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THE CASE STUDY ON ANALYSIS OF FORMABILITIES PROPERTIES OF LOW CARBON STEEL SHEET ON CONVENTIONAL PRESS

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ABSTRACT

In this paper the formability of Cold Rolled (CR) steel material metal sheets is experimentally analyzed and the sheet metal parts manufacturing industry are the minimization of costs and the improvement of products quality concerning all mechanical properties like weight, strength, and rigidity, etc. A sheet metal parts are manufacture in a number of stages due to these number of stages Geometric dimensioning and tolerances are not much precise and accurate parts cannot produced.

KEYWORDS: Cold Rolled, Quality, Sheet Metal

1. INTRODUCTION

The sheet metal forming component a blank of sheet metal is formed into a product between a male (Punch) and a female (Die). The procedure is based on sheet metal deformation caused by the relative movement between the punch tool and the sheet, an interaction that generates friction forces occurred. It is important to understand that able to control the friction generated in the forming process in order to produce good quality sheet metal products. Manufacturing defects like crack, shrinkage, springback, surface defects and tool wear can be reduced by controlling the above defects in the process. It is generally believed that the friction between two surfaces in contact varies with velocity, applied load and type of lubricant, according to the Stribeck curve. However, in a sheet stamping operation the friction cannot be considered as a static parameter due to the varying process conditions during the forming operation. It is observed that friction conditions between two surfaces in contact considering parameters such as materials, Cylindercity and roughness, etc. T he quality of the actual manufactured component shows variation in micron.

2. EXPERIMENTAL TEST

2.1 Material

The material was a low carbon steel designated as CR3. Its chemical composition is summarized in table1. The sheet metal was rectangular 0.5*20*200 mm supplied for testing.

Table1. Chemical Composition of Cold Rolled Steel Sheet

Alloys Content	Observations	DD Grade
% C	0.062	0.10 max
% Mn	0.28	0.45 max
% S	0.015	0.035 max
% P	0.007	0.035 max

2.2 Tensile Test

The tensile test was carried out on a rectangular cold rolled steel specimen and following are the Mechanical Properties of the sample summarized below in table2.

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Table2. Mechanical Properties of CR3 Material

Sr. No.	Test Conducted	Observations	Specified for " DD " Grade
1	Hardness Hv 1	89 Hv1	-
2	Tensile Strength N/mm2	285.88	270 – 370
3	Yield Strength N/mm2	166.09	250 max
4	% Elongation	28.35	
	G.L =5.65 x sq. root of area	-	26.0 min
	Gauge Length = 80 mm	-	32.0 min

The manufacture surface was inspected on Contour Measurement Machine, the contour was measured on two different points and their radiuses are 0.9141 and 0.8602mm. The radius variation between two points is 0.0539mm.

