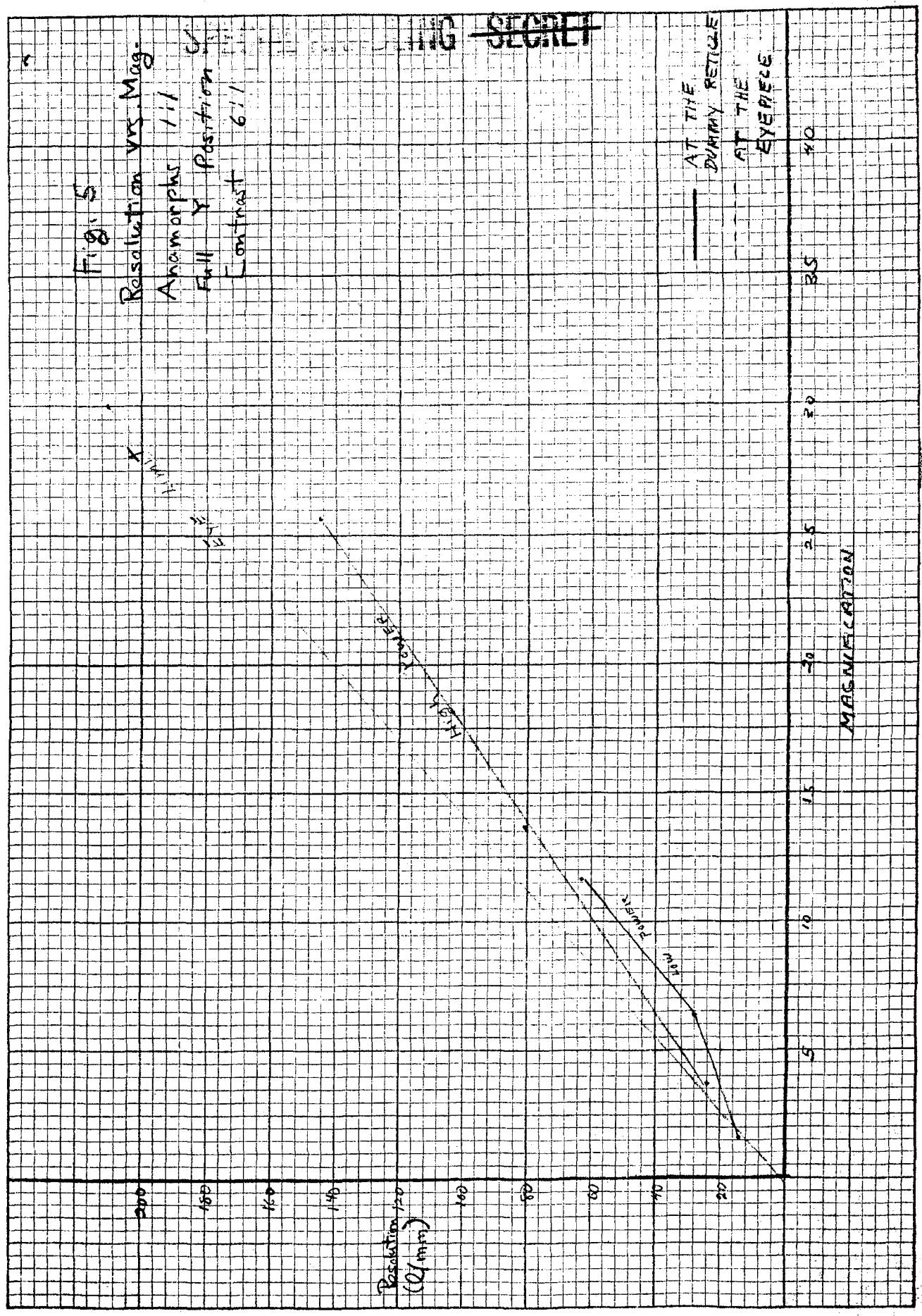


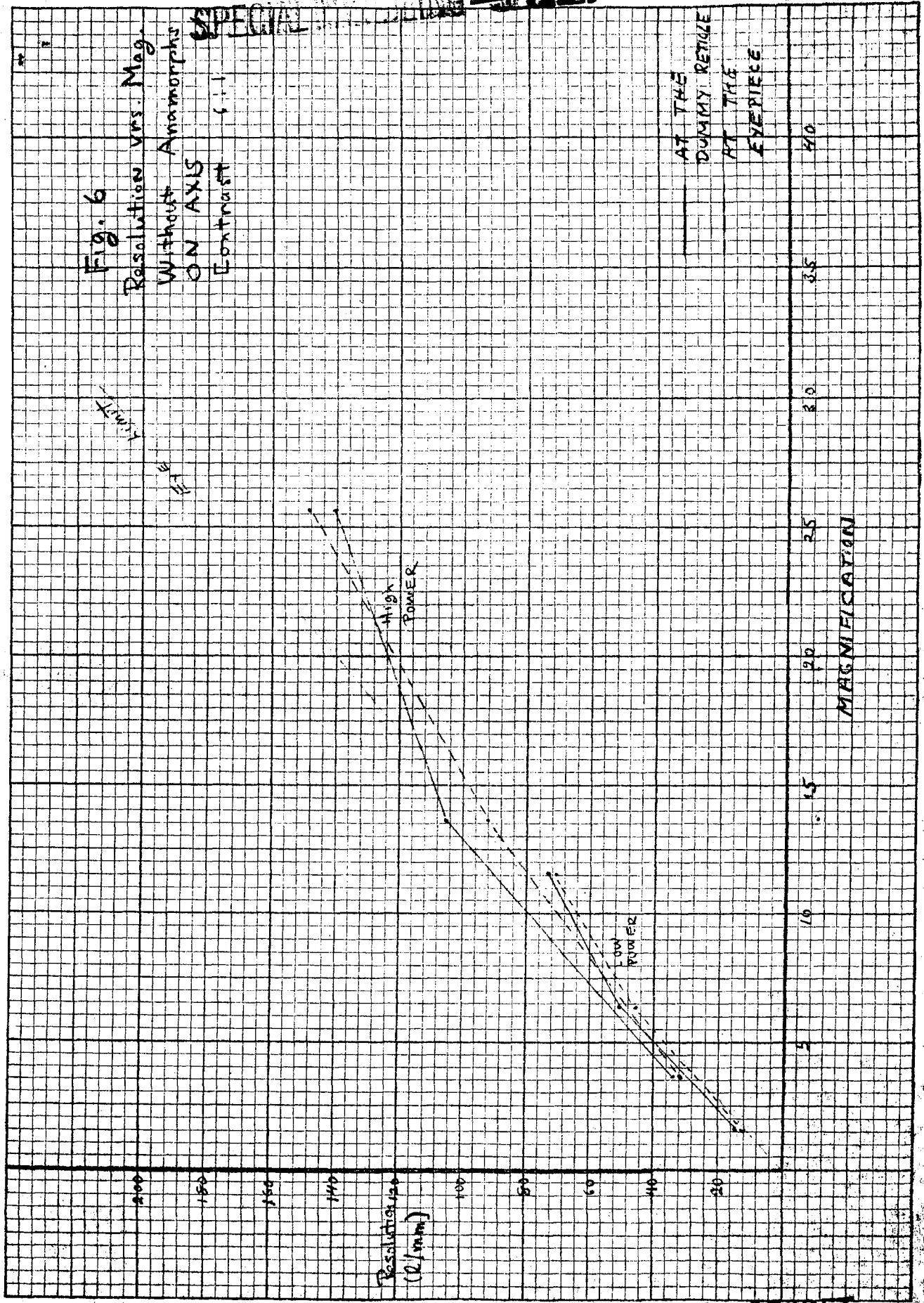
10 X 10 TO THE INCH 350-5106
KUPFER & SERRAFO

