

1 The Sundial Primer - "Dialling Guides" Vertical Direct East & West Sundials

created by
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The purpose of the "Dialling Guides" is to provide an easy method for laying out the hour lines for a number of vertical direct east and west sundials located at any latitude in either the Northern or Southern Hemispheres. The basic layout for vertical direct east and west sundials is universal and can be used anywhere in the world. All that is required is to rotate the dial plate so the gnomon points to the celestial pole. Simple adjustments to the hour lines are also required. The relative distance of the hour lines from the gnomon is the same for any vertical direct east or west sundial regardless of its size. Please go to "The Sundial Primer" and visit the "Vertical East/West Sundials" page for more details.

The "Dialling Guides" are very easy to use and will help you lay out a variety of vertical direct east and west sundials. They come in two sizes if printed out at full scale. One set can be printed on 8-1/2" by 11" paper and the other on 11" by 17" paper. The scaling is in inches and will help in determining the required size of the dial plate. The "Dialling Guides" can be printed to any size but then the scaling in inches is no longer valid. This gives you the flexibility to create any size of "Dialling Guide" you need to meet your requirements. The following summarizes the vertical direct east and west sundials "Dialling Guides" available:

1. Sizes: 6 to 18 inches in 1/2 inch increments; Time Range: 1 a.m. to 11 a.m./1 p.m. to 11 p.m.; Time Increment: 10 minutes
2. Sizes: 6 to 18 inches in 1/2 inch increments; Time Range: 1 a.m. to 11 a.m./1 p.m. to 11 p.m.; Time Increment: 15 minutes
3. Sizes: 14 to 18 inches in 1/2 inch increments; Time Range: 12:30 a.m. to 11:30 a.m./12:30 p.m. to 11:30 p.m.; Time Increment: 10 min.
4. Sizes: 14 to 18 inches in 1/2 inch increments; Time Range: 12:30 a.m. to 11:30 a.m./12:30 p.m. to 11:30 p.m. 15 minutes
5. Sizes: 18 to 30 inches in 1/2 inch increments; Time Range: 1 a.m. to 11 a.m./1 p.m. to 11 p.m.; Time Increment: 5 minutes
6. Sizes: 24 to 30 inches in 1/2 inch increments; Time Range: 12:30 a.m. to 11:30 a.m./12:30 p.m. to 11:30 p.m.; Time Increment: 5 min.

First determine the type, east or west, and size of vertical sundial you wish to create. The size indicated on the "Dialling Guides" is the dial plate width based only on the space required for the hour lines. The gnomon thickness, which will be discussed later, and any extra space required around the dial plate for aesthetics must also be considered. Select the appropriate "Dialling Guide" based on the desired time range and increment. Some of the "Dialling Guides" have hour lines extending beyond the normal defined time range. This was done whenever paper space permitted and it is up to you whether or not to include these additional time lines. Once you have the "Dialling Guide" you need it requires a little preparation before it can be used. For example, let's say we want to make vertical direct east and west sundials with a nominal width of 13 inches, time ranges of 3 a.m. to 11 a.m. and 1 p.m. to 9 p.m. respectively and 15 minute time increments. The selected width and time ranges are not absolute as will be seen later. Figure 1 shows the "Dialling Guide" that will be used.

