Individual Dimension Styles an Efficient Tool in Civil Engineering Computer Aided Design

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Summary

In this paper the authors make a critical analysis of the problems that appears in the technical drawing for construction's dimensioning process when the AutoCAD computer program is used. Then, they suggest solutions allowing the dimensioning process to be develop rapidly, with respect of the dimensioning standards and in a complete concordance with the units that are used to carry out the drawing.

KEYWORDS: Computer Graphical Communication, Technical Drawing, Computer Graphics, AutoCAD.

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1. INTRODUCTION

The AutoCAD's users knows the fact that in the process of carrying out technical drawing for construction, the time needed for the dimensioning process represent an average of 50% from the duration required for carrying out the all drawing.

At first sight, using specific commands, the technical drawing for construction's dimensioning process is very simple, because the user must specify only the particular points that are required for achieving the dimensioning process. In fact this task is very complex because the user is forced to modify the dimensioning variables values so the dimensions are drawn accordingly to the standards from these countries. Thus, a set of specifications must be done:

- the way of limiting the dimension lines (arrows, ticks or dots);
- dimension text high;
- the size of delimiting elements of dimension lines (extension lines);
- the distance between dimension text and dimension lines;
- the distance from the ends of the dimensioned elements and the starts of the extension lines;
- the distance on witch the extension lines exceeded the dimension line;
- dimension text placement according with the dimension line;
- scaling of the dimension text values;
- dimension text precision (number of decimal places).

2. ANALISIS OF ARISING PROBLEMS IN THE ESTABLISHING PROCESS OF DIMENSIONING VARIABLES

Some of the problems arising in realizing of the previously presented settings are linked by:

- the way of limiting the dimension lines (arrows, ticks or dots);
- variants of leader limiting as function of the indicated element (arrows or dots);
- the size of limiting elements of the dimension lines;
- the size of limiting elements for the leaders.

2.1. The Way of Limiting the Dimension Lines (Arrows, Ticks or Dots)

According with the up the date technical drawing standards, the way of limiting the dimension lines differs as function of the specific elements represented in the drawing, thus:

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- generally the limiting of dimension lines is made by ticks sloped at 45° (figure 1);
- in case of dimensioning of circles, arcs, and angles the limiting elements for dimension lines are arrows (figure 1);
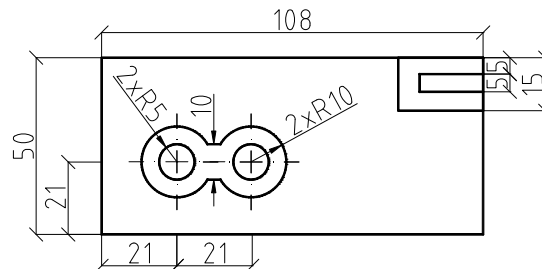

Figure 1. The dimensioning of an element according with the technical drawing standards

- in case of metal structure drawings the limiting elements for dimension lines are arrows (figure 2);
- in case that the dimensions text are small and cant' be written down the dimension text value it is possible to use the arrows in combination with dots or ticks sloped at 45° (figure 2).
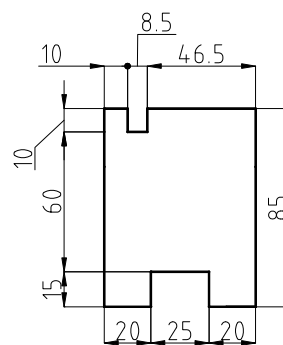
Figure 2. Part dimensioning according to the technical drawing standards

In figure 3 e.g. the dimensioning, using the AutoCAD computer program, of a metal structure detail is presented. As we see al the dimensions have arrows as delimiters. This fact is disadvantaging for the dimension texts that have the values 10 and 8.5 (figure 4), because:

- the right delimiter of the dimension 10 is overlapping on the dimension 8.5 space;
- the left delimiter of the dimension 8.5 is overlapping on the dimension 10.