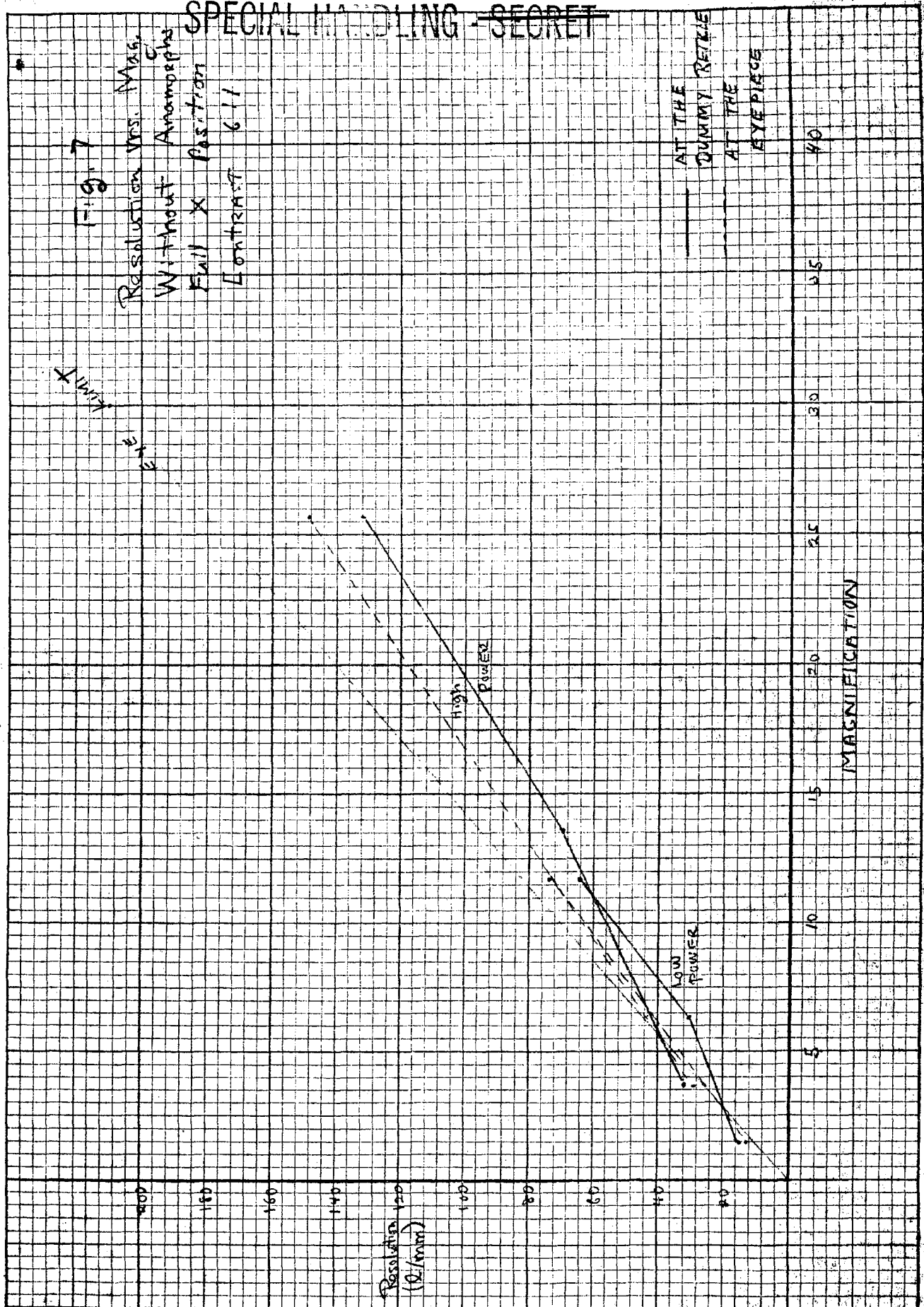
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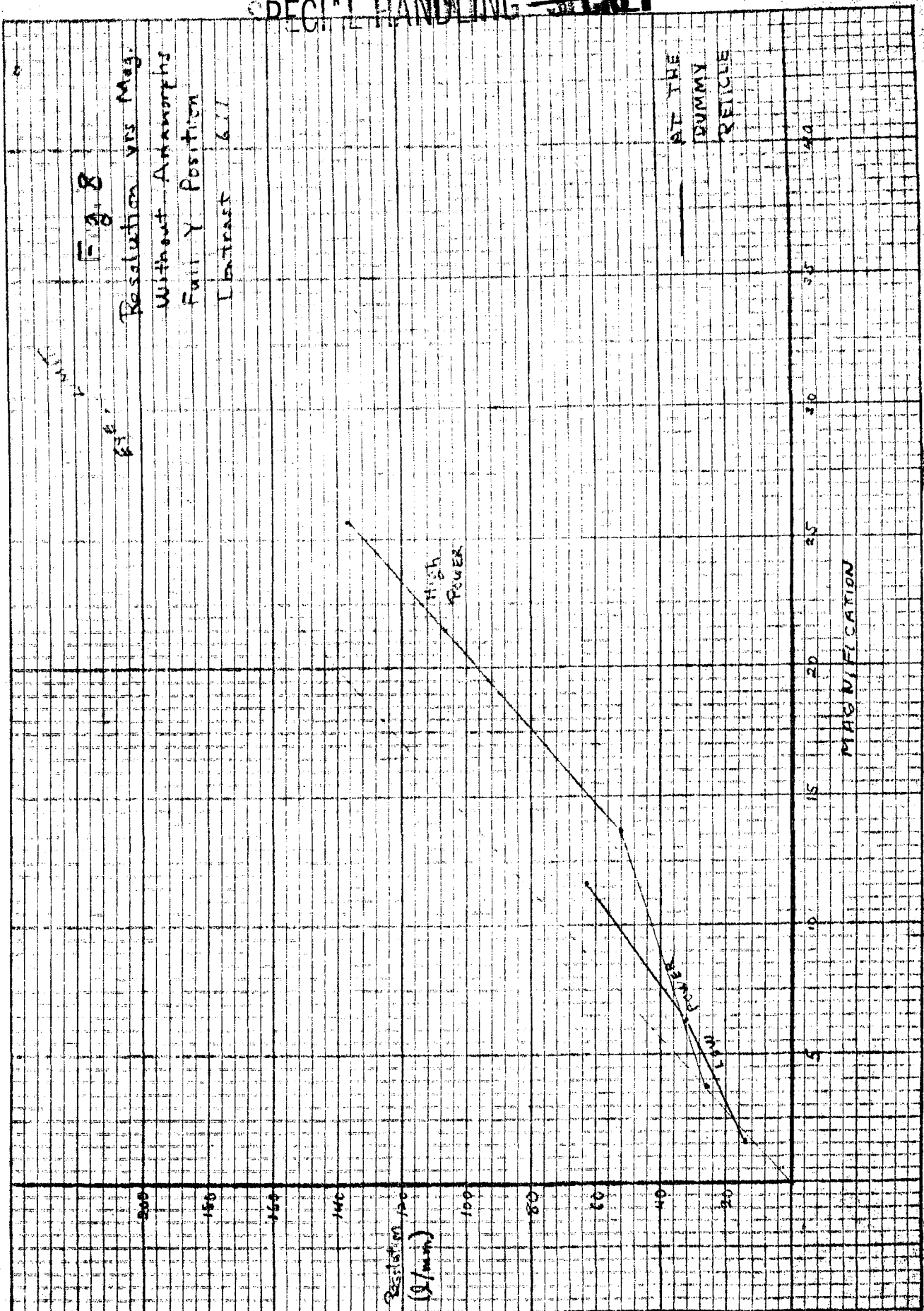