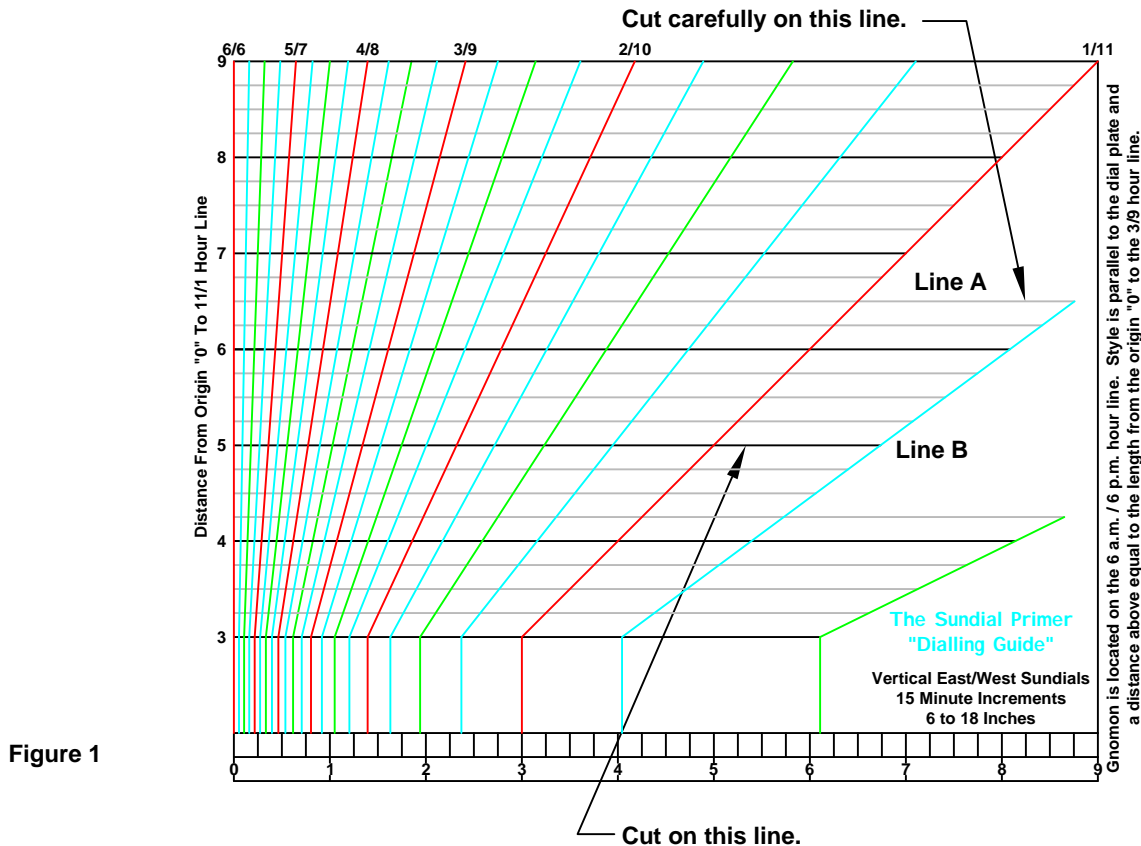


Figure 1

This "Dialling Guide" provides the layout of the hour lines for 25 vertical direct east and west sundials. Line "A" contains the required information for the hour lines of a 13 inch vertical direct east or west sundial. Extend this line to the right and cut carefully on the line. Extend and cut along line "B". This is done only to make the Guide easier to handle and line "B" can be any line you choose. All the margin information is lost when you cut out the Guide so write the numbers at each of the hour lines. It's just that easy!

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Vertical Direct East & West Sundials

Figure 2 shows the "Dialling Guide" ready for use. Note that the available time ranges are 12:45 a.m. to 11:15 a.m. for the vertical east sundial and 12:45 p.m. to 11:15 p.m. for the vertical west sundial, should you wish to include an extra 15 minutes. For this example the extra 15 minutes will not be included. The point "X" will be used later to help in laying out the hour lines.

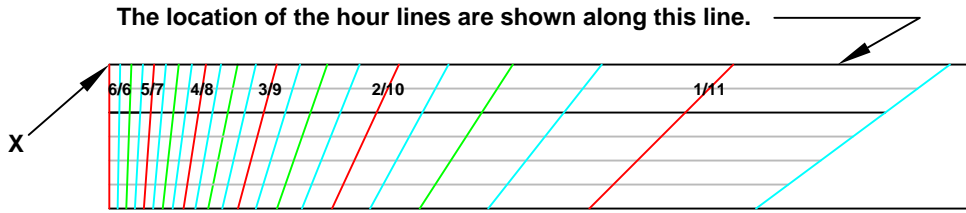


Figure 2

The hour line layout for vertical direct east and west sundials is the same as that for the classical polar sundial. The numbering of the hour lines for a polar sundial is based around 12 (noon). For a vertical direct east sundial the numbering is based around 6 a.m. and for a vertical direct west sundial it is around 6 p.m. The gnomon is the same construction as for a polar sundial. The gnomon for a polar sundial is located on the 12 (noon) hour line but for a vertical direct east sundial it is located on the 6 a.m. hour line and for a vertical direct west sundial on the 6 p.m. hour line. However to align the gnomon of the vertical direct east and west sundials with the celestial pole the entire dial must be rotated. Figure 3 illustrates these sundials at their extreme locations, the poles and the equator. Theoretically the hour lines can extend to noon and midnight but the sundial would become rather large. All other sundials will fall between these extremes.