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If some one tries to modify from the *Modify Dimension Style → Symbols and Arrows* dialog box (figure 5), the shape of delimiter that are not correctly represented (e.g. the right delimiter's shape of the dimension 10 from arrow to dot, figure 6), he noticed that this is not correctly done, because:
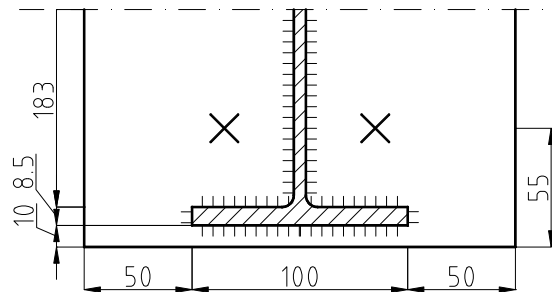
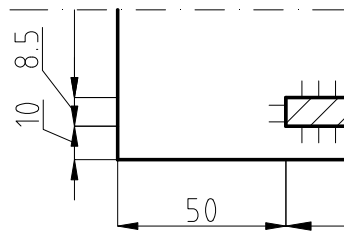Figure 3. Metal structure; the dimension line's delimiters representation
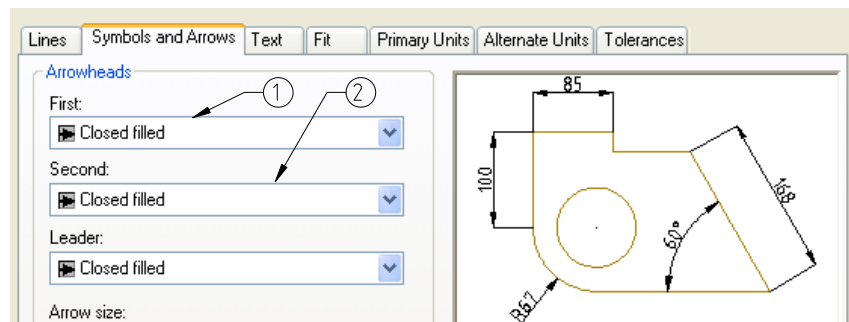
Figure 4. Dimensions' 10 and 8.5 delimiters positioning

Figure 5. *Modify Dimension Style* dialog box;
1 – left side delimiter; 2 – right side delimiter

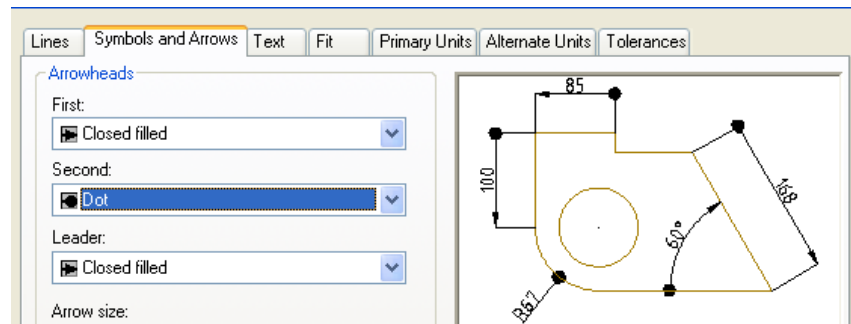*Individual Dimension Styles an Efficient Tool in Civil Engineering Computer Aided Design*

Figure 6. *Modify Dimension Style* dialog box; dimension's 10 right side
delimiter was modified from arrow to dot

- by modifying any of the delimiters, the program automatically changes for the all the dimension lines the shape of the delimiters (figure 7).
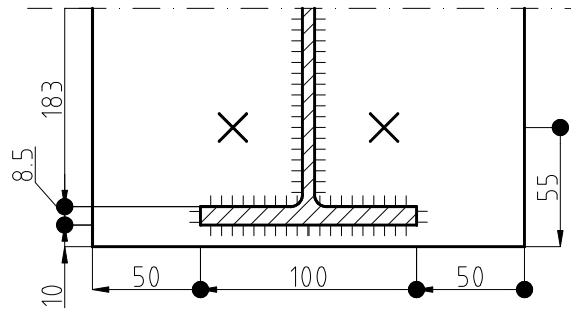

Figure. 7 Metal structure; The dimension lines' delimiters representation after the modify of dimension's 10 right side delimiter from arrow to dot

2.2. Delimiting Variants of a Leader as Function of Indicated Element (Arrows or Dots)

According to technical drawing for construction up to date standards, the way of leader delimiting differs as function of the indicated element thus:
- the leaders indicating a surface end with dots (figure 8);
- leaders indicating the contour end with arrows (figure 8).
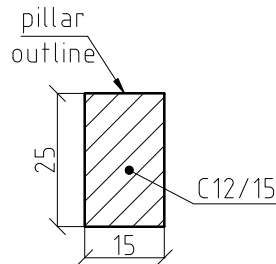
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Figure 8. Leaders representation

