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Conduit Extrusion Process Capability

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Abstract— Comfort is one of the most important parameter in Automobile sector. In which gear shifter cables plays vital role. Various industries manufacture this cables as per customer requirement. Basically it consists of two parts inner member and outer conduit. Conduit is manufactured by plastic extrusion process. Extrusion is the manufacturing process in which a softened blank of metal or plastic material is force through a shaped metal piece or die to produce a continuous ribbon of formed product. Our aim is to reduce the variation in conduit diameter which is produce by plastic extrusion process and increase process capability. This problem mainly arises due to improper solo conduit winding. In this paper we work on this misalignment of solo conduit winding. For this purpose we design such arrangement which minimize this misalignment of solo conduit before it enters into the tool head.
Keywords- Conduit, Extrusion, Process capability, Misalignment, OD variation.

I. INTRODUCTION

DURA Automotive System is well known for manufacturing of Gear shifter, Automatic gear shifter, Housing assembly and gear cable. Key customers are VW, Mahindra, NISSAN, Ford. gear Shifter cable consists of two parts shifter cable and select cable. To take the gear in neutral position shifter cable is used, while select cable is used for actual shifting of gear. Cable consists of two member inner core and outer most conduit. Conduit is main part of gear shifter cable and manufactured by the extrusion process. The raw materials used for manufacturing of conduit are Akulon, Masterbatch, Ultramide. Several problems arising during manufacturing the conduit such as variation in diameter, improper surface finish, shade variation, coating defect but 80% rejection is due to variation in OD and our workspace is to reduce this variation by using methodology "DMAIC".

II. PROBLEM DEFINATION

First we observed the current process for conduit manufacturing i.e. Extrusion process. From this we identified some of the problems due to man, machine, method and material. This problems are elaborated in following "ISHIKWA".

III. REACTION MATRIX

From Ishikwa diagram we take some trial on such parameters and find the valid parameters for the variation in conduit diameter. The validations of parameters are plotted on reaction matrix as shown in table 1.

Table 1- Reaction Matrix

INPUT VARIABLE	OUTPUT VARIABLE			
	Conduit OD	Surface finish	Colour Shade	Thickness
Temperature				
Hooper	No	Yes	Yes	No
Cooler	Yes	Yes		
Zonal	Yes	Yes	Yes	No
Speed				
Puller	Yes	Yes	No	Yes
Extruder	Yes	Yes	No	Yes
Bobbin Tension	Yes	Yes	No	Yes
Preheating	No	Yes	Yes	Yes
Solo Conduit Winding	Yes	Yes	No	Yes
Centre Offset	Yes	Yes	No	Yes

IV. PROBLEM IDENTIFICATION

The major factor from Method which will contributes more variation in external diameter: Wrong bobbin direction, Solo conduit feeding misalignment, Bobbin brake tension and Over tightening of puller. So we work on solo conduit feeding misalignment.

Fig 1- Bobbin feeding misalignment due to improper winding

V. OBSERVATION READINGS

Bobbin Position - Start	H1-255°	Z1-245°	**Range (8.85-9.05)mm**
Hopper Temp- 80°	H2-260°	Z2- 250°	
Puller Speed - 15.41Hz	H3-240°		
External Extruder - 19.22Hz			
Cooler Temp -13.9°			

Table 2- Solo conduit misalignment

Cable length 330-370mm	Cable length 370-830mm	Cable length 1080-1120mm
9.04	8.97	9.00
8.93	8.81	8.88
8.82	9.04	8.81
9.02	9.02	8.97
8.83	8.83	8.80
8.89	8.88	8.87

8.98	8.91	8.92
8.85	8.87	9.06
8.87	8.83	8.89
9.07	9.03	9.08

Above readings taken during solo conduit misalignment. The specified range of conduit diameter is 8.85 to 9.05 but due to this misalignment actual range of conduit diameter could not be achieved. The red readings indicate the slight variation in OD from a specified range. Due to this there is a huge increment in scrap.

To avoid the scrap and to increase the process capability of process we design the arrangement of guide bush which will be fitted before tool head and solo conduit is passing through it without any misalignment and any jerk.

VI. PROCESS CAPABILITY

Process capability is the measurable property of a process to the specification, express as a process capability index (e.g. Cpk or Cpm) or as a process performance index (e.g. Ppk or Ppm). The output of this measurement is usually illustrated by a Histogram and calculations that predict how many parts will be produced out of specification (OOS). Two parts of the process capability are one measure the variability of the output of a process, and second compare the variability with a proposed specification or product tolerance.

VII. CAPABILITY STUDY

Capability study the output of a process is expected to meet customer requirements, specifications, or engineering tolerances. Engineers can conduct a process capability study to determine the extent to which the process can meet these expectations. The ability of a process to meet specifications can be expressed as a single number using a process capability index or it can be assessed using control charts. Either case requires running the process to obtain enough measurable output so that engineering is confident that the process is stable and so that the process mean and variability can be reliably estimated. Statistical process control defines techniques to properly differentiate between stable processes, processes that are drifting (experiencing a long-term change in the mean of the output), and processes that are growing more variable. Process capability indices are only meaningful for processes that are statically control.

