Chapter 5
Installing Balusters

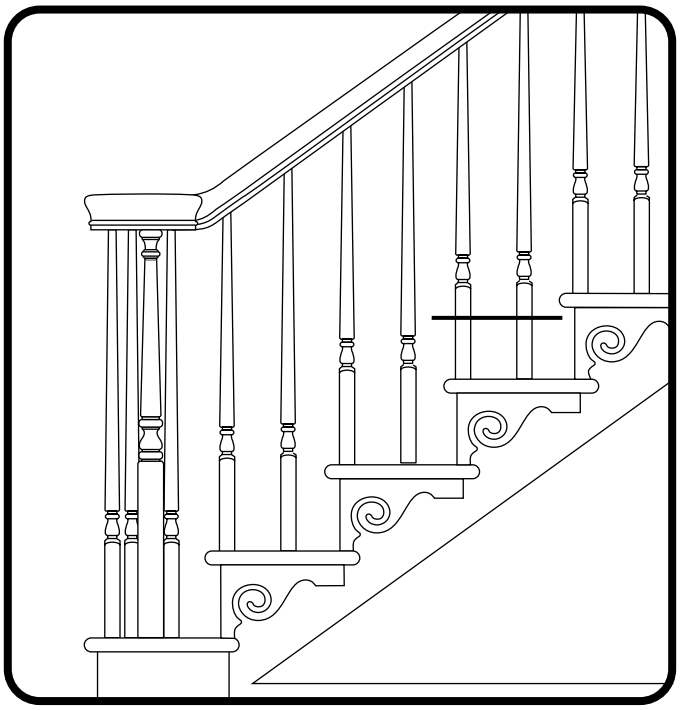
In this chapter:

Stair Balusters

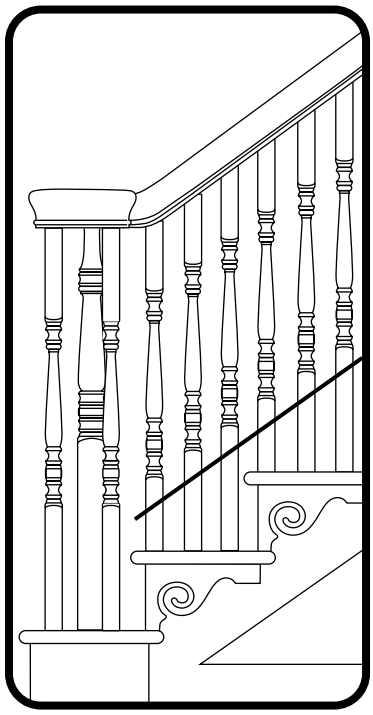
Balusters are the narrow, vertical sections of the staircase that help support the handrail. They are offered in a variety of sizes and designs and are usually selected to achieve aesthetical appeal. Due to safety reasons, baluster spacing is regulated by local building codes. The two most common types of balusters are square top and taper top.

This chapter will describe two types of baluster installations; tread-oriented baluster installation and rail-oriented baluster installation.

Traditional Tread Oriented



Rail Oriented



Tread-Oriented Balusters

Orienting the balusters to the treads is considered the more traditional installation method. With this type of installation, the bottom square on each of the balusters is the same length. Balusters are therefore oriented to correspond to the tread. Please note Fig. 5-1 here.