As we notice from figure 9, in *Modify Dimension Style → Symbols and Arrows* dialog box, the AutoCAD computer program doesn't allow distinct change of delimiters shape for leaders. In case if it establishes that the shape of the delimiters is a dot (figure 10), the drawing from figure 8 looks like in figure 11.
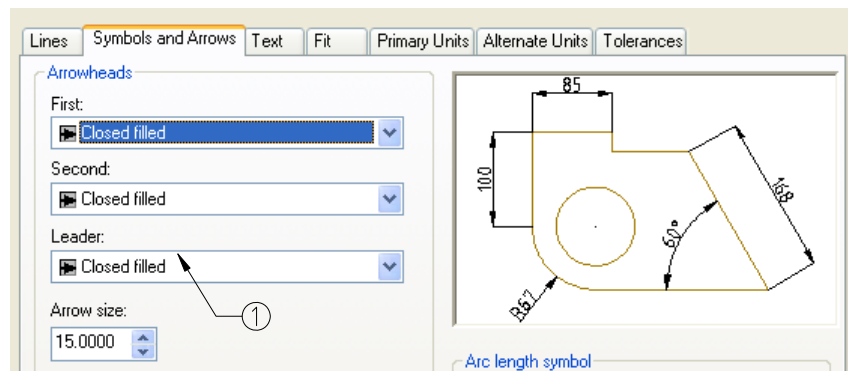

Figure 9. *Modify Dimension Style* dialog box; 1 – tile allowing to modify the shape of leaders delimiter
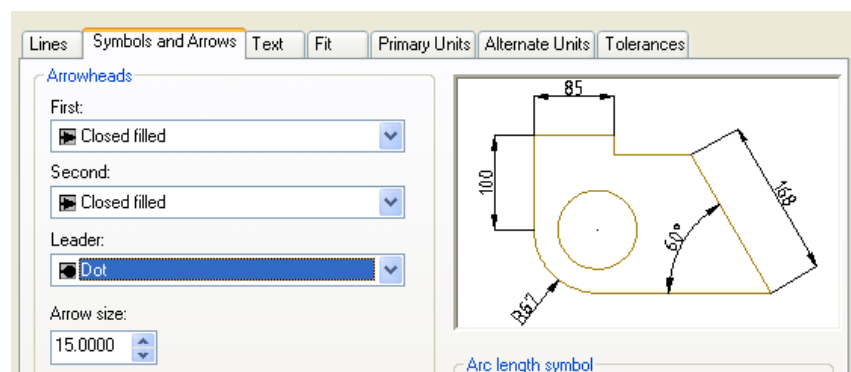

Figure 10. The leaders' delimiters have dot shape

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As we notice, in figure 11, the rules regarding leaders' representation are not respected.
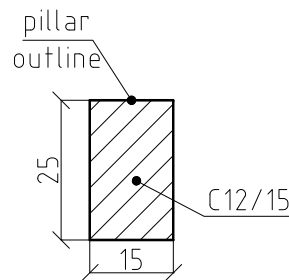

Figure 11. Leaders representation

2.3. The Dimension Lines Delimiters' Size

For the dimension lines' delimiters to be visible they must be appreciatively equal with the dimension text's high. In case that on the same drawing are used different types of delimiters (ticks sloped at 45° and dots or arrows and dots) must be established different size for dots delimiters in comparison with arrow or ticks delimiters.

As we notice in figure 12, in *Modify Dimension Style → Symbols and Arrows* dialog box, the AutoCAD code doesn't allow distinct change of the dimension lines' delimiters high, dimensioning of a drawing using different delimiters with shapes been presented in figure 7.
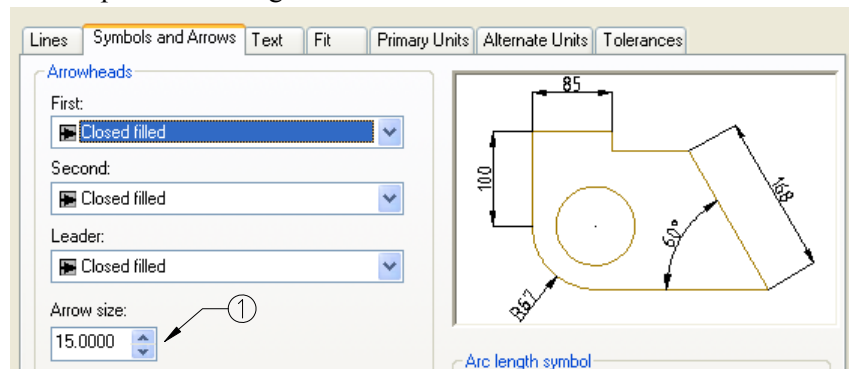

Figure 12. *Modify Dimension Style* dialog box; 1 – the dialog box allowing to modify the dimension lines' delimiters high

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As we can see in figure 7, because the delimiters sizes weren't distinctively modified, the dot delimiters are much greater than the arrow delimiters, which have a proper size.