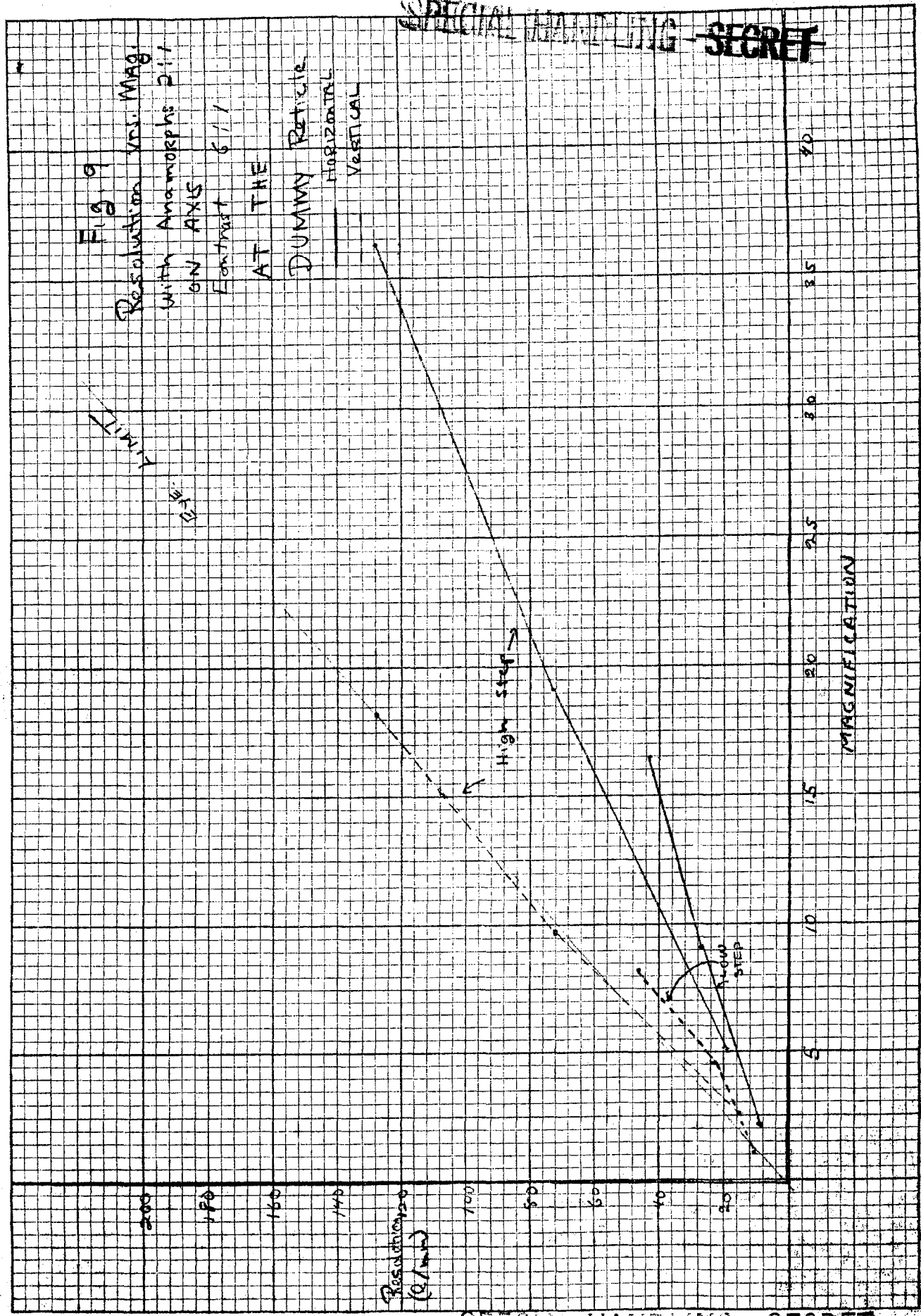




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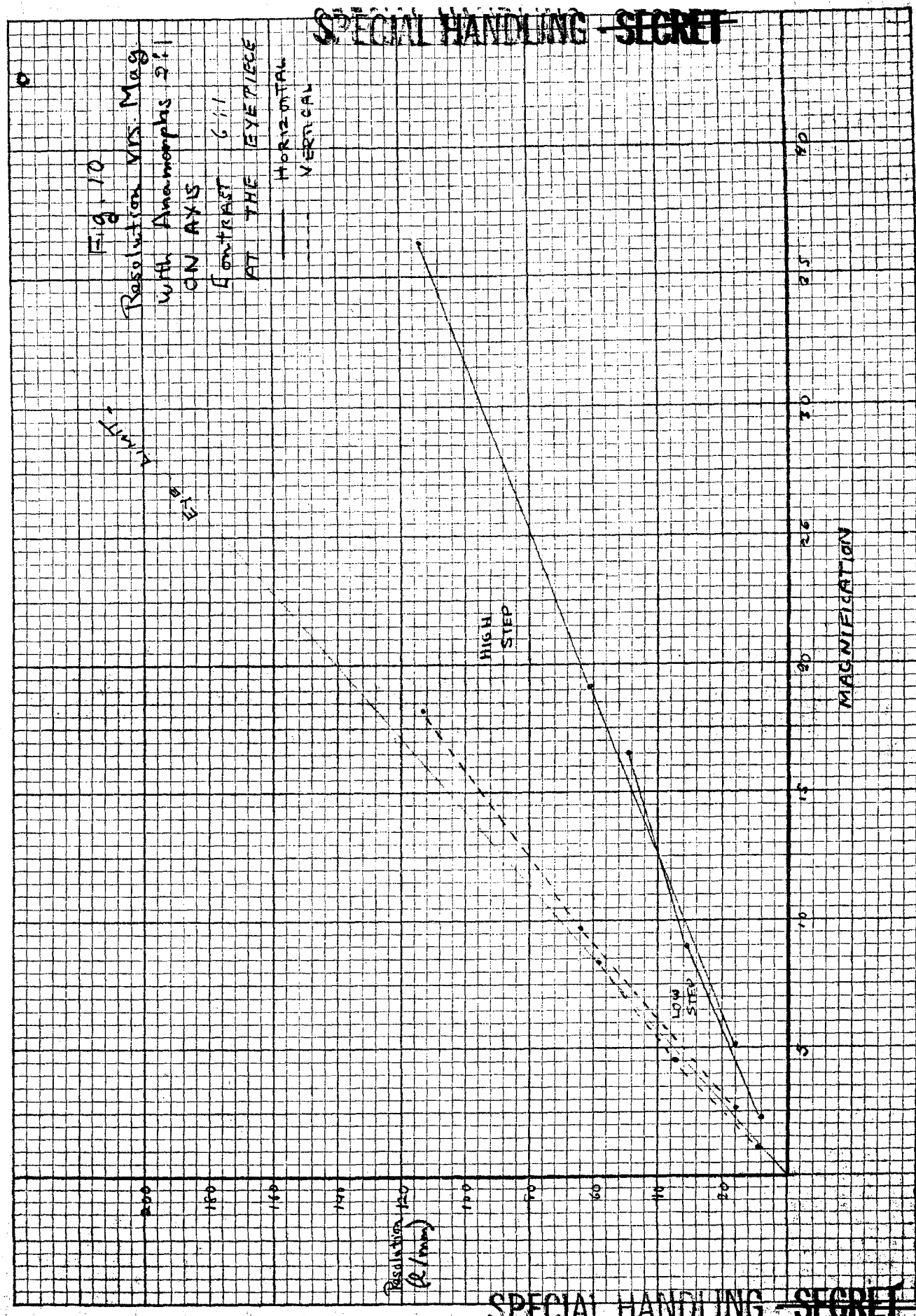


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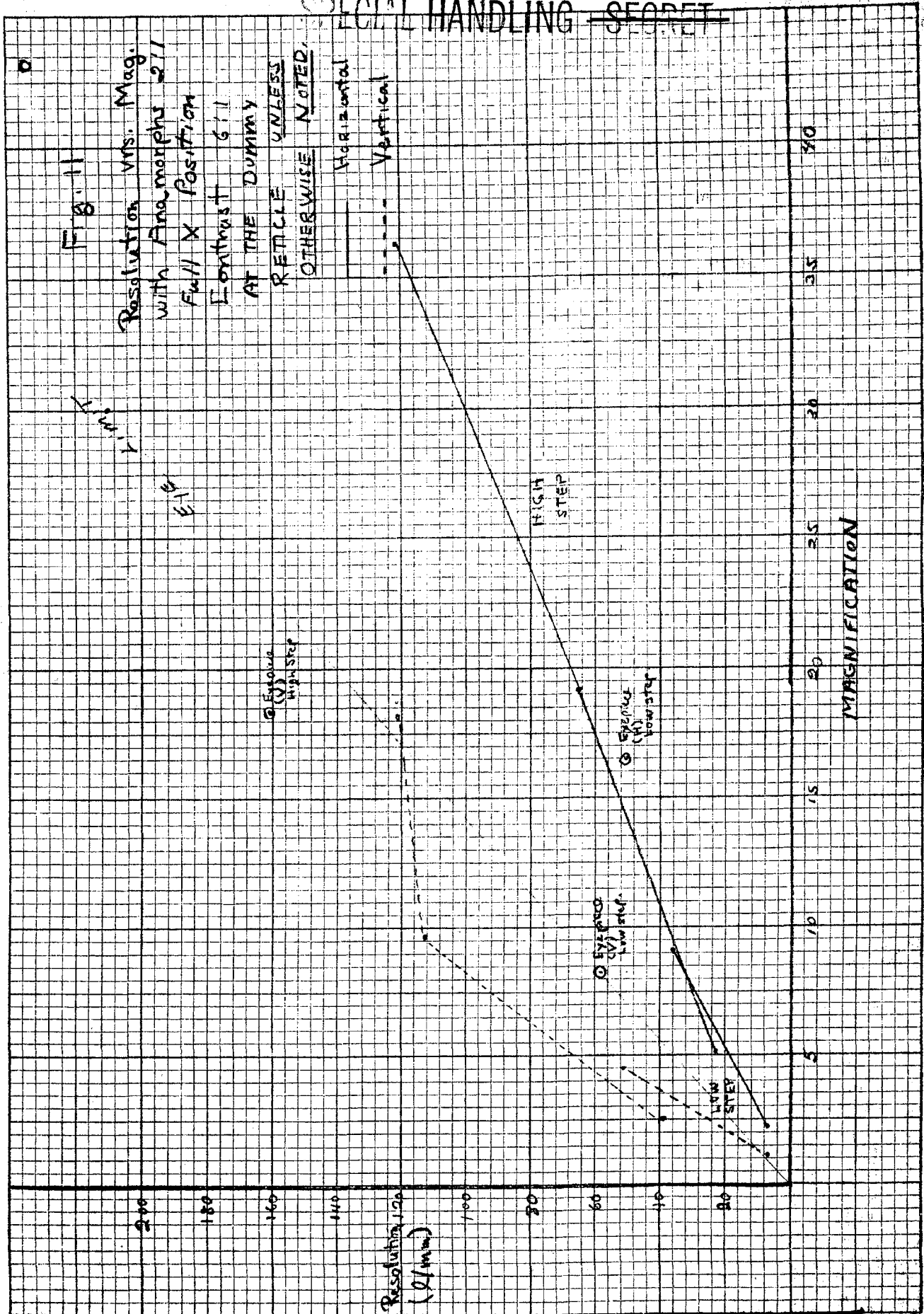
