50% Resolution Grids

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[1] `$Header: /EHamilton/General Information/Targets/Target.tex 2 12/26/06 9:39a Ehamilton $`

1 Resolution Grid [resolutiongrid]

To aid in determining the resolution of PTZ cameras,a set of grids with 50% black/white pattern which are 0.1^o wide, Have been developed for use at different distances from the camera being tested.

The method of calculating the angular distance required for 0.1^o movement at various distances away from the camera is:

$$\pi = 3.1415926$$

$$c = 2 \times \pi \times r$$

$$a = (c \times 12)/(360 \times 10)$$

Where:

- a = Arc of 0.1^o width in inches.
- c = Circumference of a circle.
- r = Radius of a circle in feet.
- 2 = Factor between diameter and radius of a circle.
- 10 = Conversion factor from whole degrees to tenths of a degree.
- 12 = Conversion factor from feet to inches.
- 360 = Degrees in a circle.

For example at 48 feet from the camera, 0.1^o of angular distance is 1.01 inch long. (Or 1.005300032 inch if more accuracy is needed.)

1.1 How to use the grids

The included grids in this note are designed for use at ranges of 2 to 11 feet in full foot increments and from 12 to 56 feet in even foot increments, between the camera and the grid[2].

1. More than one of these may be used at any one time. I.e. there may be two places that it is reasonable to point a camera at which may be on different walls, or other convenient surface, which may be at different, or the same, distances. Thus two grids would be used for the same series of tests.
2. When selecting a grid to use it should be remembered that the distance to be used is the estimated distance from the camera's "image point". This may or may not be the front of the lens of the camera.

[2]Grids may be generated for other distances if needed.

3. As a reasonably accurate indication of distance, it should be remembered that ceiling tiles are two feet on a side (some are two by four with a line down the middle). Over any reasonable distance any errors average out and the result is quite accurate. (Usually better than ±1inch.)

4. To easily calculate distance, count full tiles and double, or quadruple, their number. (Ceiling tiles being either 2 feet by 4 feet, or 2 feet by 2 feet in size.) The result is the distance between the camera and the grid.

5. When using these grids, their accuracy improves somewhat when longer distances are used. The recommended distances to use with these grids are in the 40's of feet (40, 42, 44, 46 and 48).

6. If distances other than those provided in this set of foot distances are needed please let me know and I'll generate some more grids. I am only setup to generate grids on 8 $\frac{1}{2}$ by 11 inch paper in portrait format and in whole foot distances. I.e. no landscape formats, no metric distances and no "bigger" paper. (If it is important the distances (feet and inches, metric, etc.) for which the grids are generated at may be changed.)

7. Always remember that custom grids are made on request. So a grid may be made for almost any reasonable distance. The only limitations are the size of the paper and the resolution of the printer[3].

8. An accuracy of $\pm.1^o$ is interpreted to mean: "The unit will point to within $.1^o$ from where it is supposed to point. The pointing is to be within a square box that has equal length sides of $.2^o$ and the aiming point is to be in the center of the box. This is different than using a circle with a radius of $.1^o$."

A note on the accuracy of the grids

Accuracy in the generation of the grid is controlled by the quality of the printer used to print it out and the number of times that the individual grid has been reproduced.

The generated PDF file is correct, however the actual printing process sometimes introduces sizeing errors. When paper is wrapped around a drum, as it is with most laser printers, one surface is longer (one side is on the outside of the circle so its radius is slightly longer than the other side's is).

While the paper direction that is longitudinal to the cylinder is almost always "correct". This results in dimensions in one direction being somewhat better than those in the other direction.

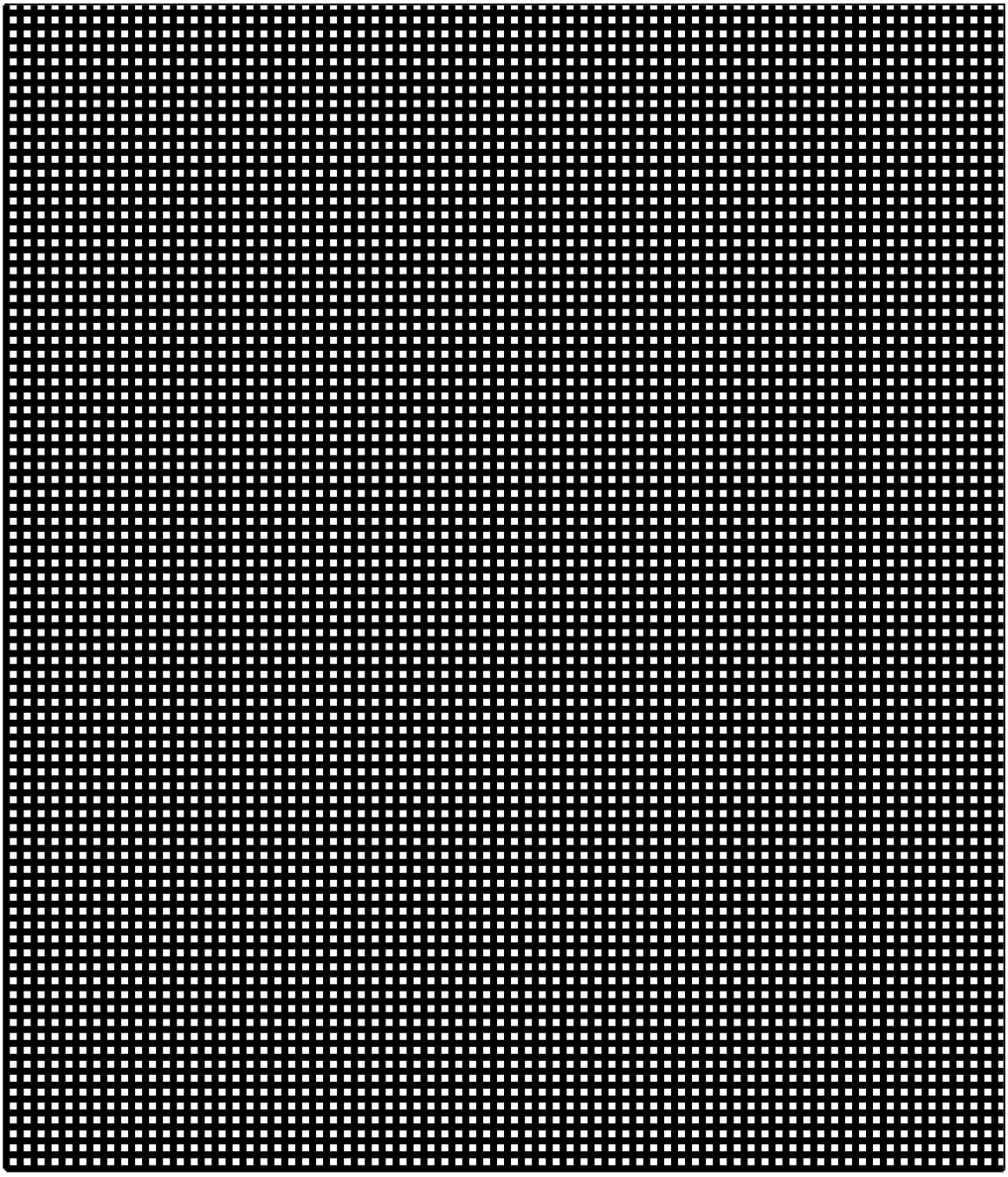
[3] And the attitude of the author!

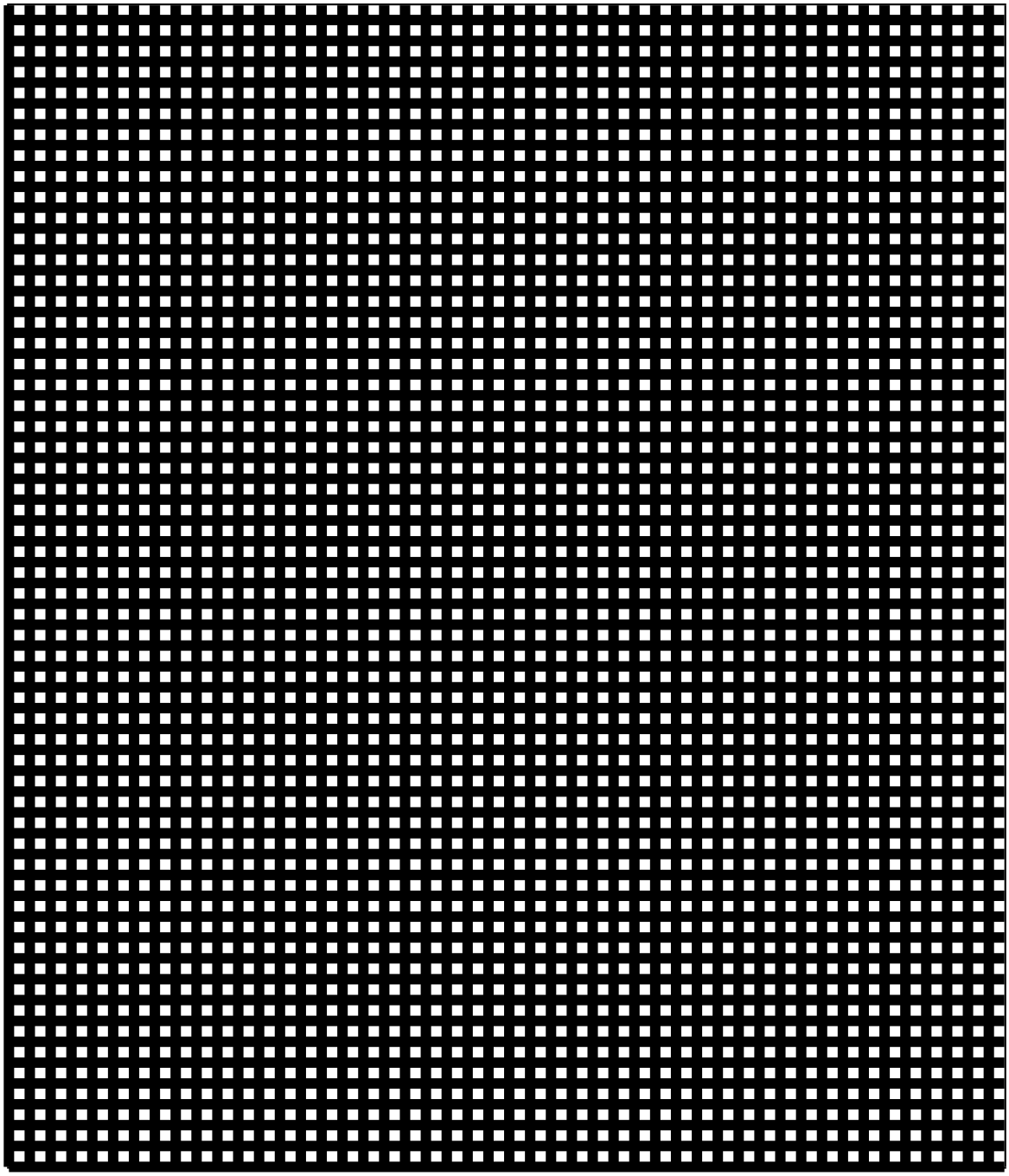
d	a	d	a	d	a	d	a
2	0.041887501	34	0.712087523	66	1.382287544	98	2.052487565
4	0.083775003	36	0.753975024	68	1.424175045	100	2.094375067
6	0.125662504	38	0.795862525	70	1.466062547	102	2.136262568
8	0.167550005	40	0.837750027	72	1.507950048	104	2.178150069
10	0.209437507	42	0.879637528	74	1.549837549	106	2.220037571
12	0.251325008	44	0.921525029	76	1.591725051	108	2.261925072
14	0.293212509	46	0.963412531	78	1.633612552	110	2.303812573
16	0.335100011	48	1.005300032	80	1.675500053	112	2.345700075
18	0.376987512	50	1.047187533	82	1.717387555	114	2.387587576
20	0.418875013	52	1.089075035	84	1.759275056	116	2.429475077
22	0.460762515	54	1.130962536	86	1.801162557	118	2.471362579
24	0.502650016	56	1.172850037	88	1.843050059	120	2.513250080
26	0.544537517	58	1.214737539	90	1.884937560	122	2.555137581
28	0.586425019	60	1.256625040	92	1.926825061	124	2.597025083
30	0.628312520	62	1.298512541	94	1.968712563	126	2.638912584
32	0.670200021	64	1.340400043	96	2.010600064	128	2.680800085

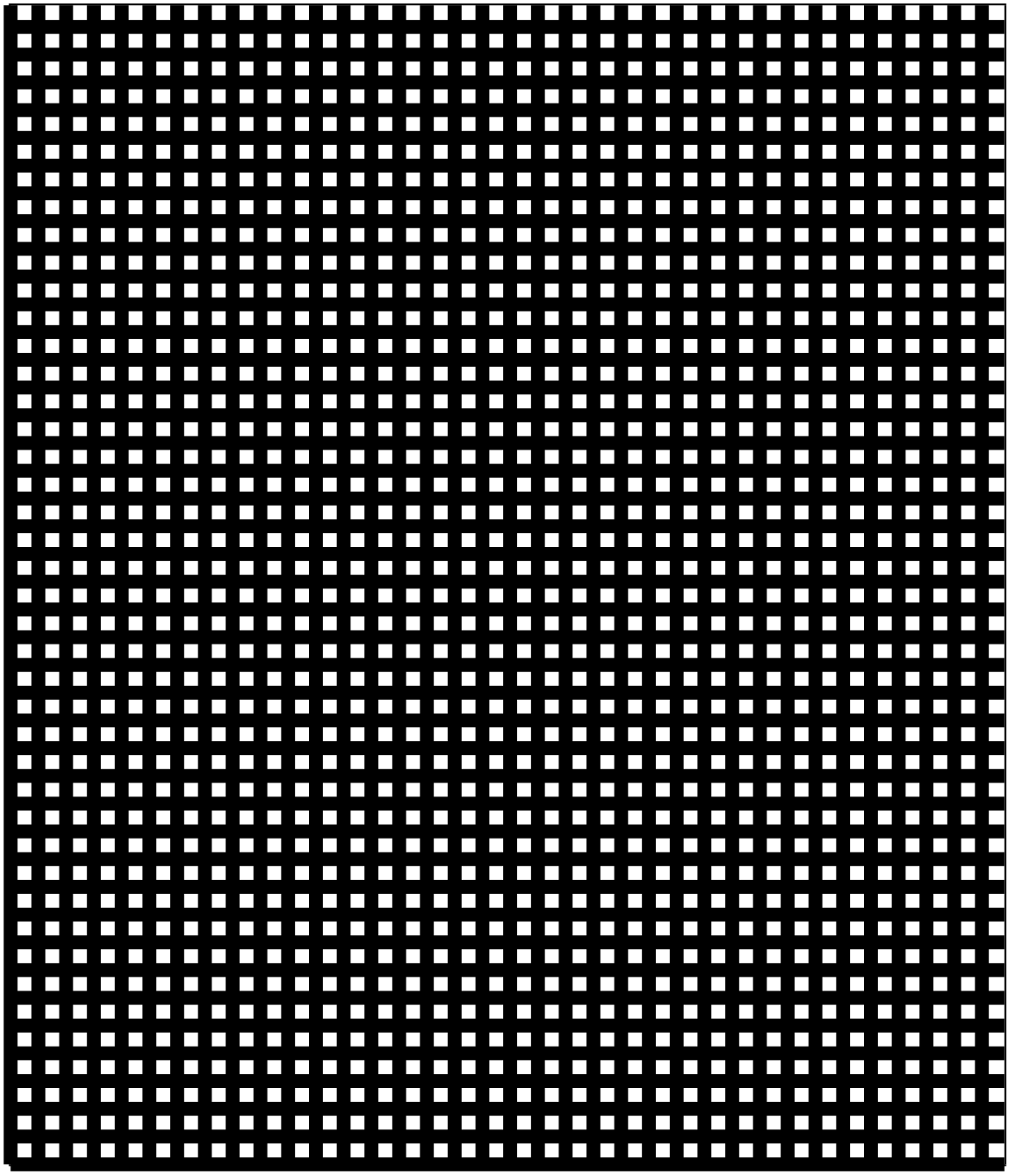
Table 1. Full Table of 0.1^o widths `[fulltable]`