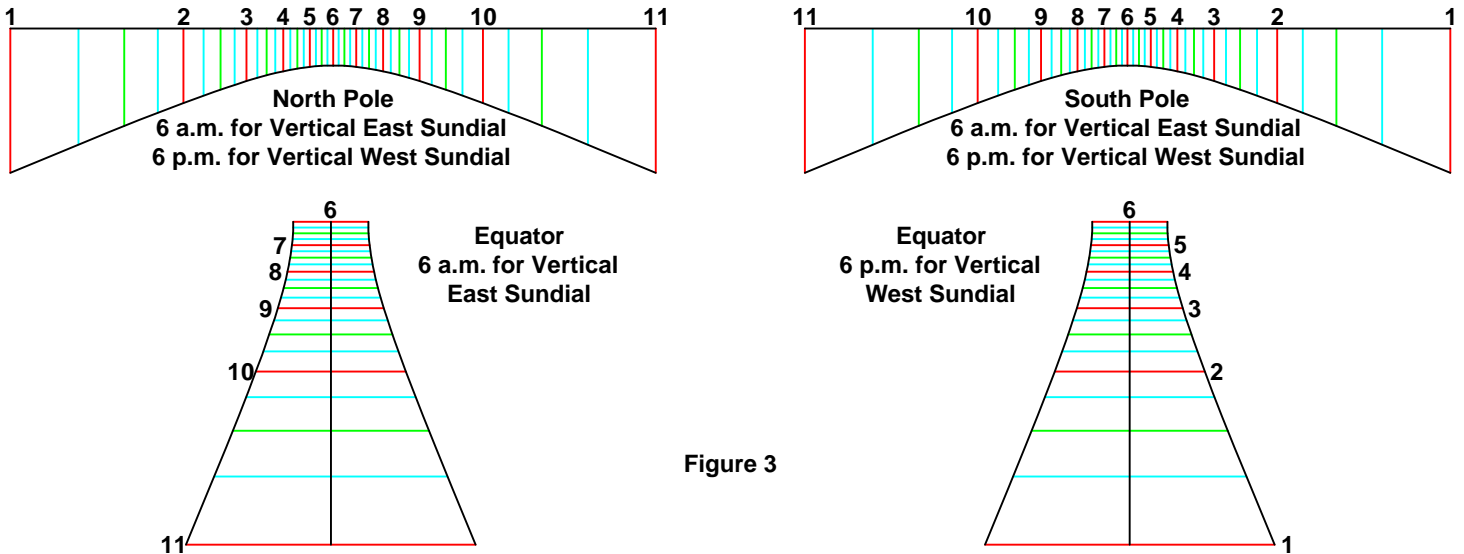


Figure 3

A vertical direct east sundial will display the hours between sunrise and noon and the vertical direct west between noon and sunset.

As can be seen from Figure 3 the dimensions of the dial plate can vary greatly depending upon the sundial's latitude. Once you learn how to lay out the sundial you will be able to determine the size that will meet your design needs. The location of the solstice lines is also similar to that of the classical polar sundial. There is a discussion in the Polar Sundial "Dialling Guides" regarding the relationship between these lines and dial plate sizing. It would be useful to read this information as it will give you guidance and it will not be reproduced in these instructions. The following figures do not take sizing into consideration and no dimensions are given.

The procedure for laying out the sundials given here will generate the sundial as it would appear on the wall. If you have a rectangular plate that you would like to place the sundial on you will find that it will be better to rotate the sundial by an angle equal to the latitude for a horizontal layout and the co-latitude ($90^\circ - \text{latitude}$) for a vertical layout on the dial plate. This will become clear when you examine the following figures.

Figure 4 illustrates the initial layout that can be used for a vertical direct east sundial in the Northern Hemisphere and a vertical direct west sundial in the Southern Hemisphere. Figure 5 illustrates the initial layout that can be used for a vertical direct west sundial in the Northern Hemisphere and a vertical direct east sundial in the Southern Hemisphere. The following description is applicable to both figures.

Draw the horizontal line AB. Draw the line CD through line AB and at angle equal to the latitude. Draw the line EF through the intersection point of lines AB and CD and perpendicular to line CD. Draw lines GH and JK parallel to line EF and on opposite sides. Use the "Dialling Guide" to obtain the correct spacing between these lines. The distance from line EF to lines GH and JK is equal to the distance from the hour lines 6/6 to 3/9 on the "Dialling Guide". Draw lines C'D' and C''D'' parallel to lines CD and at a distance equal to half the width of the gnomon. This must be done so the hour lines can be shifted to compensate for the width of the gnomon.

If you do not do this a significant error will be introduced into the sundial. Depending upon the sundial, before 6 a.m. or 6 p.m. the shadow will be cast by one edge of the gnomon's style and after 6 a.m. or 6 p.m. the shadow will be cast by the other edge. Don't miss this step! Draw the line A'B' parallel to the line AB and through the the intersection of lines C'D' and EF. The horizon line AB is moved to line A'B' as a result of the wide gnomon.