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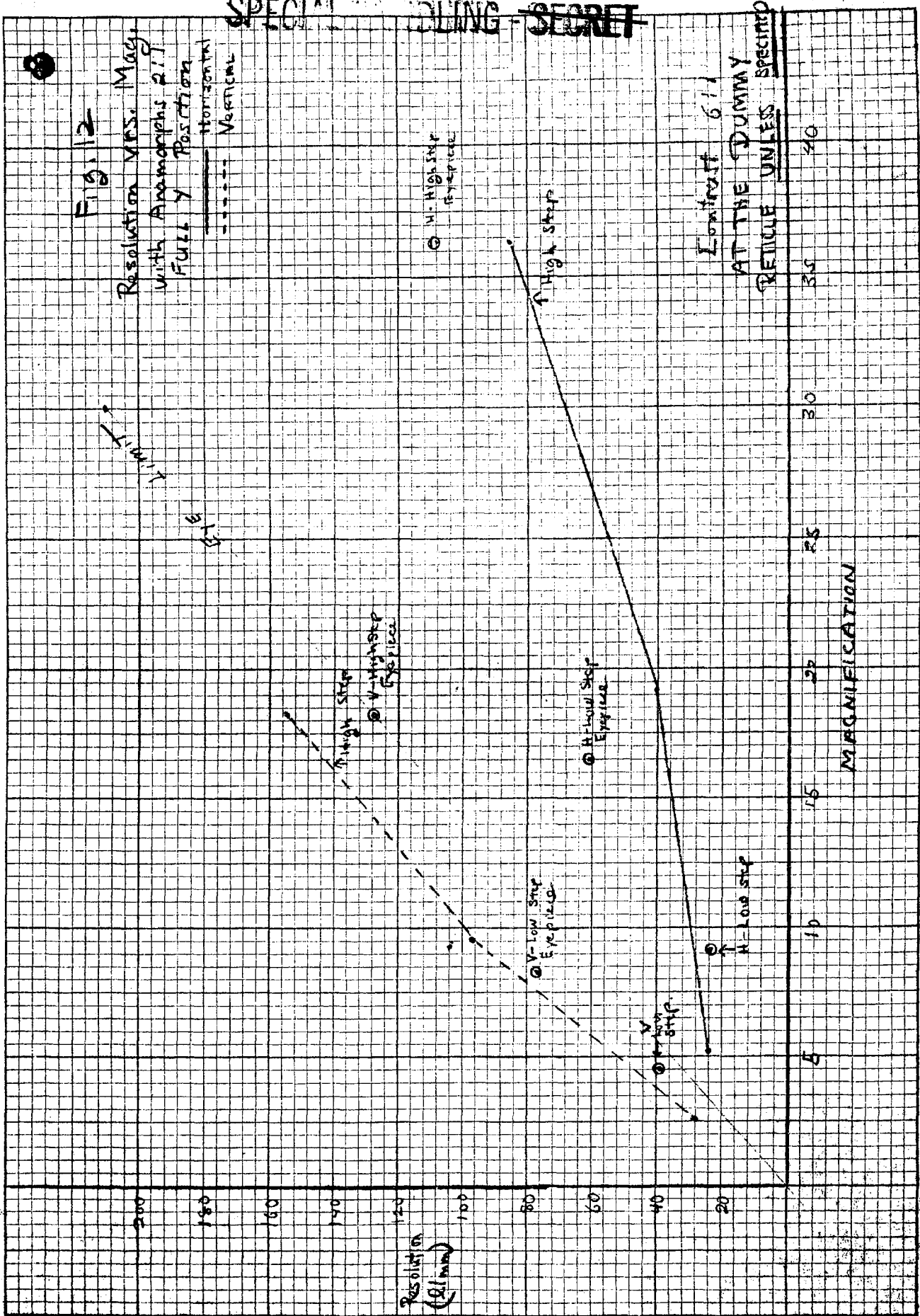
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4.3 Magnification and Resolution