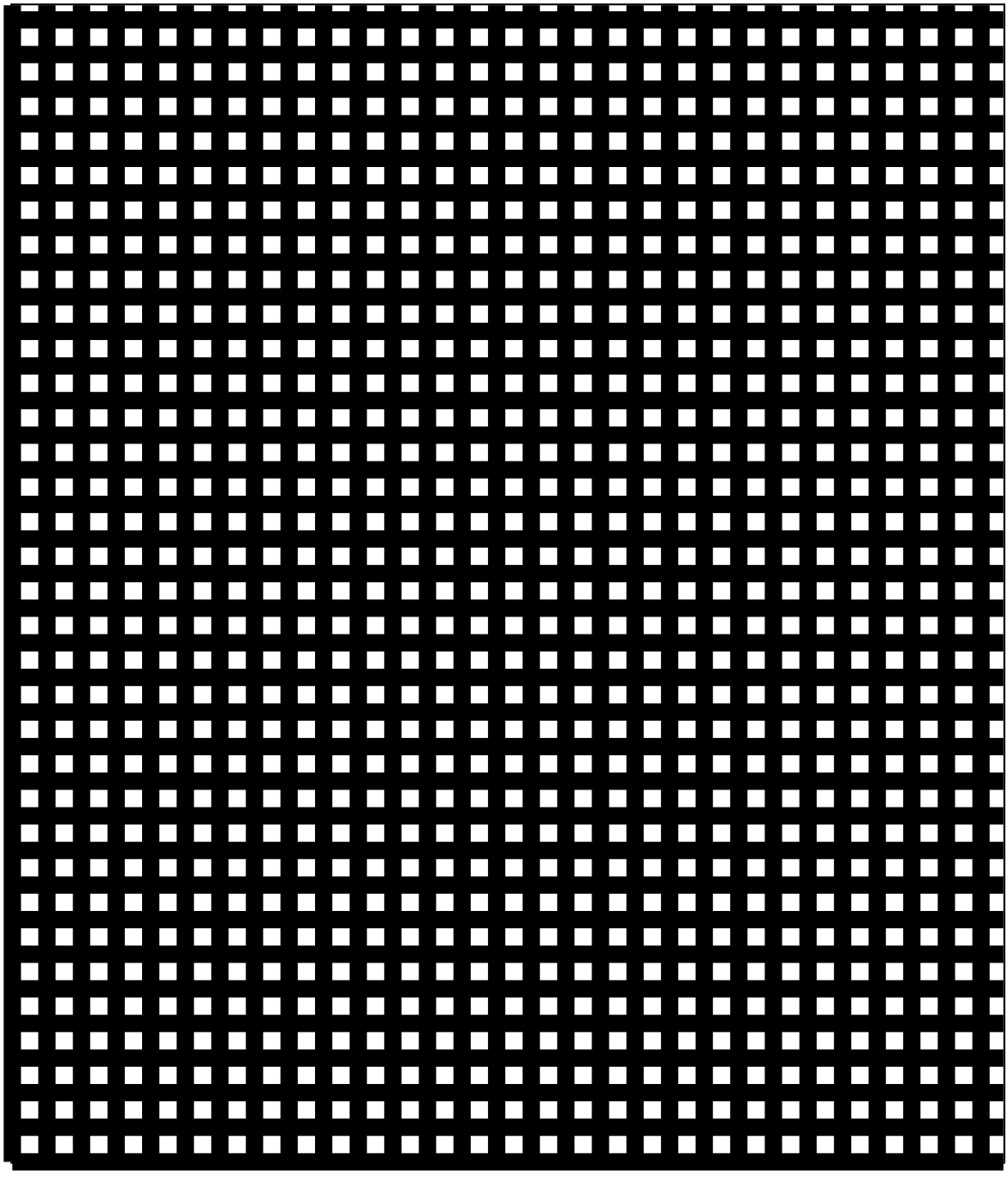
d	a	d	a	d	a	d	a
2	0.042	34	0.71	66	1.38	98	2.05
4	0.084	36	0.75	68	1.42	100	2.09
6	0.126	38	0.80	70	1.47	102	2.14
8	0.168	40	0.84	72	1.51	104	2.18
10	0.209	42	0.88	74	1.55	106	2.22
12	0.251	44	0.92	76	1.59	108	2.26
14	0.293	46	0.96	78	1.63	110	2.30
16	0.335	48	1.01	80	1.68	112	2.35
18	0.377	50	1.05	82	1.72	114	2.39
20	0.419	52	1.09	84	1.76	116	2.41
22	0.461	54	1.13	86	1.80	118	2.47
24	0.503	56	1.17	88	1.84	120	2.51
26	0.545	58	1.21	90	1.88	122	2.56
28	0.586	60	1.26	92	1.92	124	2.60
30	0.628	62	1.30	94	1.97	126	2.64
32	0.670	64	1.34	96	2.01	128	2.68

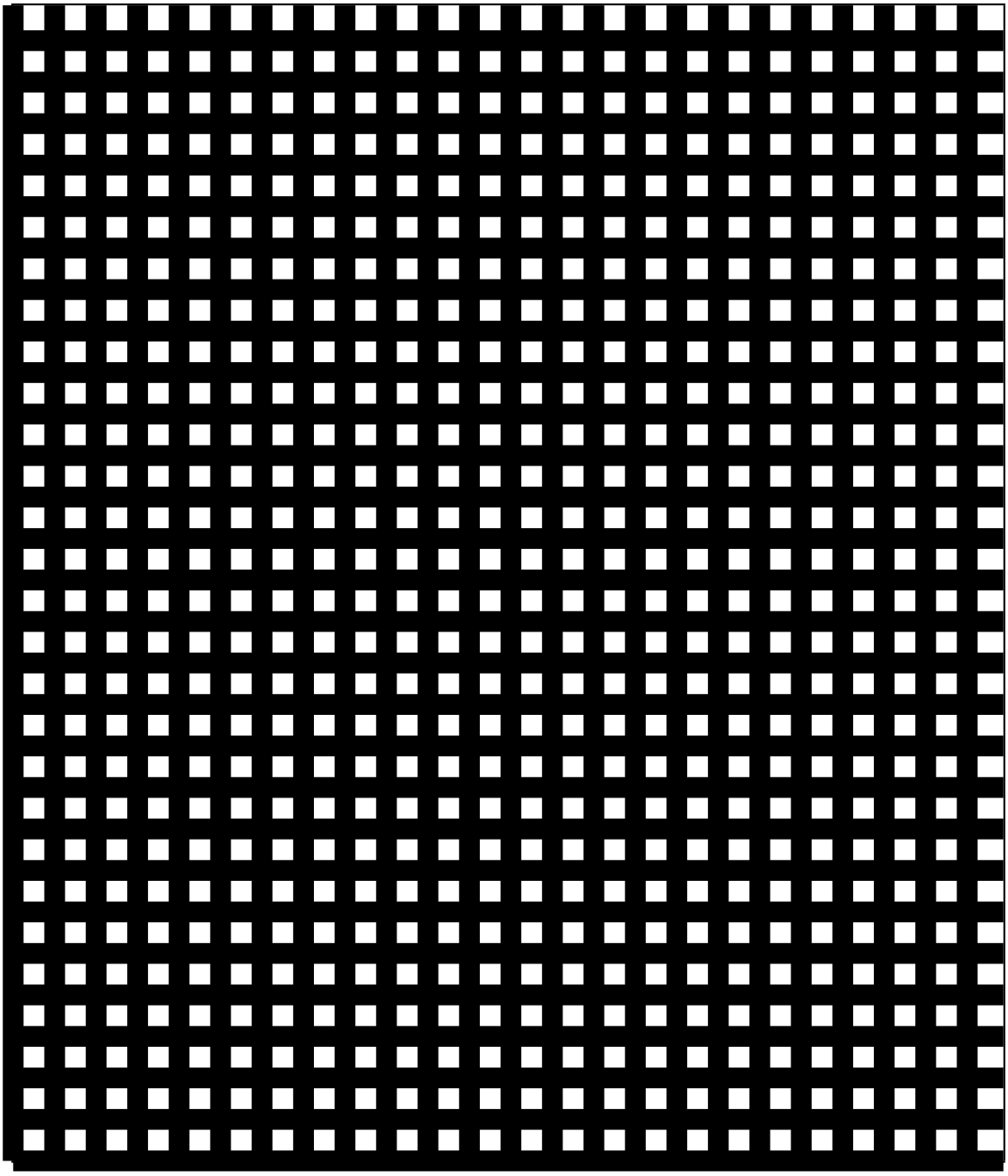
Table 2. Rounded Values of 0.1^o widths `[roundedvalues]`