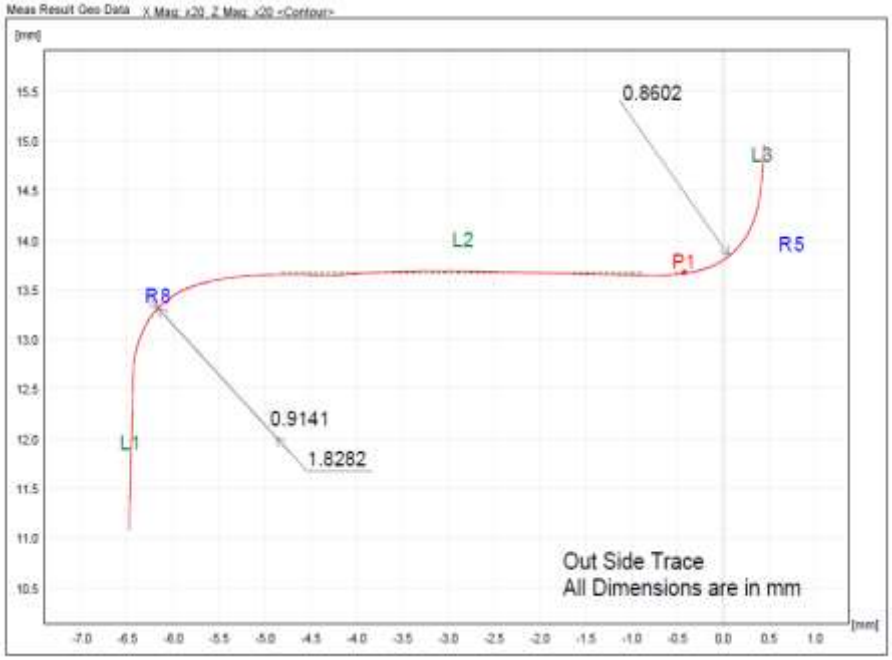

Figure 1 Longitudinal Trace

2.3 Roundness and Cylindercity Quality of draw

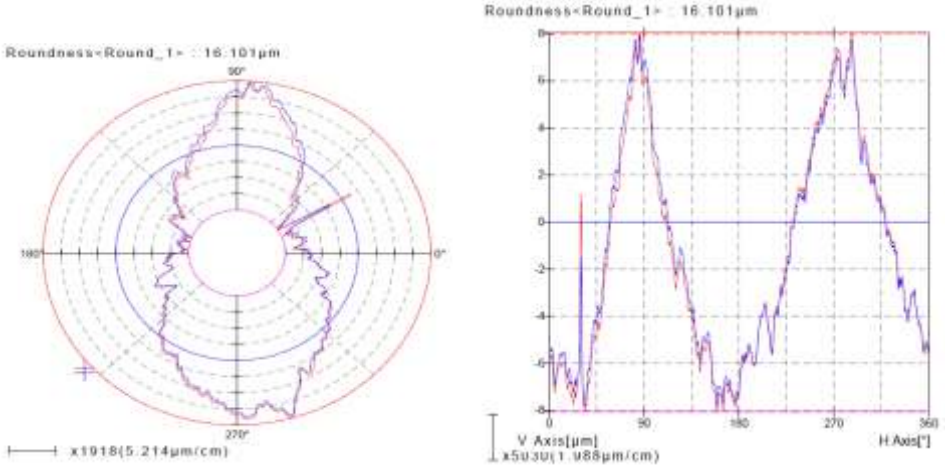

Figure 2 Roundness (1) Horizontal (2) Vertical

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Table3: Roundness Parameters value

Parameter MZCI(not up to standard)	Roundness(RONt)		
Roundness<Round_1>	16.101µm		
Extracted line	Filter Setting(not up to standard)	Z Position	Roundness(RONt)
Rotate-Outer(VERT)<RD_1>	2CRPC-75%Low[50 UPR]	-60.50 mm	16.101µm
Rotate-Outer(VERT)<RD_2>	2CRPC-75%Low[50 UPR]	-60.50 mm	15.534µm

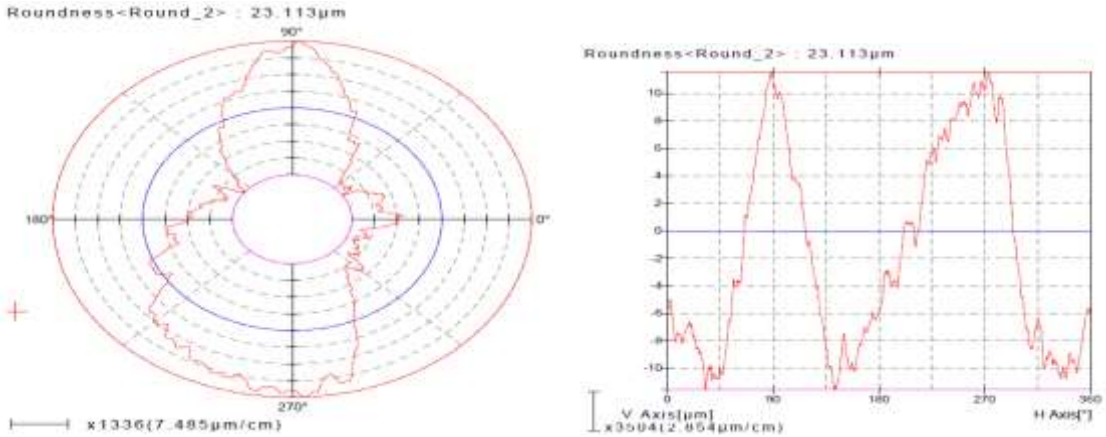

Figure 3 Roundness at other point (1) Horizontal (2) Vertical

Table4: Roundness Value on second point

Parameter MZCI(not up to standard)	Roundness(RONt)	
Roundness<Round_2>	23.113µm	
Extracted line	Filter Setting(not up to standard)	Z Position
Rotate-Outer(VERT)<RD_3>	2CRPC-75%Low[50 UPR]	-58.68 mm