Table 3 below shows the resolution difference between the dummy reticle position and the eyepiece for various magnifications. The magnification is changed by the anamorphs as shown in the previous data (Figures 9 through 12). Resolution is also reduced by the magnification fall off across the field. This is only a small sampling of the data but is sufficient to show general tendencies.

Table 3 — Magnification and Resolution

Parameters: 6:1 Contrast Anamorphs 1:1 Average Resolutions on Axis

Magnification	At Reticle	At Eyepiece
	(Horizontal/Vertical) Res. (1/mm)	(Horizontal/Vertical) Res. (1/mm)
1.6	14/14	12/12
3.6	34/34	23/26
6.4	48/48	41/46
11.7	77/68	77/82
13.6	102/102	87/92
25.7	153/144	153/144

4.4 Resolution Across the Field (X Direction)

The following generalizations can be made concerning the X field.

→ a. Without the anamorphs in the system, there is no set pattern of fall off across the field. At some of the points it has obviously decreased in resolution while at others it has increased in 0.5x position and decreased at the 1.0x position.

→ b. Placing the anamorphs in the system at 1:1 increases the resolution across the field for 1.0 X and 1.0 Y.

c. With the anamorphs at 2:1 the resolution on axis and at 1.0x and 1.0 y for the horizontal bars is reduced from the 1:1 anamorphic condition. The vertical bar resolution is increased.

4.5 Resolution Across the Field (Y Direction)

The same comments as in Section 4.4 of this report apply to the Y direction.

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4.6 Comparison of the Resolution at the Dummy Reticle Position
and at the Eyepiece

The following generalizations can be made:

- a. The resolution at the reticle is slightly higher than at the eyepiece.
- b. For field positions the dropoff of resolution is consistent for the reticle and the eyepiece.
- c. Contrast reduction effects the resolution at the dummy reticle more than at the eyepiece.
- d. When the anamorphs are taken out of the system the "X" resolution at the reticle drops while at the eyepiece the resolution rises slightly. In the Y direction the same dropoff occurs at the reticle but the eyepiece resolution slightly decreases.
- e. At both the eyepiece and reticle the resolution in the vertical remains the same on axis when the anamorphs are set at 2:1. Under the same conditions the horizontal resolution at both reticle and eyepiece deteriorates.
- f. At off axis conditions with the anamorphs at 2:1 the difference between the reticle resolution and the eyepiece resolutions are minor compared with the enhancement of vertical resolutions and the reduction of horizontal resolution brought about by the anamorphs.

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5.0 CONCLUSION

5.1 Results of Eye Examination for Participants in the Experiment

The following information was received from a certified optometrist on the vision of the four participants in the experiment. As it is noted in the data sheets only observer no. 2 and no. 4 actively collected the data.