The dial plate is now ready to have the hour lines marked. This step is carried out one way for a vertical direct east sundial in the Northern Hemisphere and a vertical direct west sundial in the Southern Hemisphere and a second way for a vertical direct west sundial in the Northern Hemisphere and a vertical direct east sundial in the Southern Hemisphere. The "Dialling Guide" shown in Figure 2 will be used. Marking the points for the hour lines is a four step process as shown in Figures 6 and 7. These steps can be carried out in any order however it is advisable to carry out Steps 1 and 2 in sequence. Step 1 establishes the number of hour lines to be drawn in Step 2 as the hour lines do not extend beyond the horizon line A'B'. The number of hours lines that will be displayed depends upon the latitude. The 6/6 hour line must always lie against one side of the gnomon and the point "X" placed in the four positions shown. After all the desired hour lines are marked the points can be joined to create a series of lines as shown in Figure 8. These are the hour lines. All that is left is to label the hour lines. This is also shown in Figure 8 and depends upon the type and location of sundial as indicated in the figure.

The next item that will be discussed is the gnomon. The gnomon is positioned on the 6 a.m. or 6 p.m. hour line and its style or shadow casting edge is parallel to the dial plate. One type of gnomon that can be used for a vertical direct east or west sundial is a simple rectangle. Figure 9 illustrates this gnomon. The height "H" is always equal to the distance from the 6/6 hour line to the 3/9 hour line. You can use the "Dialling Guide" to obtain this length as shown in Figure 10. The thickness "T" of the gnomon must be known before the sundial design is started. This is the distance that the two parts of the dial plate must be separated as was discussed earlier.

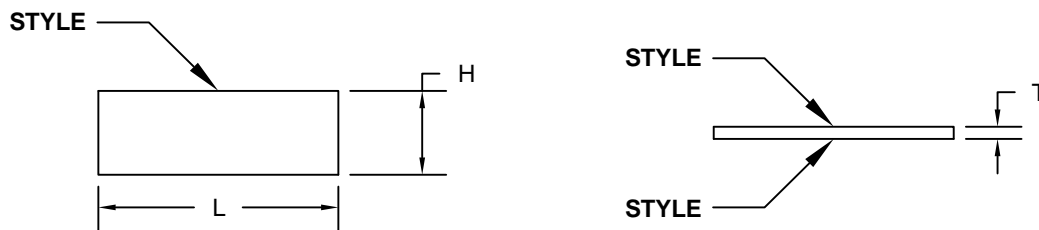


Figure 9

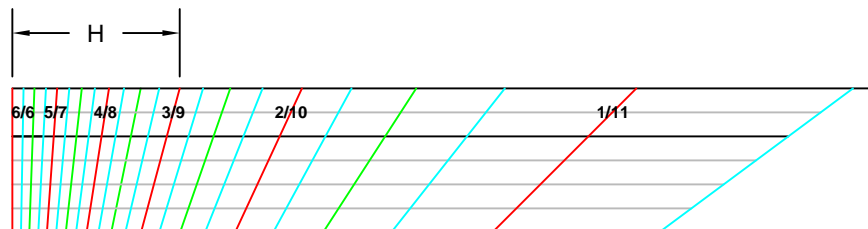


Figure 10

To help position the sundial correctly when installing it the horizon line AB should be marked in some way on the dial plate. This line must be horizontal when the sundial is in its final position.

Again it is suggested that you read the instruction for the Polar Sundial "Dialling Guides". There is information there that will be useful.

Happy Dialling!

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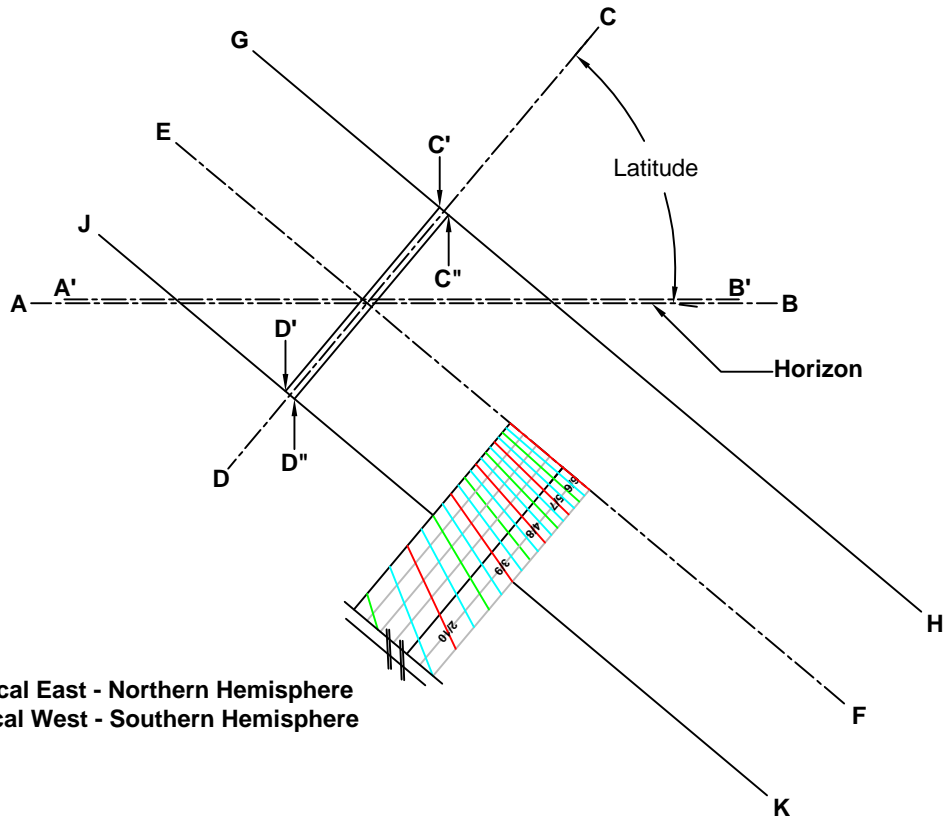