2.4. Leader Delimiters Sizes

To be visible the delimiters for leader lines must be near equal with the dimension text high. In case that on the same drawing different kinds of delimiters are used (dots and arrows) different sizes must be established for dot delimiters in comparison with arrow delimiters.

As we notice in figure 12, in *Modify Dimension Style → Symbols and Arrows* dialog box, the AutoCAD computer program doesn't allow distinctively modifying of delimiters high for leaders, the results of a drawing dimensioning using different shape of delimiters with same high being presented in figure 13.
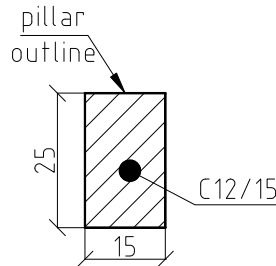

Figure 13 Leaders representation with the
same high for delimiters

According with the previously presented ideas it seems that the AutoCAD computer program is useless for dimensioning of technical drawing for constructions according with the up to day standards witch, is totally false because the program allows the dimensioning to be rapidly done if different dimensioning styles are created allowing individual settings for dimension text, dimension lines, leaders an so on.

3. CREATION AND USING OF INDIVIDUAL DIMENSION STYLES

For explaining the logic at the basis of constructing individual dimension styles we will use two examples (figure 14). The first example refers to the correct making of the dimension lines' delimiters and the second one for the leaders. As we notice in

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neither of the two examples the rules referring to the technical drawing for constructions are not respected.
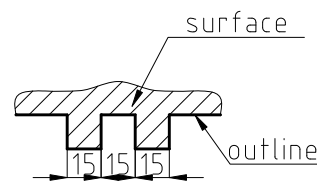

Figure 14. Sample for creation of individual dimension styles

3.1. Creation and Using of Individual Dimension Styles for Correct Representation of Dimension Lines Delimiters

If we try to separate the three assemblies (dimension text, dimension line and extension line) having the dimension text of value 15, we would noticed that each of them have arrows as delimiters (figure 15).
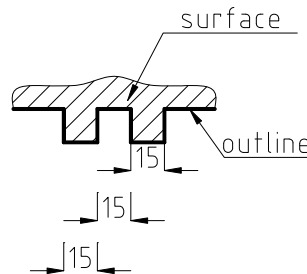

Figure 15. Assemblies' separation for visualizing of the delimiting way of dimension lines

As we can see in figure 15:
- the right side delimiter of the first dimension with value 15 should be replaced with a dot;
- the left side delimiter of the third dimension with value 15 should be replaced with a dot ;
- the two delimiters for the second dimension with value 15 should be replaced with dots.

For making possible the replacing of the delimiters individual dimension styles are created. Individual dimension styles creation is realized from *Dimension Style Manager* dialog box, pushing button *New* (figure 16).

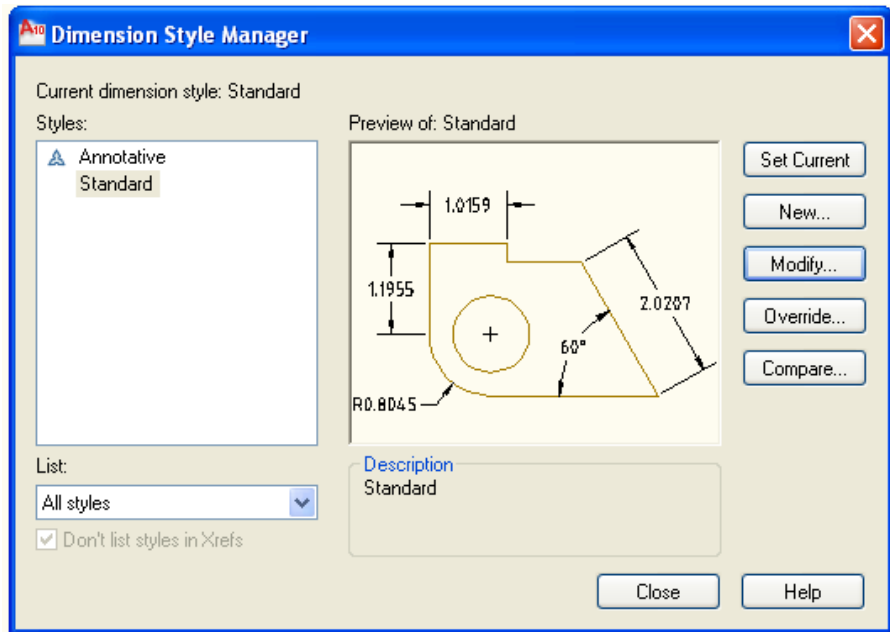*Andrei Slonovschi, Liviu Prună and Ion Antonescu*