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SUDBURY, MASS.
HILLTOP 3-2088

April 11, 1968

Richard Dyer - OBSERVER #1

Visual Acuity: O.D. 20/100
 O.S. 20/400

with Rx: O.D. 20/20
 O.S. 20/20

Visual Acuity at Near : O.D. J-1
 with Rx. O.S. J-1

Corneal Curves: O.D. 44.25/45.00 90/180
 O.S. 43.75/44.00 90/180

Rx: O.D. -1.75 sph
 O.S. -7.25 = +0.50 cx45

Morton V. Ross, O.D.

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April 11, 1968

Robert McCarthy OBSERVER #2

Visual Acuity: O.D. 20/300 with Rx: O.D. 20/20
O.S. 20/300 O.S. 20/20

Visual Acuity at Near with Rx: O.D. J-1
O.S. J-1

Corneal Curves: O.D. 44.25/45.00 90/180
O.S. 44.50/45.00 90/180

Rx: O.D. -4.50 = +0.50 cx180
O.S. -4.50 = +0.50 cx180

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Jason Raymond OBSERVER #3

Visual Acuity: O.D. 20/15
 O.S. 20/15

Visual Acuity at Near : O.D. J-1
 O.S. J-1

Corneal Curves: O.D. ~~43.50/43.75~~ 43.50/43.75 90/180
 O.S. 44.00/44.00

Rx: O.D. plano
 O.S. +0.25 cx180 +0.75 , O.U., for prolonged near point
 tasks may be needed.

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Morton V. Ross, O.D.

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Dr. Morton V. Ross
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HILLTOP 3-2088

April 11, 1968 OBSERVER # 4

George Lawless

Visual Acuity O.D. 20/20
O.S. 20/20

Visual Acuity at Near with Rx: O.D. J-1
O.S. J-1

Corneal Curves : O.D. 43.25/43.75 90/180
O.S. 43.50/44.00 90/180

Rx: O.D. +0.50cx45 ADD O.U. +2.25
O.S. * +0.25 sphere

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Morton V. Ross, O.D.

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5.3 Summary

The resolution varies as a function of magnification, field position, contrast, and anamorphism. It increases with increased magnification, increased contrast, and positive anamorphism. Even though these generalizations could easily have been predicted, the exact amount of resolution degradation was not known nor was the effect of eye limitation on the system operator performance.

Further experiments will be conducted on the interim eyepiece data to reduce the eye limitations using a telescope to view the eyepiece image. This will be published as an addendum to the report and will compare these results with the present findings.

Prior to taking the data reported here, the bench was moved and realigned using a "pinhole" method. This created a better quality image with much less color and reduced flare. The resolution does not differ from all previous testing at the dummy reticle.

→ The eyepiece data can not be compared until the tests with the telescope (as mentioned above) are complete.

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6.0 APPENDIX

6.1 Data Sheets

- A. Individual Operator Resolution (Group-Element) versus Matrix Parameters
- B. Individual Operation Resolution (lines per millimeter) versus Matrix Parameters
- C. Conversion Chart

6.2 Averaged Resolution (lines per millimeter) Versus Matrix Parameters

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a. TITLE: AT "DUMMY" RETICLE WITH EYEPIECE b. REF. c. SPECIAL CONDITIONS:

STEP CHANGE	ANAMORPHIC	ZOOM SETTINGS	MAGNIFICATION										BENCH MODE				
			0.0	0.5X	1.0X	0.5Y	1.0Y	0.0	0.5X	1.0X	0.5Y	1.0Y	CONTRAST	FIELD POSITION (H)			
LOW POWER	1:1	L	4/3	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	d. TEST EQUIPMENT
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
	2:1	L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	NAME
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
HIGH POWER	1:1	L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	INITIAL CONDITION
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
	2:1	L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	CONFIGURATION
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
		H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	
NONE	L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	e. COMMENTS	
	M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6		
	H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6		
	L	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6		
	M	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6		
	H	5/4	6/1	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6	5/4	5/6		

f. OBSERVER: George F. Lawless
 DATE: March 28, 29, April 1951
 TIME: 12:30
 TEMP: 60°F

NOTES: (1) MEASUREMENTS WILL BE REPEATED AT THREE (3) RADIAL FIELD POSITIONS (H), AXIAL (0.0), 50% ZONE (0.5), & FULL FIELD (1.0), X HORIZONTAL TO RIGHT, Y VERTICAL UP.
 (2) THE THREE (3) BASIC ZOOM LENS FOCAL LENGTH SETTINGS CORRESPOND TO MINIMUM MAGNIFICATION (L), MAXIMUM MAGNIFICATION WHEN RETROFIT ZOOM EYEPIECE IS USED (M), & MAXIMUM MAGNIFICATION WHEN INTERIM EYEPIECE IS USED (H). SPECIFIC FOCAL LENGTH VALUES ARE TO BE CALIBRATED.
 (3) READINGS ARE RECORDED: HORIZONTAL BAR/VERTICAL BAR.

SPECIAL HANDLING - SECRET

UNCLASSIFIED
DATE 10/15/2013
BY 60322

a. TITLE: AT 'DUMMY' RETICLE WITH EYEPIECE b. REF. c. SPECIAL CONDITIONS:

STEP CHANGE	ANAMORPHIC	ZOOM SETTING	AT 'DUMMY' RETICLE			WITH EYEPIECE			BENCH MODE				
			6:1	1.6:1	1.6:1	6:1	1.6:1	1.6:1					
			0.0	0.5X	1.0X	0.5Y	1.0Y	0.0	0.5X	1.0X	0.5Y	1.0Y	
LOW POWER	1:1	H	6/8	6/4	5/3	5/6	5/6	6/6	6/4	6/1	5/3	5/6	5/6
		M	5/5	5/4	5/2	5/6	5/6	6/2	6/4	6/1	5/2	5/6	5/6
		L	3/5	3/4	3/3	3/6	3/6	3/3	3/3	3/3	3/3	3/3	3/3
		H	5/4	5/3	5/2	5/6	5/6	5/3	5/3	5/3	5/3	5/3	5/3
		M	4/5	4/4	4/3	4/6	4/6	4/3	4/3	4/3	4/3	4/3	4/3
		L	2/3	2/2	2/2	2/6	2/6	2/2	2/2	2/2	2/2	2/2	2/2
		H	6/2	6/1	5/2	6/6	6/6	6/1	6/1	6/1	6/1	6/1	6/1
		M	5/2	4/2	4/2	5/6	5/6	5/2	5/2	5/2	5/2	5/2	5/2
		L	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6
		H	7/2	7/2	7/2	7/6	7/6	7/2	7/2	7/2	7/2	7/2	7/2
		M	6/5	6/4	6/4	6/6	6/6	6/5	6/5	6/5	6/5	6/5	6/5
		L	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6	3/6
		H	3/4	3/4	3/4	3/6	3/6	3/4	3/4	3/4	3/4	3/4	3/4
		M	1/2	1/2	1/2	1/6	1/6	1/2	1/2	1/2	1/2	1/2	1/2
		L	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
		H	2/2	2/2	2/2	2/6	2/6	2/2	2/2	2/2	2/2	2/2	2/2
		M	1/2	1/2	1/2	1/6	1/6	1/2	1/2	1/2	1/2	1/2	1/2
		L	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6
		H	2/2	2/2	2/2	2/6	2/6	2/2	2/2	2/2	2/2	2/2	2/2
		M	1/2	1/2	1/2	1/6	1/6	1/2	1/2	1/2	1/2	1/2	1/2
		L	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6	5/6

d. TEST EQUIPMENT

NAME _____

INITIAL CONDITION _____

CONFIGURATION *Retinal*

less Intensity

TARGET *USAF 1951*

e. COMMENTS

48 mm objective

10X eyepiece

reticle parameter

used for dummy

reticle.

