

## EXPLANATION OF PAIRS IN AUTOCAD.

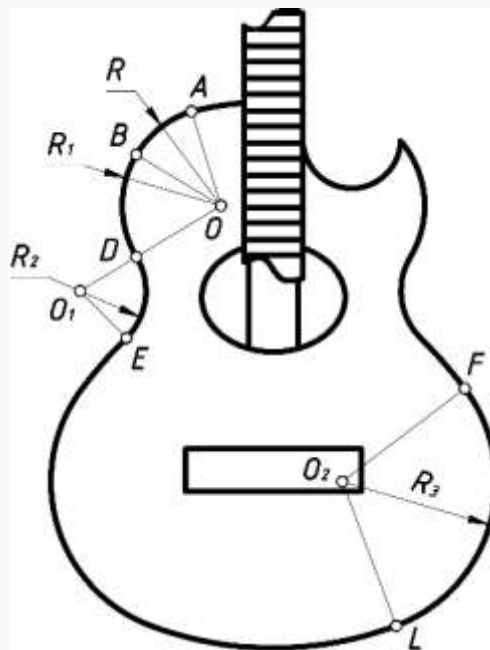
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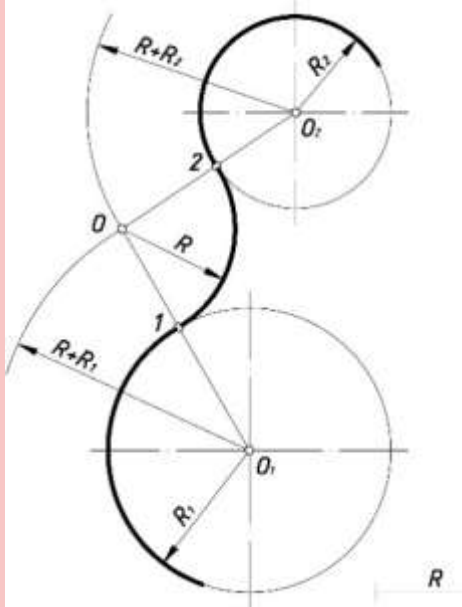
**Annotation.** *The article reveals the specifics of establishing connections in drawing lessons, which is one of the most pressing issues of modern pedagogy, as well as the introduction of innovative technologies into computer programs. The purpose of the work is the role of connections in the development of equipment that we encounter in our lives, and their implementation using graphics software. The drawing broadly shows the execution of fillets and their processing in AutoCAD.*

**Keywords:** *circle, radius, diameter, mate, center mate, mate point, outer mate, inner mate, mixed mate, graphics application, AutoCAD, visualization, experiment.*

In this evolving age of technology, many innovations are based on designs and blueprints. Models of various designs, buildings and machines for production are being developed. We know that to implement such projects you need to be a strong specialist, a strong engineer. In most of the equipment we use in our day-to-day life, we are faced with mates. Mates are used at the edges or other parts of the equipment to prevent injury and facilitate human use.



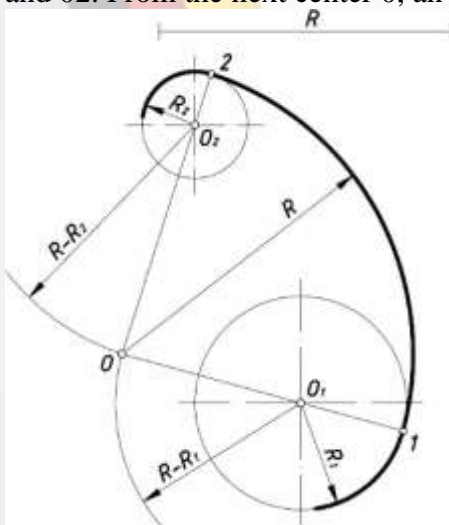
A fillet is called a smooth and smooth connection of two lines directly to each other along an arc of a circle. A fillet is defined by the radius of the joint  $R$ , the center of the fillet  $O$ , and the fillet point  $L$ . Relationships occur in parts as external mate, internal mate, and mixed mate. When two or more circles are connected by external forces, an external conjugation of the circles is formed. Connect the two circles drawn from centers  $O_1$  and  $O_2$  with radii  $R_1 + R_2$  using the given  $R$ , respectively. Place the circular arcs at a distance  $R$  from the given circles, the center of which is  $O$ . The length of a point on a circle is measured along a radial line. Arcs are drawn with radius  $R_1 + R$  from center  $O_1$  and radius  $R_2 + R$  from center  $O_2$ . The intersection point of these arcs is the junction center  $O$ . We merge centers  $O_1$  and  $O_2$  with center  $O$ , and if their intersection points are marked accordingly, intersection points 1 and 2 are formed. By connecting circles with radius  $R$  from center  $O$ , we can get to the end of this fillet. Thus, the center of the connection with the outer fillet of circles is found by adding the fillet radius to the radii of these circles  $O$ .