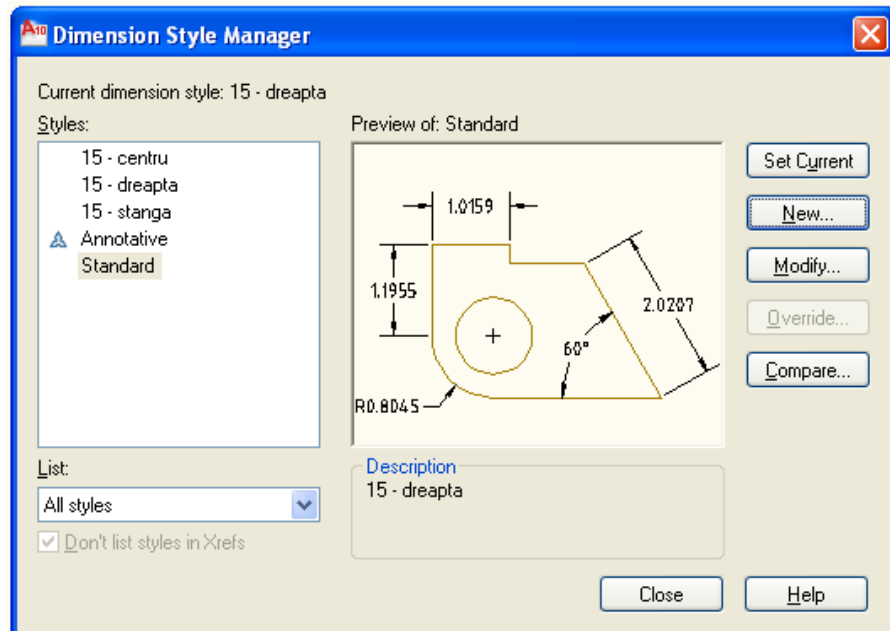Figure 16. *Dimension Style manager* dialog box

Figure 17. Presentation of the created dimension styles

By pushing the button *New*, the computer program opens the *Create New Dimension Style* dialog box. The created styles were named *15 – stânga*, *15 – centru* şi *15 – dreapta* for each of the assembly that that must be modified (figure 17).

Next the style *15 – stânga* is selected, e.g., and the shape of the dimension line's right side delimiter is modified (figure 18).
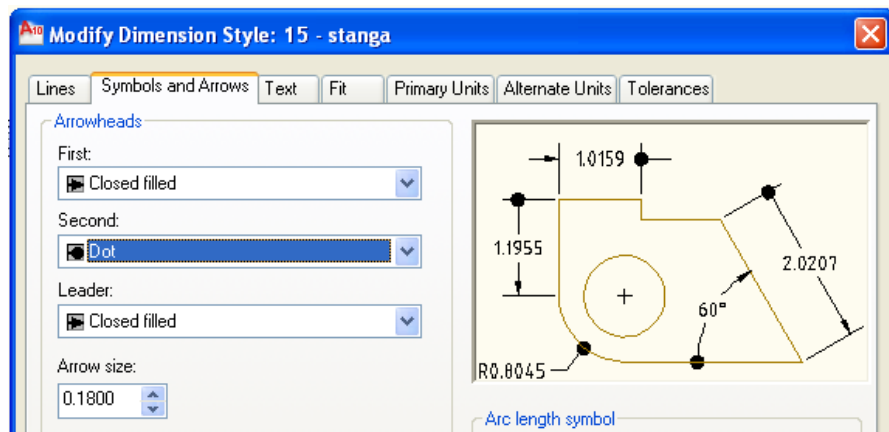