f. OBSERVER

Robert G. McCarthy

DATE *March 28, 19 April 1951*

TIME _____

TEMP _____ °F

NOTES: (1) MEASUREMENTS WILL BE REPEATED AT THREE (3) RADIAL FIELD POSITIONS (H), AXIAL (O.O), 50% ZONE (O.5), & FULL FIELD (1.0), X HORIZONTAL TO RIGHT, Y VERTICAL UP.

(2) THE THREE (3) BASIC ZOOM LENS FOCAL LENGTH SETTINGS CORRESPOND TO MINIMUM MAGNIFICATION (L), MAXIMUM MAGNIFICATION WHEN RETROFIT ZOOM EYEPIECE IS USED (M), & MAXIMUM MAGNIFICATION WHEN INTERIM EYEPIECE IS USED (H). SPECIFIC FOCAL LENGTH VALUES ARE TO BE CALIBRATED.

(3) READINGS ARE RECORDED: HORIZONTAL BAR/VERTICAL BAR.

~~SPECIAL HANDLING - SECRET~~

DATA SHEET

1951 USAF RESOLUTION TARGET



Group Number	Element Number	Resolution (cycles/mm)	Line Width (microns)	Group Number	Element Number	Resolution (cycles/mm)	Line Width (microns)	Group Number	Element Number	Resolution (cycles/mm)	Line Width (microns)
-2	1	0.250	2000	2	1	4.00	125.0	6	1	64.0	7.81
	2	0.281	1782		2	4.49	111.4		2	71.8	6.96
	3	0.315	1587		3	5.04	99.2		3	80.6	6.20
	4	0.354	1414		4	5.66	88.4		4	90.5	5.52
	5	0.397	1260		5	6.35	78.8		5	101	4.92
	6	0.445	1122		6	7.13	70.1		6	114	4.39
-1	1	0.500	1000	3	1	8.00	62.50	7	1	128	3.91
	2	0.561	890.0		2	8.98	55.68		2	143	3.48
	3	0.629	793.7		3	10.1	49.61		3	161	3.10
	4	0.707	707.1		4	11.3	44.19		4	181	2.76
	5	0.794	629.9		5	12.7	39.37		5	203	2.46
	6	0.891	561.2		6	14.3	35.08		6	228	2.19
0	1	1.00	500.0	4	1	16.0	31.25	8	1	256	1.95
	2	1.12	445.5		2	17.9	27.84		2	287	1.74
	3	1.26	396.9		3	20.1	24.80		3	323	1.55
	4	1.41	353.6		4	22.6	22.10		4	362	1.38
	5	1.59	315.0		5	25.4	19.69		5	406	1.23
	6	1.78	280.6		6	28.5	17.54		6	456	1.10
1	1	2.00	250.0	5	1	32.0	15.63	9	1	512	0.98
	2	2.24	222.7		2	35.9	13.92		2	575	0.87
	3	2.52	198.4		3	40.3	12.40		3	645	0.78
	4	2.83	176.8		4	45.3	11.05		4	724	0.69
	5	3.17	157.5		5	50.8	9.84		5	813	0.62
	6	3.56	140.3		6	57.0	8.77		6	912	0.55

~~SPECIAL HANDLING - SECRET~~

MICROPHOTOGRAPHY

Itek

NO APPROVED FOR RELEASE

a. TITLE: AT "DUMMY" RETICLE WITH EYEPIECE b. REF: 6. SPECIAL CONDITIONS: 6.1

STEP CHANGE	ANAMORPH PW	ZOOM SETTING	WITH EYEPIECE										BENCH MODE			
			AT "DUMMY" RETICLE					WITH EYEPIECE								
			6:1					6:1								
			0.0	0.5X	1.0X	1.0X	1.0X	0.5X	1.0X	1.0X	0.5X	1.0X	1.0X	0.5X	1.0X	CONTRAST
LOW POWER	1:1	H	117	64	31	40	34	36	40	32	34	34	34	34	34	6:1
	2:1	M	64	31	20	25	25	25	25	25	25	25	25	25	25	6:1
	2:1	L	16	8	4	4	4	4	4	4	4	4	4	4	4	6:1
	2:1	H	165	82	41	51	51	51	51	51	51	51	51	51	51	6:1
	2:1	M	82	41	20	25	25	25	25	25	25	25	25	25	25	6:1
	2:1	L	23	11	6	6	6	6	6	6	6	6	6	6	6	6:1
	NONE	H	117	64	31	40	34	36	40	32	34	34	34	34	34	6:1
	NONE	M	64	31	20	25	25	25	25	25	25	25	25	25	25	6:1
	NONE	L	16	8	4	4	4	4	4	4	4	4	4	4	4	6:1
HIGH POWER	1:1	H	257	128	64	81	81	81	81	81	81	81	81	81	81	6:1
	2:1	M	128	64	32	40	40	40	40	40	40	40	40	40	40	6:1
	2:1	L	32	16	8	8	8	8	8	8	8	8	8	8	8	6:1
	2:1	H	183	91	45	57	57	57	57	57	57	57	57	57	57	6:1
	2:1	M	91	45	22	28	28	28	28	28	28	28	28	28	28	6:1
	2:1	L	22	11	6	6	6	6	6	6	6	6	6	6	6	6:1
	NONE	H	257	128	64	81	81	81	81	81	81	81	81	81	81	6:1
	NONE	M	128	64	32	40	40	40	40	40	40	40	40	40	40	6:1
	NONE	L	32	16	8	8	8	8	8	8	8	8	8	8	8	6:1

NOTES: (1) MEASUREMENTS WILL BE REPEATED AT THREE (3) RADIAL FIELD POSITIONS (H, V, DIA) (0.5), 50% ZONE (0.5), & FULL FIELD (1.0), X HORIZONTAL TO RIGHT, Y VERTICAL UP.
 (2) THE THREE (3) BASIC ZOOM LENS FOCAL LENGTH SETTINGS CORRESPOND TO MINIMUM MAGNIFICATION (1), MAXIMUM MAGNIFICATION WHEN RETROFIT ZOOM EYEPIECE IS USED (2), & MAXIMUM MAGNIFICATION WHEN INTERUM EYEPIECE IS USED (H). SPECIFIC FOCAL LENGTH VALUES ARE TO BE DETERMINED.
 (3) READINGS ARE RECORDED: HORIZONTAL BAR / VERTICAL BAR

