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Barrel TRT tension plate dimension measurements

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This report describes the results of the measurements of the Barrel TRT tension plates. Ten production tension plates were measures (5 mirror and 5 non-mirror). In addition on production plate without sockets was measured.

1. Description of measuring equipment and technique.

The tension plates are measured using a non-contact measuring machine. The Optical Gauge Products (OGP) Avant-600 is shown in figure 1. This machine has a measurement accuracy of ± 0.005mm as determined by a 100mm x 300mm glass calibration standard. This machine as a measurement area of 18" x 24" (457 x 610mm). The OGP machine is has three modes of illuminating the part under measurement: backlighting (best for measuring the straw holes and fixation hole), through the lens lighting and off-axis lighting. Figure 2 shows the image of a typical socket as seen by the OGP machine. The spring inside of the socket used to hold the pin from the IC chip can clearly be seen.

The features measured were the two socket holes in each of the 33 regions. The socket hole number scheme follows the standard IC pin numbering convention with socket 1 in the upper left corner one of the regions in figure 3 and the socket number increasing in a counter clockwise manner. There are 22 sockets in each ASDBLR region. Region 1 had all 22 sockets measured (plate serial # 293 had no sockets installed so bare holes were measured instead). The rest of the 33 regions had only two sockets measured. The sockets were located in opposite corners of the regions. For the even serial number parts the sockets #9 and #20 were measured. For the odd serial number parts the sockets #1 and #12 were measured. The origin of the even serial number parts was socket #9 in region 28 and the x-axis was aligned with the line from the origin to region 5, socket #20. The odd serial number parts had region 28 socket #12 as the origin and socket #1 in region 5 was used to align the x-axis.

Figure 4 shows a distribution of the distance between holes in region 1 for the even serial number parts. The odd serial number distribution is shown in figure 5. The average deviation and the rms (shown as error bars) are depicted in figure 6. From each distribution we see that the hole spacing for the pins within an ASDBLR socket are fairly uniform (< 0.100 mm variation.) Using two holes in each of 33 ASDBLR regions, the uniformity of hole placement is seen in figures 9 and 10.

In order to determine the center the center of each ASDBLR region, two sockets in opposite corners of the region were measured (holes #1 and #12 for odd serial number plates and holes #9 and #20 for even serial number plates). Figures 7 and 8 show the deviation in the in the center position from the ideal part position of all 33 ASDBLR regions in all of the plates. Three regions 11, 15 and 16 show appreciable deviation for both the even and odd parts. Figures 9 and 10 show the deviation from ideal in x and y for two holes measured in each of 33 ASDBLR regions. Table 1 shows the deviation of the center from ideal (Δx, Δy) for the three bad regions and the average of the rest of the regions and each of the parts measured.

Table 1

	serial # 221		serial # 233		serial # 235		serial #237		serial #251		serial #293 (no pins)	
	✣X	✣Y	✣X	✣Y	✣X	✣Y	✣X	✣Y	✣X	✣Y	✣X	✣Y
Center Region 11	0.204	-0.842	0.208	-0.847	0.247	-0.817	0.244	-0.811	0.218	-0.837	0.236	-0.822
Center Region 15	-1.328	0.372	-1.338	0.368	-1.350	0.430	-1.356	0.369	-1.348	0.336	-1.352	0.378
Center Region 16	0.436	-0.381	0.461	-0.376	0.472	-0.338	0.494	-0.380	0.443	-0.382	0.470	-0.367
average rest of regions	-0.031	0.005	-0.024	-0.005	-0.021	0.020	-0.015	-0.013	-0.029	-0.011	-0.022	-0.001
rms rest of regions	0.018	0.018	0.014	0.017	0.018	0.017	0.019	0.014	0.012	0.015	0.013	0.008
	serial # 220		serial # 232		serial # 234		serial #236		serial #250			
	✣X	✣Y	✣X	✣Y	✣X	✣Y	✣X	✣Y	✣X	✣Y		
Center Region 11	0.301	0.795	0.193	0.826	0.159	0.833	0.206	0.840	0.194	0.837		
Center Region 15	-1.294	-0.408	-1.364	-0.372	-1.396	-0.367	-1.386	-0.328	-1.399	-0.362		
Center Region 16	0.527	0.380	0.406	0.401	0.374	0.398	0.413	0.363	0.409	0.402		
average rest of regions	0.027	-0.024	-0.050	-0.006	-0.062	-0.005	-0.049	-0.005	-0.066	-0.002		

2. **Conclusions:**

Within a single ASDBLR region, the holes (sockets) are fairly uniform (<0.100 mm) in almost all cases. There are three ASDBLR regions that are significantly different from the CAD file used to determine the position of the ideal part. This could either be a mistake in fabrication of the tension plates themselves, or more likely it is that correct version of the CAD file describing the location of the ASDBLR holes was not sent to the United States. We need to determine the source of this error. If can not be attributed to drawing version control mismanagement, then we will need to measure more of these plates for all of the types.

