forated panels have low induction ratios and thus will provide lower impingement temperatures.[6] See Chap. 31.

6. Generally the outlets should have remote directional or volume control or, preferably, both. The worker should be able in most cases to operate the outlet damper, vanes or louvers (or to turn the outlet) from the floor by some convenient means.

The damper control should provide at least 80 percent reduction in velocity. The workers may desire the full air velocity in hot weather, but may wish to reduce the velocity or to direct the air above the head zone in cold weather.

7. Generally the spot cooling air should be directed to the front and to the torso of the worker. If possible the air should not be directed at the head, shoulders or the back of the worker.

8. When providing spot cooling with evaporatively cooled air, be sure that conditions of high humidity will not exist and cause conditions detrimental to the comfort of the personnel or cause rusting or other difficulty with the equipment or process.

Generally the evaporatively cooled air should be limited to 20 to 50 percent of the total outside air circulated through the building.

Odors

There is little information available either on the rate of generation of common odors, or on the maximum concentration which would be tolerated by a majority of persons. Thus a quantitative specification covering systems for locker rooms and toilet rooms, or other applications where odors constitute the contaminant, is not now possible. Pending research in this important field, it is suggested that the data in Table 1, Chapter 6, showing the outside air supply required per person, at various socio-economic levels, be used.

REFERENCES

[1] Heat Relief in Industry, by Bartlett R. Small (*Iron and Steel Engineers Magazine*, April, 1952).

[2] Industrial Heat Exposures—Evaluation and Control, by George F. Haines, Jr. and Theodore Hatch (*Heating and Ventilating*, Nov. 1952, p. 94).

[3] *Physiology of Heat Regulation and the Science of Clothing*, by L. H. Newburgh (W. B. Saunders Co.).

[4] Thermal Standards in Industry—C. P. Yaglou, American Public Health Association Yearbook, 1949.

[5] Temperature and Human Life—C.-E. A. Winslow and L. P. Herrington, Princeton University Press.

[6] Private Discussion with G. L. Tuve and Alfred Koestel (*Case Institute of Technology*, May 31, 1952).

BIBLIOGRAPHY

Processing

When Is Complete Air Conditioning of the Modern Factory Advisable? by H. A. Mosher (*Heating Piping and Air Conditioning*, June, 1945, p. 305 and July, 1945, p. 385).

Air Conditioning Design Conditions for Various Industries, by N. N. Wolpert (*Heating and Ventilating*, May 1949, p. 70; June 1949, p. 73; July 1949, p. 79; Aug. 1949, p. 102).

Air Conditioning Design Data for Commercial Applications, by N. N. Wolpert (*Heating and Ventilating*, Feb. 1950, p. 68).

ASRE Data Book 1950 (*American Society of Refrigerating Engineers*).

Refrigeration of Oranges in California, by H. M. Hendrikson and J. R. MacRill, Refrigerating Engineering Application Data, No. 17-R (*American Society of Refrigerating Engineers*).

Refrigeration of Lemons and Grapefruit, by H. M. Hendrikson and J. R. MacRill, Refrigerating Engineering Application Data No. 18-R (*American Society of Refrigerating Engineers*).

Air Conditioning in the Bakery, by W. L. Fleisher (A.S.H.V.E. Transactions, Vol. 37, 1931, p. 141).

Air Condition the Bakery Throughout, by W. W. Reece (*Heating, Piping and Air Conditioning*, August, 1936, p. 419).

The Air Conditioning of Processes in the Bread Bakery, by H. R. Gable (A.S.H.V.E. Journal Section, *Heating, Piping and Air Conditioning*, October 1947, p. 107).

Air Conditioning in Candy Manufacture, by H. C. Hoffmann (Section 39, Refrigerating Engineering Application Data, *Refrigerating Engineering*, April, 1947).

Proper Air Conditions for the Manufacturing of Confections, by A. E. Stacey, Jr. (A.S.H.V.E. Journal Section, *Heating, Piping and Air Conditioning*, October 1937, p. 640).

Air Conditioning for Sausage Manufacturing Plants, by M. G. Harbula (A.S.H.V.E. Transactions, Vol. 28, 1922, p. 343).