Figure 18. Modifying the right side delimiter for the dimension style *15 - stânga*

It is notice that no change appears in the delimiters representation, because the dimensions were created with base dimension style named *Standard* witch exist before the creation of the three new styles. For the dot delimiters to appear in place of the arrow delimiters two variants exist:
- the dimension represented with *Standard* dimension style is erased and drawing is dimensioned with the newly created style *15 – stânga*;
- the left side dimension is selected and the associated dimension style is change from the *STYLE* tool box (figure 19 and 20).
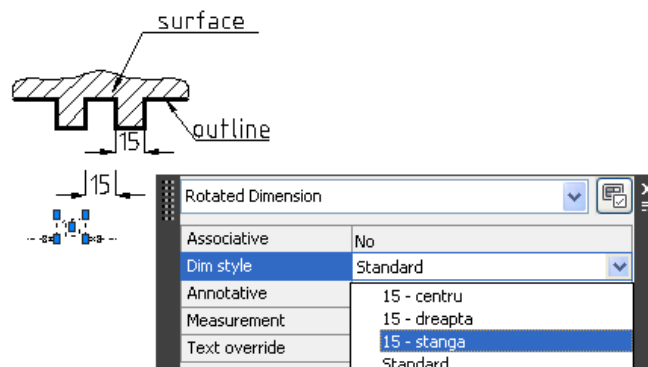

Figure 19. Modifying of dimension style from *STANDARD* to *15 - stânga*
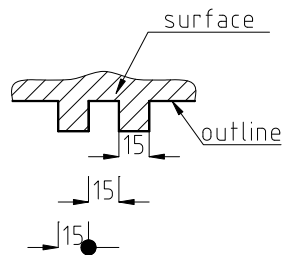
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Figure 20. Results of changing the dimension style from *STANDARD* to *15 - stânga*

As we can see in figure 20 the dot delimiter's size is much bigger than the arrow delimiter's size. Because for a dimension line can't be established different size for delimiters (figure 18) follows that the must convenient way for creating the delimiters for those three dimension line is:

- the first dimension line's left delimiter from *CLOSED FILLED* (arrow) changes in *NONE* (without delimiter) (figure 21);
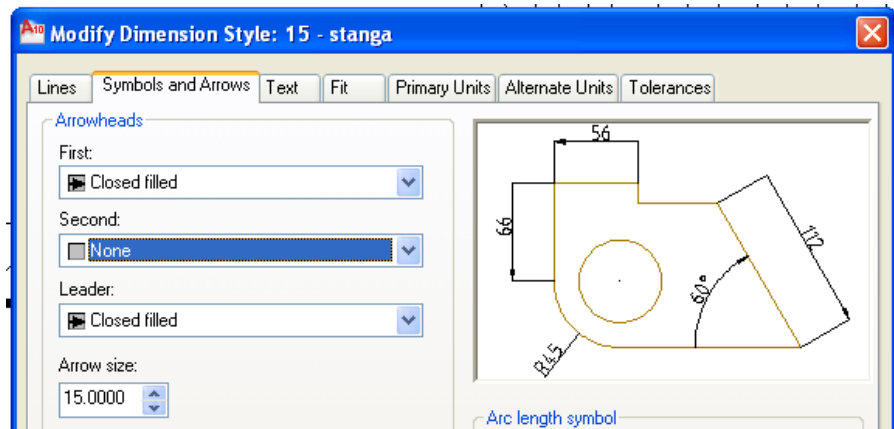