Figure 4

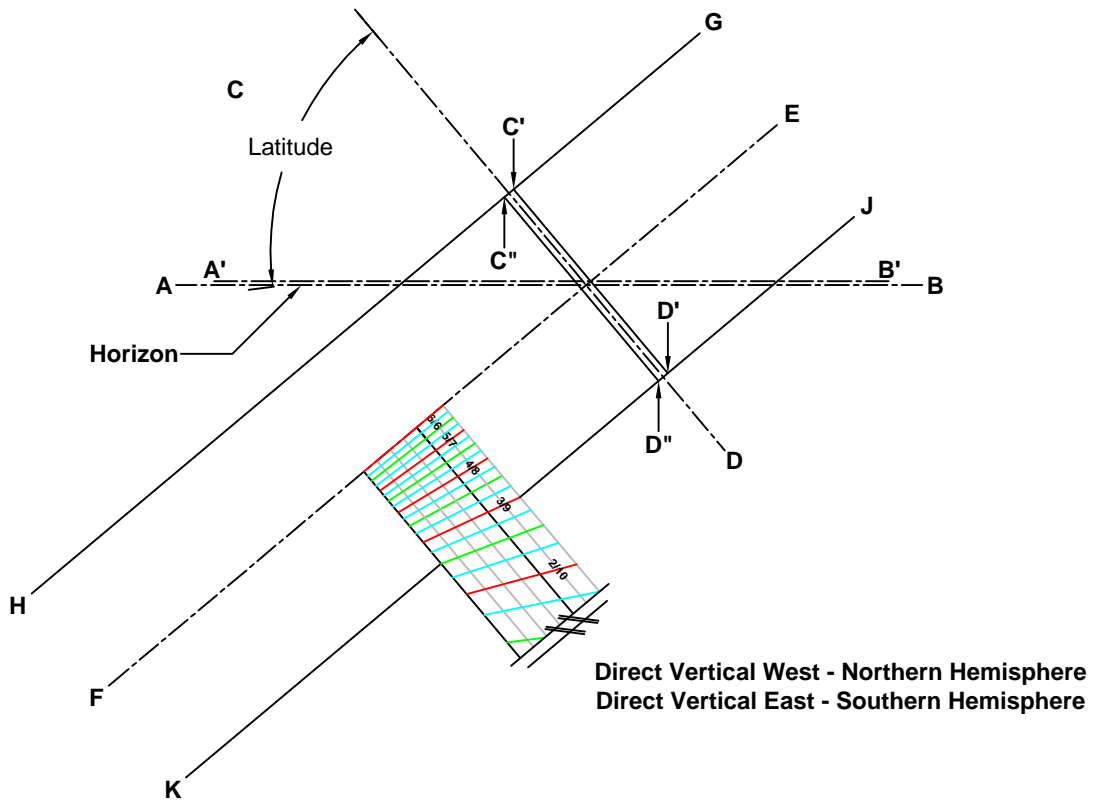


Figure 5

The Sundial Primer - "Dialling Guides" Vertical Direct East & West Sundials