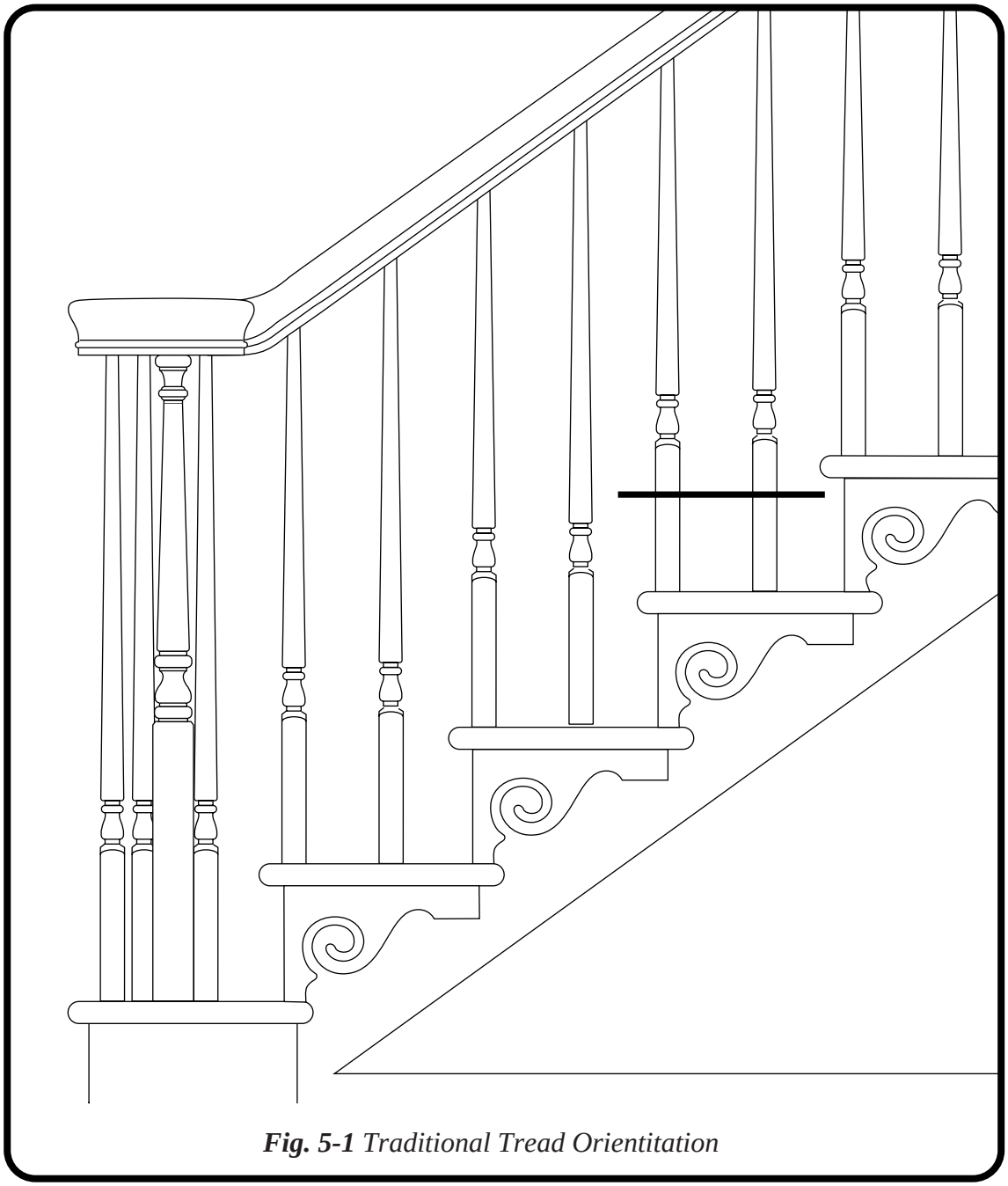


Fig. 5-1 *Traditional Tread Orientitation*

Installing Square Top Balusters

Laying Out the Treads

In the previous chapters you learned that when you set the newels and rail, you established a baluster or rail centerline for the staircase. You will use this centerline to determine the placement of the balusters on the treads. The face of the front or first baluster is usually even with the face of the riser.

The following steps describe the process:

1. From the face of the riser, measure back half the width of the baluster you are using and place a mark intersecting it with the rail centerline.

2. Space the second baluster evenly on the tread, so that all the balusters, up the rake (slope) are the same distance apart. On a "two baluster per step" installation, this is achieved by dividing the run of the stair by two. (This is the distance between adjacent risers.) Then measure back from the center mark of the first baluster and place a mark that intersects with the rail centerline. This will be the center mark of the second baluster. Please note Fig. 5-2 here.

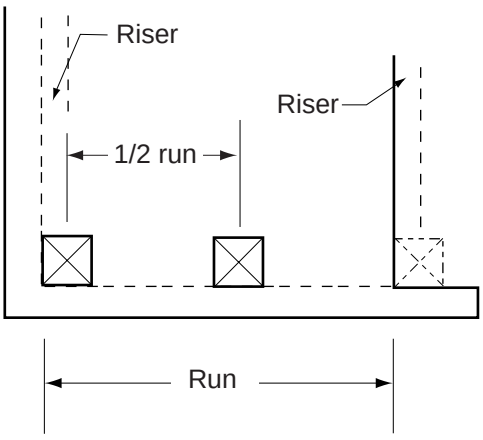


Fig. 5-2 *Determining placement of balusters on treads for "two baluster per step" installation.*

In the "three baluster per step installation" the placement is calculated the same way, except you must take the run and divide by three. Please note Fig. 5-3 here.

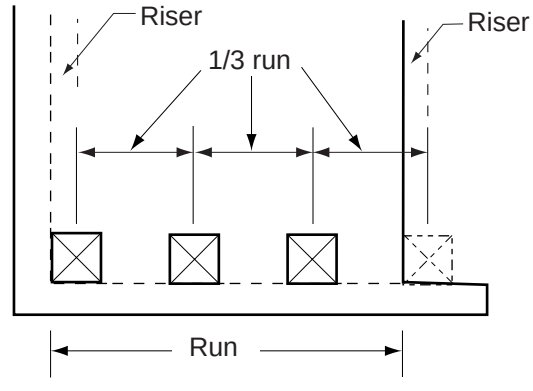


Fig. 5-3 *Determining placement of balusters on treads for "three baluster per step" installation.*

Note: Most building codes dictate that baluster placement must not allow a 4-inch sphere to pass through it. Consult local building codes for exact requirements.