Figure 21. Modification of the first dimension's right side delimiter

- the second dimension line's delimiters change in *DOT*, by reducing to the half the size of these in comparison with the arrow delimiters' size (fig 22);
- the third dimension line's left delimiter from *CLOSED FILLED* (arrow) changes in *NONE* (without delimiter) (figure 23);
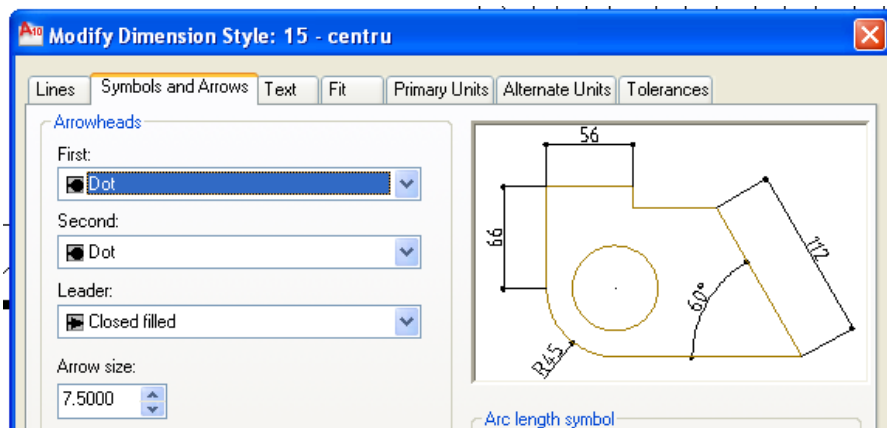
Figure 22. Modification of shapes and sizes of the second dimension's delimiters
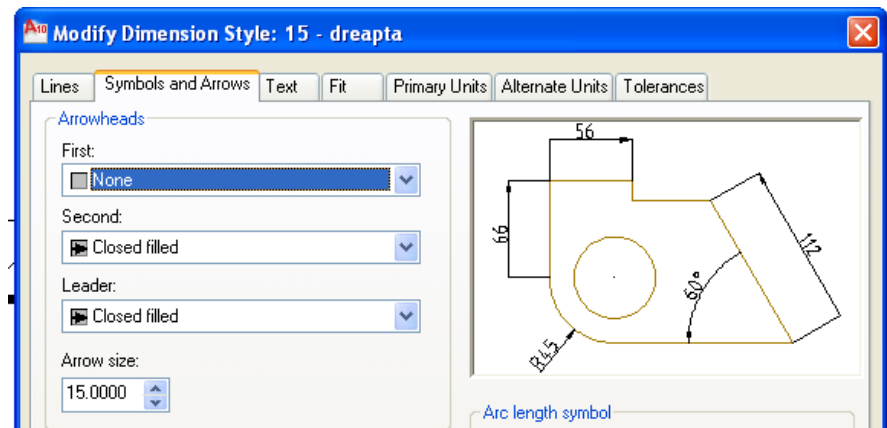

Figure 23. Shape modification of the third dimension's right side delimiter

After the change of the delimiters' representations for those tree dimension lines, the dimension are selected one by one and changing dimension styles, from *STYLE* button bar, the result being presented in figure 24.

3.2. Creation and Using of the Individual Dimension Styles for the Correct Achieving of the Leaders' Delimiters

As we can see in figure 24 in case that aren't using different dimension's styles, the AutoCAD computer program doesn't allows the different representation of the

delimiters for leaders. The individual dimension styles creation is realized from *Multileader Style Manager* dialog box, pushing button *New* (figure 25).

By pushing the *New* button, the computer program opens the *Create New Multileader Style* dialog box. The style that is created was named *punct*.
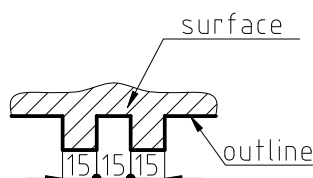

Figure 24. Dimensioning representation using individual dimension styles
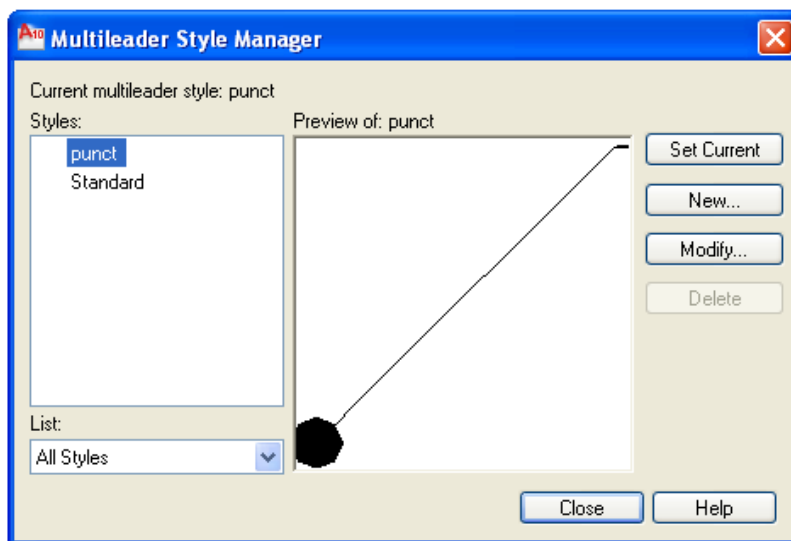

Figure 25. The presentation of the created dimension individual style

Then the *punct* style is selected and the delimiter's size and the shape are changed from *CLOSED FILLED* (arrow) in *DOT* (figure 26).