Formation of internal pairing. The zero-centered circle is the inner blend of the circle as we sample the circles with centers  $O_1$  and  $O_2$  and place them inward. Interior fillets often have a larger radius than the radii of the given circles. We connect points  $O_1$  and  $O_2$  with the radii  $R$  of the circles with the radii  $R_1$  and  $R_2$ . This connecting arch connects to both circles by pressing from the inside. The radius of the circle, defined by the fillet radius, is separated from the center of the circle divided by the circle, the arcs of the circle intersecting the radius of difference from the center of the two circles form the center of the inner circle.

Drawing an arc from center  $O_1$  with radius  $R-R_1$  and from center  $O_2$  with radius  $R-R_2$  creates point  $O$ , which is the fillet center, as mentioned above. If this  $O$  continues by merging with the centers of the given circles, then the circles formed by the continuation of these straight lines intersect, forming an internal connection point. Let's define the connection points with points 1 and 2. Then we connect points 1 and 2 from point  $O$  with radius  $R$ .

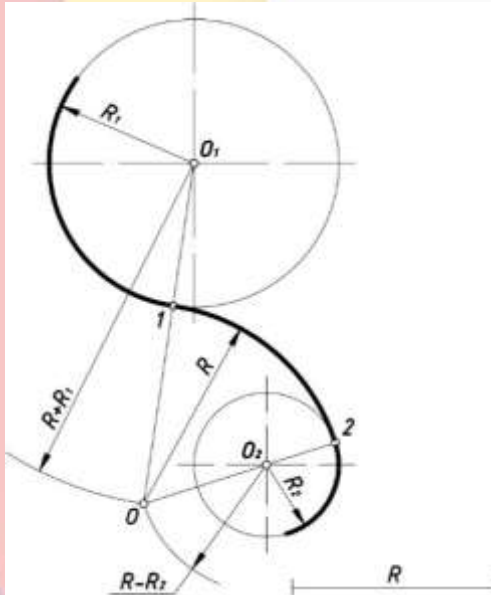
Arcs of radius  $R-R_2$  with the center of the small circle  $O_2$  and arcs with radius  $R-R_1$  from the center of the large circle  $O_1$  are constructed. These arcs intersect to give the center of the connecting line  $O$  points. Given point  $O$ , we marked the starting points 1 and 2 of the fillet by connecting the centers of the circles to points  $O_1$  and  $O_2$ . From the next center  $O$ , an arc of the joint is defined, passing through points 1 and 2 with a radius  $R$ .



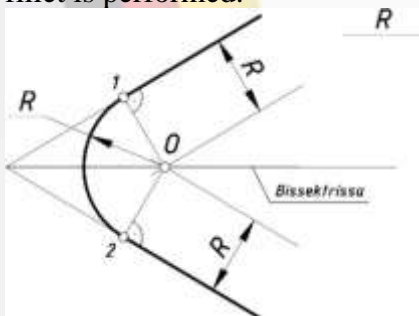
The above connections are common to all types of machine parts. Each detail is made according to his drawing. We use some or all types of links in projections and stick to them. The above methods are used to display exact links in forms.

However, blended joint seams are also drawn in accordance with the above. That is, one of these circles is connected to the outside, and the other to the inside. In this case, it is a mixed bond. From here, the radius of

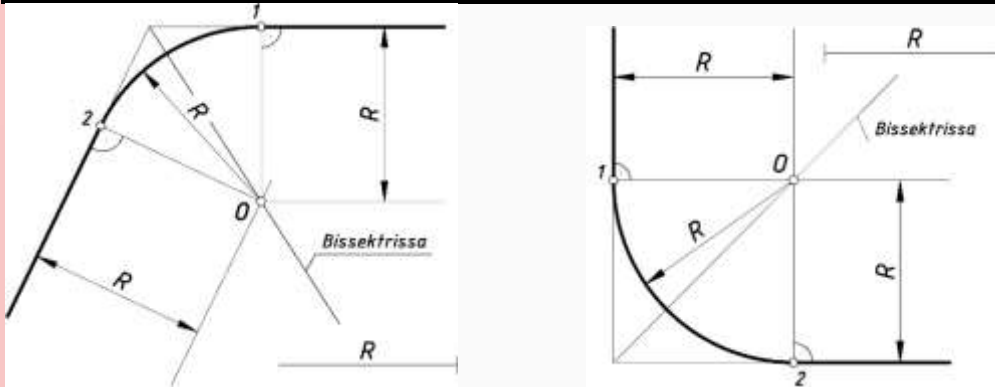
a given circle in the internal state is subtracted from the radius of the conjugation, which must be found, the radius of this circle in the external state is added to it, and the arcs of the circle rotate along the radii of the difference and the sums are connected. The center of the found fillet with the center of the circle outside the mixed fillet is connected by a straight line, and the fillet point is formed at the intersection of the circle. The center of this circle is connected to the center of the mixed circle by a straight line, and its intersection point is marked at the intersection with the circle. The fillet points are merged with the specified radius  $R$  to complete the blend fillet.