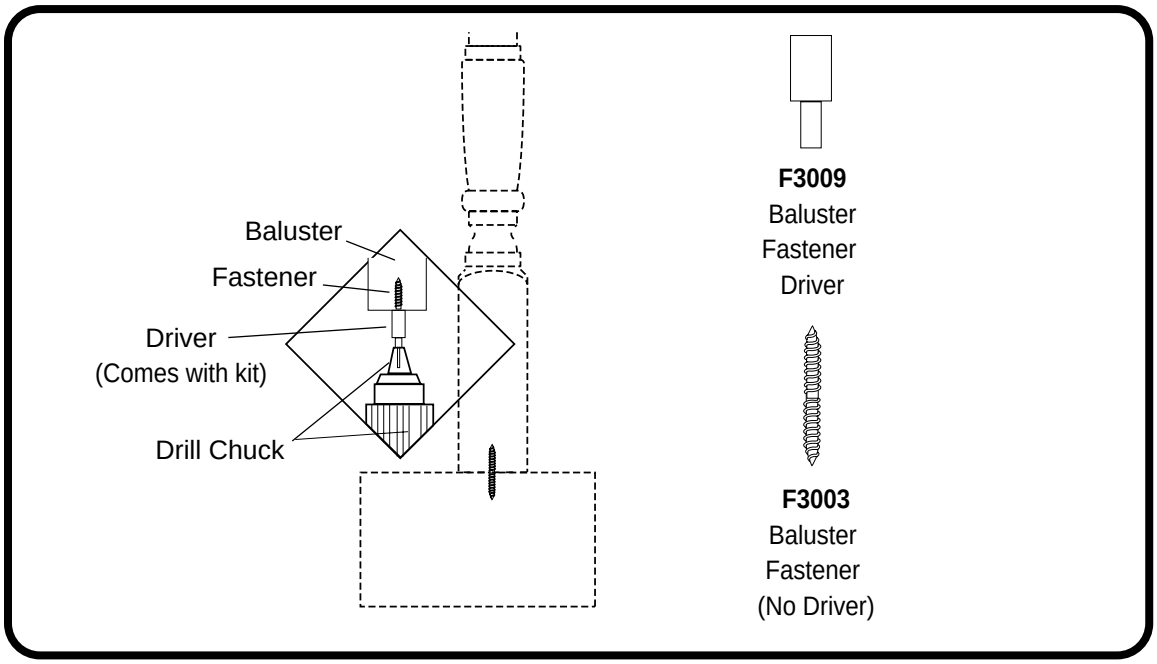
Boring the Treads

1. When installing manufactured balusters, drill the tread to accept the pre-made pins on the bottom of the baluster. If a factory turned dowel is not available, there are two basic types of dowels that may be added to your baluster: the wood dowel and the metal baluster screw.

   To install a wood dowel, drill a 1-inch hole in the bottom of the baluster (taking special care to match the correct diameter) and insert the dowel into the baluster. The dowel should be glued into the hole with at least 1/2-inch extending out from the bottom of the baluster.

Note: The dowel should be large enough to withstand the structural requirements.

   The second dowel type is a double-ended dowel screw. (Dowel screws and dowel screwdrivers can be purchased through your local stair parts distributor.) Dowel screws are utilized by inserting one end into the bottom of the baluster and leaving half of the screw exposed to insert into the tread.



Note: This dowel should be large enough to withstand the structural requirements.

2. On the previously marked intersecting lines of the baluster, drill a hole about 1-inch deep with a brad point bit of the appropriate diameter. Make sure the hole is perpendicular to the top of the tread.

Cutting the Balusters

1. Measure the length of every baluster in place.
2. Hold the baluster in place with the dowel pushed firmly into the hole in the tread.
3. Use a level to plumb the baluster perfectly. Please note Fig. 5-4 here.

