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SOLIFTEC INFORMATION PAGE

The Ringelmann Smoke Chart

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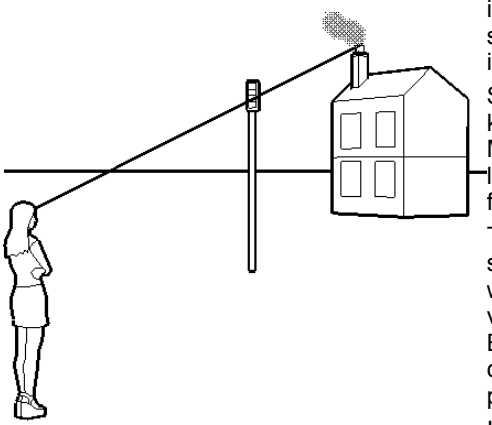
Dark smoke is partially burned particles of fuel, the result of incomplete combustion. It can be dangerous because small particles are absorbed into the lungs. **White smoke** is mainly tiny water droplets, generated when vapour released during combustion condenses in cool air. Generally, dark smoke is clearly visible against a light sky but difficult to see at night or against a dark background, white smoke is visible in darkness when illuminated but will be more difficult to see against a light sky background.



Smoke is commonly measured in terms of its apparent density in relation to a scale of known greyness. The most widely-used scale is that developed by Professor Maximilian Ringelmann of La Station d'Essais de Machines in Paris in 1888. It has a 5 levels of density inferred from a grid of black lines on a white surface which, if viewed from a distance, merge into known shades of grey.

There is no definitive chart, rather, Prof. Ringelmann provides a specification; where smoke level '0' is represented by white, levels '1' to '4' by 10mm square grids drawn with 1mm, 2.3mm, 3.7mm and 5.5 mm wide lines and level '5' by all black. A popular version is that published by the U.S. Bureau of Mines in circular 8333 of 1967. The British Standard version (BS2742:1969) alters Ringelmann's specification to give a chart similar, on modern paper with modern ink, to the probable appearance of charts produced on earlier, possibly darker, paper, with paler ink.

It should be remembered that the data obtained has definite limitations. The apparent darkness of a smoke depends upon the concentration of the particulate matter in the effluent, the size of the particulate, the depth of the smoke column being viewed, and natural lighting conditions such as the direction of the sun relative to the observer while the accuracy of the chart itself depends on the whiteness of the paper and blackness of the ink used.

USING THE CHARTS

The large chart on page 4 should be printed with black ink onto very white card and mounted vertically on a board. It is preferably fixed to a pole or held by an assistant at a sufficient distance (typically c20m) for the lines to appear to merge into uniform grey rectangles and to be seen in line with the top of the chimney. The addition of a white (No. 0) square can provide a useful indication that both the chart and chimney are equally illuminated. If a larger chart is needed, the shaded rectangles can be made up into larger ones as mosaics.

The observer glances from the smoke, as it issues from the stack, to the chart and notes the number most nearly corresponding with the shade of the smoke. A clear stack is recorded as No. 0, and 100 percent black smoke as No. 5.

There is very little value in making a single observation. A series of observations should be made, preferably by two or more observers, over an extended period, at regular intervals. There is an example of a recording table on page 3.

The Miniature Charts on page 2 are not the official Ringelmann chart, but a handy interpretation of it, intended to be held at arm's length.

PRINTING THESE CHARTS

Print this document on very white A4 size (210mm x 297mm) card – when printed, the box below should be 150mm long and 10mm high. For the charts on page 4, use only highest print quality and only black ink – you may have to adjust your printer settings.

Smoke Laws in both the UK and RoI define the level of smoke prohibited by law as 'dark smoke', darker than shade 2 of the Ringelmann Chart

RoI: The Control of Atmospheric Pollution Regulation (1970) prohibits the emission of dark smoke from non-domestic premises for more than a very few (specified) minutes per day.

UK: The Clean Air Act (1993) prohibits the emission of dark smoke from all industrial premises and from domestic premises in designated smoke control areas, but allows a defence that the heating equipment was cold and being first lit.