Figure 1 Photograph of the OGP Avant-600 non-contact optical measuring machine used to measure the Barrel TRT tension plates .It has measurement area of 18”x24” and measurement accuracy of ± 0.005mm.

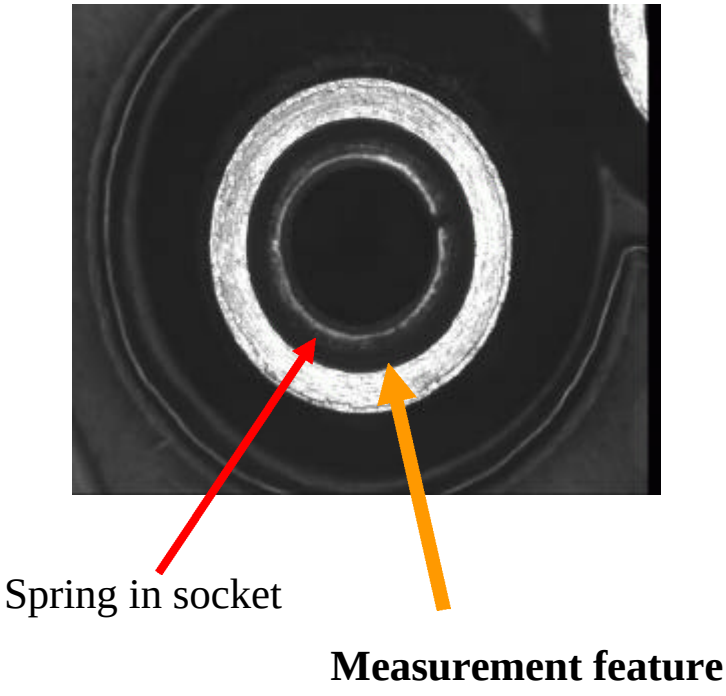

Figure 2 Image of a typical socket used in this measurement. The spring used to hold the pin of an IC chip can clearly be seen. We measured the inside of the thick wide band of metal which is the socket. Because the part could not be backlit. Through the lens lighting was used.