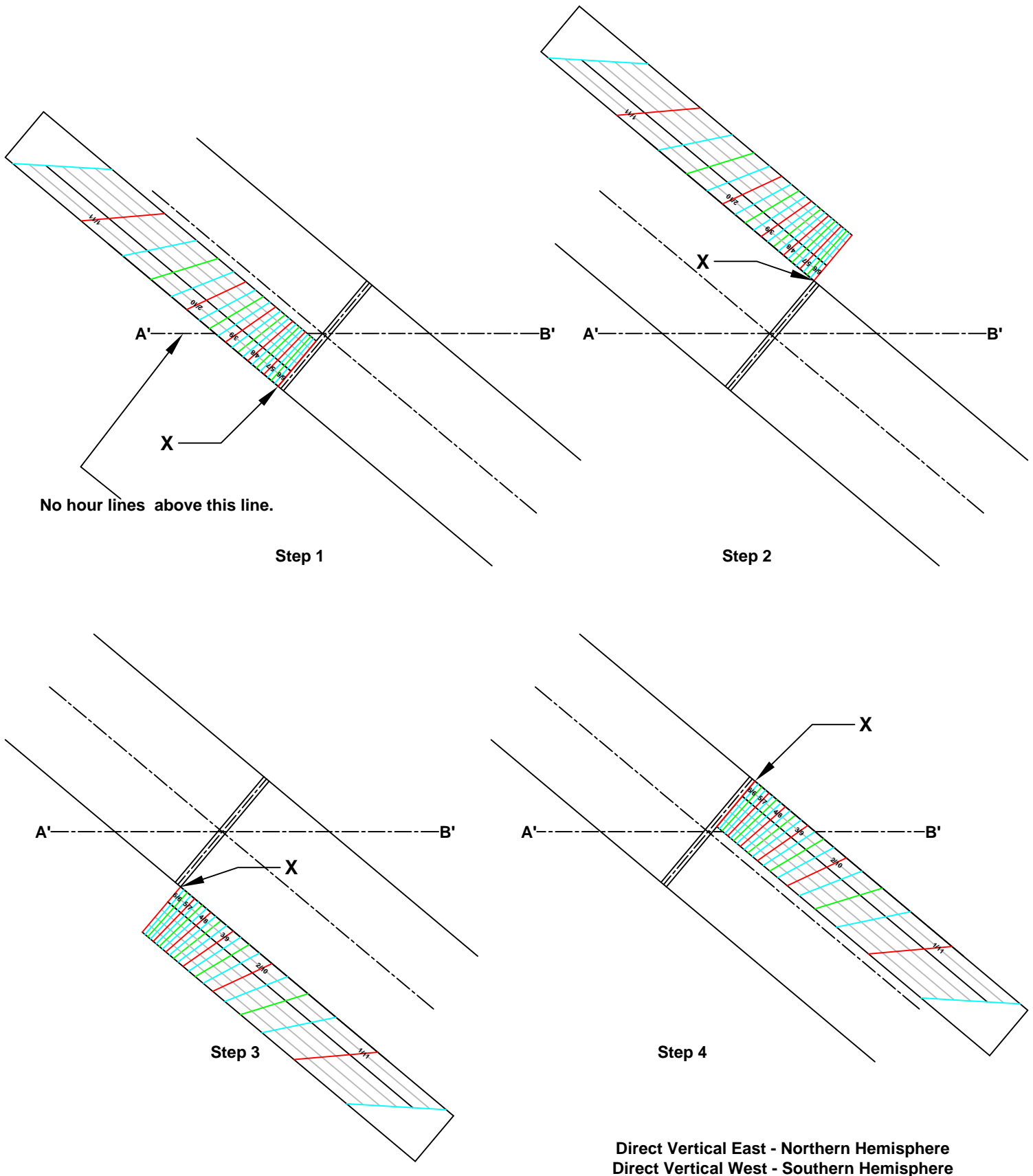


Figure 6

The Sundial Primer - "Dialling Guides" Vertical Direct East & West Sundials