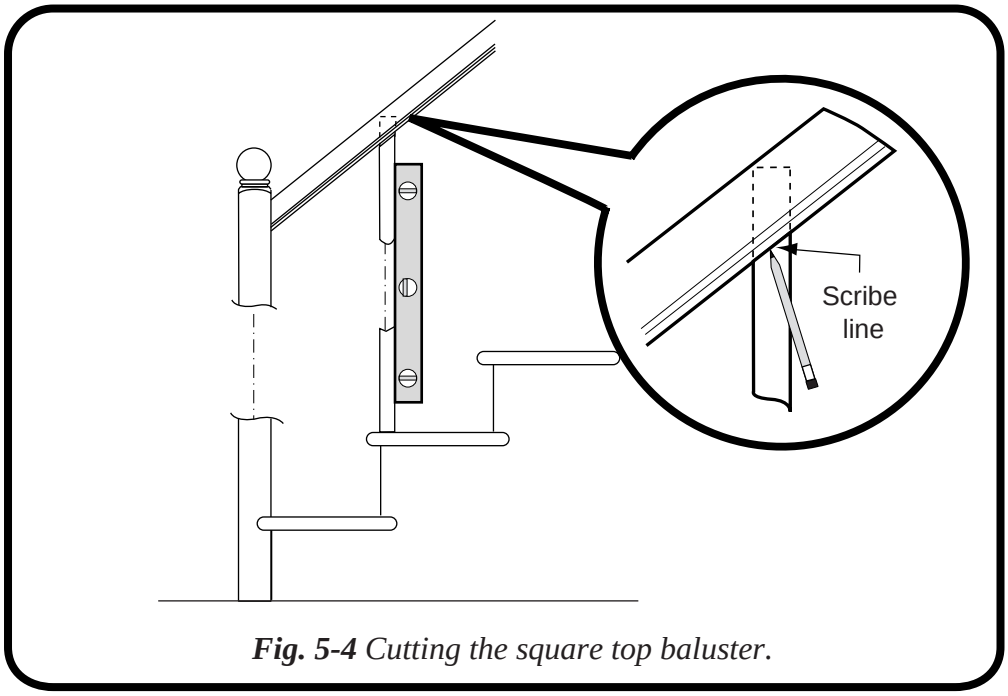


Fig. 5-4 *Cutting the square top baluster.*

4. Scribe a line even with the pitch of the rail.
5. Add the depth of the plow in the bottom of the rail to this length.
6. Using a miter-saw, cut the baluster at the proper angle.

Installing the Balusters

1. Place a small amount of glue into the hole in the tread and push the bottom dowel of the baluster firmly into the hole.
2. Next, place a small drop of glue on the top of the baluster and slide the angle cut of the baluster into the plowed portion of the rail.

3. Fasten the baluster to the rail with two small nails.
4. Use fillet to fill the plow between the balusters.
5. Measure the distance between the balusters and cut the fillet with the proper angles on each end.
6. Place two drops of glue on the bottom of the fillet and push it firmly into the plow.
7. Secure it with two small nails.

Installing Round Top Balusters

Boring the Treads

The instructions for this procedure are identical to the installation of square top balusters. Please note the prior section.

Boring the Rail

1. Using a level or a plumb bob, make a mark on the bottom of the rail directly above and corresponding with the baluster center on the tread.
2. Drill a hole of the appropriate diameter in the bottom of the rail. The hole size is determined by the diameter of the baluster top you have chosen.

Note: This hole must be drilled accurately.

There are several ways to bore the hole. One method is to use a jig made with a pitch block (see instructions in Chapter 3 on making a pitch block).

Drill a hole perpendicular to the run. The hole must be accurate and is best done on a drill press with the run side flat on the table. The drill bit should be the exact diameter of the baluster tops. This hole will guide your drill. Please note Fig. 5-5 here.

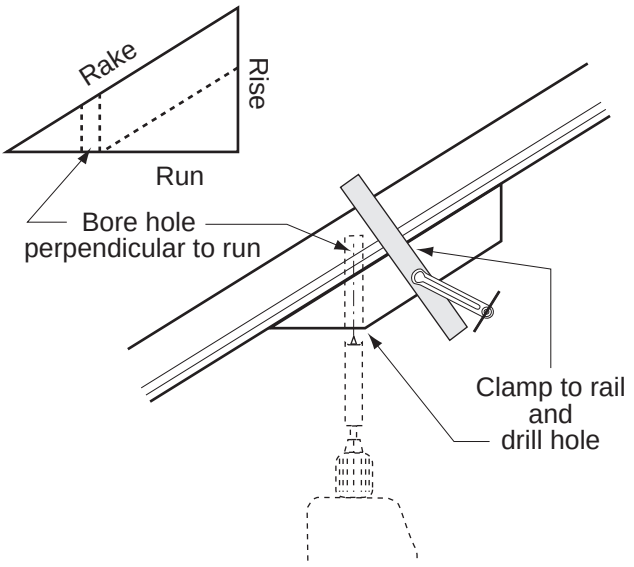


Fig. 5-5 *Using a jig to drill holes on a slope.*

3. Next, clamp the jig to the bottom of the rail with the run side parallel with the treads and the jig hole centered with the baluster mark on the bottom of the rail.
4. Drill the holes in the bottom of the rail about 1-1/2-inch deep. Place a piece of tape on the drill bit to make the holes uniform in depth and to prevent drilling too deep.

Cutting and Installing the Balusters

1. Measure the length of every baluster in place.
2. Hold the baluster in place with the dowel pushed firmly into the hole in the tread.
3. Line the center of the top of the baluster with the center of the hole in the bottom of the rail.