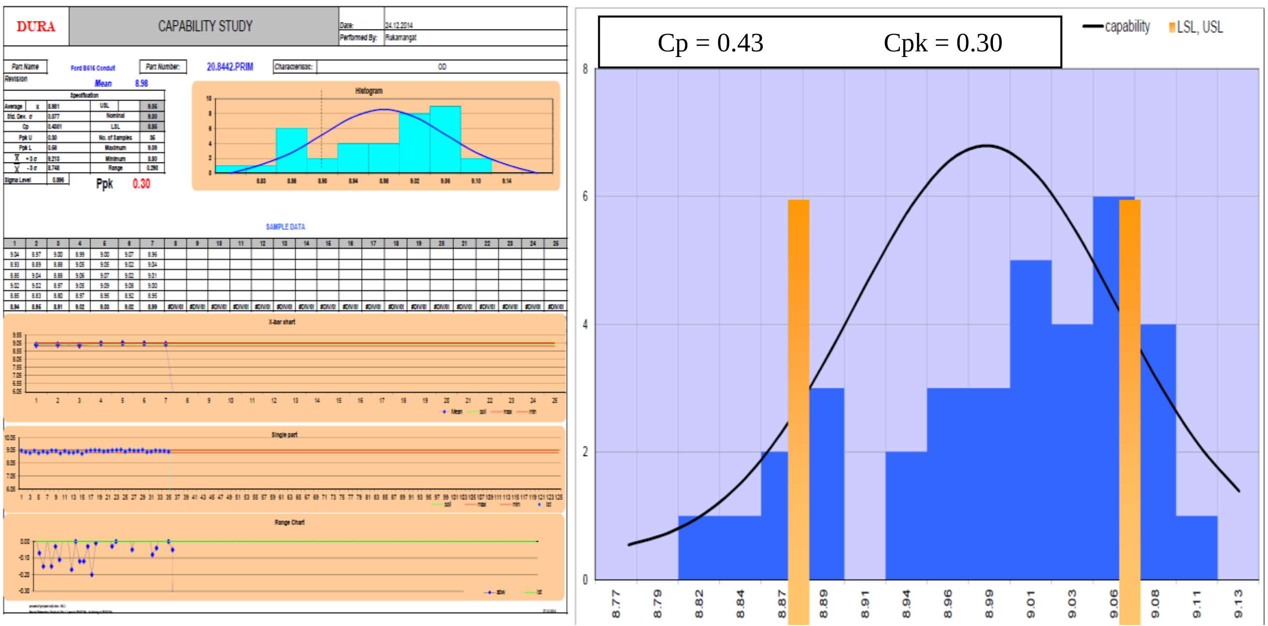

Fig 2-Capability Study-Histogram and Bell Curve

VIII. GUIDE BUSH DESIGN

From reaction matrix we found that there are four major parameter that would actually affecting the conduit OD. We analyze the process and found some errors in Man, Machine, Method and Material. From which we prepare the reaction matrix in which validation of each variable conducted. These are major factor from Method which will contributes more variation in external diameter: Wrong bobbin direction, Solo conduit feeding misalignment, Bobbin brake tension and Over tightening of puller. So we work on solo conduit feeding misalignment. We design the guide bush which reduces conduit OD variation an ultimately increases process capability. By implementing this solution we find out the new process capability of the system which is increases.