STEP CHANGE	ANAMORPHIC	ZOOM SETTINGS	AT "DUMMY" RETICLE										WITH EYEPIECE										BENCH MODE	
			6:1					1.6:1					6:1					1.6:1					CONTRAST	FIELD POSITION (°)
			0.0	0.5X	1.0X	1.0Y	0.0	0.5X	1.0X	0.5Y	1.0Y	0.0	0.5X	1.0X	0.5Y	1.0Y	0.0	0.5X	1.0X	0.5Y	1.0Y			
		H	107	91/72	81/71	57/72	45/40	57/72	45/40	57/72	45/40	57/72	45/40	57/72	45/40	57/72	45/40	57/72	45/40	57/72	45/40			
		M	64	45/45	40/40	69/51	22/22	69/51	22/22	69/51	22/22	69/51	22/22	69/51	22/22	69/51	22/22	69/51	22/22	69/51	22/22			
		L	116	14/14	18/16	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14	14/14			
		H	145	40/40	36/35	25/45	23/23	25/45	23/23	25/45	23/23	25/45	23/23	25/45	23/23	25/45	23/23	25/45	23/23	25/45	23/23			
		M	23	7/11	7/7	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6	8/6			
		L	117	91/64	57/4	57/64	45/45	57/64	45/45	57/64	45/45	57/64	45/45	57/64	45/45	57/64	45/45	57/64	45/45	57/64	45/45			
		H	64	45/51	45/51	57/57	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29	25/29			
		M	116	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16	16/16			
		L	257	16/144	203/181	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81	76/81			
		H	136	102/81	102/81	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102	81/102			
		M	36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36	36/36			
		L	182	127/127	103/128	91/181	72/81	91/181	72/81	91/181	72/81	91/181	72/81	91/181	72/81	91/181	72/81	91/181	72/81	91/181	72/81			
		H	96	81/71	72/114	40/102	51/51	40/102	51/51	40/102	51/51	40/102	51/51	40/102	51/51	40/102	51/51	40/102	51/51	40/102	51/51			
		M	57	83/16	55/45	25/29	16/13	25/29	16/13	25/29	16/13	25/29	16/13	25/29	16/13	25/29	16/13	25/29	16/13	25/29	16/13			
		L	257	144/144	127/128	144/128	64/64	144/128	64/64	144/128	64/64	144/128	64/64	144/128	64/64	144/128	64/64	144/128	64/64	144/128	64/64			
		H	186	102/114	81/102	102/81	45/51	102/81	45/51	102/81	45/51	102/81	45/51	102/81	45/51	102/81	45/51	102/81	45/51	102/81	45/51			
		M	36	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32	32/32			

NOTES: (1) MEASUREMENTS WILL BE REPEATED AT THREE (3) RADIAL FIELD POSITIONS (H), AXIAL (O), 50% ZONE (O.S), & FULL FIELD (O), X HORIZONTAL TO RIGHT, Y VERTICAL UP.
 (2) THE THREE (3) BASIC ZOOM LENGTH SETTINGS CORRESPOND TO MINIMUM MAGNIFICATION (L), MAXIMUM MAGNIFICATION WHEN RETROFIT ZOOM EYEPIECE IS USED (M), & MAXIMUM MAGNIFICATION WHEN INTERIM EYEPIECE IS USED (H). SPECIFIC FOCAL LENGTH VALUES ARE TO BE CALIBRATED.
 (3) READINGS ARE RECORDED: HORIZONTAL BAR/VERTICAL BAR.

SPECIAL HANDLING - SECRET

f. OBSERVER 62
03 SEP 68
 DATE _____
 TIME _____
 TEMP _____ OF

APPROVED FOR RELEASE

TITLE: BREF.

SPECIAL CONDITIONS:

STEP CHANGE	ANAMORPHIC	ZOOM SETTING	AT "DUMMY" RETICLE		WITH EYEPIECE		BENCH MODE							
			6:1	1.6:1	6:1	1.6:1	CONTRAST	FIELD POSITION						
			0.0	0.5X	1.0X	0.0	0.5X	1.0X	0.0	0.5X	1.0X			
LOW POWER	L	1.6	77/58	57/58	43/38	79/82	54/51	79/82	54/51	79/82	54/51			
	M	6.4	78/48	40/46	30/29	41/46	30/29	41/46	30/29	41/46	30/29			
	H	1.6	15/14	15/16	19/11	19/12	19/11	19/12	19/11	19/12	19/11			
	L	16.5	72/46		22/22	34/34	31/31	34/34	31/31	34/34	31/31			
	M	9.1	57/43		27/39	27/39	27/39	27/39	27/39	27/39	27/39			
	H	2.7	7/11		7/6	7/6	7/6	7/6	7/6	7/6	7/6			
HIGH POWER	L	11.7	77/58	57/58	43/38	79/82	54/51	79/82	54/51	79/82	54/51			
	M	6.4	78/48	40/46	30/29	41/46	30/29	41/46	30/29	41/46	30/29			
	H	1.6	15/14	15/16	19/11	19/12	19/11	19/12	19/11	19/12	19/11			
	L	25.7	153/104		55/75	181/127	55/75	181/127	55/75	181/127	55/75			
	M	13.6	102/102		51/57	47/47	51/57	47/47	51/57	47/47	51/57			
	H	3.6	34/34		21/22	17/21	21/22	17/21	21/22	17/21	21/22			

NAME _____ INITIAL CONDITION _____ CONFIGURATION _____ TARGET _____ COMMENTS _____

OBSERVER _____ DATE _____ TIME _____ TEMP _____

AVIATION - TWO - 28-10-1964

NOTES: (1) MEASUREMENTS WILL BE REPEATED AT THREE (3) RADIAL FIELD POSITIONS (H, AXIAL (O), 50% ZONE (D), & FULL FIELD (L), X HORIZONTAL TO RIGHT, Y VERTICAL, UP)

(2) THE THREE (3) BASIC ZOOM LENS FOCAL LENGTH SETTINGS CORRESPOND TO MINIMUM MAGNIFICATION (L), MAXIMUM MAGNIFICATION WHEN RETROFIT ZOOM EYEPIECE IS USED (M), & MAXIMUM MAGNIFICATION WHEN INTERIM EYEPIECE IS USED (H). SPECIFIC FOCAL LENGTH VALUES ARE TO BE SPECIFIED.

(3) READINGS ARE RECORDED: HORIZONTAL BAR/VERTICAL BAR.