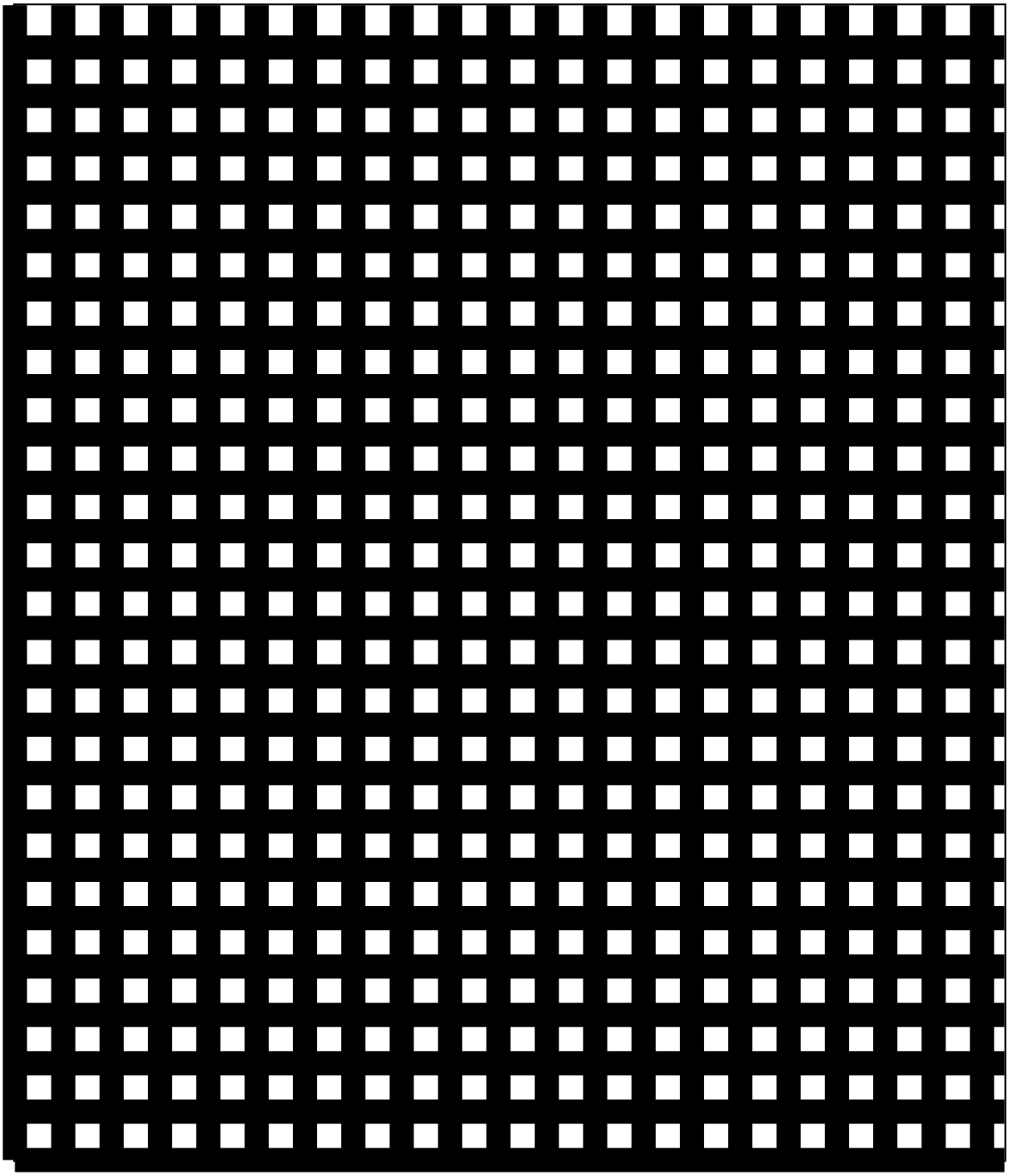


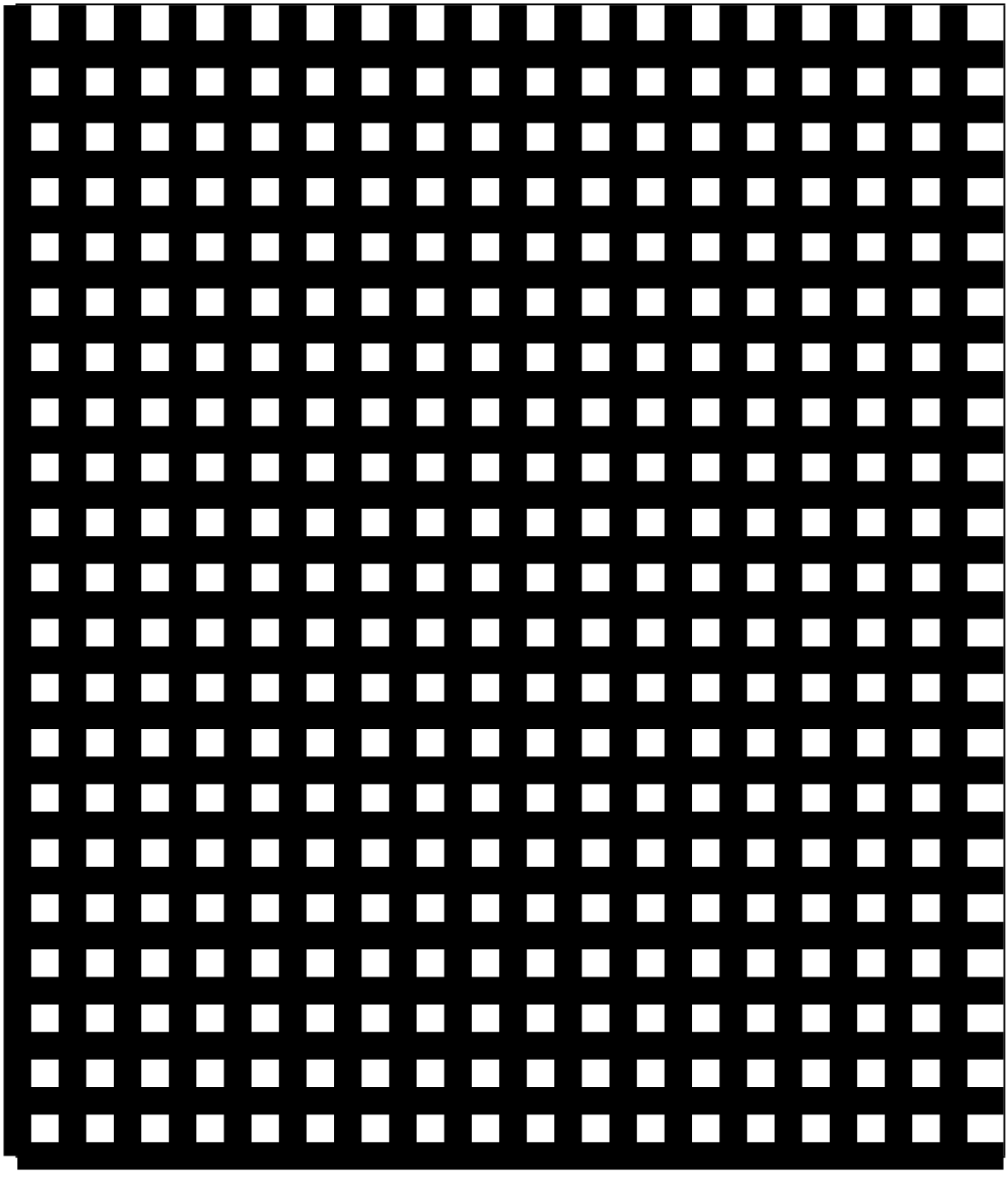


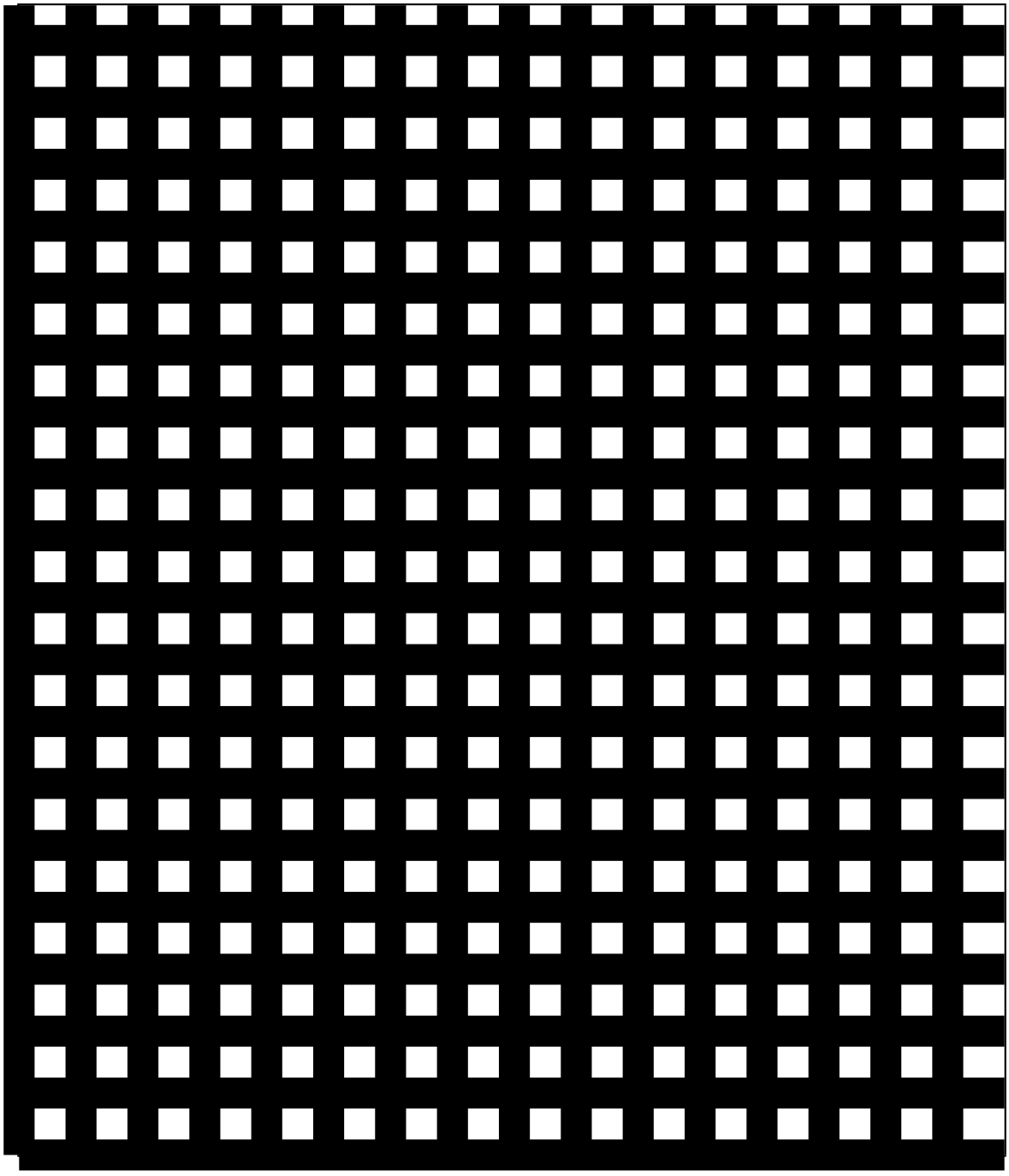


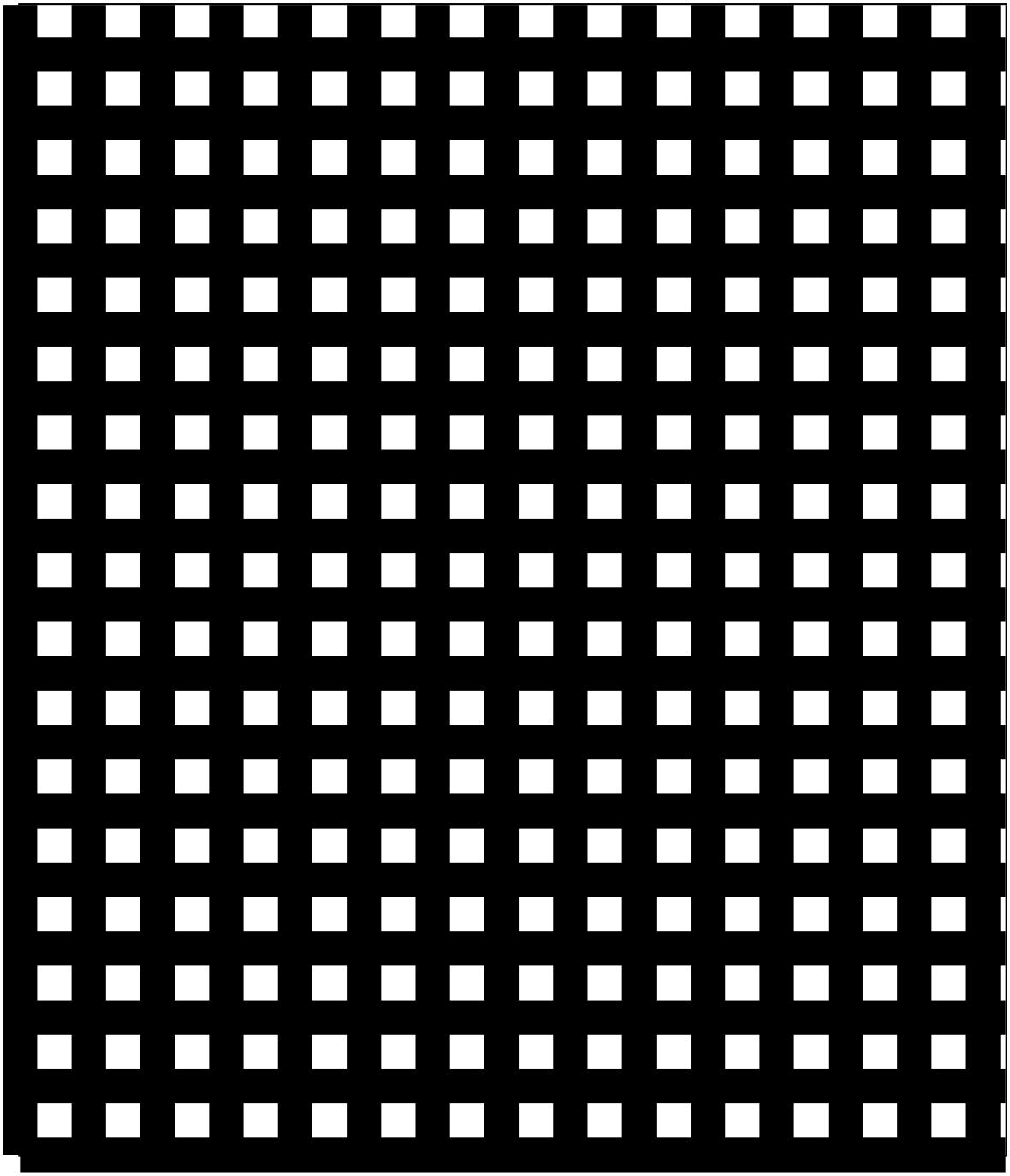


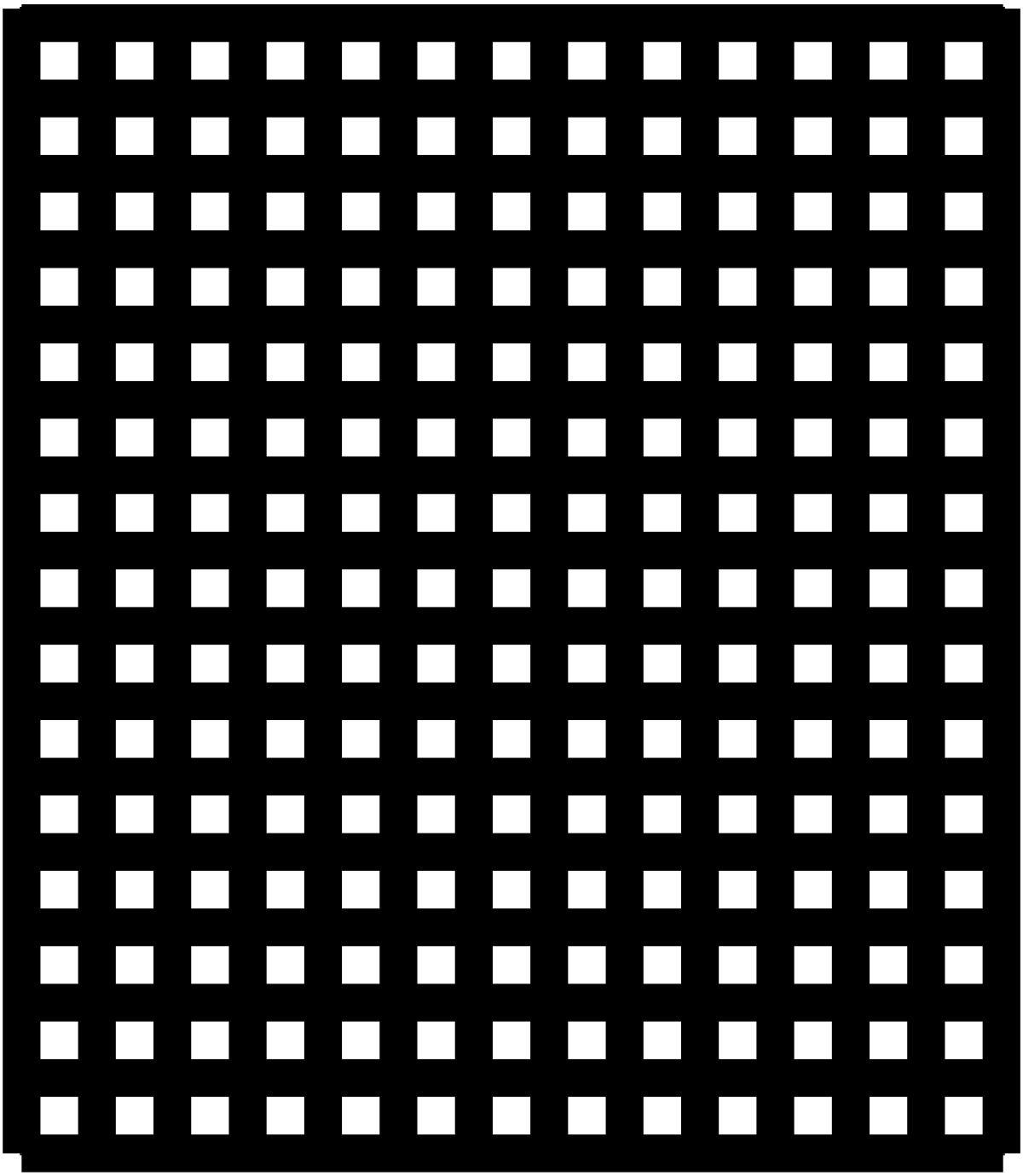


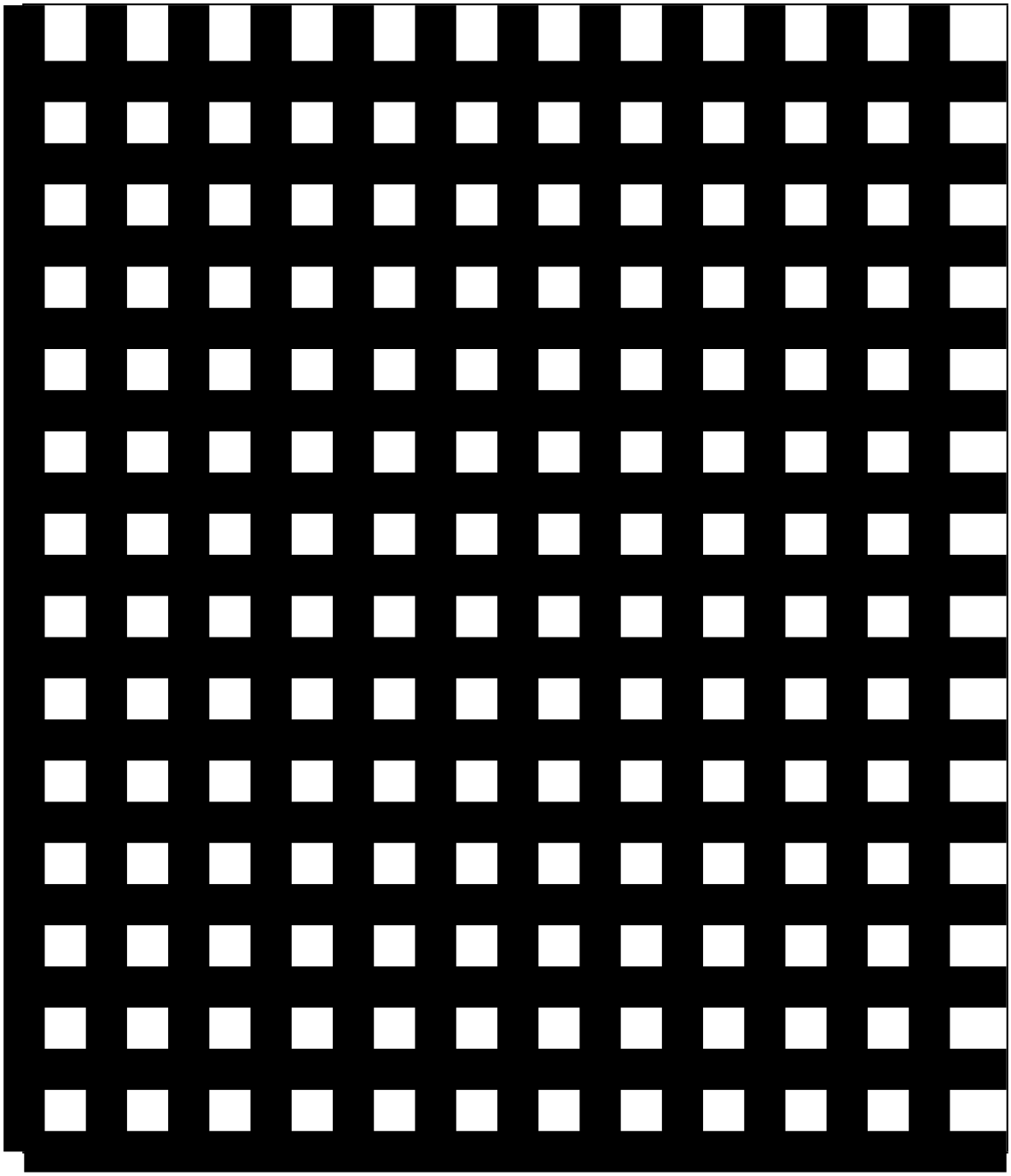


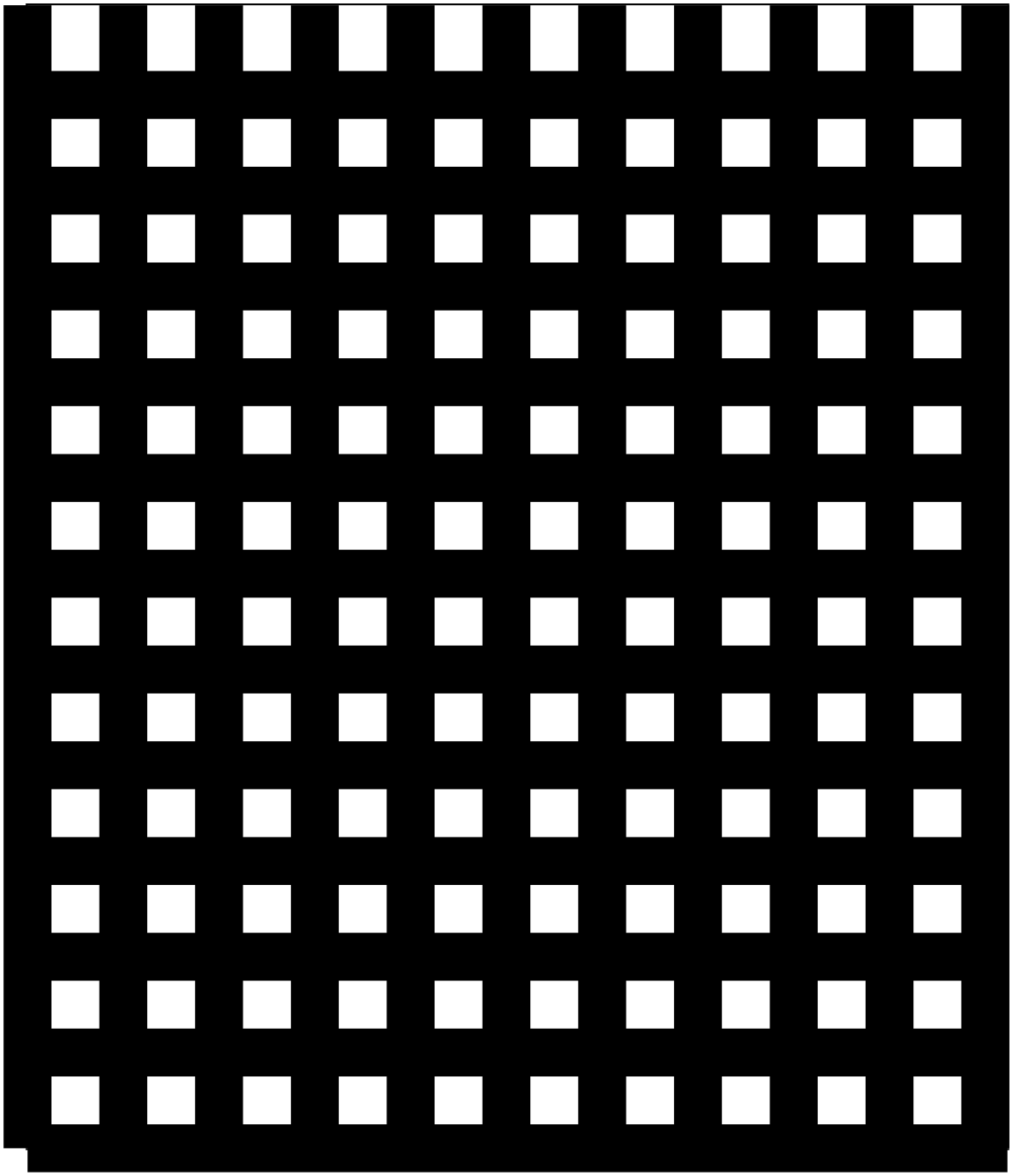


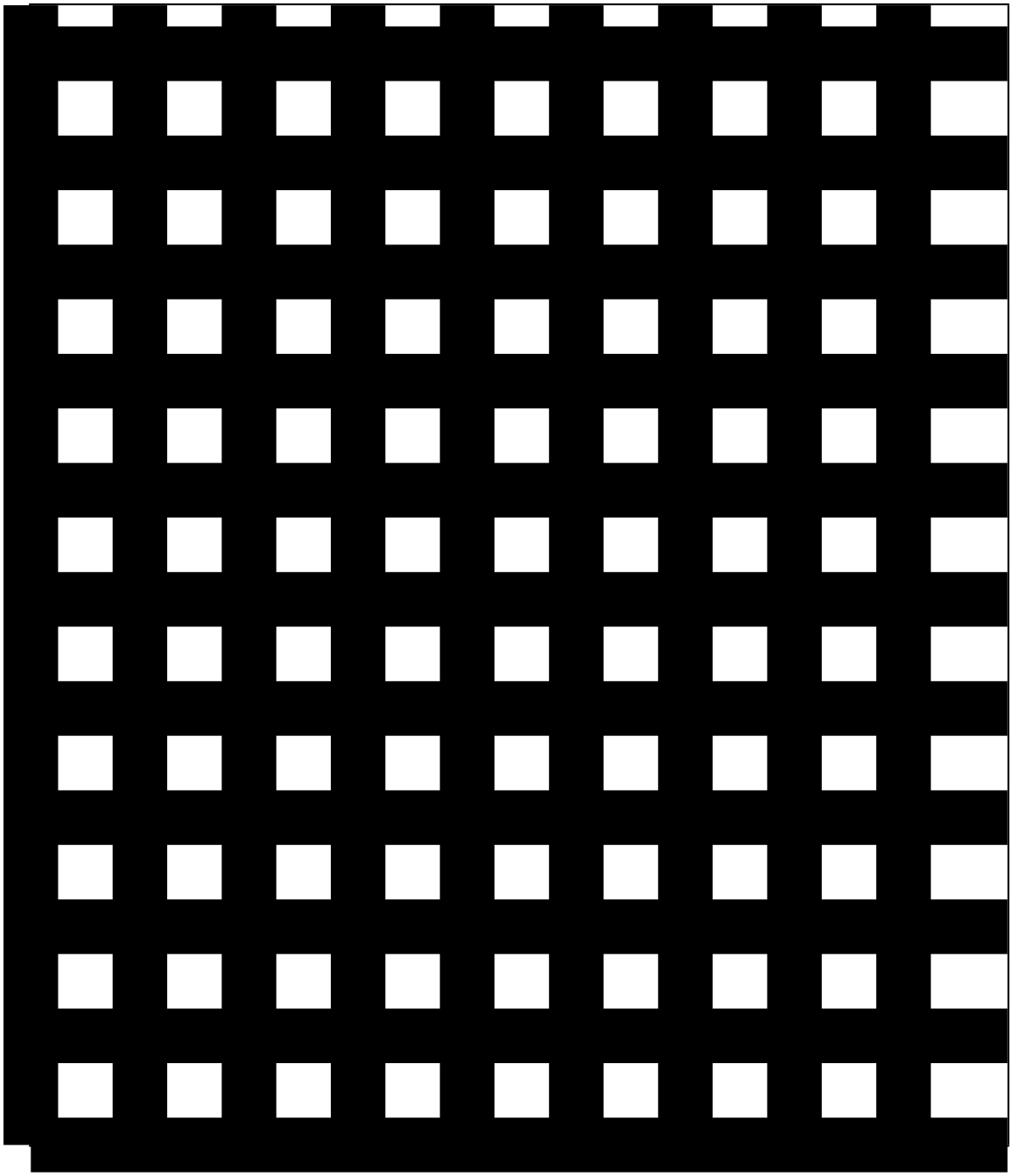


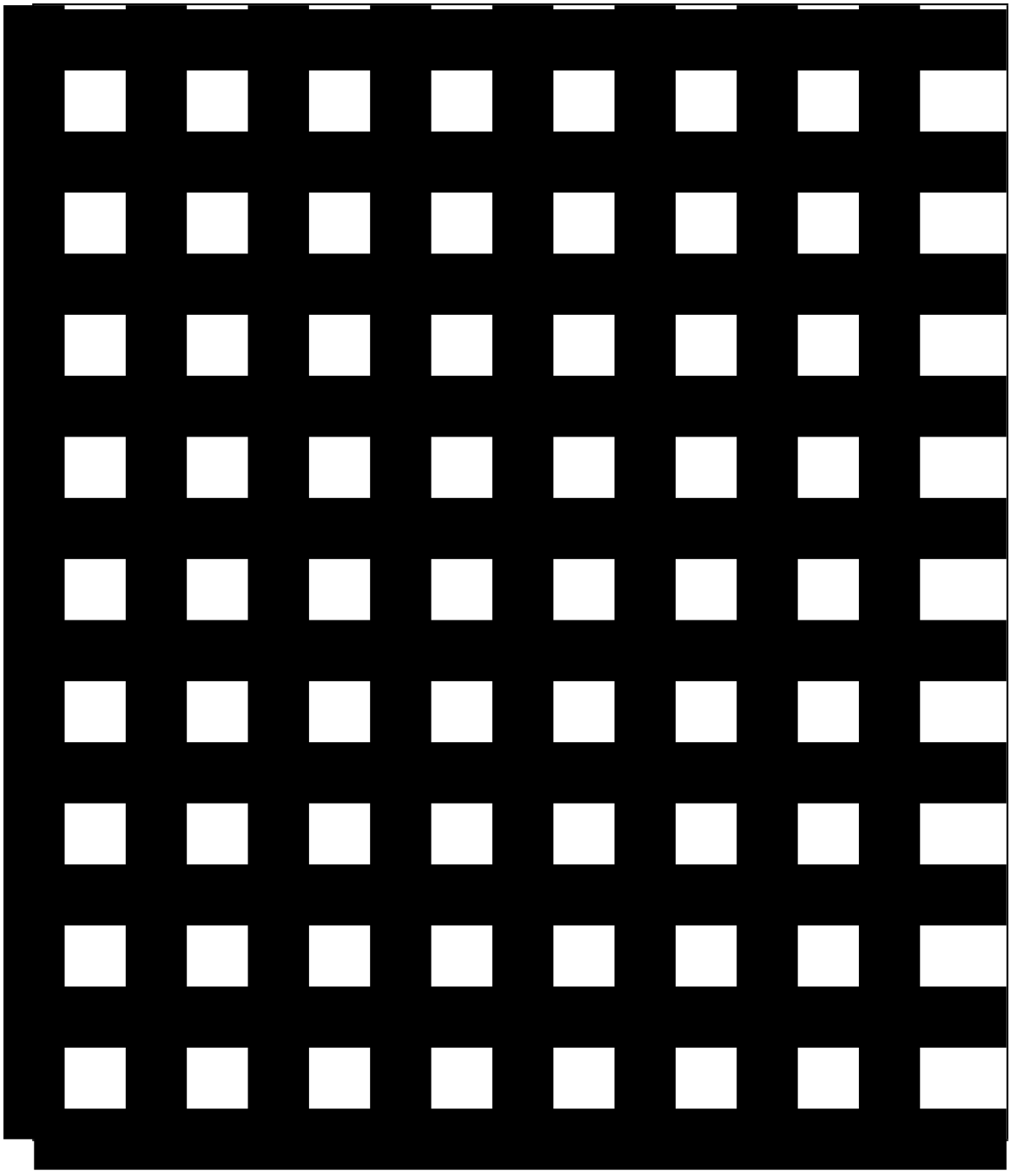


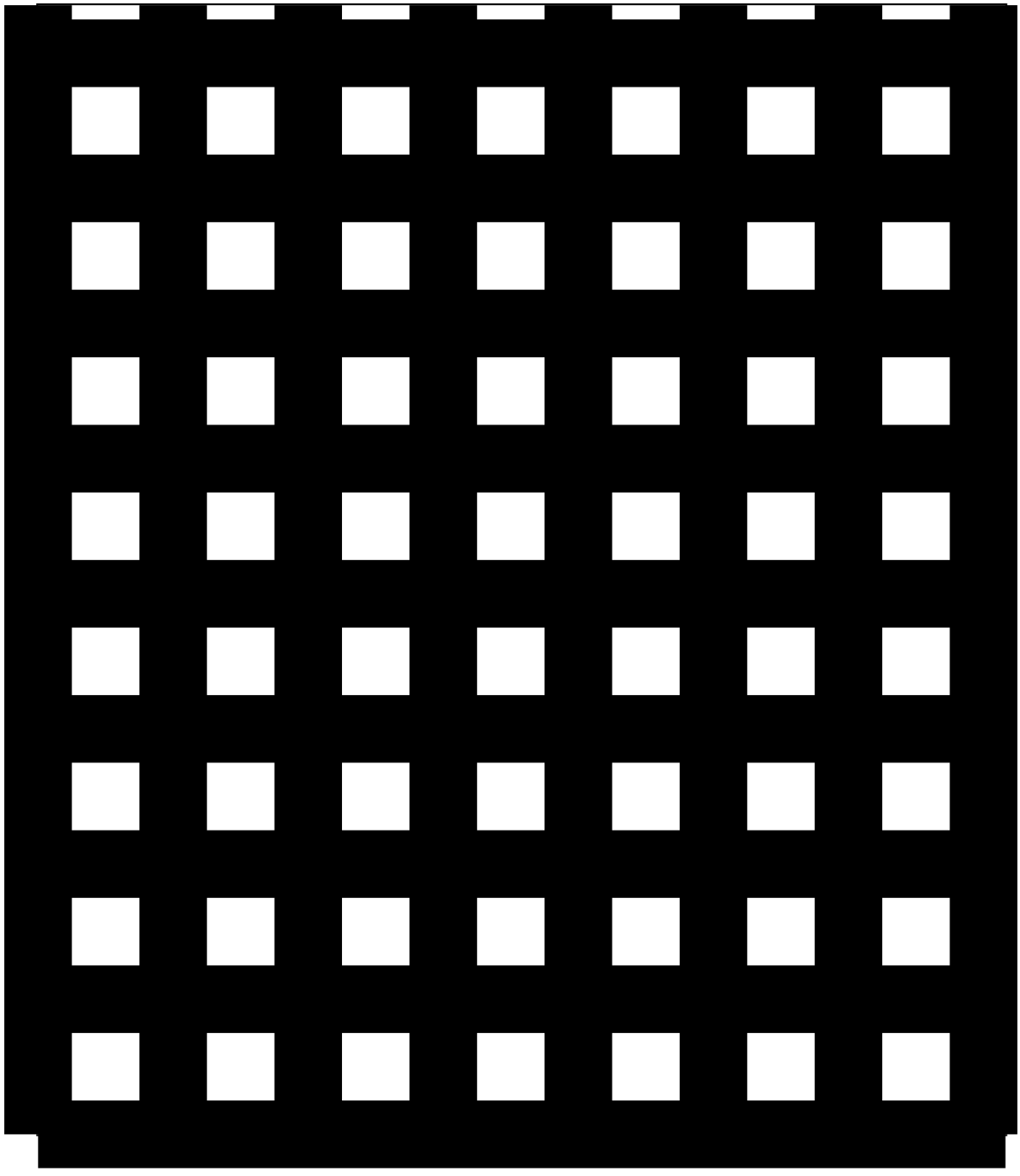


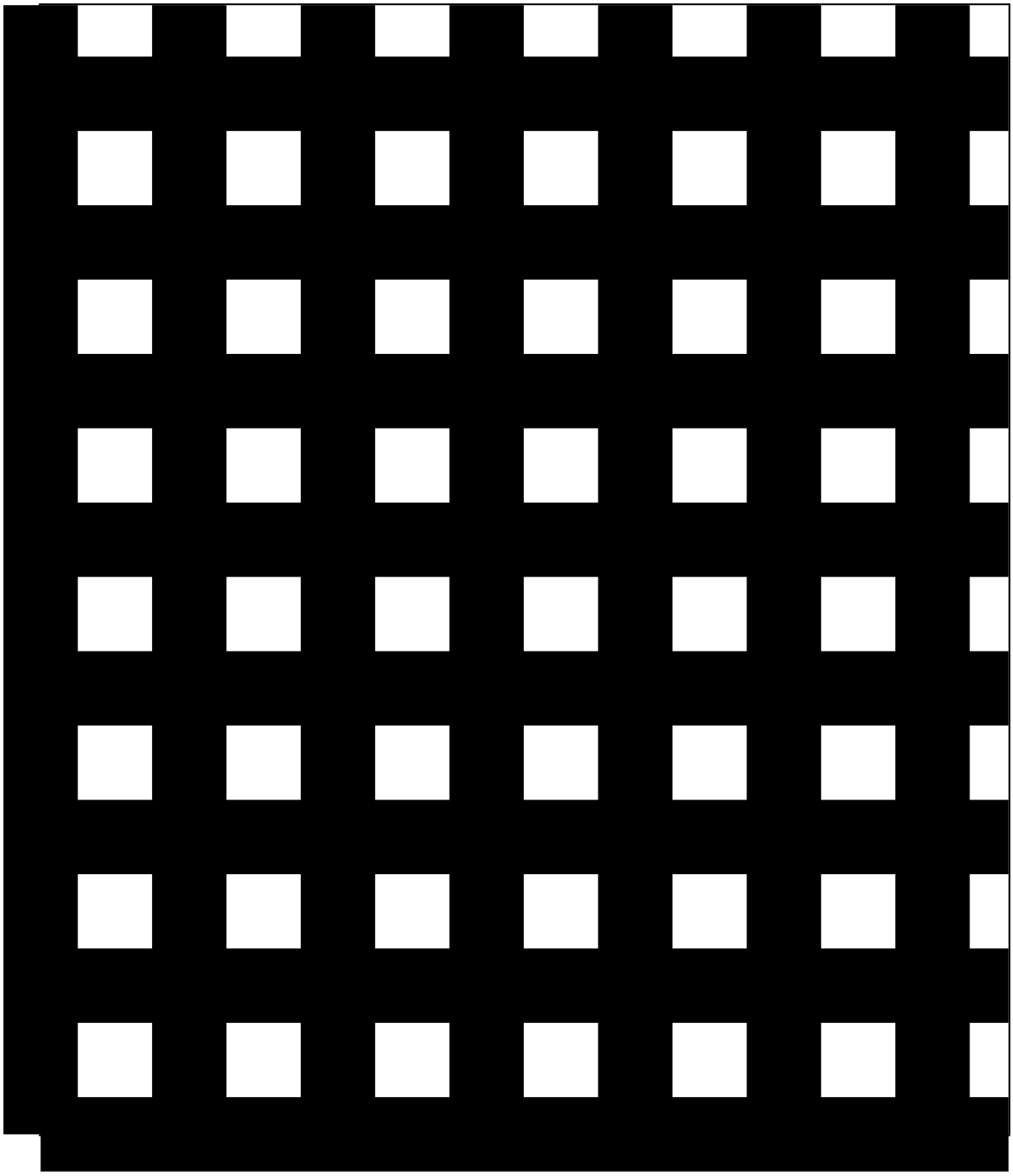


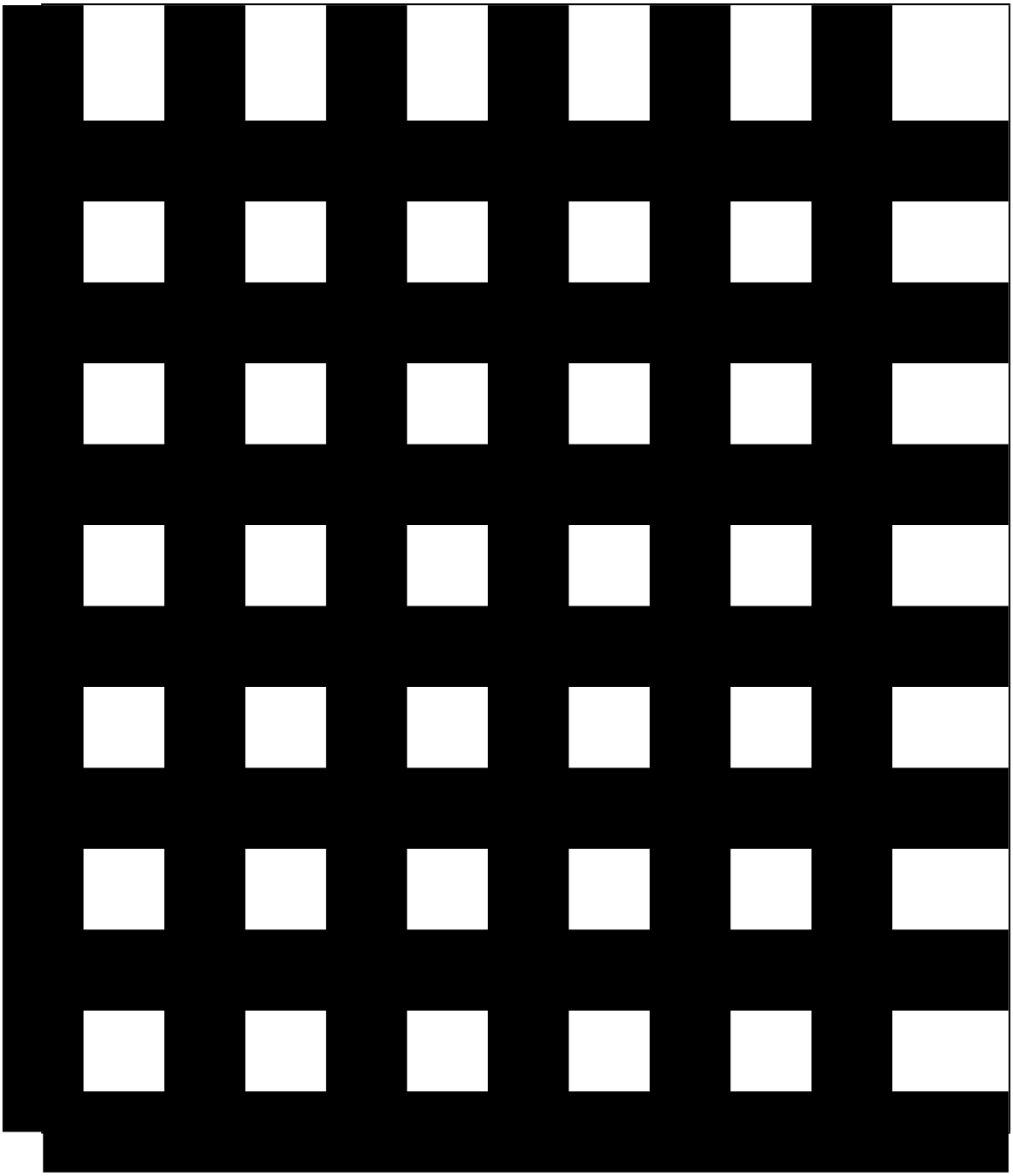


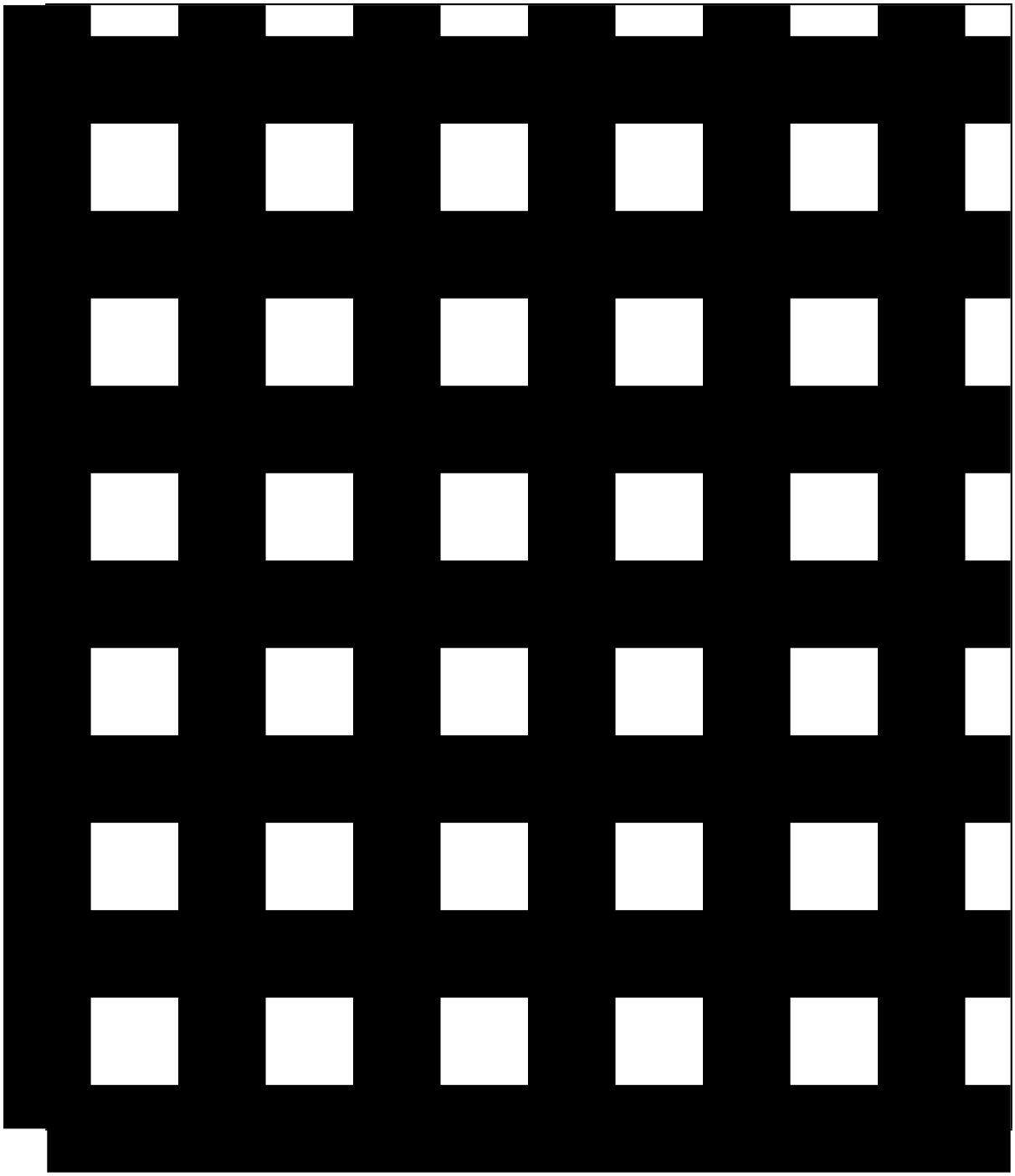


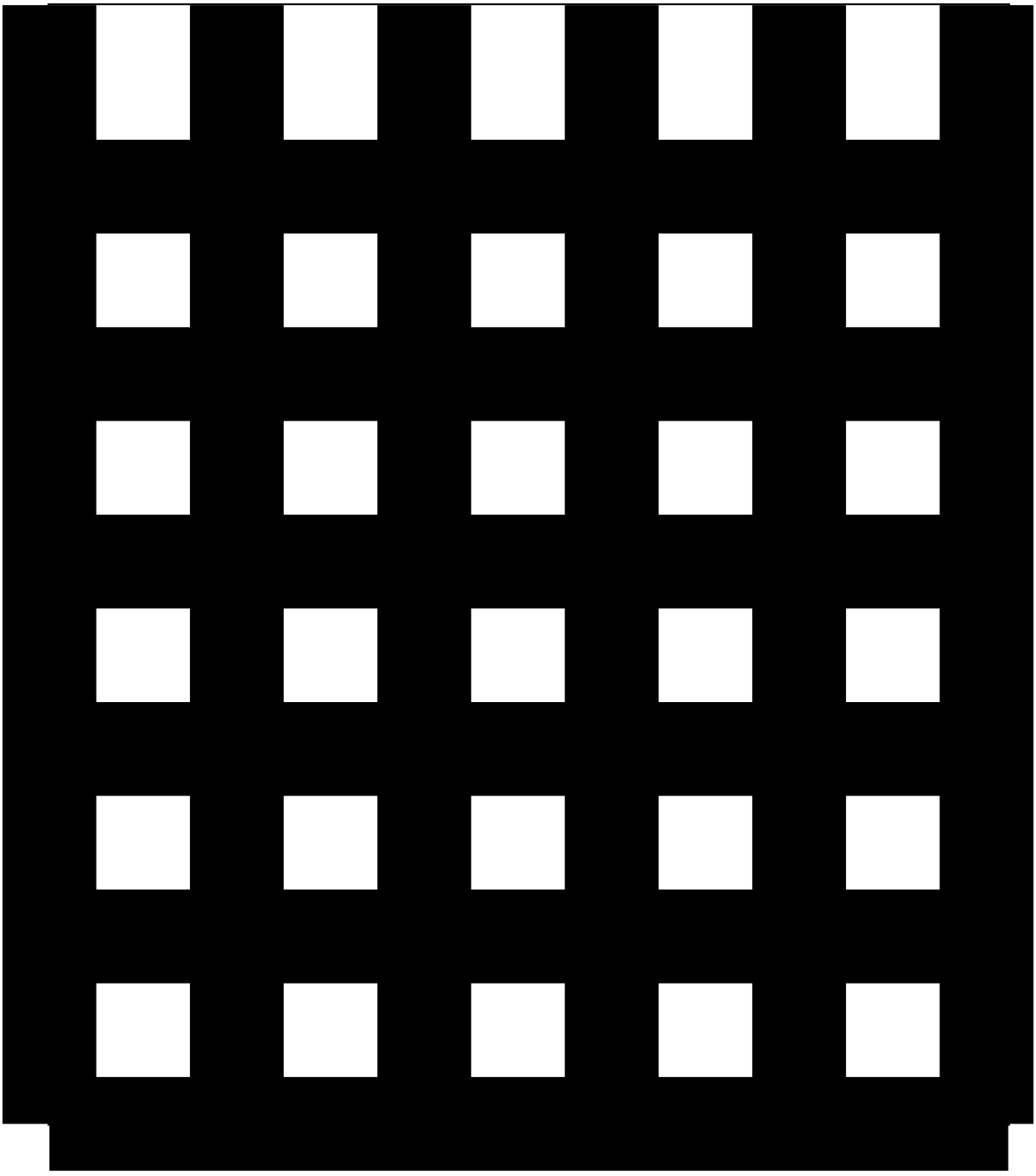


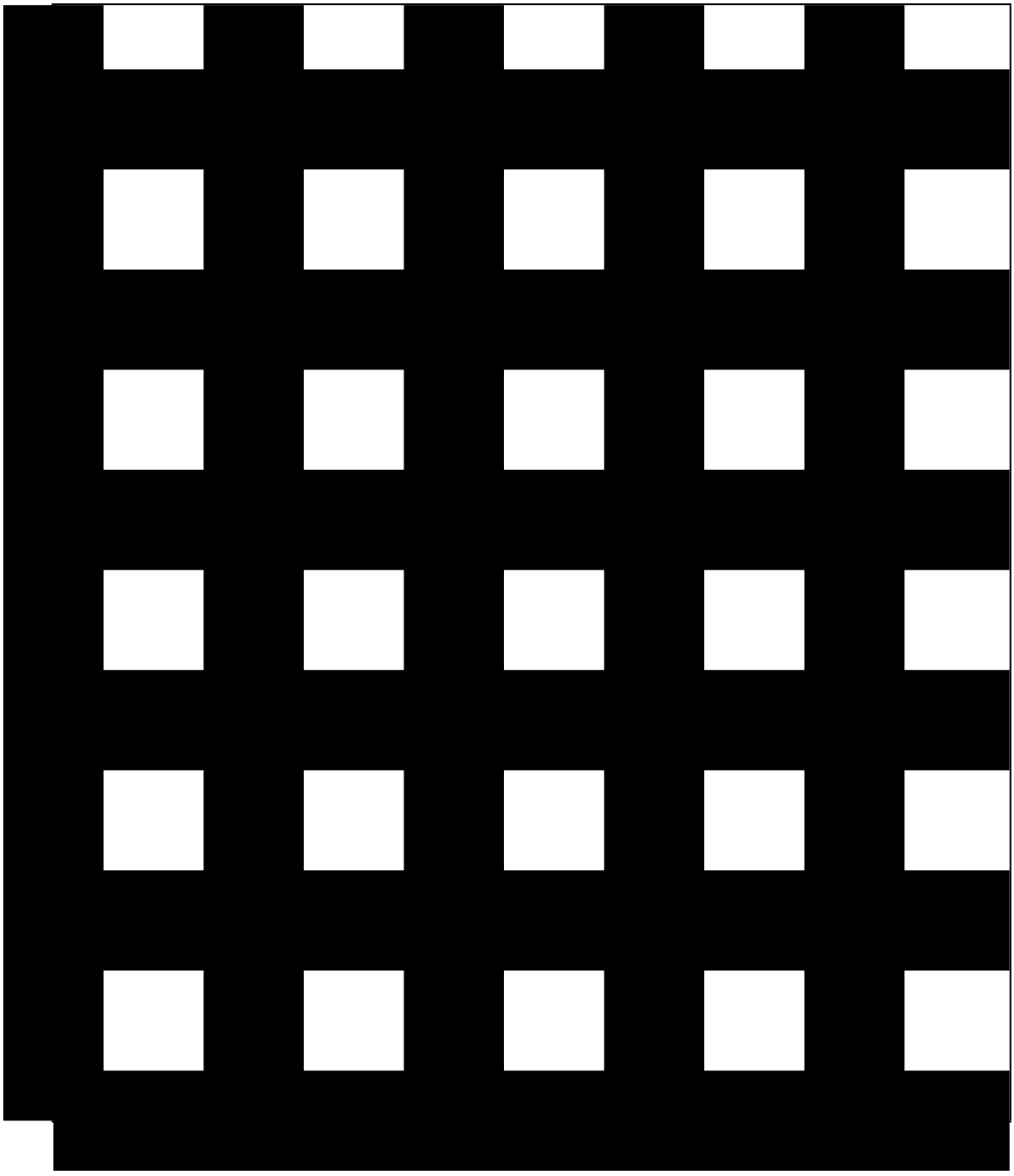


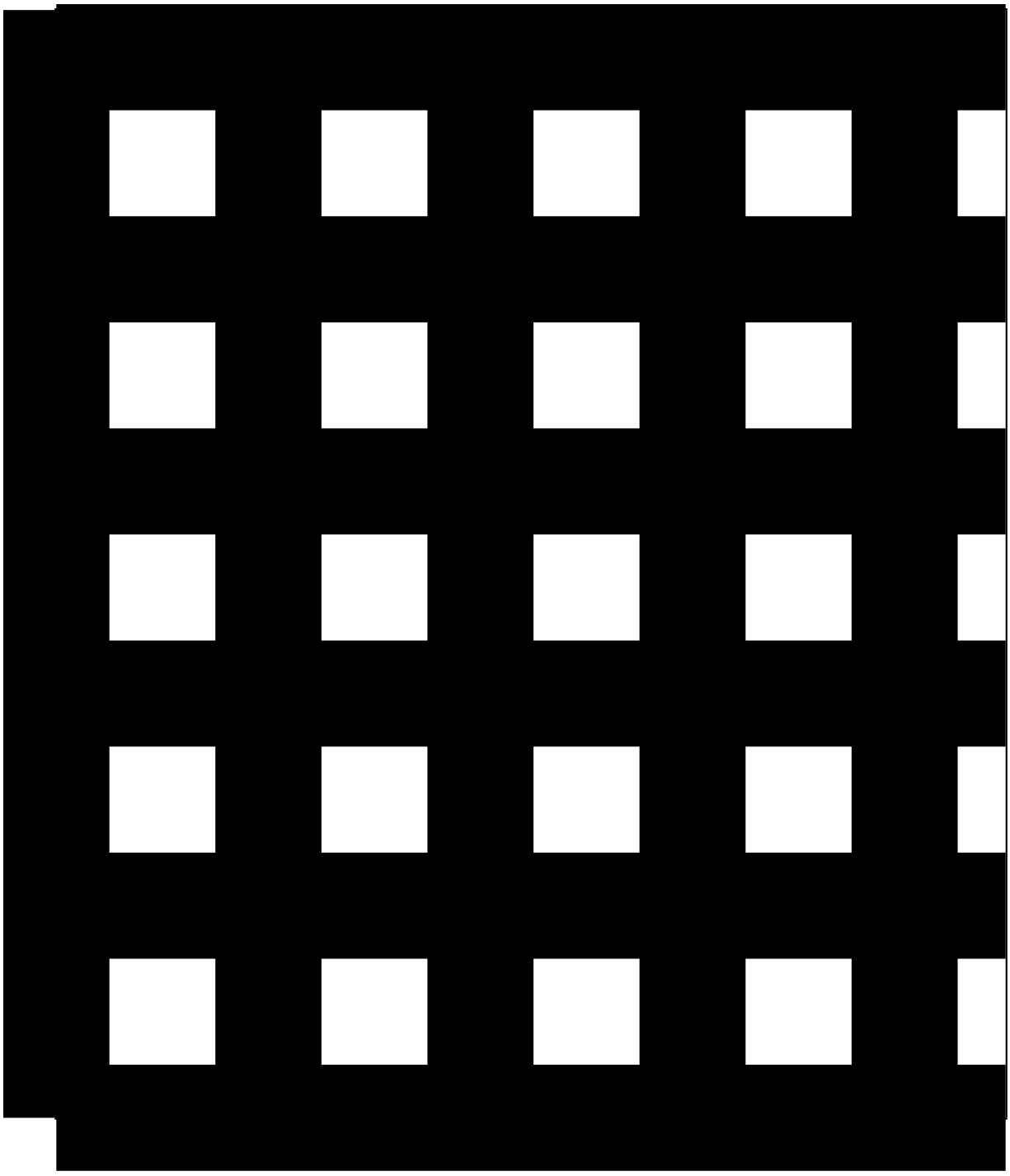


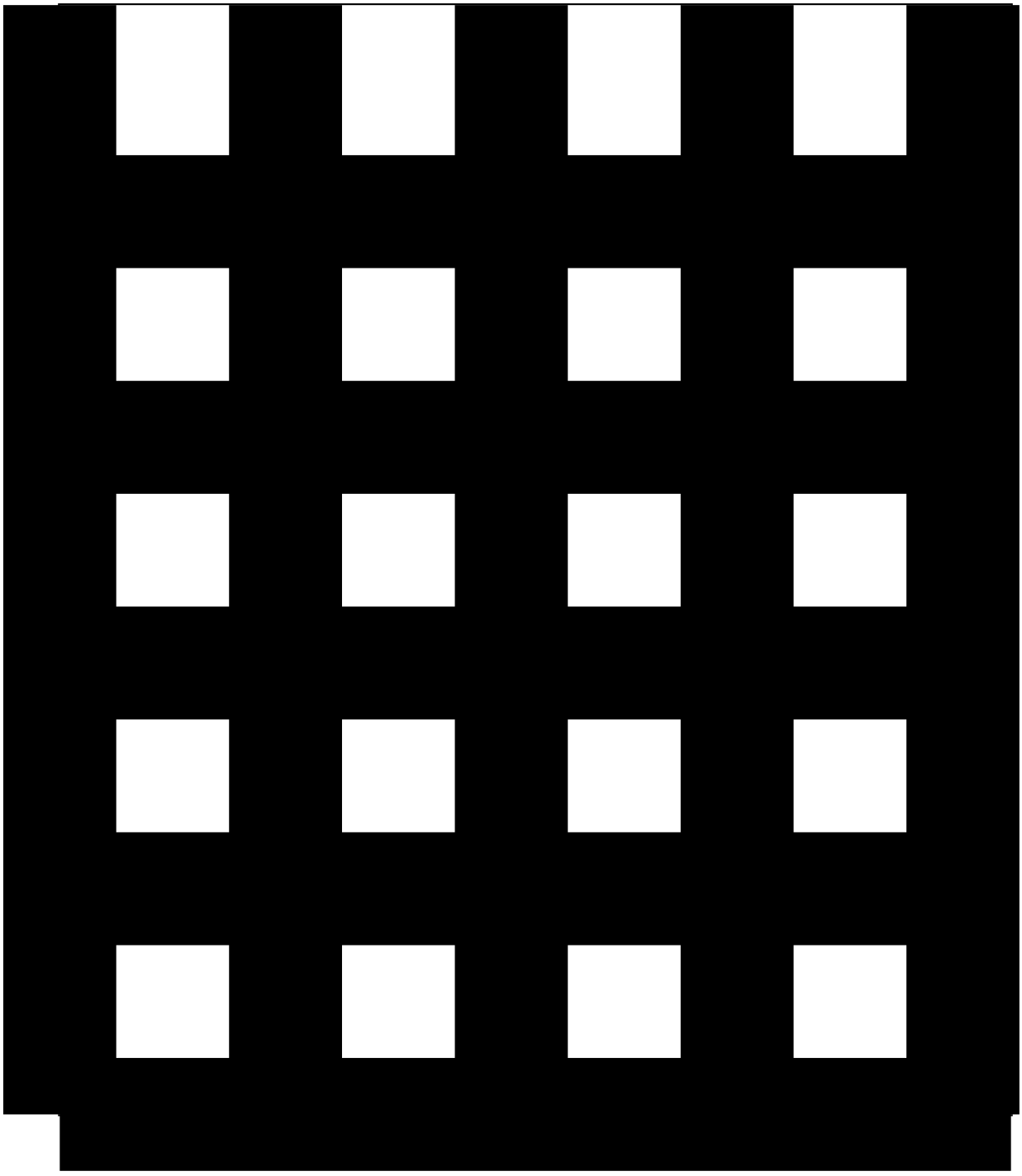


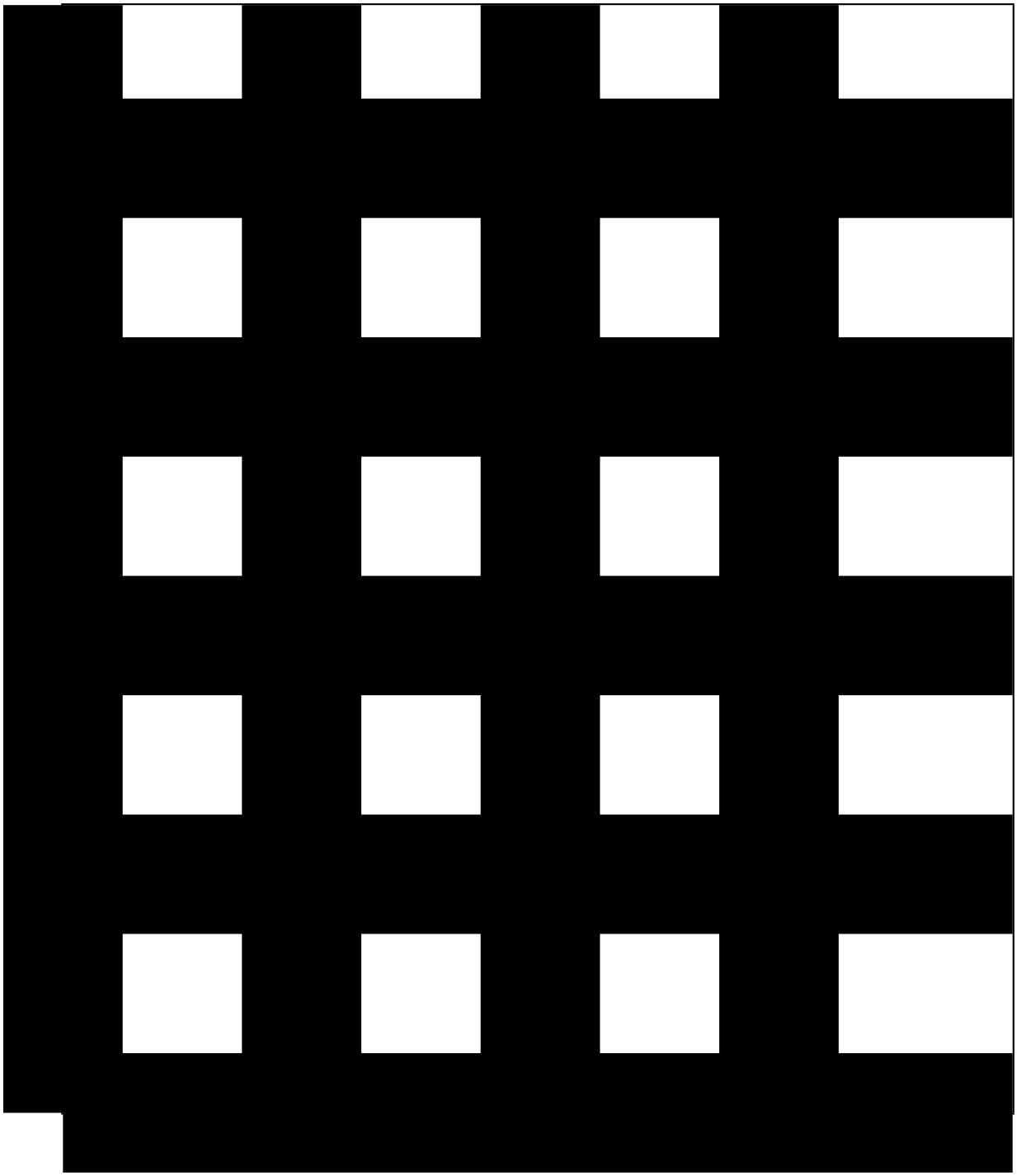


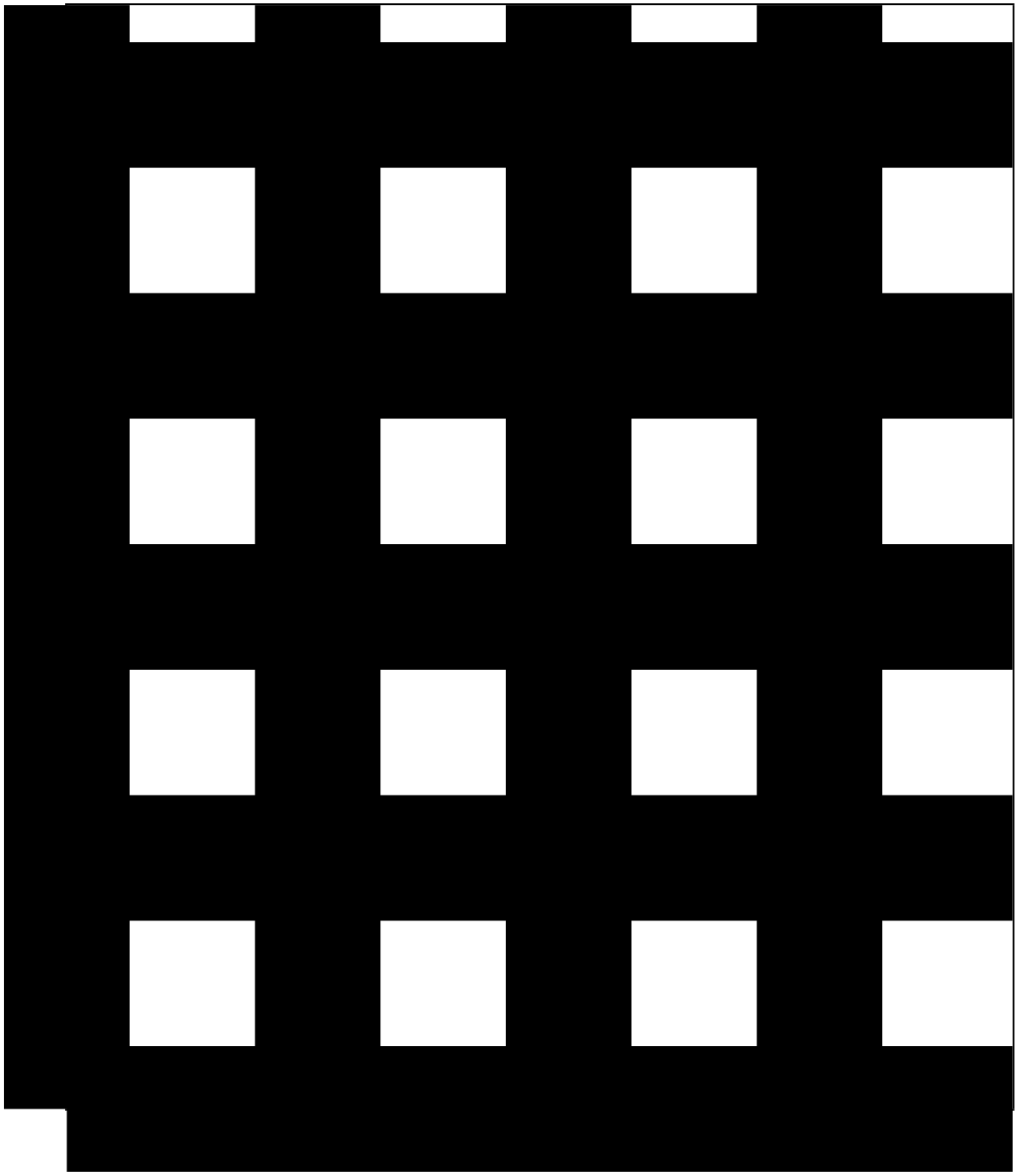


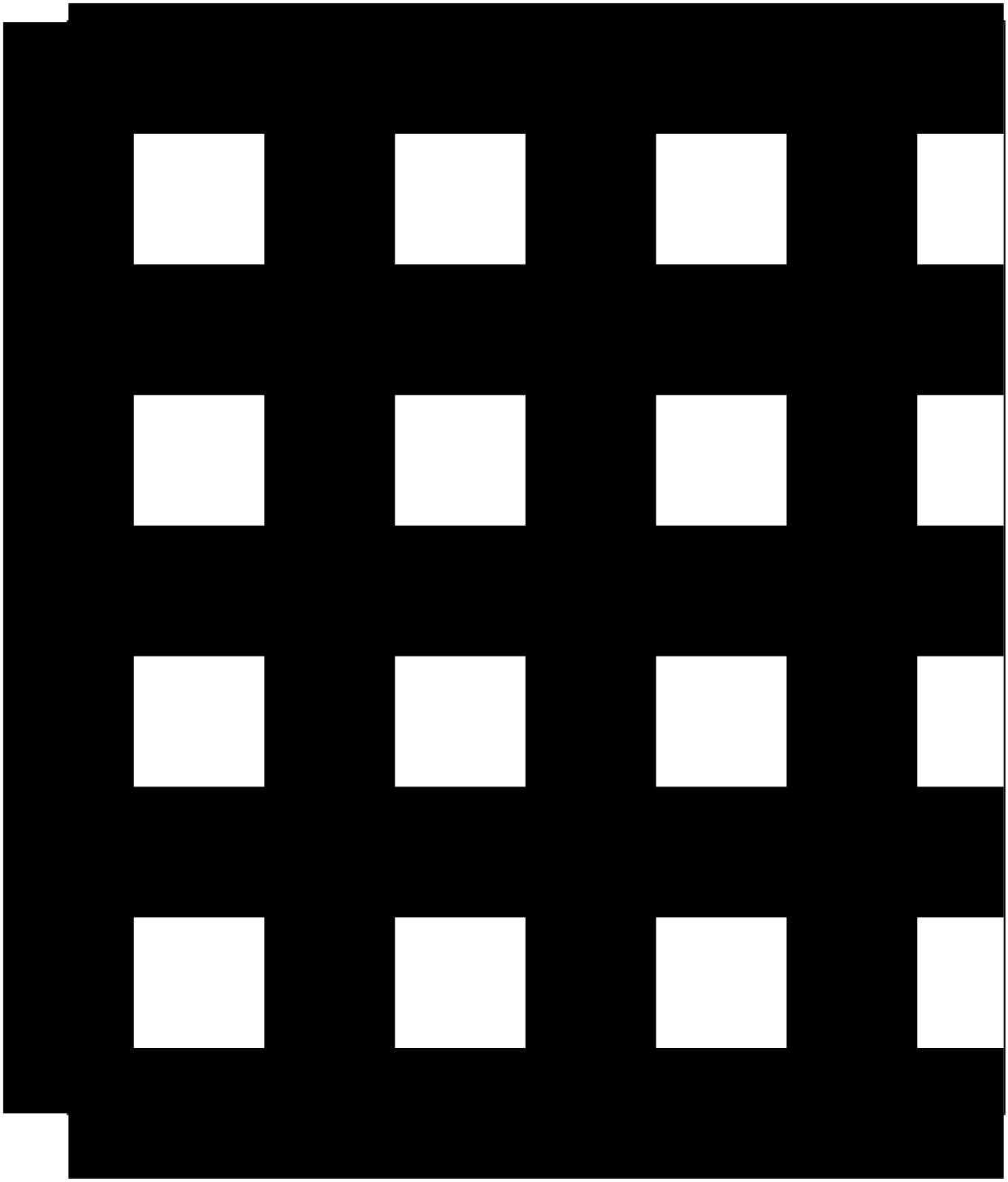


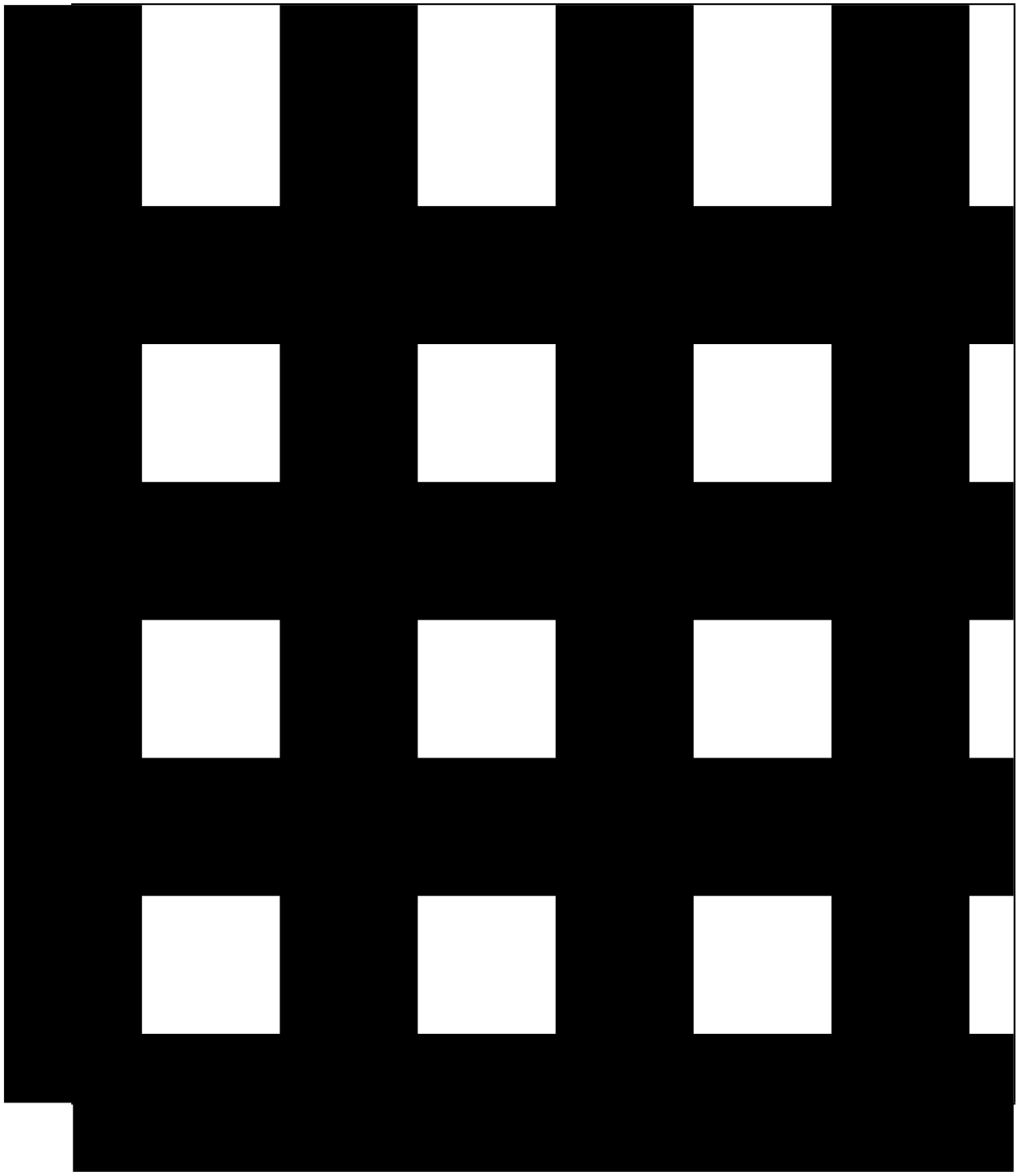


