

FIGURE 305.—A Mercator map of the world.

The formula for meridional parts, given in the explanation to table 5, is derived from an integral representing the exact relationship.

307. Mercator chart construction.—To construct a Mercator chart, first select the scale and then proceed as follows:

Draw a series of vertical lines to represent the meridians, spacing them in accordance with the scale selected. If the chart is to include the equator, the distances of the various parallels from the equator are given directly in table 5, although it may be desirable to convert the tabulated values to more convenient units. Thus, if $1^\circ(60')$ of longitude is to be shown as one inch, each meridional part will be $\frac{1}{60}$ or 0.01667 inch in length. The distance, in inches, of any parallel from the equator is then determined by dividing its meridional parts by 60 or multiplying them by 0.01667.

If the equator is not to be included, the **meridional difference (m)** is used. This is the difference between the meridional parts of the various latitudes and that of the lowest parallel (the one nearest the equator) to be shown. Distances so determined are measured from the lowest parallel.

It is often desired to show a minimum area on a chart of limited size, to the largest possible scale. The scale is then dictated by the limitations.

When the graticule has been completed, the features to be shown are located by means of the latitude and longitude scales.

Example.—A Mercator chart is to be constructed at the maximum scale on a sheet of paper 35×46 inches, with a minimum two-inch margin outside the **neat line** limiting

the charted area. The minimum area to be covered is lat. 44°–50° north and long. 56°–68° west.

Solution.—*Step one:* Determine which dimension to place horizontal. From table 5 the meridional difference is:

$$\begin{array}{r} M_{50^\circ} \text{ 3456.6} \\ M_{44^\circ} \text{ 2929.6} \\ \hline m \quad \text{527.0} \end{array}$$

The chart is to cover at least 12° (68°–56°) of longitude. The longitude is therefore to cover a distance of $12 \times 60 = 720$ meridional parts. Since there are a greater number of meridional parts of longitude to be shown than of latitude, the long dimension is placed horizontal.

Step two: Determine whether the latitude or longitude is the limiting scale factor. The number of inches available for latitude coverage is 31 (35 inches minus a two-inch margin top and bottom). If 527 meridional parts are to be shown in 31 inches, each meridional part will be $\frac{31}{527} = 0.05882$ inch. There are $46 - 4 = 42$ inches available for

longitude, and therefore the length of each meridional part will be $\frac{42}{720} = 0.05833$ inch. Thus, the longitude is the limiting scale factor, for all of the desired area could not be shown in the available space if the larger scale were to be used. Using the smaller scale, it is found that 30.74 inches (0.05833×527) will be needed to show the desired latitude coverage. The top and bottom margins can be increased slightly, or additional latitude coverage can be shown. If it is desired to include the additional coverage, the amount can be determined by dividing the available space, 31 inches, by the scale, 0.05833. This is 531.5 meridional parts, or 4.5 more than the minimum. By inspection of table 5, it is seen that the latitude can be extended either 3'.3 below 44° or 2'.9 above 50°. Suppose it is decided that the margin will be increased slightly and only the desired minimum coverage shown.

Step three: Determine the spacing of the meridians and parallels. Meridians 1° or 60' apart will be placed $60 \times 0.05833 = 3.50$ inches apart. Next, determine each degree of latitude separately. First, compute the meridional difference between the lowest parallel and the various parallels to be shown:

M_{45° 3013.5	M_{46° 3098.8	M_{47° 3185.7	M_{48° 3274.2	M_{49° 3364.5	M_{50° 3456.6
M_{44° <u>2929.6</u>	M_{44° <u>2929.6</u>	M_{44° <u>2929.6</u>	M_{44° <u>2929.6</u>	M_{44° <u>2929.6</u>	M_{44° <u>2929.6</u>
m 83.9	m 169.2	m 256.1	m 344.6	m 434.9	m 527.0

Next, determine the distance of each parallel from that of L 44°N by multiplying its meridional difference by the scale, 0.05833:

$$\begin{array}{l} L \ 44^\circ \text{ to } L \ 45^\circ = 0.05833 \times 83.9 = 4.89 \text{ in.} \\ L \ 44^\circ \text{ to } L \ 46^\circ = 0.05833 \times 169.2 = 9.87 \text{ in.} \\ L \ 44^\circ \text{ to } L \ 47^\circ = 0.05833 \times 256.1 = 14.94 \text{ in.} \\ L \ 44^\circ \text{ to } L \ 48^\circ = 0.05833 \times 344.6 = 20.10 \text{ in.} \\ L \ 44^\circ \text{ to } L \ 49^\circ = 0.05833 \times 434.9 = 25.37 \text{ in.} \\ L \ 44^\circ \text{ to } L \ 50^\circ = 0.05833 \times 527.0 = 30.74 \text{ in.} \end{array}$$