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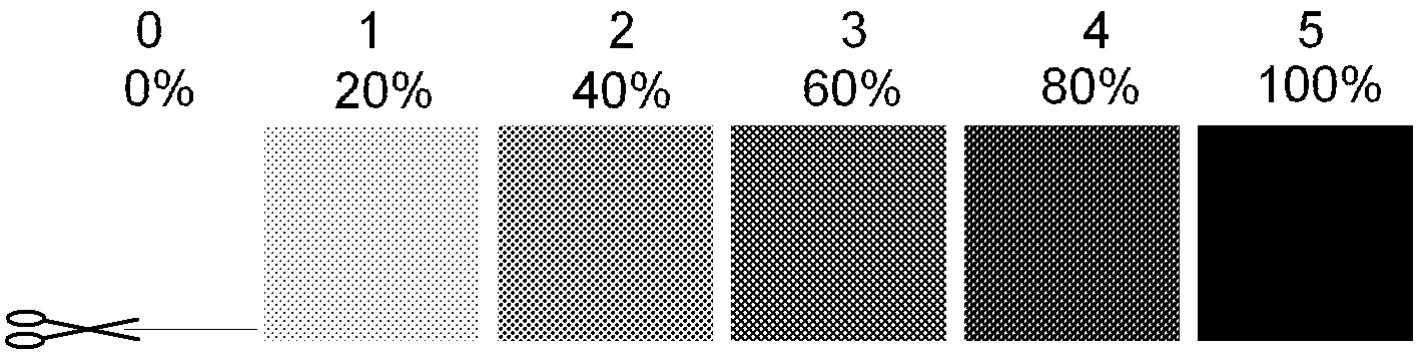
MINIATURE SMOKE CHARTS

These charts are not the official Ringelmann chart, but simplified interpretations of it for everyday use.

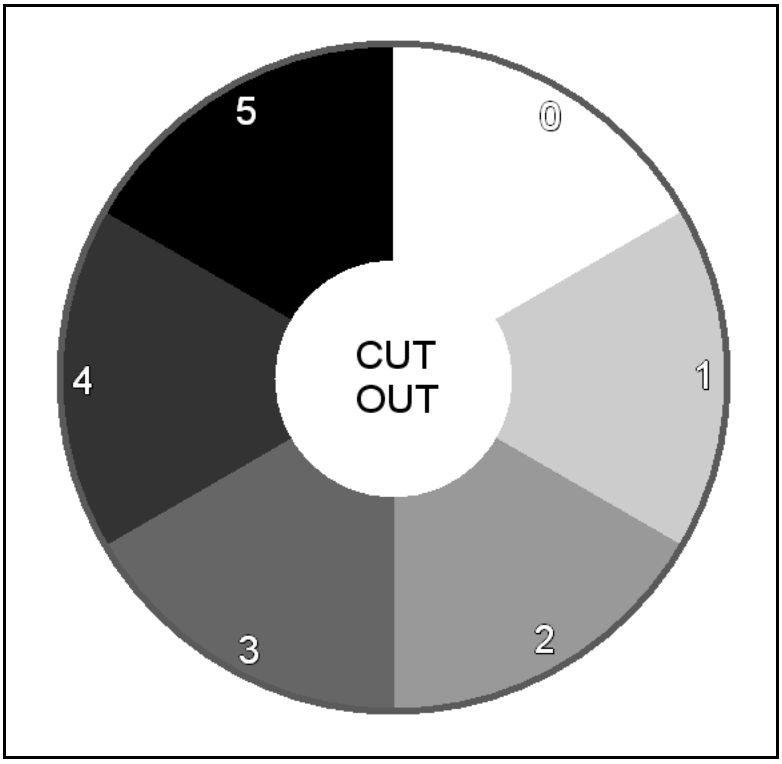
BAR TYPE

Black and white print. Cut along the edge shown, hold at arm's length and compare the smoke source with the cut edge.



CIRCLE TYPE

Grey-scale print. Cut out the central hole and hold at arm's length and view the smoke source through the hole.