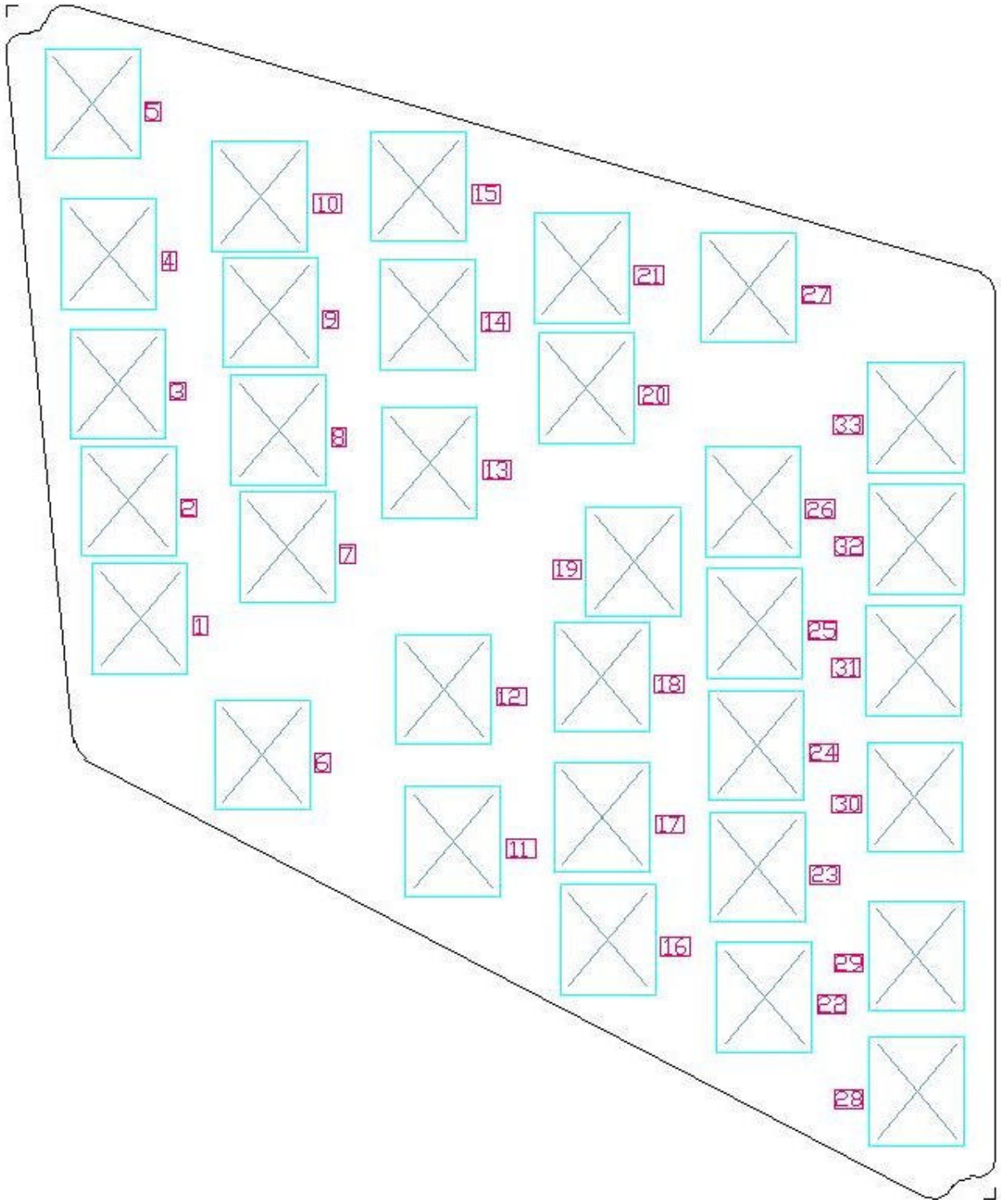

Figure 3 drawing of Type 2 tension plate showing the regions (ASDBLR sockets) measured by the OGP machine

Figure - 4: Deviation from ideal hole to hole distance region 1

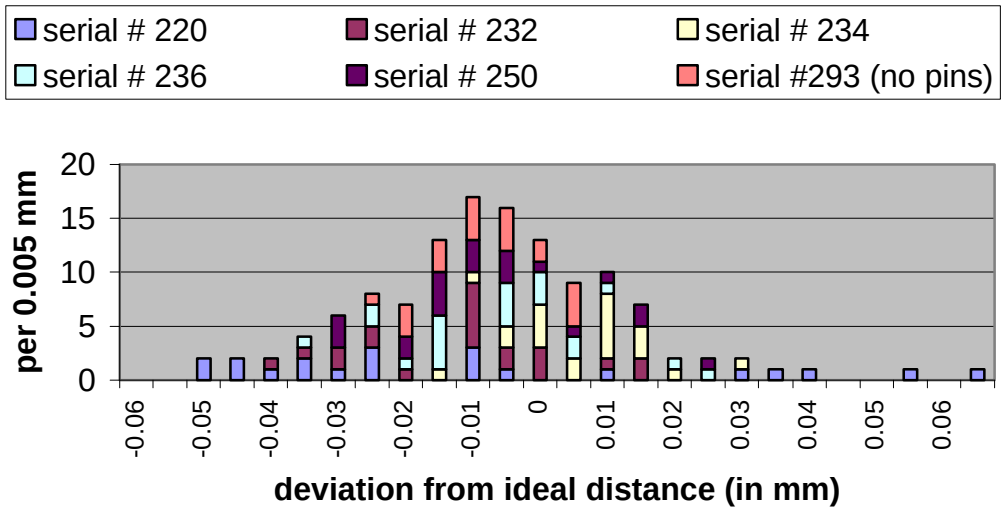

Figure 4 Deviation from ideal - hole to hole distance in region 1 - even serial numbers