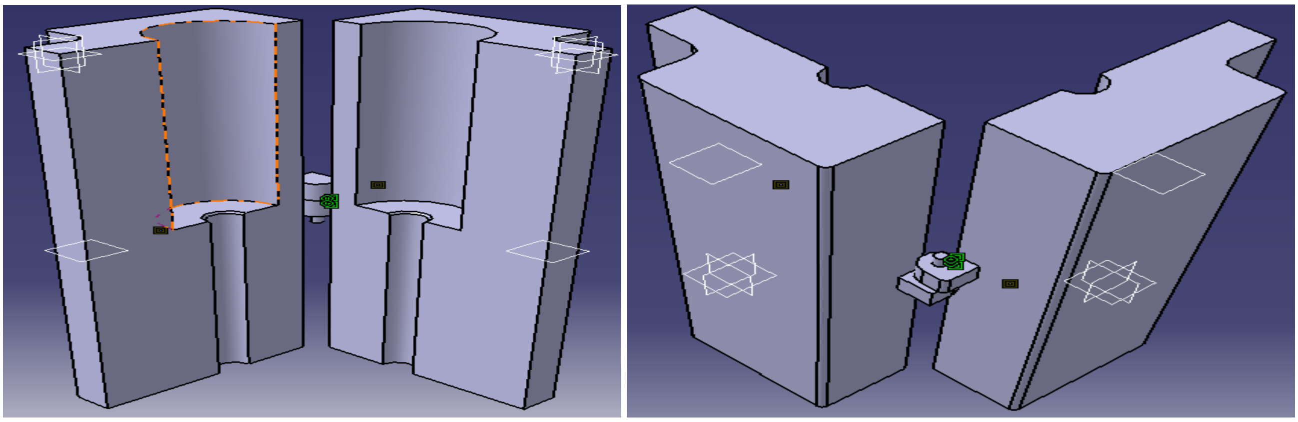

Fig 3 - Guide Bush Design From Catia Software

IX. ADVANTAGES OF IMPLEMENTED GUIDE BUSH

1. It avoids solo conduit misalignment
2. It guides the solo conduit into tool head.
3. Avoids vibration.
4. Guide bush halves meet concentric.

X. COMPARISON

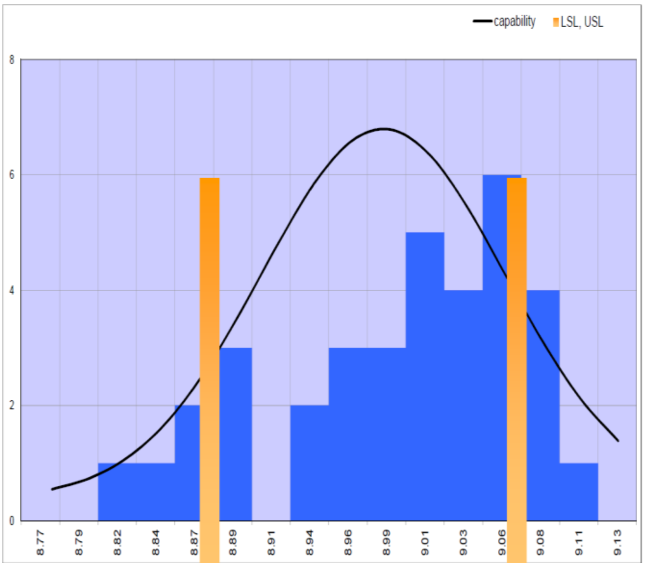

Fig ***4-Bell Curves Before Guide Bush***
Cp=0.43
Cpk=0.3

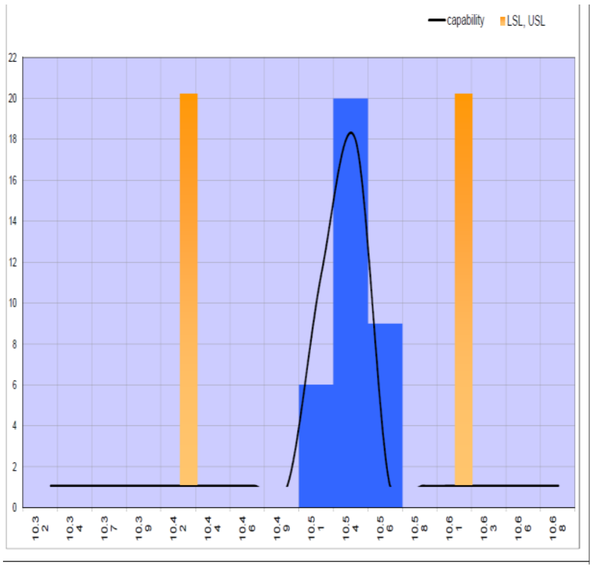

Fig 5-Bell Curves After Guide Bush
Cp=0.83
Cpk=0.6

XI. CONCLUSION

Thus by implementing the guide bush we increased the Process Capability of the system from 0.43 to 0.83. This can reduce the variation in conduit diameter and ultimately reduce number of parts produce out of specification(OOS).

REFERANCES

[1] Geo Raju1, Mohan Lal Sharma2, Makkhan Lal Meena3,"Recent Methods for Optimization of Plastic Extrusion Process: A Literature Review", International Journal of Advanced Mechanical Engineering. ISSN 2250-3234 Volume 4, Number 6 (2014), pp. 583-588.

[2] Prejem Rokopisa1, "Improving the process capability of a turning operation by the application of statistical techniques", ISSN 1580-2949, MTAEC9, 43(1)55(2009).

[3] Ramakrishnan B, Sandborn P, Pecht M. Process capability indices and product reliability. Microelectronics Reliability 41 (2001), 2067–2070

[4] Montgomery DC. Introduction to Statistical Quality Control. New York: John Wiley & Sons Inc.; 2005, 364–413

[5] Wright PA. The cumulative distribution function of process capability index *C*pm. Statistics and Probability Letters 47 (2000), 49–251

[6] Pearn WL, Shu MH, Hsu BM. Monitoring manufacturing quality for multiple Li-BPIC processes based on capability index *C*pmk. Int. Journal of Production Research 43 (2005) 12, 2493–2512