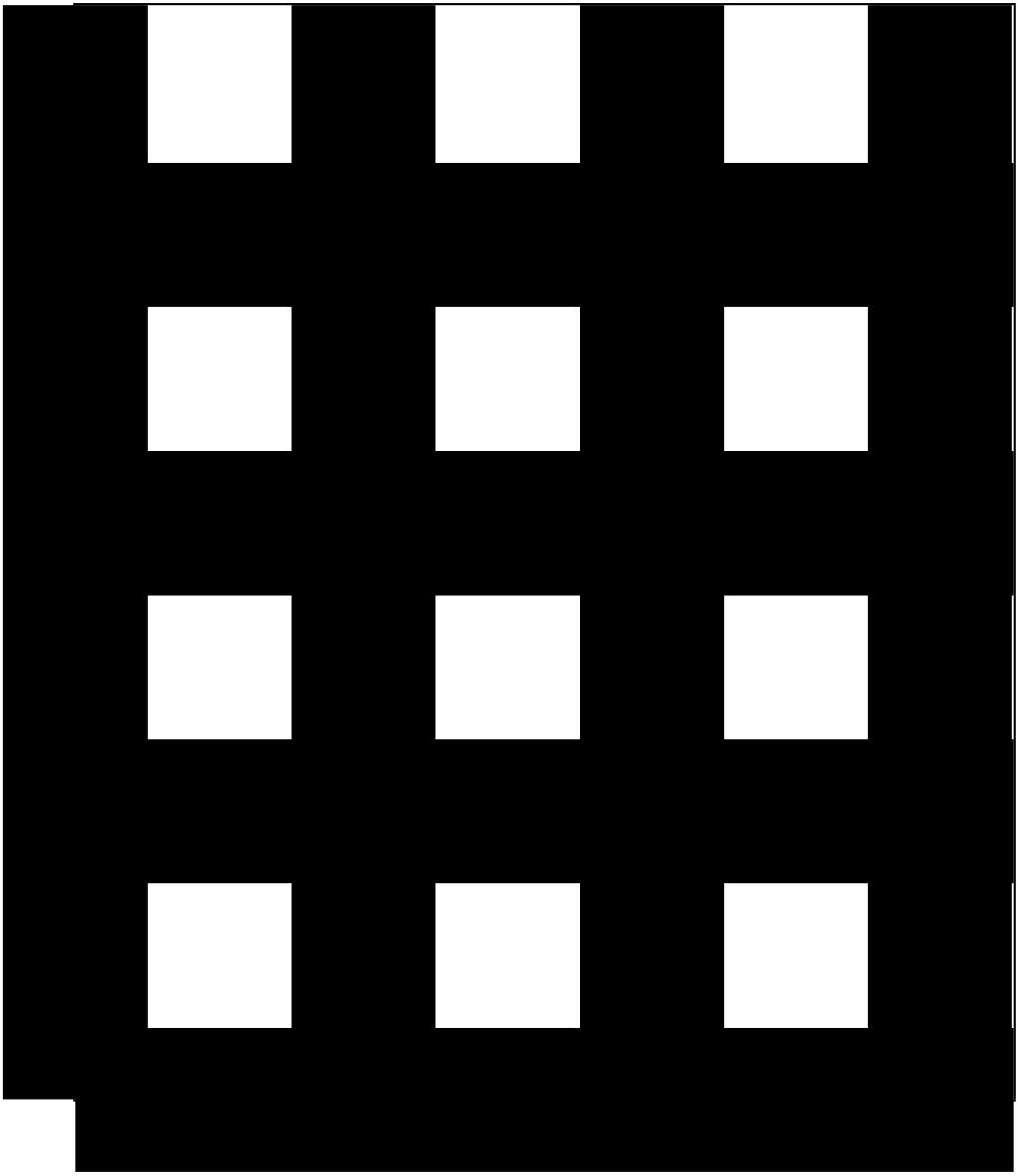


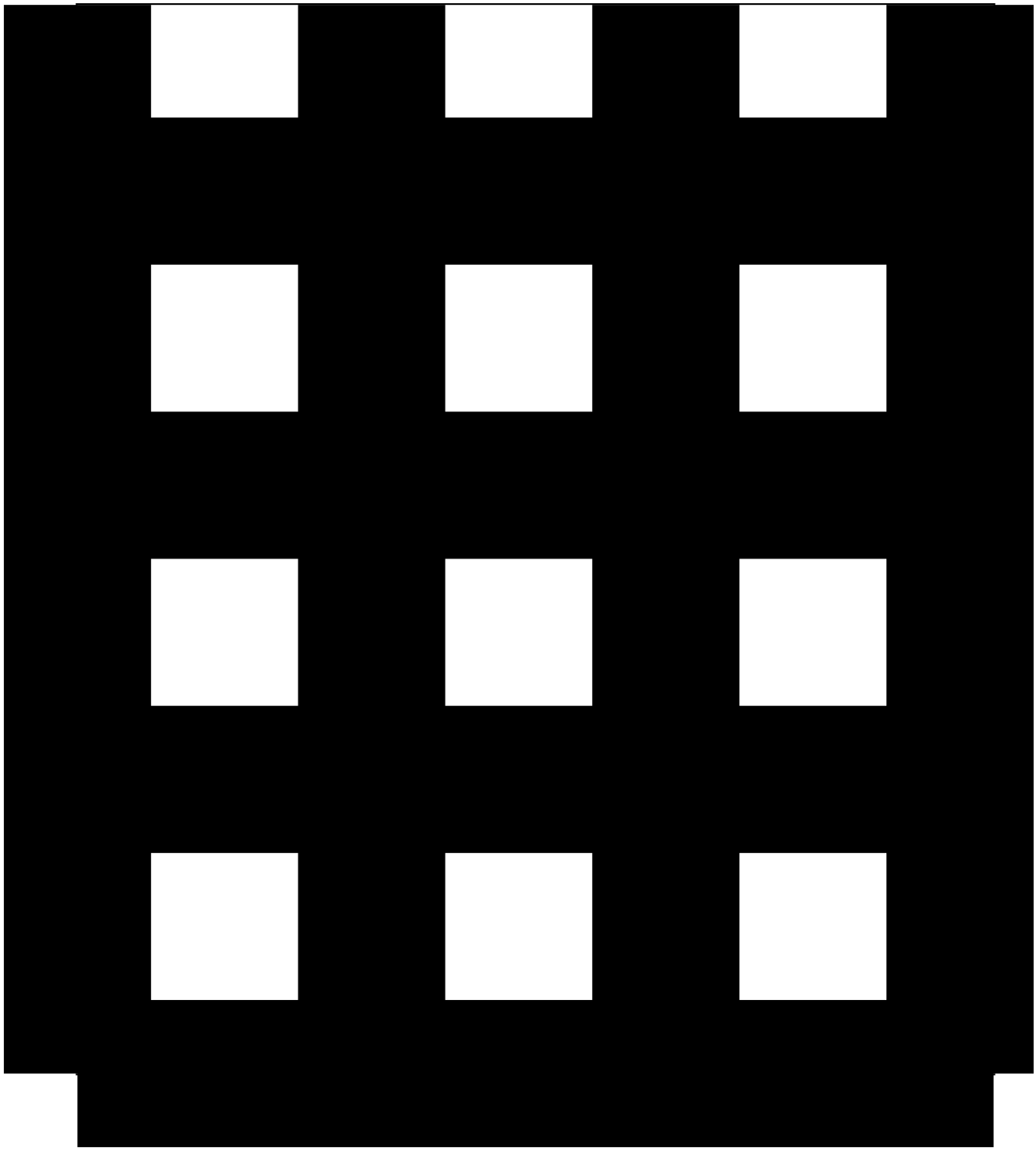


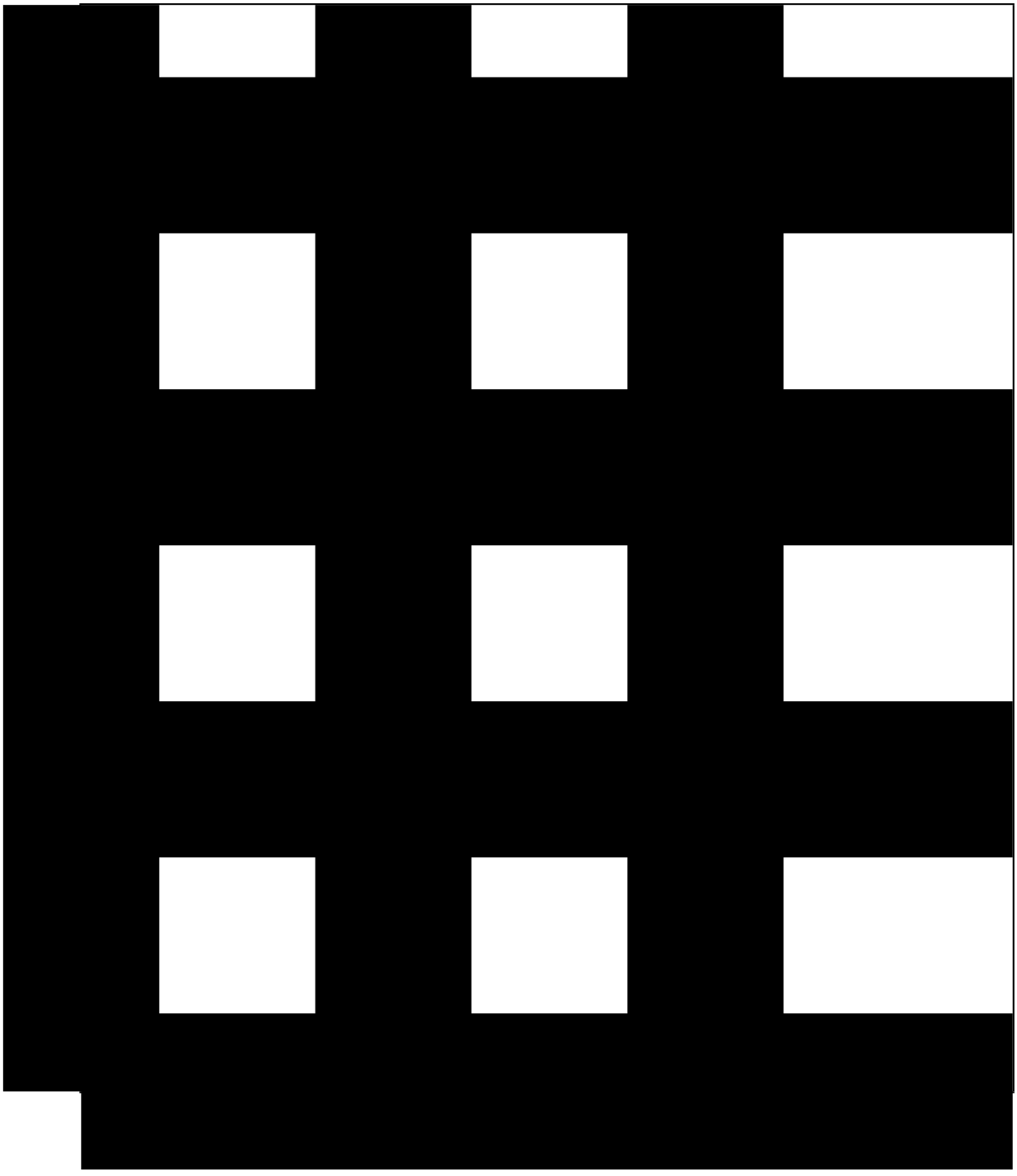


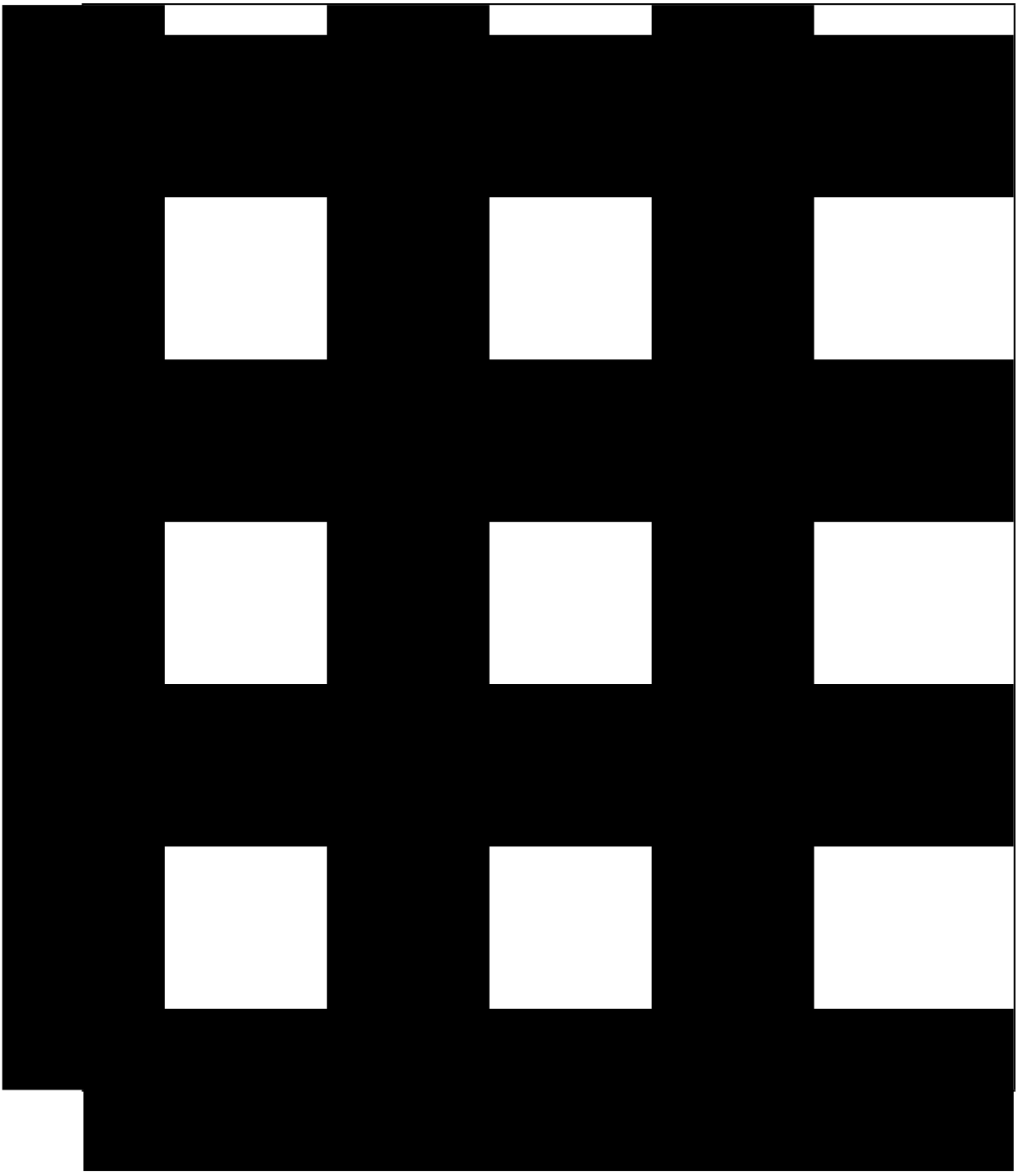


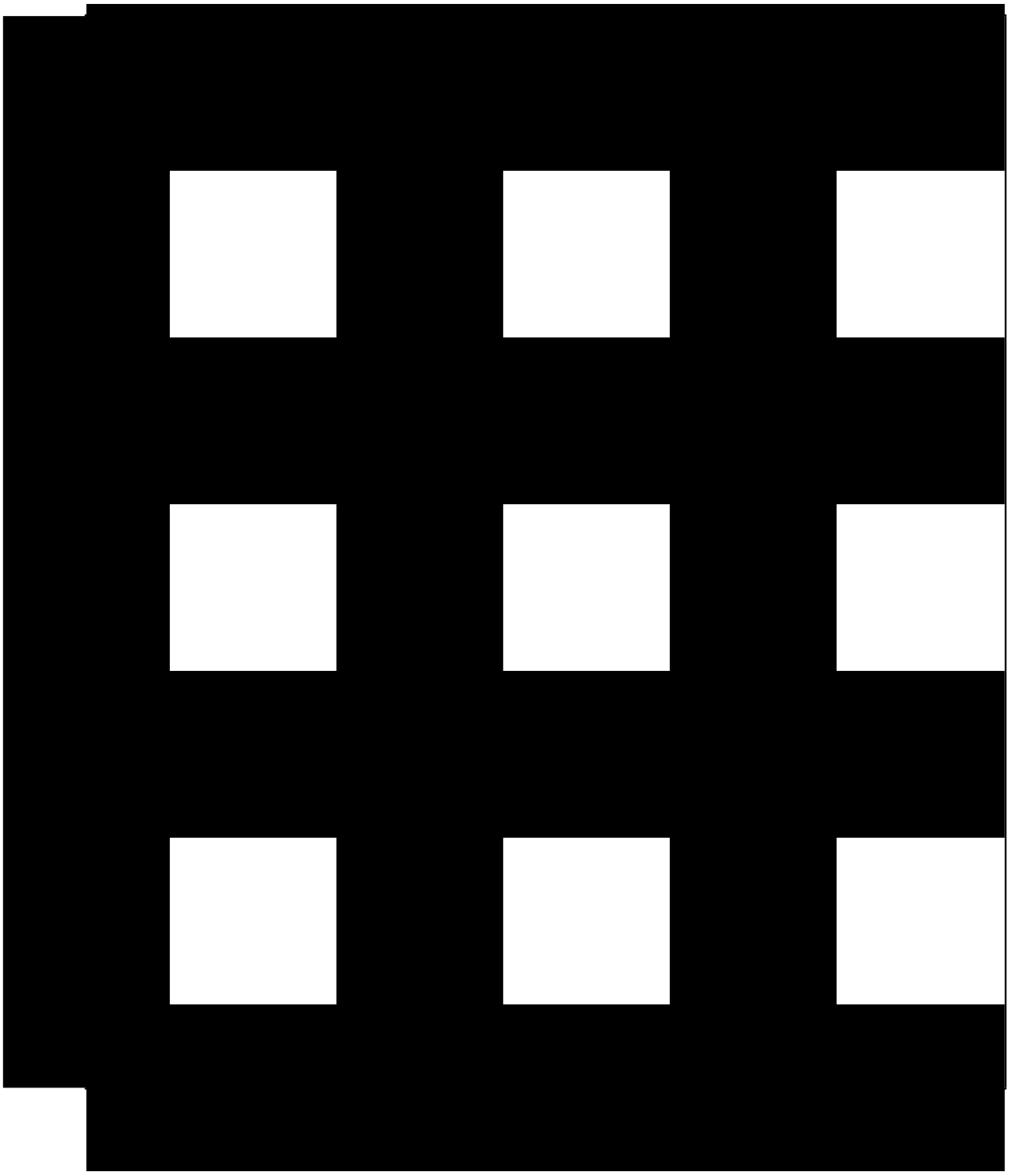


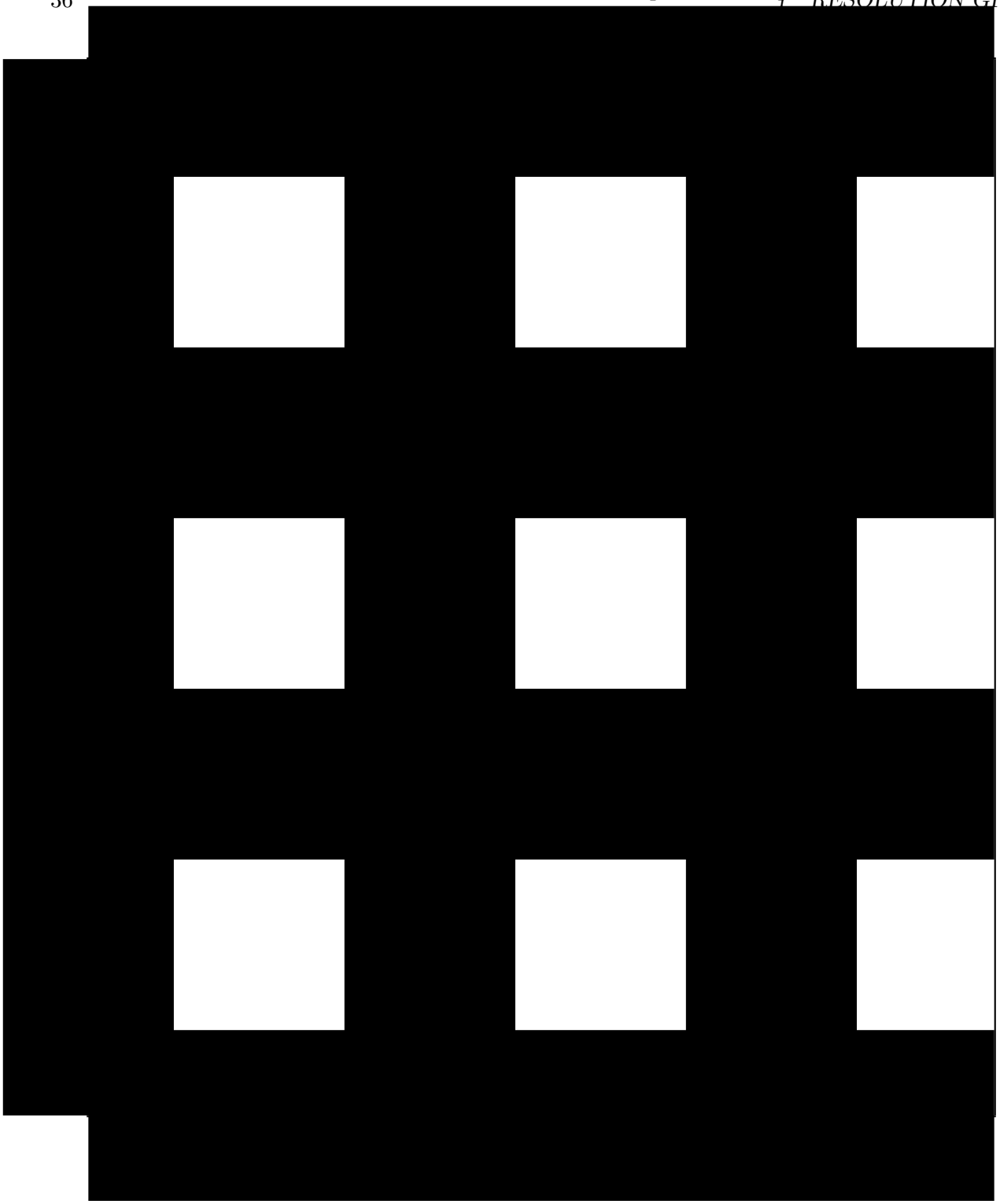


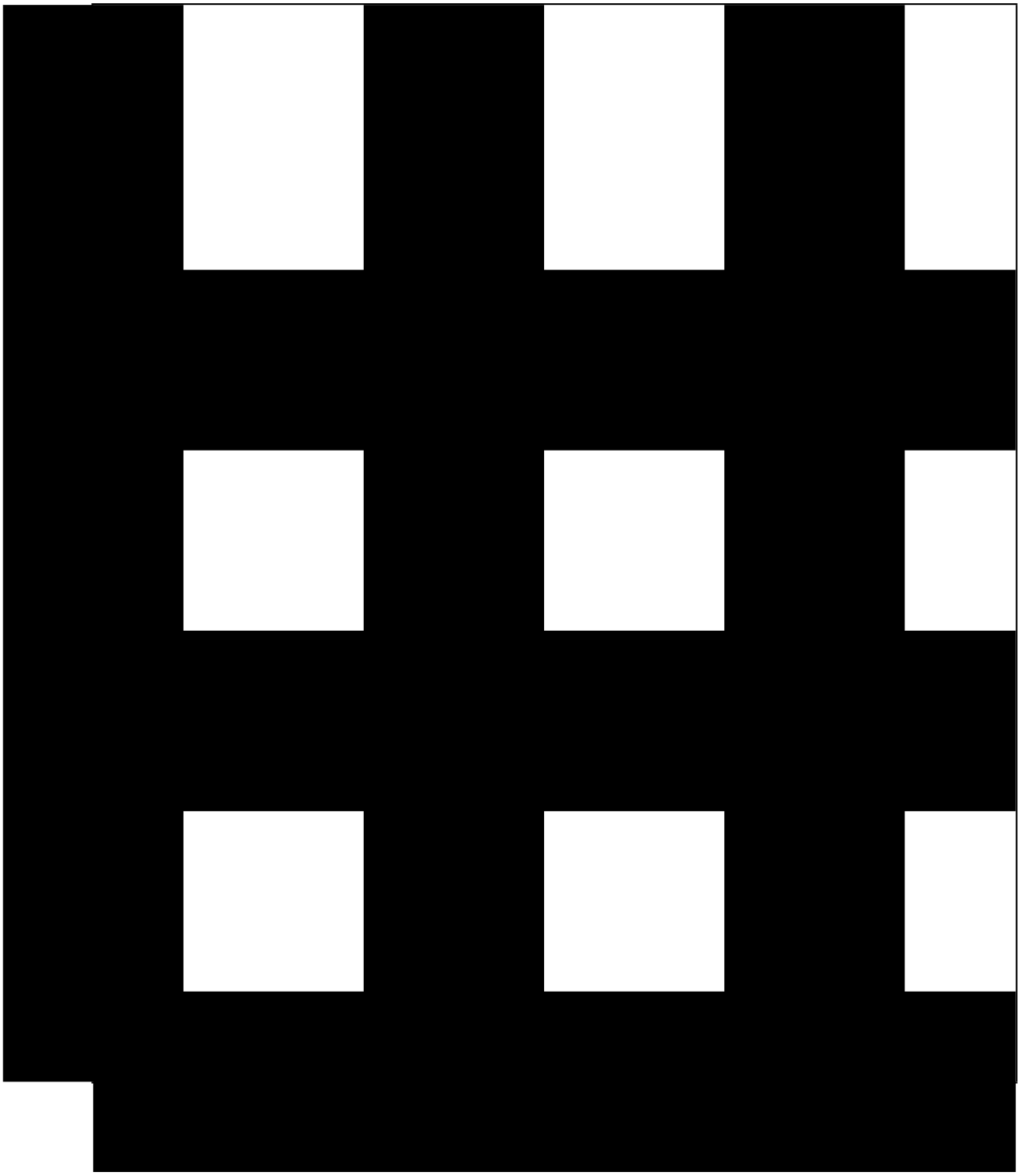












1.2 Bars.bas

A short program written in GW-BASIC was developed to generate the LaTeXplot files used in making the actual grids. Here it is.

```
 1  10 CLS: REV$ = "$Id: TgtGen.bas,v 1.1 2005-08-22 12:45:02-07 Hamilton Exp Hamilton $"
 2  20 REM $Header: /EHamilton/General Information/Targets/Bars.bas 2     12/26/06 1:02p Ehamilton $
 3  30 PRINT REV$
 4  40 PRINT "Make 50% resolution targets in LaTeX"
 5  50 '
 6  60 S$ = "\"
 7  70 PI = 3.1415962#
 8  80 FOOTTOINCH = 12
 9  90 DEGREESINCIRCLE = 360
10  100 TENTHS = 10
11  110 SMALL = 1: REM Used to suppress small grids on small grids
