

APPENDIX 5-1

ANIMAL HEAT AND MOISTURE PRODUCTION

Moisture production (MP), latent heat production (LHP), sensible heat production (SHP) and total heat production (THP) of livestock. Adapted from data reference D270.4 of the American Society of Agricultural Engineers, and other sources. Heat of vaporization of water taken as 2410 kJ/kg (at animal body temperature). All data are taken from housing studies.

NOTE: Although these data are presented as design numbers; such data are frequently updated. Actual designs of environmental control systems should incorporate the latest research information. Such data would be available, for example, in reports in the Transactions of the American Society of Agricultural Engineers, Canadian Agricultural Engineering, and the Journal of Agricultural Engineering Research.

<u>Animal</u>	<u>Air Temperature</u>	<u>MP</u> <u>mg/kg s</u>	<u>LHP</u> <u>W/kg</u>	<u>SHP</u> <u>W/kg</u>	<u>THP</u> <u>W/kg</u>	
Dairy cow, 500 kg	-1 C	0.21	0.5	1.9	2.4	
	10	0.28	0.7	1.5	2.2	
	15	0.36	0.9	1.2	2.1	
	21	0.36	0.9	1.1	2.0	
	27	0.50	1.3	0.6	1.9	
Brown Swiss and Holstein, 16 wk	10	0.56	1.4	2.3	3.7	
	27	0.83	2.0	1.5	3.5	
	32 wk	10	0.33	0.9	1.5	2.4
		27	0.61	1.5	1.1	2.6
	48 wk	10	0.33	0.7	1.5	2.2
		27	0.53	1.2	1.0	2.2
Jersey, 16 wk	10	0.67	1.6	2.5	4.1	
	27	1.06	2.5	1.4	3.9	
	32 wk	10	0.42	1.0	1.8	2.8
		27	0.69	1.7	1.0	2.7
	48 wk	10	0.36	0.9	1.6	2.5
		27	0.64	1.2	1.0	2.2
Calf, Ayreshire male, 39 kg	3	0.19	0.4	2.5	2.9	
	23	0.19	0.4	2.0	2.4	
	40 kg	3	0.19	0.4	2.4	2.8
		23	0.19	0.4	1.9	2.3
	45 kg	3	0.19	0.4	2.6	3.0
		23	0.19	0.4	2.0	2.4
Laying hen, leghorn, 1.8 kg (a)	8	0.72	1.7	5.2	6.9	
	12	0.82	2.0	4.6	6.6	
	18	0.97	2.3	4.5	6.8	
	28	1.19	2.9	3.7	6.6	
Broilers, 0.1 kg	29	6.11	15.0	4.5	19.5	
	0.4 kg	24	3.47	8.5	6.5	15.0
		16	2.92	7.0	6.0	13.0
	0.7 kg	27	2.92	7.0	3.0	10.0
		16	2.22	5.5	5.0	10.5
	1.0 kg	27	2.64	6.5	3.0	9.5
		16	2.08	5.0	4.5	9.5
	1.5 kg	27	2.50	6.0	3.0	9.0
		16	1.81	4.5	4.0	8.5
	Growing/finishing pigs, solid floor, 20 kg	5	0.69	1.7	4.2	5.9
10		0.75	1.4	4.0	5.4	
15		0.86	2.0	3.0	5.0	
20		1.03	2.5	2.3	4.8	
25		1.31	3.1	1.6	4.8	
30		1.75	4.2	0.6	4.8	

40 kg	5	0.42	1.0	3.0	4.0
	10	0.44	1.1	2.5	3.6
	15	0.53	1.3	2.0	3.3
	20	0.61	1.5	1.6	3.1
	25	0.78	1.8	1.2	3.0
	30	1.00	2.4	0.6	3.0
60 kg	5	0.33	0.8	2.5	3.3
	10	0.36	0.9	2.0	2.9
	15	0.39	0.9	1.7	2.6
	20	0.47	1.1	1.3	2.4
	25	0.56	1.3	1.0	2.3
	30	0.75	1.8	0.5	2.3
80 kg	5	0.31	0.7	2.2	2.9
	10	0.31	0.7	1.8	2.5
	15	0.33	0.8	1.5	2.3
	20	0.39	0.9	1.2	2.1
	25	0.47	1.15	0.85	2.0
	30	0.61	1.4	0.5	1.9
100 kg	5	0.26	0.6	2.0	2.6
	10	0.28	0.7	1.6	2.3
	15	0.31	0.7	1.3	2.0
	20	0.33	0.8	1.1	1.9
	25	0.39	1.0	0.8	1.8
	30	0.50	1.2	0.5	1.7
Gilts, sows and boars, solid floor, 140 kg	5	0.22	0.5	1.8	2.3
	10	0.22	0.5	1.5	2.0
	15	0.23	0.6	1.2	1.8
	20	0.26	0.6	1.0	1.6
	25	0.31	0.7	0.8	1.5
	30	0.36	0.9	0.5	1.4
180 kg	5	0.18	0.4	1.7	2.1
	10	0.18	0.4	1.4	1.8
	15	0.18	0.4	1.2	1.6
	20	0.19	0.4	1.0	1.4
	25	0.22	0.5	0.8	1.3
	30	0.27	0.7	0.6	1.3

a. Moisture production estimated from data in ASAE data D270.4, then scaled according to:

Timmons, M.B. and R.S. Gates. 1985. Risk analysis methodology applied to environmental control options for animal housing: Part I, poultry layers. Paper No. 85-4507, American Society of Agricultural Engineers, St. Joseph MI.

Moisture calculated as equal to respired moisture, plus 13% of defecated moisture, with the sum increased by 15% because of the higher egg production of today's laying hens (the original data was published in 1966). The sensible heat production is also scaled by 15% for the same reason.