TABLE 2. CUBIC INCHES OF AMMONIA VAPOR TO BE CIRCULATED TO PRODUCE ONE TON OF REFRIGERATION IN TWENTY-FOUR HOURS

| Condenser Pressure | | Gage | 95 | 110 | 125 | 140 | 155 | 170 | 185 | 200 | 215 | 230 | 245 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Abs. | 109.7 | 124.7 | 139.7 | 154.7 | 169.7 | 184.7 | 199.7 | 214.7 | 229.7 | 244.7 | 259.7 |
| Temperature of Liquid | | | 61°F. | 68° | 74.4° | 80.3° | 85.8° | 91° | 95.8° | 100.3° | 104.6° | 108.7° | 112.6° |
| Suction Pressure | | Temp. of Suction | Ammonia Vapor in Cubic Feet per Minute | | | | | | | | | | |
| Gage | Abs. | | | | | | | | | | | | |
| 5"V. | 12.2# | −33.6°F | 14,880 | 15,100 | 15,310 | 15,525 | 15,750 | 15,975 | 16,175 | 16,375 | 16,575 | 16,775 | 16,975 |
| 4" | 12.7 | −32.3° | 14,320 | 14,550 | 14,750 | 14,950 | 15,170 | 15,375 | 15,560 | 15,750 | 15,940 | 16,120 | 16,310 |
| 3" | 13.2 | −30.9° | 13,820 | 14,040 | 14,240 | 14,440 | 14,630 | 14,825 | 15,010 | 15,190 | 15,375 | 15,560 | 15,740 |
| 2" | 13.7 | −29.6° | 13,340 | 13,540 | 13,720 | 13,920 | 14,110 | 14,300 | 14,480 | 14,660 | 14,840 | 15,010 | 15,190 |
| 1" | 14.2 | −28.4° | 12,885 | 13,075 | 13,250 | 13,445 | 13,640 | 13,820 | 13,990 | 14,150 | 14,320 | 14,490 | 14,660 |
| 0# | 14.7 | −27.1° | 12,460 | 12,650 | 12,840 | 13,020 | 13,200 | 13,375 | 13,540 | 13,700 | 13,860 | 14,025 | 14,190 |
| 1# | 15.7 | −24.8° | 11,700 | 11,855 | 12,020 | 12,210 | 12,380 | 12,545 | 12,720 | 12,875 | 13,010 | 13,150 | 13,305 |
| 2 | 16.7 | −22.6° | 11,005 | 11,160 | 11,340 | 11,500 | 11,660 | 11,810 | 11,950 | 12,100 | 12,240 | 12,400 | 12,540 |
| 3 | 17.7 | −20.4° | 10,410 | 10,575 | 10,710 | 10,850 | 11,020 | 11,175 | 11,310 | 11,450 | 11,590 | 11,730 | 11,860 |
| 4 | 18.7 | −18.4° | 9885 | 10,020 | 10,180 | 10,310 | 10,450 | 10,595 | 10,720 | 10,850 | 10,990 | 11,110 | 11,225 |
| 5 | 19.7 | −16.5° | 9400 | 9540 | 9690 | 9820 | 9960 | 10,090 | 10,210 | 10,340 | 10,450 | 10,580 | 10,700 |
| 8 | 22.7 | −11.0° | 8200 | 8310 | 8425 | 8550 | 8675 | 8790 | 8895 | 9000 | 9100 | 9200 | 9305 |
| 10 | 24.7 | −7.7° | 7550 | 7670 | 7770 | 7880 | 7990 | 8090 | 8190 | 8290 | 8390 | 8480 | 8580 |
| 12 | 26.7 | −4.7° | 7010 | 7110 | 7210 | 7320 | 7420 | 7520 | 7610 | 7700 | 7795 | 7880 | 7980 |
| 15 | 29.7 | −0.3° | 6320 | 6420 | 6510 | 6610 | 6695 | 6790 | 6860 | 6940 | 7025 | 7110 | 7190 |
| 20 | 34.7 | +6.1° | 5445 | 5530 | 5605 | 5690 | 5750 | 5825 | 5905 | 5990 | 6040 | 6110 | 6190 |
| 25 | 39.7 | +11.9° | 4780 | 4850 | 4910 | 4990 | 5050 | 5110 | 5190 | 5240 | 5300 | 5380 | 5420 |
| 30 | 44.7 | +17.0° | 4250 | 4310 | 4380 | 4440 | 4500 | 4560 | 4620 | 4680 | 4725 | 4790 | 4840 |
| 35 | 49.7 | +21.8° | 3850 | 3910 | 3970 | 4020 | 4070 | 4120 | 4170 | 4220 | 4270 | 4320 | 4370 |
| 40 | 54.7 | +26.2° | 3510 | 3560 | 3610 | 3655 | 3705 | 3760 | 3810 | 3855 | 3905 | 3940 | 3980 |
| 45 | 59.7 | +30.3° | 3220 | 3280 | 3320 | 3360 | 3410 | 3450 | 3500 | 3540 | 3590 | 3630 | 3680 |
| 50 | 64.7 | +34.1° | 2980 | 3020 | 3070 | 3110 | 3150 | 3190 | 3225 | 3275 | 3310 | 3350 | 3390 |





Estimates as shown by the dotted lines on the charts are made as follows:

1. Total heat load—4,000 B.t.u. per minute
   20 tons refrigeration
2. Design and conditions allow 6 deg. rise in water temperature
3. Average water temperature 44 deg.
4. Average ammonia temperature 10 deg.
5. Difference ammonia and water 34 deg.
6. Gallons handled per ft. of trough 1¼
7. Standard unit available allows 8 ft. long troughs

Fig. 1 shows that 80 gallons water per minute are required.

Fig. 2 shows that 140 sq. ft. of cooling coil surface are required when working at the rate of 50 B.t.u. per hour per square foot per degree difference.

Fig. 3 shows 64 lineal feet trough required.

Also shows 8 troughs and coils wide and space required as follows:

6 in. coil centers require space 54 in. wide
8 in. coil centers require space 68 in. wide
10 in. coil centers require space 82 in. wide
12 in. coil centers require space 96 in. wide

From Figs. 2 and 3 it was found that 140 sq. ft. of surface and 64 lineal feet of troughs were required. Fig. 4 shows the following:

| | | | |
|---|---|---|---|
| Pipe diameter | 1½ in. | 1¼ in. | 1 in. |
| Lineal Feet | 225 | 283 | 404 |
| Pipes High | 5 | 6 | 7 |

Pipes High have been increased to eliminate fractions and in designing a unit the lineal feet of coil required would have to be increased in proportion. Allowance must be made for dirty coils, uneven water distribution, quick control of temperatures, and other factors, all of which might double the coil surface shown mathematically by the charts.

The heat-transfer which may be obtained in the upper chamber and the maximum rise in the water temperature, and therefore the use of Fig. 1, will vary with each change in nozzle, pump pressure, time element, pounds of water used per pound of air, water to air temperature differences, and other such factors as might be expected, but once the volume of water and the temperature through which it must be cooled are determined, the design of that part of the apparatus using refrigeration will be a comparatively simple problem to those familiar with such work.

In this work the problems are many and varied, for cooling is used in many industries as well as for the conditioning of air in hotel dining-rooms, theatre auditoriums, and many other rooms where it is desirable to maintain a temperature under that prevailing out of doors.

With modern refrigerating and dehumidifying apparatus properly designed and applied it is possible to obtain most any percentage of ventilation perfection. Unless artificial cooling is resorted to it is hardly