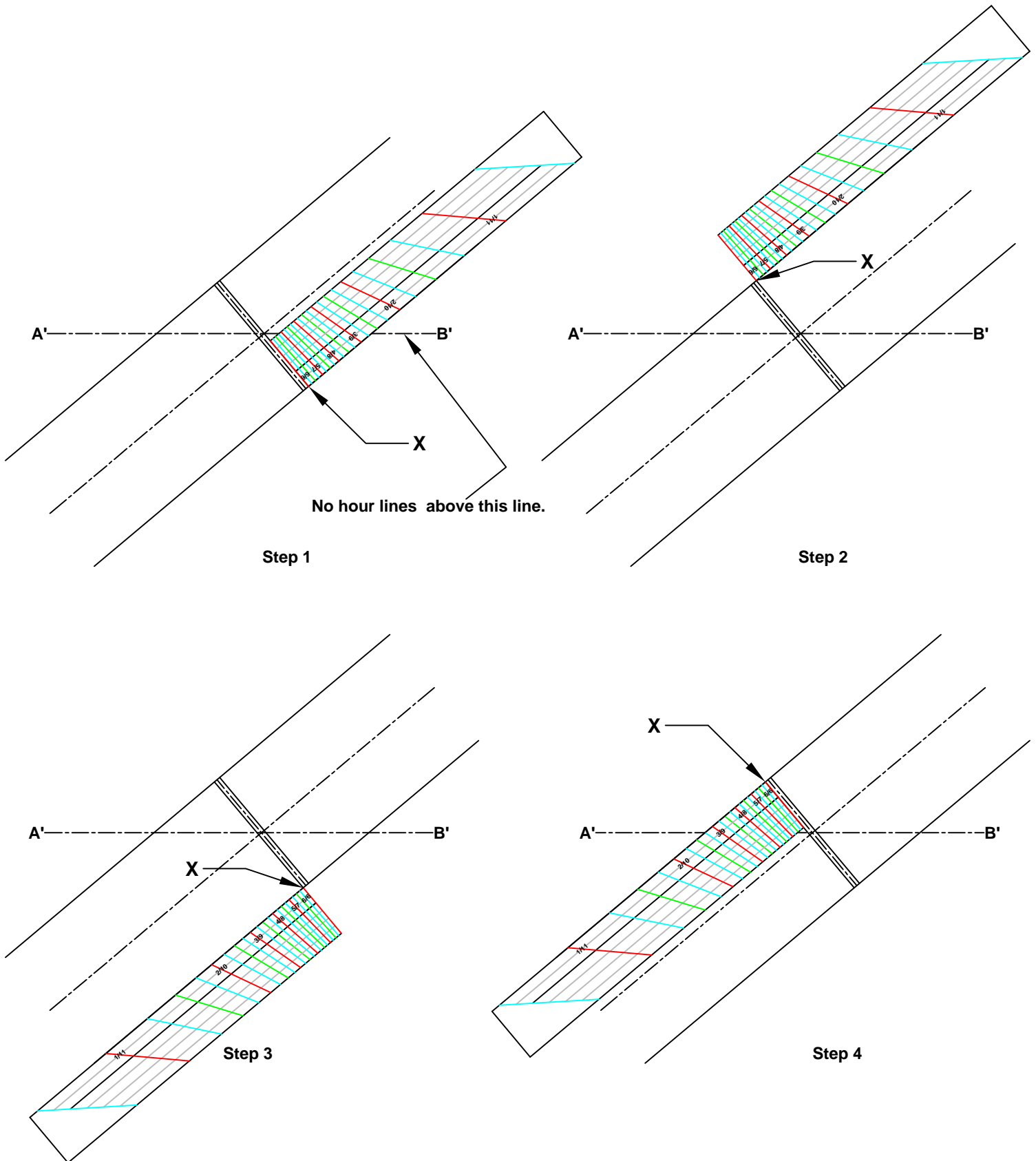
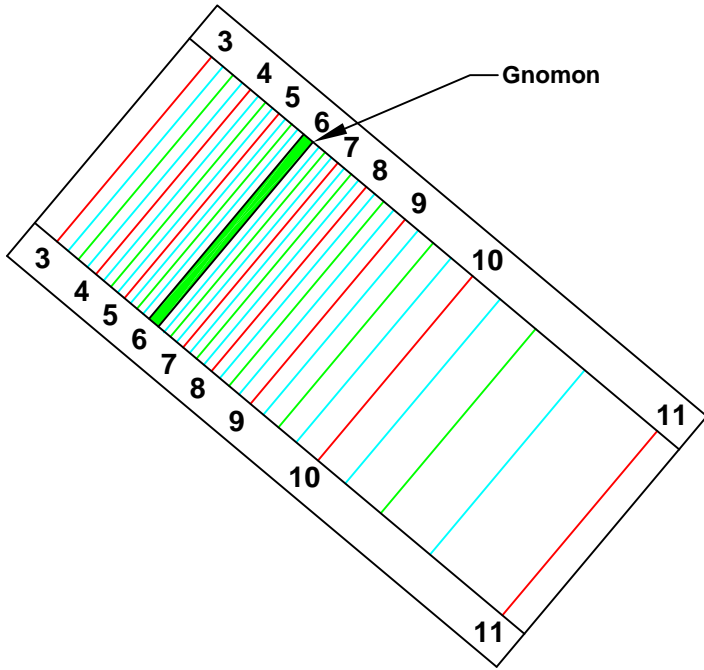
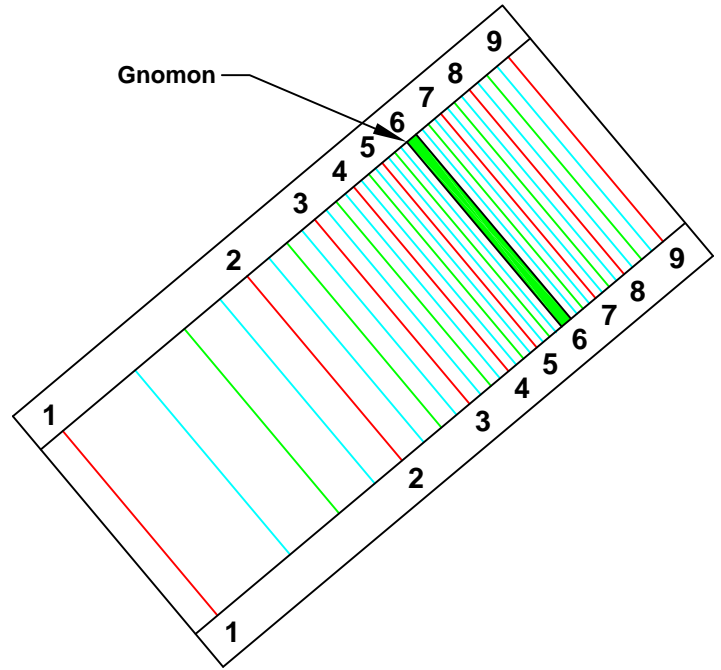