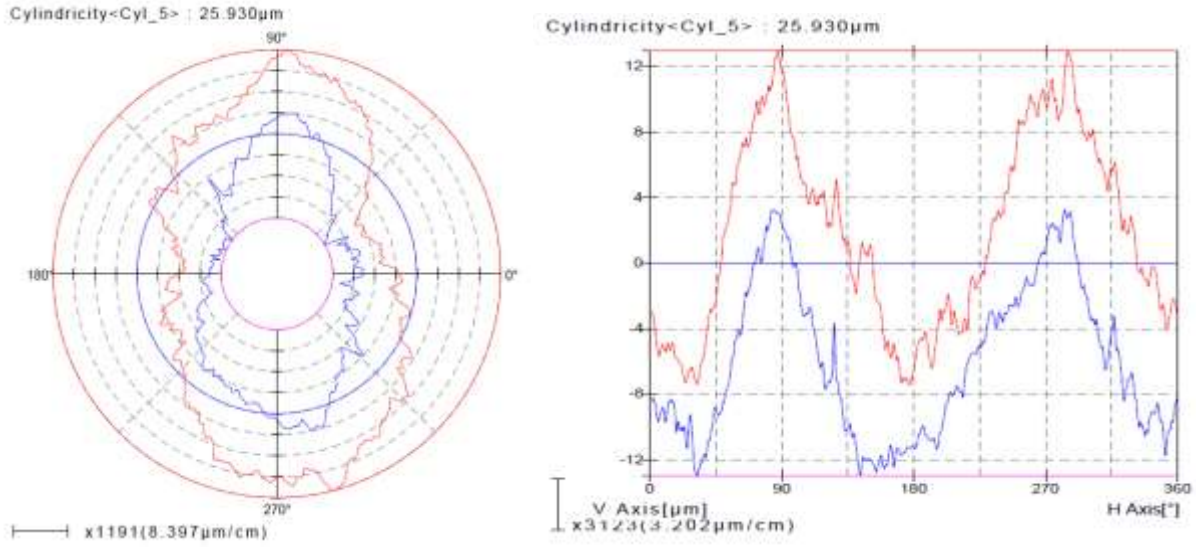

Figure 4 Cylindricity on external surface (1) Horizontal (2) Vertical

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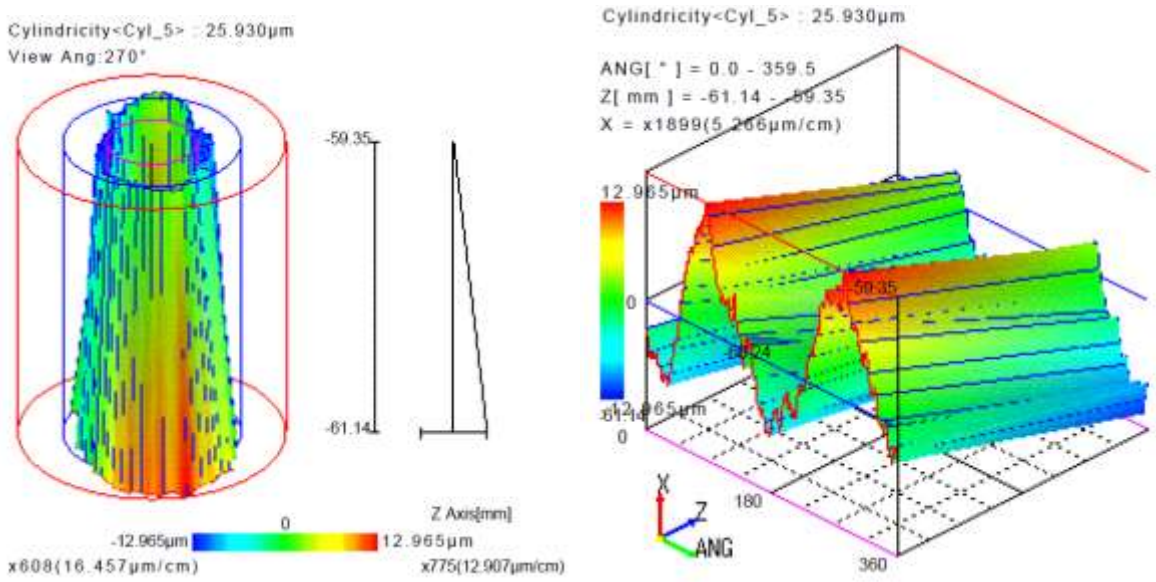

Figure 5 Cylindicity along (1) Roundness (2) Weaviness

Table5: Cylindricity Parameters

Parameter MZCY	Cylindricity(CYLt)		
Cylindricity<Cyl_5>	25.930µm		
Extracted line	Filter Setting	Z Position	Roundness
(REF)Rotate-Outer(VERT)<RD_6>	2CRPC-75%Low[50 UPR]	-61.14 mm	20.382µm
(REF)Rotate-Outer(VERT)<RD_7>	2CRPC-75%Low[50 UPR]	-59.35 mm	16.225µm

3. METAL FORMING CALCULATIONS

3.1 Die Design Calculation

The material CR3 steel DD as per the grade IS513-1994 and the thickness of cup is 0.5mm. The developed blank diameter 80mm and for draw ratio is less than 1 it means draw is simple and it may required only one stage.
The draw force can calculate by using following Empirical relation.

$$Draw\ Force\ (Ton) = Pi * Punch\ diameter * thickness\ of\ metal * yield\ strength * \left(\left(\frac{Blank\ Dia}{Punch\ Dia}\right) - Constant\right)$$

The factor of safety should be taken as 1.25 and then draw force can be calculated. The draw radius ranges will be from 4 to 10 times of Blank Thickness and punch radius ranges from 3 to 4 times of Blank thickness.
The Press tonnage capacity required for various thicknesses can be calculated as

$$Press\ Tonnage = Draw\ Force + Blank\ Holding\ Force\ (BHF)$$

$$i.e.\ BHF = 30\%\ of\ Draw\ Force$$

4. CONCLUSION

In this paper, the sheet metal component formed by conventional manufacturing press machine, in this study the numbers of setups are required to manufacture any single sheet metal component and there dimension tolerance is less maintained because of changing the number component setup for completing the manufacturing procedure for getting

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required component. Finally, these components can be assembled and while assembly the tolerance variation does matter. The forming sheet component they are using oil for reducing the corrosion on final component.

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