Heat in air exhausted from oven at 422 F per pound fuel burned = $0.333 \times 123.9 \times (S_{422} - S_{70}) = 41.3\ (91 - 8.6) = 3{,}400$ Btu.

Btu available for heating material = 16,005 − 3,400 = 12,605 Btu per pound fuel.

Fuel used in first hour = 2,180,470 ÷ 12,605 = 173 lb = 25.6 gal.

During the second hour the heater capacity will be much greater than required. If an automatic oven temperature control operates on the oil supply, the delivery temperature of the air entering the oven and the quantity of oil burned will decrease, the air supply being constant.

Heat in air exhausted = $41.3\ (S_{575} - S_{70}) = 41.3\ (127 - 8.6) = 4{,}880$ Btu per pound fuel.

Heat available for heating material = 16,005 − 4,880 = 11,125 Btu.

Fuel used in second hour = 1,072,008 ÷ 11,125 = 96.5 lb oil = 14.3 gal.

Total oil used per load = 25.6 + 14.3 = 39.9 gal.

HEATING LOAD FIRST HOUR

	Heated to		Btu
Sand	212 F	$\frac{142}{330} \times 120{,}120$ =	51,688
Binder[a]	212 F	$\frac{142}{330} \times 7{,}920$ =	3,408
Water	212 F	=	17,040
Evaporation	66.7%	$0.667 \times 116{,}520$ =	77,680
Superheat	66.7%	$0.667 \times 9{,}800$ =	6,530
Total Per Ton			156,346
For 6 ton		$6 \times 156{,}346$ =	938,076
Steel plates	390 F	$320 \times 30{,}000 \times 0.12$ =	1,152,000
Radiation[b]	422 F Avg	$352 \times 856 \times 0.30$ =	90,394
Total			2,180,470

HEATING LOAD SECOND HOUR

Sand	400 F	$\frac{188}{330} \times 120{,}120$ =	68,432
Binder[a]	400 F	$\frac{188}{330} \times 7{,}920$ =	4,512
Water			
Evaporation	33.3%	$0.333 \times 116{,}520$ =	38,840
Superheat	33.3%	$0.333 \times 9{,}800$ =	3,270
Total Per Ton			115,054
For 6 ton		$6 \times 115{,}054$ =	690,324
Steel plates	460	$70 \times 30{,}000 \times 0.12$ =	252,000
Radiation[b]	575	$505 \times 856 \times 0.30$ =	129,684
Total			1,072,008

[a] Binder oxidizes and liberates heat, which is neglected in this calculation.

[b] Average value of coefficient is less than 0.3 because oven is not up to 575 F. This is neglected. 422 F is arrived at by taking area under curve as compared to area under 575 F ordinate.

ESTIMATING METHODS

Values based on practical experience are available for rough estimating of drying problems. The temperature will drop approximately 8.5 F per grain of water evaporated per cubic foot of air (measured at 70 F) or approximately 0.62 F per pound of air at any temperature. Air will drop 55 F per cubic foot for each Btu extracted. Generally air will absorb from 2 grains to 5 grains per cubic foot of air in one passage through an air dryer, depending on the temperature and the degree of contact with the material. The amount of steam required to evaporate a pound of water will vary from 1.5 lb to a more usual figure of from 2.5 to 3 lb of steam per pound of water evaporated.

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