Figure 7

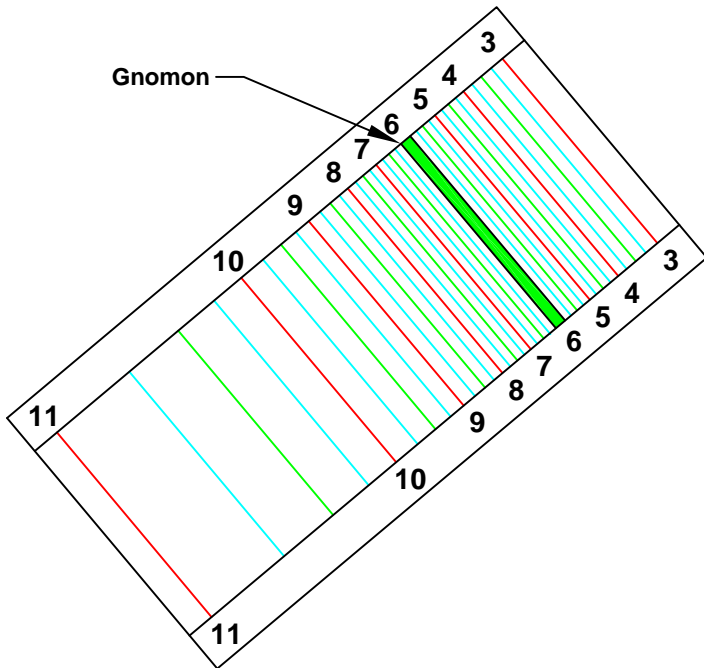
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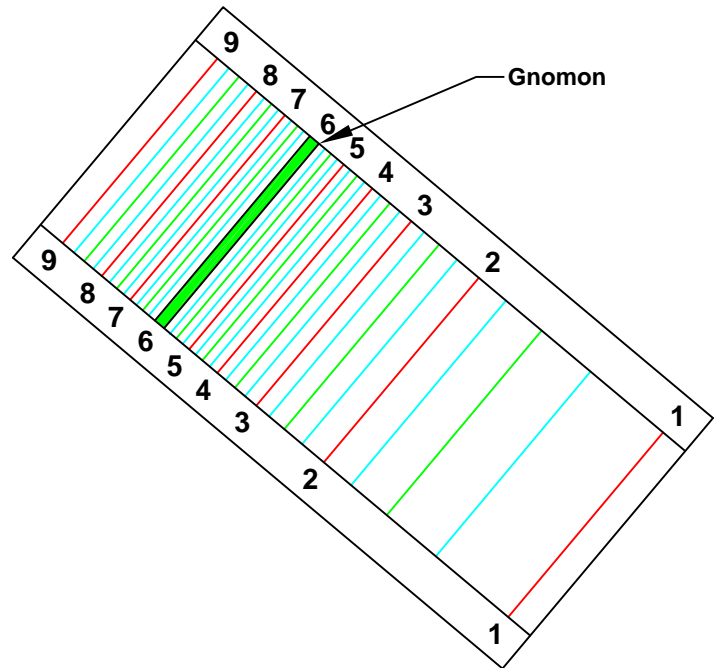
Direct Vertical East - Northern Hemisphere



Direct Vertical West - Northern Hemisphere



Direct Vertical East - Southern Hemisphere



Direct Vertical West - Southern Hemisphere

Figure 8