4. On the baluster, scribe a line equal to the pitch of the rail. Please note Fig. 5-6 here.

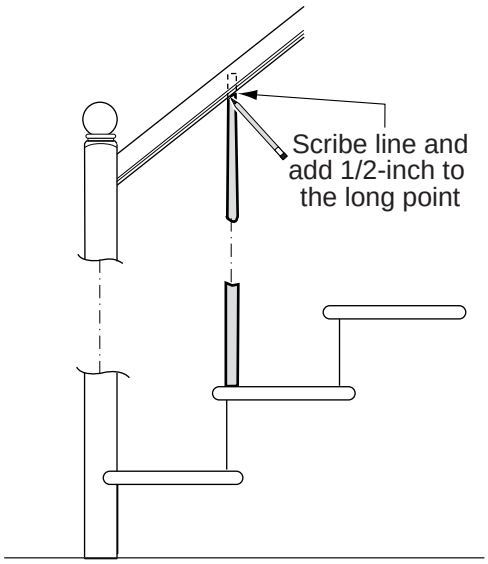


Fig. 5-6 *Alternative method for installing round top balusters.*

5. Add 1/2-inch to the longest point of this line and make a square cut on this mark with a miter saw.

6. Gently remove the rail.

7. Glue and nail the bottoms of each baluster into the tread. This will keep the balusters from spinning.

8. Push the rail down on top of the baluster, tapping it firmly with a rubber mallet.

9. Secure the rail to the newels.

10. Attach the baluster to the rail with a small nail.

Note: There is an alternate way to install round top balusters. When drilling the holes in the bottom of the rail, the holes should be 1-1/2-inches deep. Cut the balusters 1/2-inch longer than the length of the baluster as above. Next, push the top of the baluster up into the hole in the bottom of the rail. Then place glue in the hole in the tread and pull the baluster down, placing the dowel on the bottom of the baluster firmly into the hole. Secure each end with a small nail.

Rail-oriented or Raking the Balusters

The term "rail - oriented" generally applies to a baluster installation in which the bottom square and turning of the baluster is parallel to the handrail and not the tread. It is important in this method of installation that all the balusters have the same turning and top square lengths. Please note Fig. 5-7 here.

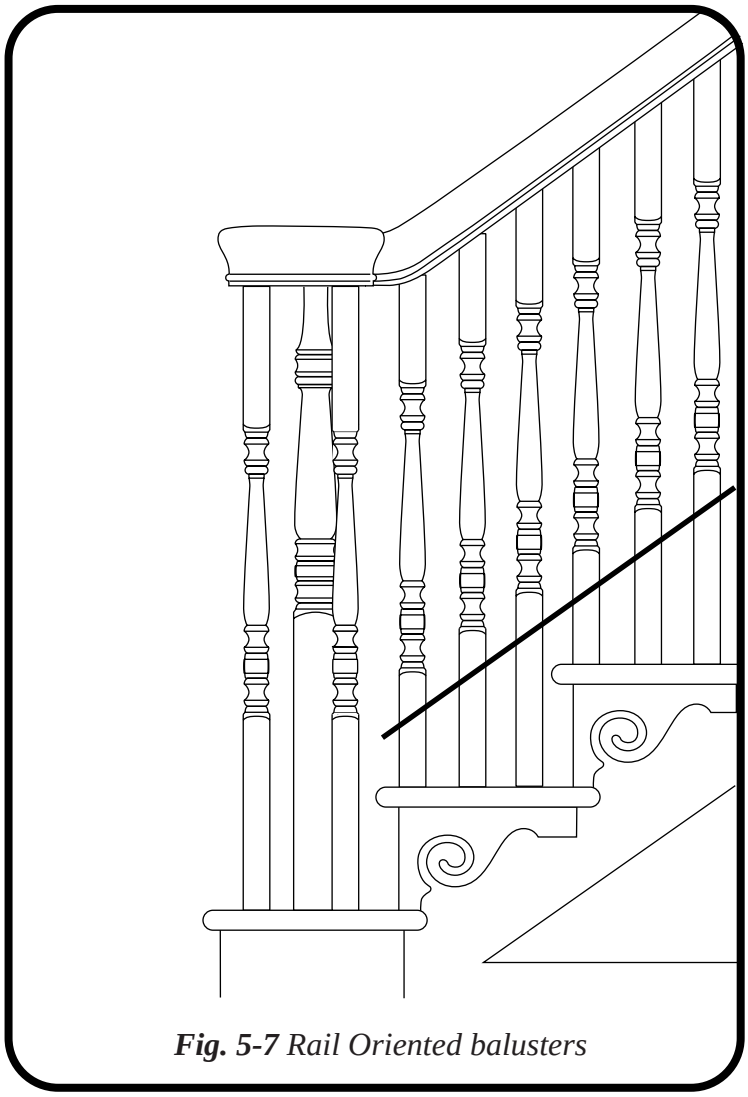


Fig. 5-7 *Rail Oriented balusters*

Installing Square Top Balusters

To install square top balusters, follow steps on laying out and boring tread as stated previously in the chapter. Then proceed as indicated below.

1. Cut the tops of each baluster at an angle equal to the pitch of the stair so that all the top squares are the same length. Please note Fig. 5-8 on the next page.
2. Turn the baluster upside down.
3. Center the top of the baluster with the hole in the tread and plumb it with a level.
4. Scribe a line with the bottom of the rail and add an amount equal to the depth of the plow in the rail.

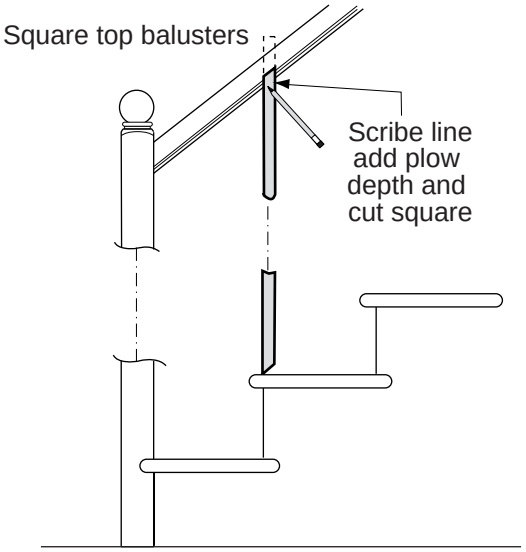


Fig. 5-8 *Raking the balusters using square top balusters.*

5. From this mark, cut the balusters square and add a dowel to the bottom as directed above.
6. Complete the installation as previously shown.