Ringelmann Smoke Observations Record

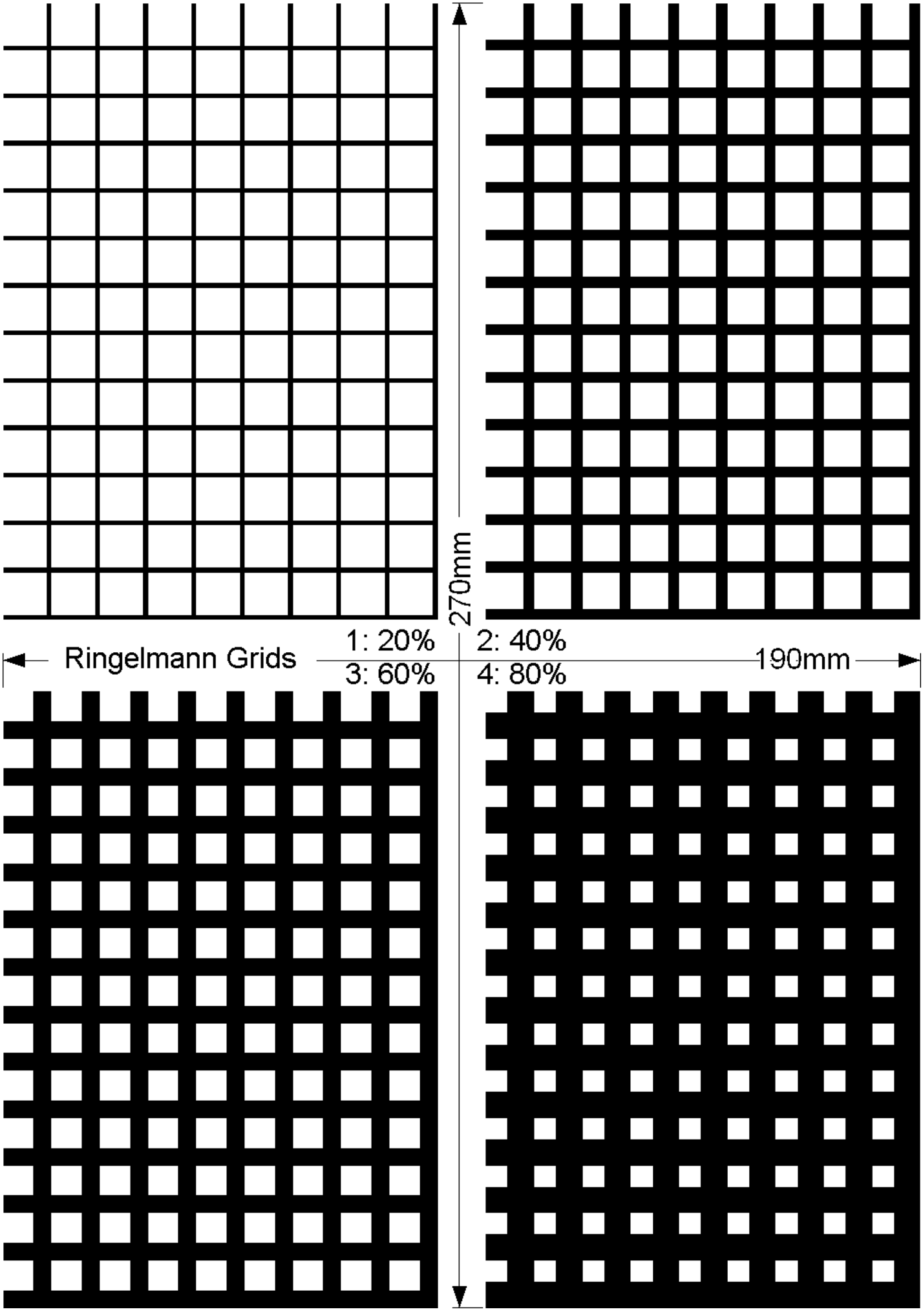
An example of a smoke observation record made every minute over a half-hour period. For observations of a commercial smokestack observations might be made every two to five minutes over 24 hours.

Recorded by	
Date	
Point of observation	
Distance to stack	
Direction of wind	
Velocity of wind	

MEASUREMENT NUMBER	TIME	OBSERVED RINGELMANN NUMBER
1	12:00	0
2	12:01	0
3	12:02	0
4	12:03	0
5	12:04	0
6	12:05	0
7	12:06	1
8	12:07	1
9	12:08	1
10	12:09	2
11	12:10	2
12	12:11	2
13	12:12	0
14	12:13	3
15	12:14	3
16	12:15	3
17	12:16	1
18	12:17	1
19	12:18	1
20	12:19	1
21	12:20	1
22	12:21	1
23	12:22	1
24	12:23	1
25	12:24	1
26	12:25	3
27	12:26	3
28	12:27	3
29	12:28	3
30	12:29	3
	TOTAL	**42**

SUMMARY

		Average Ringelmann Number		Average smoke density, %
Total of Ringelmann Numbers	**42**			
Total number of observations	**30**	**= 1.4**	**x 20**	**= 28**


270mm
Ringelmann Grids
1: 20%
2: 40%
3: 60%
4: 80%
190mm