12  120 LARGE = 2: REM Used to enable small grids on large grids
13  130 '
14  140 INPUT "Write into which file (cr = test.inc)";OUTFILE$
15  150 IF OUTFILE$ = "" THEN OUTFILE$ = "test.inc"
16  160 OPEN OUTFILE$ FOR OUTPUT AS #2
17  170 OPEN "status.log" FOR APPEND AS #3
18  180 PRINT #3,
19  190 PRINT #3,REV$
20  200 PRINT #3,DATE$,TIME$
21  210 PRINT #3,"Writing into ";OUTFILE$
22  220 '
23  230 REM STEPS        = Width in displayed dots, must be an even number
24  240 REM RADIUS       = Distance from camera to target in feet
25  250 '
26  260 DOTSIN = 5
27  270 GRIDSIZE = SMALL
28  280 STEPS = 40
29  290 DOTSIZESMALL = 1: DOTSIZELARGE = 2
30  300 RADIUS = 2: GOSUB 650: RADIUS = 3: GOSUB 650: RADIUS = 4: GOSUB 650
31  310 STEPS = 30: DOTSIZESMALL = 1: DOTSIZELARGE = 3: RADIUS = 5: GOSUB 650
32  320 STEPS = 20: DOTSIN = 3: DOTSIZESMALL = 2: DOTSIZELARGE = 3
33  330 RADIUS = 6: GOSUB 650
34  340 DOTSIN = 2: RADIUS = 7: GOSUB 650