We can observe once again that any change in delimiter's representation doesn't appear, because the two leaders were drawn with the basis *Standard* style that exists before the creation of *punct* style. For the dot delimiter to appear in place of the arrow delimiter two variants exist:
- deleting the leader that indicates a surface and that should have a dot for delimiter's shape and drawing it again using the style named *punct*.

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- Selecting the leader that indicates a surface and changing the dimension style from *STYLE* tool bar (figure 27 and 28).
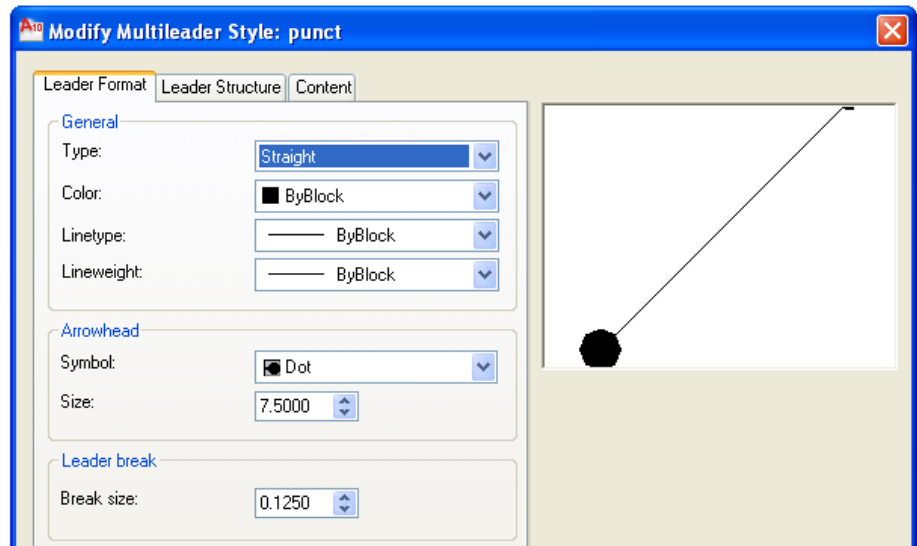

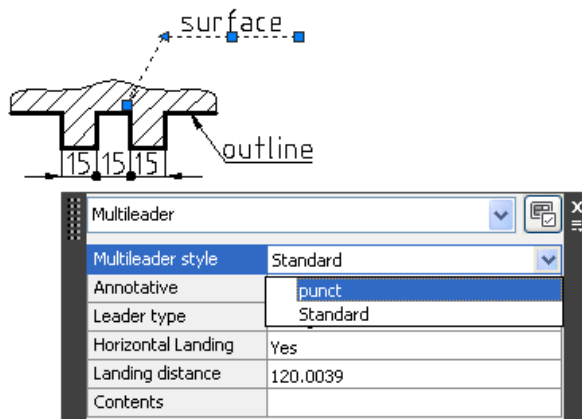Figure 26. Modifing of size and shape of the delimiter for the created dimension style

Figure 27. Modifying of dimension style from *STANDARD* to *punct*
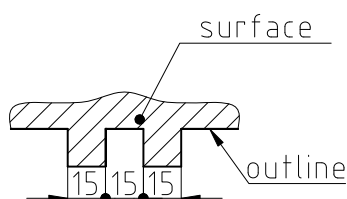
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Figure 28 Dimensioning representation using the dimension
styles for dimesnion lines and leaderss

4. CONCLUSIONS

Creation and using the individual dimension styles allows the solving of the drawing problems that refer to the respect of technical drawing for construction's dimensioning standards from each country. More than that, if these are built in a unitary way, the time needful for accomplish the dimensioning operation may be reduce.

We notice that it is possible to build libraries with a sufficient number of individual dimension styles that could be used from one to another technical drawing. Doing so, the effort that is necessary to achieve the technical drawings for construction will reduce in a significant way.

Finally, we underline the fact that the person's skill that built such a library can be evaluated in concordance with the way that she think out an optimum number of individual dimension styles. We affirm that because a too little number of individual dimension styles won't totally cover the dimension's problems that could be meet on technical drawing for construction and a too large number can create confusion.