As between a circle and a circle, connections are established, so also between a straight line and a straight line. That is, joints of different radii can be used between straight, acute and obtuse corners. Sharp angles less than  $90^\circ$ . If straight lines AB and BC, forming an acute angle, must be connected with a radius  $R$ , then straight lines parallel to straight lines AB and BC are drawn at a distance  $R$ . Their intersection point is marked with the number 0. Point 0 is point AB and BC at a distance of  $R$  mm from straight lines, which is called the fillet center. Draw points 0 and AB perpendicular to the straight lines and mark points 1 and 2 from them to form points 1 and 2. Using a compass from center 0, draw an arc connecting points 1 and 2 with radius  $R$ , and the fillet is performed.



Impenetrable corners are angles over  $90^\circ$ . In the case of non-transitional corner joints, as well as in the case of joints between right corners, parallel lines are drawn from lines specified at a given radius distance, which must be found as indicated above. Where they meet and intersect is the mating center. If a line is drawn perpendicular to the specified lines from the fillet center, the fillet point on that line is determined. In the radius you want to find from the center of the fillet, the intersection points are connected to form a fillet.



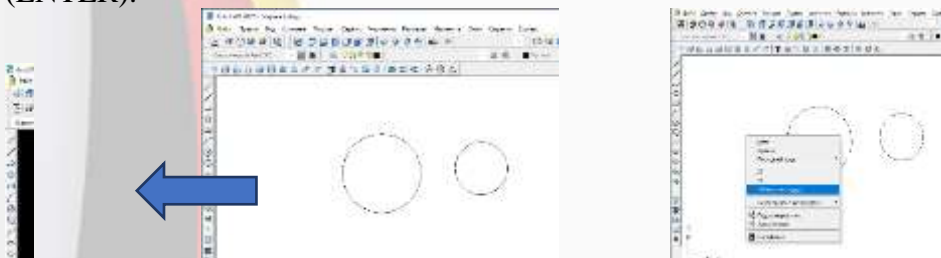
In addition, there can be parts between a straight line and a circle, objects that need to be used for internal, external and mixed mates. In all of them, if there is a straight line, a parallel line with a given radius is drawn, and if there is a circle, arcs are drawn on the radius of the difference or sum, depending on whether the fillet is internal or external. If the fillet centers are located between straight join lines, they will always be on the perpendicular line from the fillet center to that straight line. If the circles have an outer fillet, they are at the point where the center of the circle, given by the center of intersection, intersects the circle, and if there is an inner fillet, the center of the circle, given by the center of the join, is at the point of intersection with the edge of the circle. Through the connection centers, the connection points are connected and the pairing connects smoothly.

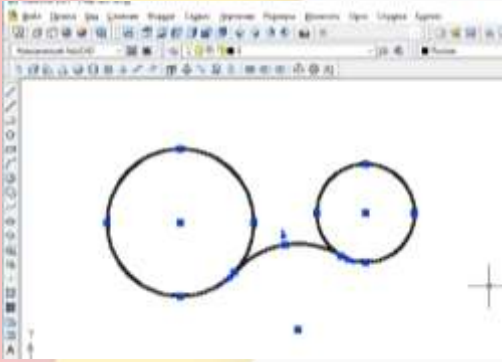
The mates are done in the above order using drawing tools as well as using computer programs that are currently being developed. Each specialist is recommended to first learn how to draw with tools, and then work in computer programs. Because without a complete understanding of drawing and without knowledge of the rules of the law, it would be wrong to work with graphic programs related to drawing.

Many drawing programs are available for drawing drawings, most of which are AutoCAD, a handy tool for working with precise dimensions in accordance with drawing standards. AutoCAD is a graphics program that can express itself quickly and efficiently and is equipped with equipment that complies with the rules and requirements of drawing. With this program, we can draw many construction drawings and machine drawings in high quality condition, saving time.

The procedure for making mates in AutoCAD is much easier than drawing with the drawing tools. This requires a good knowledge of the program interface, as well as a good understanding of how to work with toolbars. The circle command is commonly used for mating. The button for drawing a circle is on the "Draw" panel, when this command is selected, the center of the circle is displayed and marked with the left mouse button, and the desired radius is entered and confirmed on the keyboard (ENTER).

To set a fillet, select the circle command and right-click in the working window, in the menu that appears, select KKP (touch, tangency, radius). The approximate location of the connection points formed in the circles is marked with the left mouse button, and the radius to be found is entered and confirmed using the keyboard (ENTER).





It should be noted that in the latest versions of the program, the stages of visualization will be finalized and implemented. This allows them to be more alive than previous versions of the program. It is a program that allows you to draw graphic works not only on 2D objects, but also in a 3D environment with a wide range of possibilities based on drawing rules.

In conclusion, the pursuit of innovation and its implementation with a thorough study of each science at its core and the use of experience and opportunities for its development will further increase the interest of all professionals in their profession.

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