35  350 PRINT #2,"\clearpage"
36  360 STEPS = 18: DOTSIZESMALL = 2: DOTSIZELARGE = 4
37  370 RADIUS = 8: GOSUB 650: RADIUS = 9: GOSUB 650
38  380 GRIDSIZE = LARGE
39  390 RADIUS = 10: GOSUB 650: RADIUS = 11: GOSUB 650: RADIUS = 12: GOSUB 650
40  400 STEPS = 16: RADIUS = 14: GOSUB 650
41  410 DOTSIN = 1: STEPS = 14: RADIUS = 16: GOSUB 650
42  420 '
43  430 STEPS = 12: RADIUS = 18: GOSUB 650: RADIUS = 20: GOSUB 650
44  440 PRINT #2,"\clearpage\bigskip"
45  450 STEPS = 10: DOTSIZESMALL = 3: DOTSIZELARGE = 4
46  460 RADIUS = 22: GOSUB 650: RADIUS = 24: GOSUB 650: RADIUS = 26: GOSUB 650
47  470 STEPS = 8: DOTSIZESMALL = 3: DOTSIZELARGE = 4
48  480 RADIUS = 28: GOSUB 650: RADIUS = 30: GOSUB 650: RADIUS = 32: GOSUB 650
49  490 STEPS = 6: DOTSIZESMALL = 3: DOTSIZELARGE = 5
50  500 RADIUS = 34: GOSUB 650: RADIUS = 36: GOSUB 650: RADIUS = 38: GOSUB 650
51  510 RADIUS = 40: GOSUB 650: RADIUS = 42: GOSUB 650: RADIUS = 44: GOSUB 650