Figure 5 Deviation from ideal hole to hole distance region 1

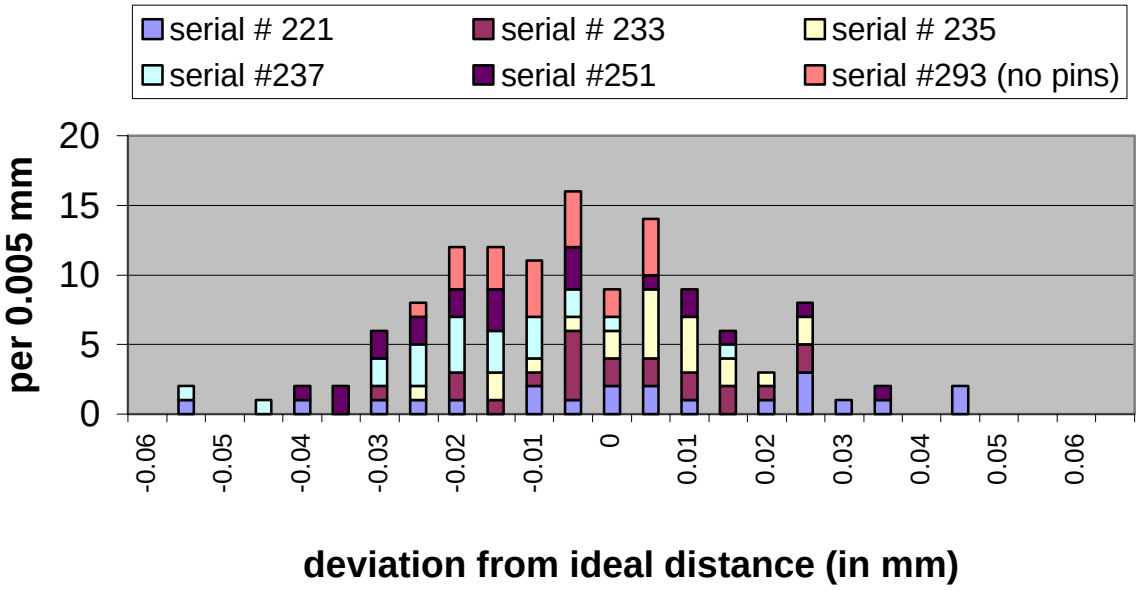

Figure 5 Deviation from ideal - hole to hole distance in region 1 - odd serial numbers

