

## EXPERIMENTAL PARAMETERS MEASURING AT THE TUBE HYDROFORMING PROCESS

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### ABSTRACT

*Hydro forming is included in counting of advanced technology processes whose application isn't presented in the production of big series. The data of process parameter influence on its application are gotten by experimental analysis of hydro forming process. The hydraulic press can be used for experimental analysis of hydro forming process among the devices applied in labor examinations of hydro forming processes. The example of such device is given in this paper as possible error form occurred during experimental analysis.*

**Key words:** hydro forming, tube, parameters, experimental measuring.

### 1. INTRODUCTION

The forming with fluid is included in counting of new technologies of thin sheet of metal forming, tube elements as full and empty pieces gotten by hydro statistic pulling out. There are processes known 40 years ago, but their application in the big series isn't numerous (frequently). From this ground are made the theoretical and experimental analysis of these processes in the aim of application confirmation, according to advantage finding out of these processes in according to conventional processes. In the paper are given the examples of hydro forming processes, influenced parameters on the hydro forming process, devices and examples of analysis of tube element forming [1,2,3,4,6,7].

### 2. PLASTI FORMING WITH FLUID

The processing with impressed fluid so called hydraulic forming with fluid is assigned to unconventional processes of metal processing. The processing with fluid has found the widest application in car industry applying process of deep pulling out and tube hydro forming. Through distortion process of tube work pieces of simple form can be gotten products of simple but complex form by widening and shrinking method or combining method [6]. The aim of this process way is with smallest number of working operations and possible smallest litter zo get the productions of satisfied quality. Some of these processes of plastic forming with fluid are given at the figure 1.

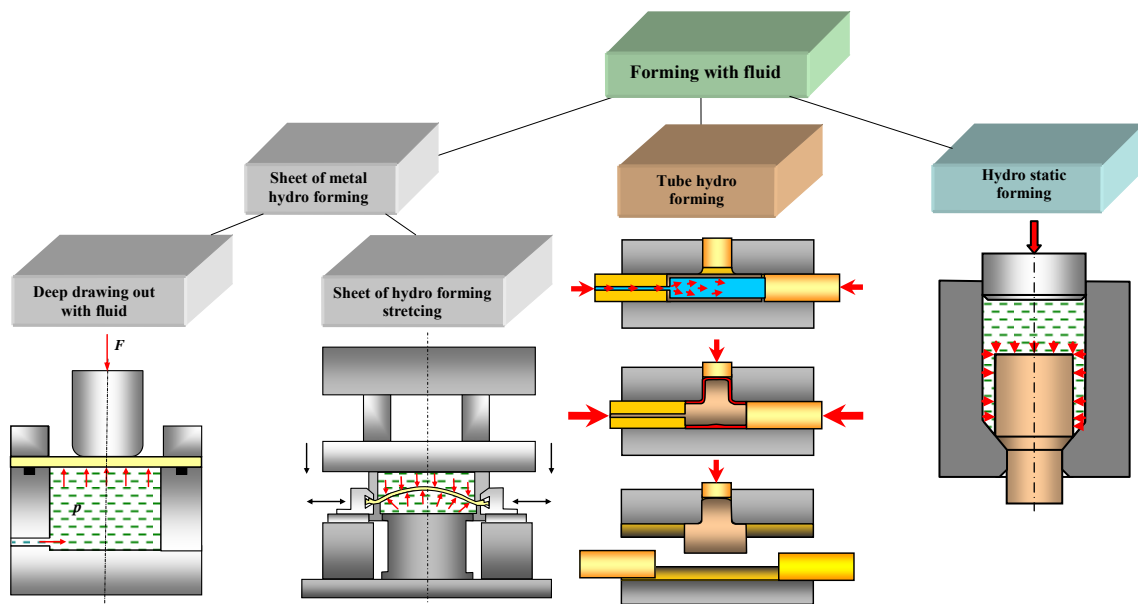


Figure 1. The processes of plastic forming with fluid

### 2.1. Tube hydro forming

Hydro forming process  $T$  – piece is composed from three forming phases and it is presented at figure 2. In the hydro forming phase, the fluid of defined pressure goes into the tube and particularly it widens tube wall. In the pre forming phase, according to bulge becoming it comes to significantly length change, but the calibration phase is characterised by pressure increasing using tube thickness keeping. The speed change of presser motion is important in the forming phase where is formed a bulge on the tube [5,6].