52  520 RADIUS = 46: GOSUB 650: RADIUS = 48: GOSUB 650
53  530 STEPS = 40: DOTSIZESMALL = 3: DOTSIZELARGE = 5
54  540 RADIUS = 50: GOSUB 650: RADIUS = 52: GOSUB 650
55  550 RADIUS = 54: GOSUB 650: RADIUS = 56: GOSUB 650
```

```
 56  560 '
 57  570 PRINT #2,"\clearpage"
 58  580 '
 59  590 REM All done
 60  600 PRINT #3,"All done"
 61  610 PRINT #3,DATE$,TIME$
 62  620 PRINT "All done, quitting"
 63  630 END
 64  640 '
 65  650 REM Build the grid
 66  660 PAGEWIDTH = 600
 67  670 PAGEHEIGTH = 700
 68  680 ARC = (2 * PI * RADIUS * FOOTTOINCH) / (DEGREESINCIRCLE * TENTHS)
 69  690 HBARS = INT(PAGEHEIGTH / (2*ARC))
 70  700 VBARS = INT(PAGEWIDTH  / (2*ARC))
 71  710 HBARCOUNT = INT((HBARS+.5)/100) + 1
 72  720 VBARCOUNT = INT((VBARS+.5)/100) + 1
 73  730 '
 74  740 PRINT #2,""
 75  750 PRINT #2,"\clearpage"
 76  760 PRINT #2,"\begin{center}"
 77  770 PRINT #2,"\setlength{\unitlength}{.01in}"