Relation of Air Conditions to Tobacco Curing, by J. Johnson and W. B. Ogden (*Wisconsin Agricultural Research Bureau* 110: 1–48, 1931).

Heating, Air Conditioning and Insulation for Penicillin Production, by J. C. Siegesmund (*Heating, Piping and Air Conditioning*, August, 1944, p. 475).

Air Conditioning in Textile Mills, Research Department Technical Report, *Textile Workers Union of America, C.I.O.*

Air Conditioning for Textile Plants Making and Using Synthetic Yarns, by L. L. Lewis (*Rayon Textile Monthly*, July, August, September, 1930).

Refrigeration for Textile Mill Air Conditioning, by P. L. Davidson (*Heating and Ventilating*, May, 1947, p. 57).

Bureau of Standards Studies Determine Press Room Conditioning Requirements, by C. G. Weber (*Heating, Piping and Air Conditioning*, March, 1936, p. 137).

Humidity in the Pressroom (*Heating and Ventilating*, May, 1932, p. 35).

Dehumidifying with Gas in a Printing Plant (*Heating and Ventilating*, May, 1935, p. 31).

Air Conditioning the Newspaper Plant, by R. T. Williams (*Heating and Ventilating*, September, 1937, p. 63).

Air Conditioning in the Paper Industry (*Heating and Ventilating*, October, 1935, p. 23).

Air Conditioning Requirements of Multicolor Offset Printing, by C. G. Weber (*Refrigerating Engineering*, December, 1936, p. 6).

Reactions of Lithographic Papers to Variations in Humidity and Temperature, by C. G. Weber and L. W. Snyder (*U. S. Bureau of Standards Journal of Research*, January, 1934).

The Treatment of Offset Papers for Optimum Register, by C. G. Weber and M. N. V. Geib (*U. S. Bureau of Standards Journal of Research*, February, 1936).

Silica Gel Air Conditioning System Serves Rotogravure Printing Plant, by H. E. Ryerson (*Heating, Piping and Air Conditioning*, August, 1937, p. 497).

Air Conditioning for Clothing Research Laboratory (*Heating and Ventilating*, July, 1943, p. 69).

Refrigeration Insures Quality of Clothing for the Army, by A. J. Mallinckrodt (*Heating and Ventilating*, March, 1944, p. 79).

Controlled Air Supply for Supercharger, Carburetor and Engine Testing, by C. S. Leopold (*Refrigerating Engineering*, August, 1943, p. 85).

Close Machine Tolerances Possible Through Temperature Control, by R. P. Dewey (*Heating and Ventilating*, April, 1944, p. 60).

Moisture Control by Liquid Absorption Offers a Useful Air Conditioning Tool, by F. M. Johnson (*Heating, Piping and Air Conditioning*, December, 1938, p. 782).

Air Processing Needs of Plywood Plane Parts, by F. O. Jordan (*Heating and Ventilating*, April, 1944, p. 67).

The Engineering Control of Some Solvent Hazards in War Industries, by S. C. Rothman (A.S.H.V.E. Transactions, Vol. 50, 1944, p. 319).

Air Conditioning as Applied in Theatres and Film Laboratories, by D. C. Lindsay (*Transactions Society of Motion Picture Engineers*, April, 1927, Vol. XI, No. 30 p. 335–365).

Industrial Air Conditioning, by F. F. Stevenson (*Heating, Piping and Air Conditioning*, May, 1948, p. 100; June, 1948, p. 94; and Jack F. Salsburg, July, 1948, p. 88, and Oct. 1948, p. 93).

Industrial Air Conditioning, by Charles S. Cave (*Industry and Power*, July 1945, p. 67; Sept. 1945, p. 57).

Reducing Heat Loads in Industrial Air Conditioning, by L. R. St. Onge (*Refrigerating Engineering*, January 1946, p. 35).

Air, Light, and Sound Controlled in Western Electric's New Plant (*Heating, Piping and Air Conditioning*, Nov. 1948, p. 79).

New IBM Plant Addition, Poughkeepsie, N. Y., by J. T. Browne (*Heating, Piping and Air Conditioning*, Jan. 1949, p. 111).