Installing Round Top Balusters

To install round top balusters, follow steps on laying out the tread, boring the tread and boring the rail in the round top baluster (Tread-Oriented) section described earlier in this chapter. Then proceed as indicated below.

1. Turn the baluster upside-down and line the top up with the hole in the tread. Make sure not to let the baluster slide into the hole.

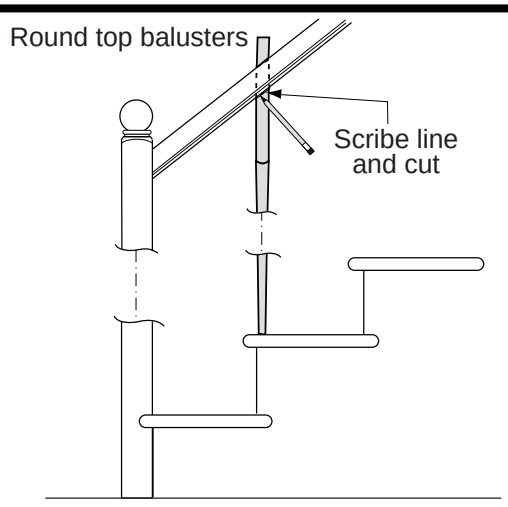


Fig. 5-9 *Raking the balusters using round top balusters.*

2. Center the bottom of the baluster with the hole in the bottom of the rail and scribe a line on the baluster along the pitch of the rail using the bottom of the rail as a guide. Please note Fig. 5-9 on the previous page.
3. Make a square cut on the bottom of the baluster at the long point of the line scribed.
4. Add a wooden dowel or metal dowel screw to the baluster. Complete the installation as previously shown.

Installing Balcony or Landing Balusters

Layout and Boring

1. Make sure that the baluster adjacent to the newel is close enough to meet local building code requirements.
2. Once you have determined this distance, measure from each newel and scribe a line.
3. Measure the distance between the two marks in a balcony section.
4. Divide this distance by the maximum spacing allowed by local building codes plus the thickness of the baluster at its narrowest point.

Baluster Spacing (Balcony or Landing)

_____ Distance

_____ ÷ Maximum baluster spacing + Thickness of narrowest part of baluster

_____ Round to the nearest whole number

_____ = Minimum number of baluster spacing

5. Round this number up to the nearest whole number. This number represents the minimum number of baluster spaces you must use.
6. Divide the distance between marks by the amount in step 5.
7. Mark the balusters out on the landing tread where they intersect with the rail centerline.
8. Plumb up to the rail and transfer these marks to the center of the rail above.
9. Bore lower landing tread and rail.
10. Cut and install balusters as shown in earlier sections. Make sure that the installation is consistent throughout the stair.

Volute Balusters

Laying out the balusters under the volute can be achieved by using the manufacturer-provided template inside the volute package.

One thing to keep in mind is that the size of the balusters you use determines the number of balusters you will need. For example, when using the 1-1/4-inch balusters, you will install five balusters under the volute. When using 1-3/4-inch balusters, you will need four balusters under the volute. These numbers can vary depending on the desired appearance.

Volute Baluster Layout Using Manufacturer-Provided Template

1. Place the template on the tread with the straight portion of the volute centered with the rail centerline.
2. Using a nail set, mark the holes that correspond to the desired baluster and newel layout.
3. Align the template with the bottom of the volute.
4. Using a nail set, mark the holes that you used to mark the tread.
5. Use these holes after the volute is installed to drill the appropriate diameter holes to accept the balusters.