 78  780 PRINT #2,"\begin{picture}(";PAGEWIDTH;",";PAGEHEIGTH;") {"
 79  790 PRINT #2,""
 80  800 PRINT #2,USING "&put(300,740){&makebox(0,0)[b]{";S$;S$;
 81  810 PRINT #2,USING "&bf 0.1&degree& at ## feet is ##.######
inch&label{##footbars}}}";S$;S$;S$;RADIUS;ARC;S$;RADIUS
 82  820 PRINT #2,"\thicklines\put(0,0){\framebox(";PAGEWIDTH;",";PAGEHEIGTH;"){}}\thinlines"
 83  830 PRINT #2,""
 84  840 '
 85  850 REM Now the main grid
 86  860 PRINT #2,"% Main Grid"
 87  870 PRINT #2,USING "&linethickness{##.#### in}";S$;ARC
 88  880 PRINT #2,"\put(0,0){\multiput(0,0)(0,";200*ARC;"){";HBARCOUNT;"}{\line(1,0){";PAGEWIDTH;"}}}"
 89  890 PRINT #2,"\put(0,0){\multiput(0,0)(";200*ARC;",0){";VBARCOUNT;"}{\line(0,1){";PAGEHEIGTH;"}}}"
 90  900 PRINT #2,"}"
 91  910 '
 92  920 PRINT #2,"\end{picture}"
 93  930 PRINT #2,"\end{center}"
 94  940 RETURN
 95
```

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