Step four: Draw the graticule. Draw a horizontal line 2.13 inches $\left(\frac{35 - 30.74}{2}\right)$ from the bottom. This is the lower neat line. Label it "44°N." Draw the right-hand neat line two inches from the edge. Label it "56°W." Along the lower parallel measure off distances in units of 3.50 inches from λ 56°W at the right to λ 68°W at the left. Through the points thus located draw vertical lines to represent the meridians.

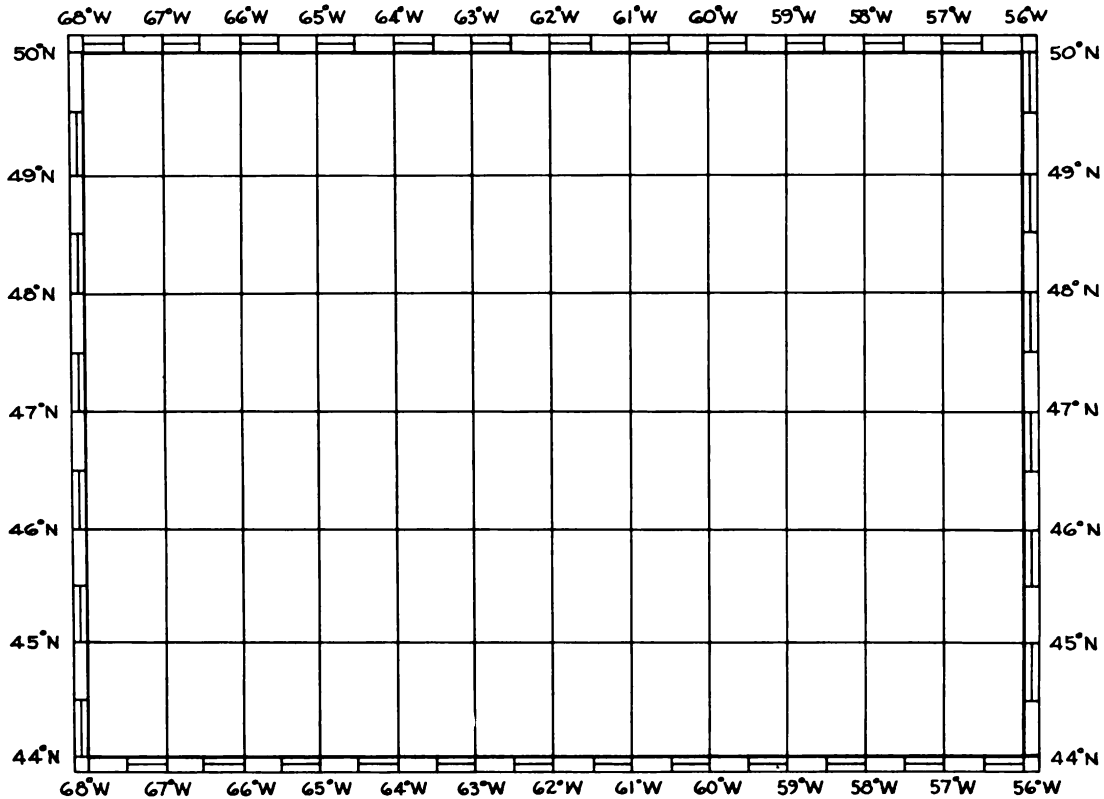


FIGURE 307.—The graticule of a Mercator chart from L 44° N to L 50° N and from λ 56° W to λ 68° W.

Along any meridian measure upward from the horizontal line a series of distances as determined by the calculations above. Through these points draw horizontal lines to represent the parallels. Label the meridians and parallels as shown in figure 307.

Step five: Mark off the latitude and longitude scales around the neat line. The scales can be graduated in units as small as desired. Determine the longitude scale by dividing the degrees into equal parts. Establish the latitude scale by computing each subdivision of a degree in the same manner as described above for whole degrees. In low latitudes degrees of latitude can be divided into equal parts without serious loss of accuracy.

Step six: Fill in the desired detail.

In *south* latitude the distance between consecutive parallels increases toward the *south*. The top parallel is drawn first and distances measured downward from it. Latitude labels increase toward the *south* (down).

In *east* longitude the longitude labels increase toward the *east* (right).