Designing a Custom Volute Baluster Layout

1. Make a centerline on the bottom of the volute.

2. Measure the distance from the back of the third riser to the center of the back baluster. Please note Fig. 5-10 here.

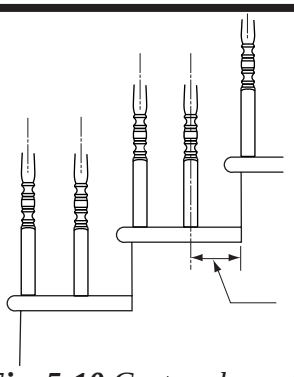


Fig. 5-10 *Custom layout*

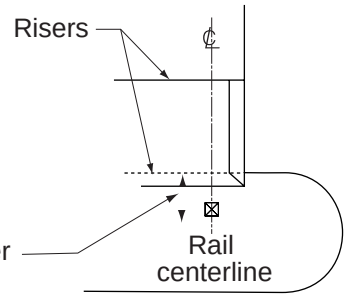


Fig. 5-11 *Custom layout*

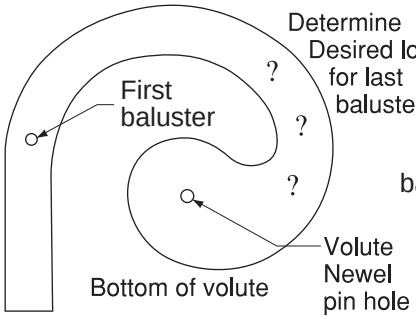


Fig. 5-12 *Custom layout*

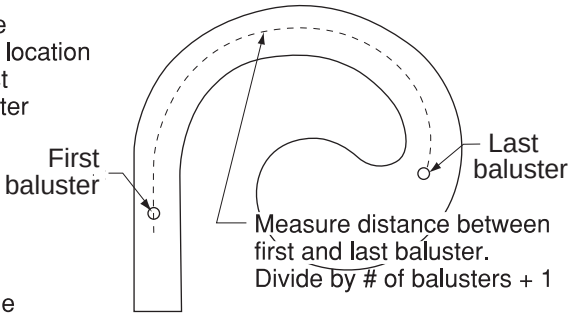


Fig. 5-13 *Custom layout*

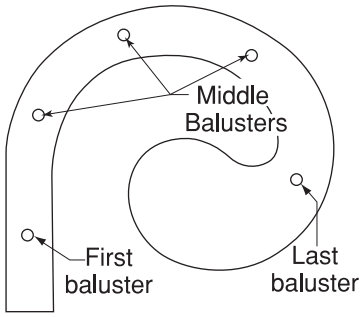


Fig. 5-14 *Custom layout*

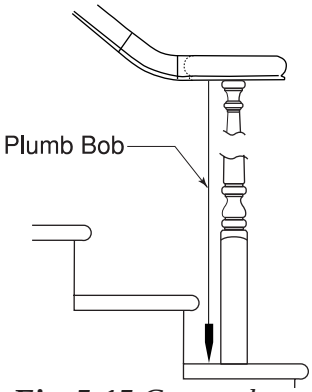


Fig. 5-15 *Custom layout*

3. From the face of the second riser, measure this distance and draw a line on the bullnose tread that intersects with the rail centerline. This will cause the back baluster of the volute to match the back baluster on the other treads. Please note Fig. 5-11 here.

4. Using a plumb bob, make a mark on the bottom of the volute that corresponds to the back baluster mark made in the previous step.
5. You must determine how far around the bottom of the volute the last baluster will be located. This is for aesthetical purposes only. Please note Fig. 5-12 here.
6. Divide the radial distance between these two baluster marks by the number of balusters you want between them and add one. This will give the necessary spacing.

   Note: This can also be done through trial and error until you achieve the desired layout. Please note Fig. 5-13 here.

7. Using this spacing distance, start with the layout mark of the back baluster and mark intersecting lines on the centerline on the bottom of the volute for all of the desired balusters. Please note Fig. 5-14 here.
8. Using a plumb bob, mark a line on the tread that corresponds with the marks on the bottom of the volute. Please note Fig. 5-15 here.

Installing Volute Balusters

1. Bore holes in the tread. These holes should fit the appropriate dowel size (i.e., factory dowel, wood dowel or metal dowel in the bottom of the baluster).
2. Bore holes in the volute. Make sure that the holes are the appropriate diameter.

   Note: When using square top balusters it will be necessary to mortise square holes in the bottom of the volute to accept the square top of the baluster. (It is also possible to insert dowels in the tops of the balusters).

3. Place the bottom dowels of the balusters into the holes in the tread.
4. Line the baluster up with the corresponding hole in the volute; scribe a line on the baluster 1/2-inch above the bottom of the volute.
5. Repeat the process for the other volute balusters.
6. Trim the balusters along the scribed lines.
7. Remove top rail and install each baluster into the tread with the other balusters on the rail. Place a small amount of wood glue into the hole where the baluster will be installed.
8. Gently push the rail back on the top of the newels and balusters and tap down firmly with a rubber mallet.

Large Turnout Baluster Layout
Using Manufacturer-Provided Template

1. Place the template on the tread with the straight portion of the tread centered with the rail centerline.
2. Using a nail set, mark the holes that correspond to the desired baluster and newel layout.
3. Align the template with the bottom of the turnout.
4. Using a nail set, mark the holes that you used to mark the tread.
5. Use these holes after the turnout is installed to drill the appropriate diameter holes to accept the balusters.

Designing a Custom Large Turnout Baluster Layout

1. Measure the distance on the tread from the back of the riser to the center of the back baluster. Please note Fig. 5-16 here.
2. From the face of the second riser, measure this distance and draw a line on the bullnose tread that intersects with the rail centerline. This will cause the back baluster of the large turnout to match the back baluster on the other treads. Please note Fig. 5-17 here.
3. Using a plumb bob, make a mark on the bottom of the large turnout that corresponds to the back baluster mark made in the previous step.