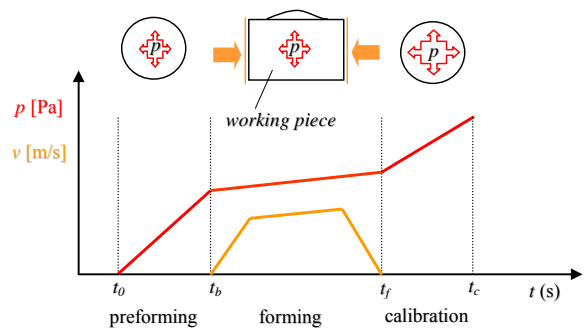


Figure 2. Hydro forming phases of  $T$ -piece

### 3. TUBE HYDRO FORMING PARAMETERS

The processing results of the process of tube hydro forming depend on much influencing parameters (process parameters, tube, tool and processing) some of which are given at the figure 3 [6,8].

To bring down the error occurring to minimum, there is knowledge of process parameter and measuring/regulation possibility during forming process, machine choosing, helping devices and equipment, cooling devices etc.

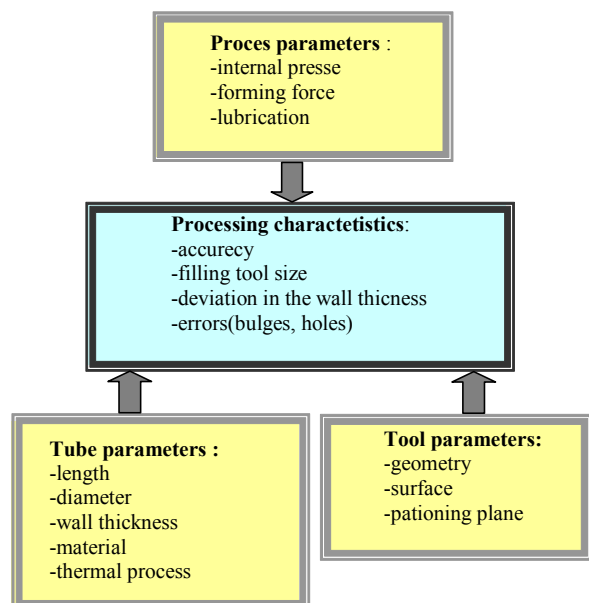


Figure 3. The parameter influence on tube forming process

#### 4. EXPERIMENTAL MEASUREMENTS IN THE HYDRO FORMING PROCESS

The theoretical hydro forming process analysis are grounded on the calculated counting of defined parameters important for success of hydro forming process, but the experimental results gotten by measurement of given quantities in the real process conditions are important for value correcting of influencing parameters on the process. From experience is known that there are sophisticated for following of the processing performance following and the results gotten by experimental analysis have worthy importance for process performance.

##### 4.1. A device for experimental measurement

The experimental measurements of tube hydro forming can be made at the devices for experimental processing parameters [6,8], figure 4.

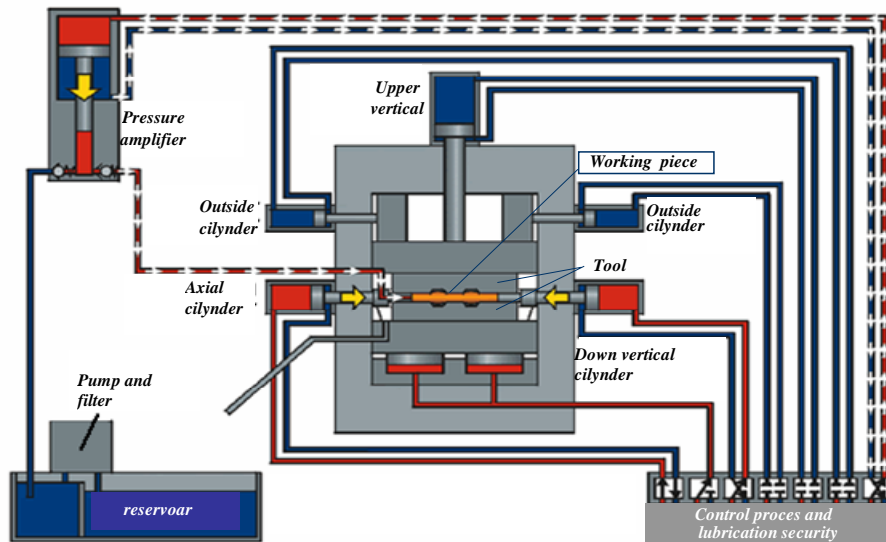


Figure 4. Tube forming with internal pressure and axial force

The device must provide synchronized work because of axial presser and internal pressure to reach expected forming results.