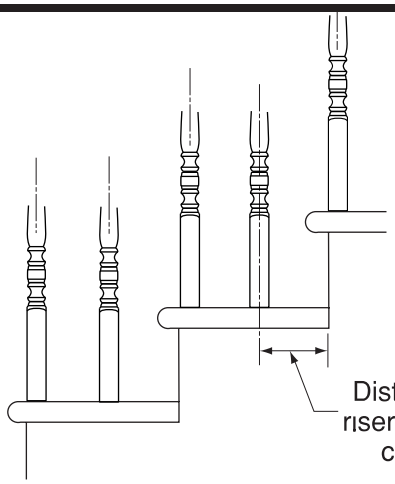


Fig. 5-16
Custom layout for Turnout

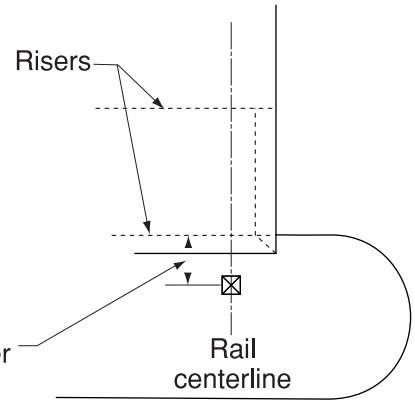


Fig. 5-17
Custom layout for Turnout

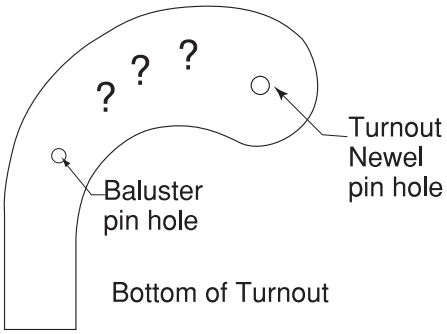


Fig. 5-18
Custom layout-Step 4, 5

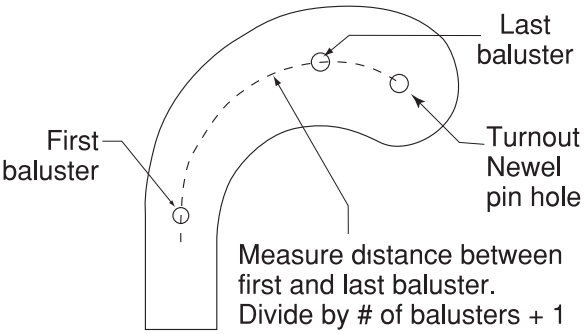


Fig. 5-19

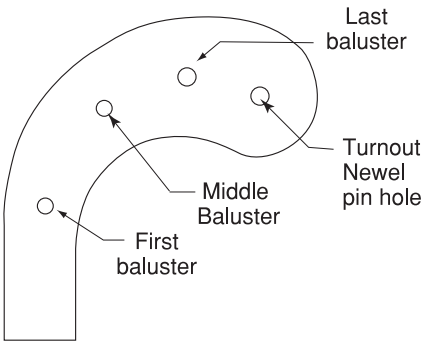


Fig. 5-20 *Large Turnout custom layout-step 7*

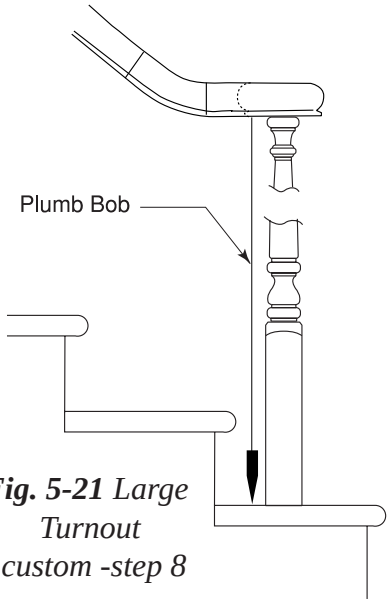


Fig. 5-21 *Large Turnout custom -step 8*

4. Determine how far around the bottom of the turnout the last baluster will be to achieve the desired look. Please note Fig. 5-18 here.
5. If using more than two balusters, divide the radial distance between these two baluster marks by one plus the number of balusters you want between them.

   Note: This can also be done through trial and error until you achieve the desired layout. This will give the necessary spacing. Please note Fig. 5-19 here.

6. Make a centerline on the bottom of the large turnout.
7. Using the spacing distance from step 5 and starting from the layout mark of the back baluster, mark the intersecting lines on the bottom of the large turnout from the other balusters. Please note Fig. 5-20 here.
8. Using a plumb bob, mark a line on the tread that corresponds with the marks on the bottom of the large turnout. Please note Fig. 5-21 here.

Chapter 5: Things to Remember

1. Always consult your local building codes before building a stair.
2. Predetermine whether you will use a tread oriented or a rail oriented baluster layout.
3. When installing the balusters, take extra care to bore holes to the correct diameter. This will insure a proper fit.
4. Make sure dowel screws or non-factory dowel pins will meet necessary load requirements.
5. Pay close attention to baluster placement, (especially on balcony rails), so that you adhere to all building codes.
6. Glue and nail all baluster bases so that balusters will not “spin” in place.