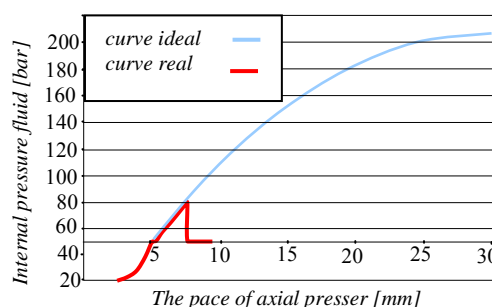
##### 4.2. The examples of experimental measurements at the tube forming

For analysis in this paper is given a example of T-tube piece hydro forming, figure 5.

The experimental measurement importance during T-piece forming is presented by foollowing examples of possible errors at the worjng piece according to characterised sizes of internal pressure and axial presser pace (figure 6)[1,7,9].



Figure 5. T- piece gotten by hydro forming [9]



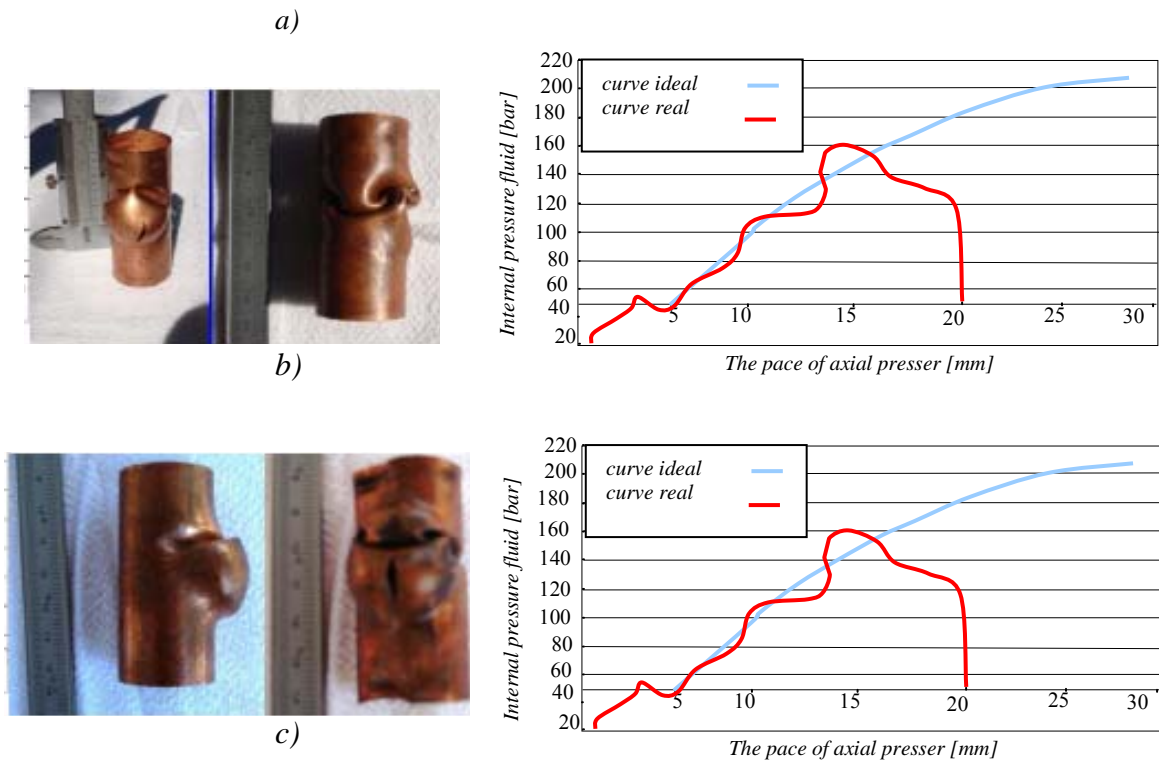


Figure 6. The experimental measurements during T-piece hydro forming [1]

The knowledge of relations of hydro forming process parameter sizes gives possibility of self correcting in the aim to reach satisfied quality of mended piece.

## 5. CONCLUSION

The application of the new processing technologies understands continuous analysis of processing parameters theoretically as well as in the experimental conditions. From experience it is known that there are deviations comparing indications of calculating according to experimental values during made researches. The results gotten by experimental way give parameter values in the real process conditions. Through parameter correcting during experimental analysis of the process to needed quality reaching, there can be influenced on the processing optimization.

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