Figure 6: average deviation from ideal

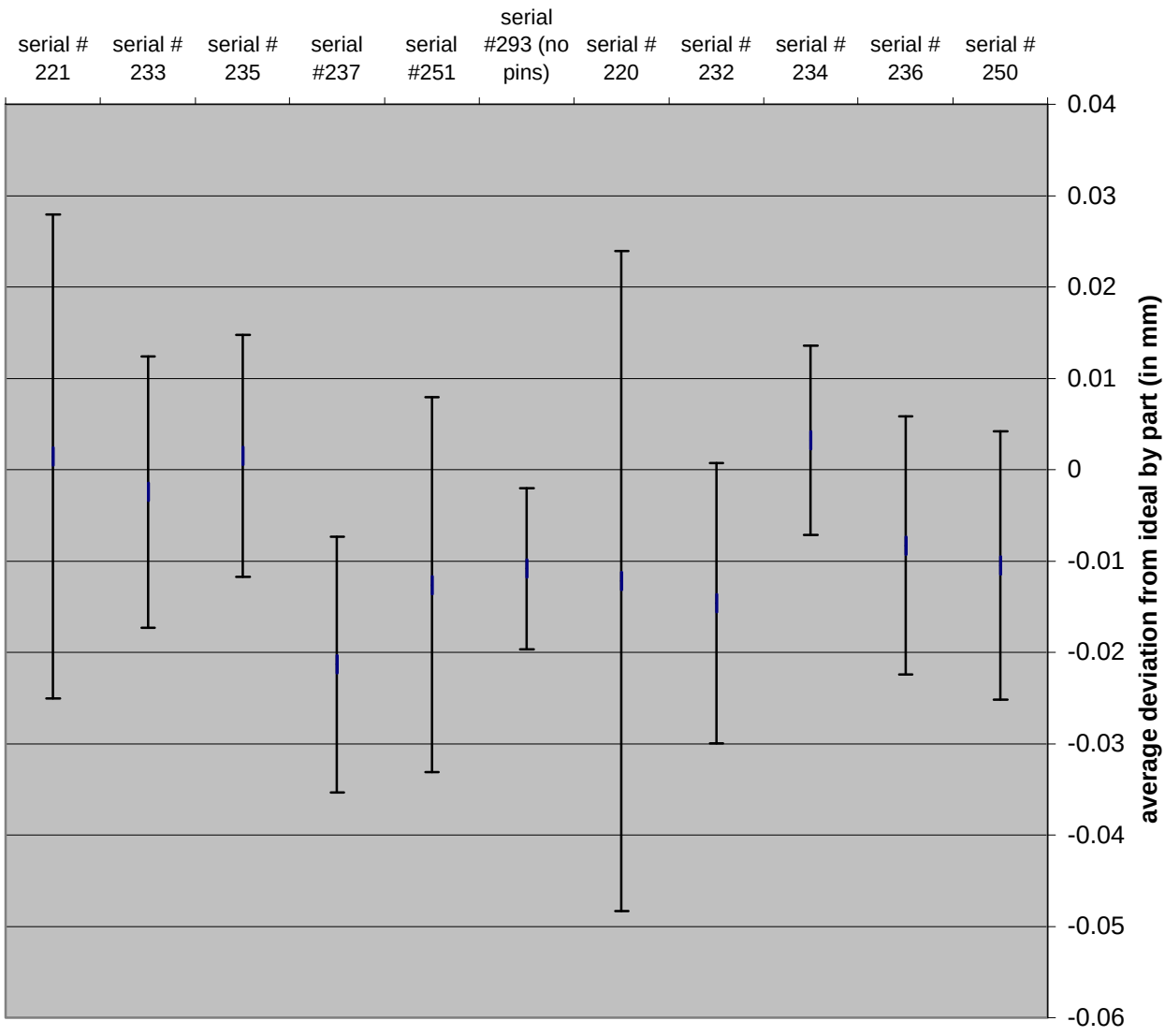

Figure 6 Average deviation from ideal (in region 1) for all parts measured. The rms of the average is denoted by the error bars

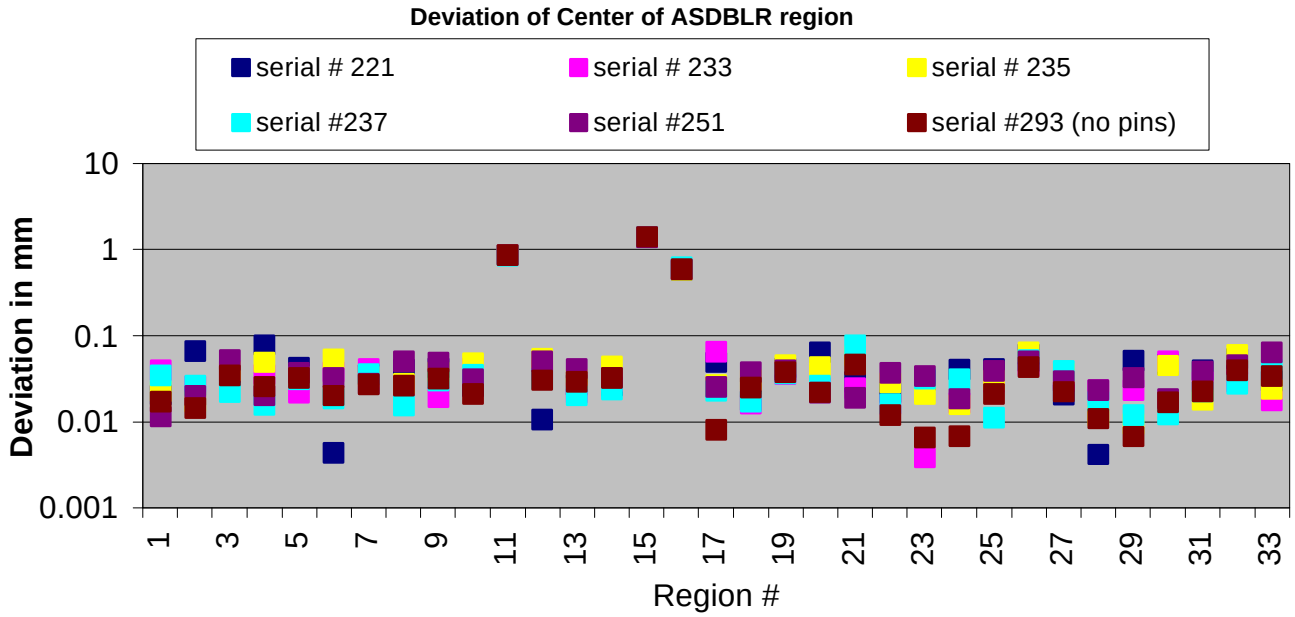

Figure 7 Deviation of center of ASDBLR region from the ideal part. The center position is determined from socket holes 1 and 12. Three regions 11,15 and 16 are inconsistent with the perfect part. The deviation of the rest of the ASDBLR regions is < 0.100 mm.

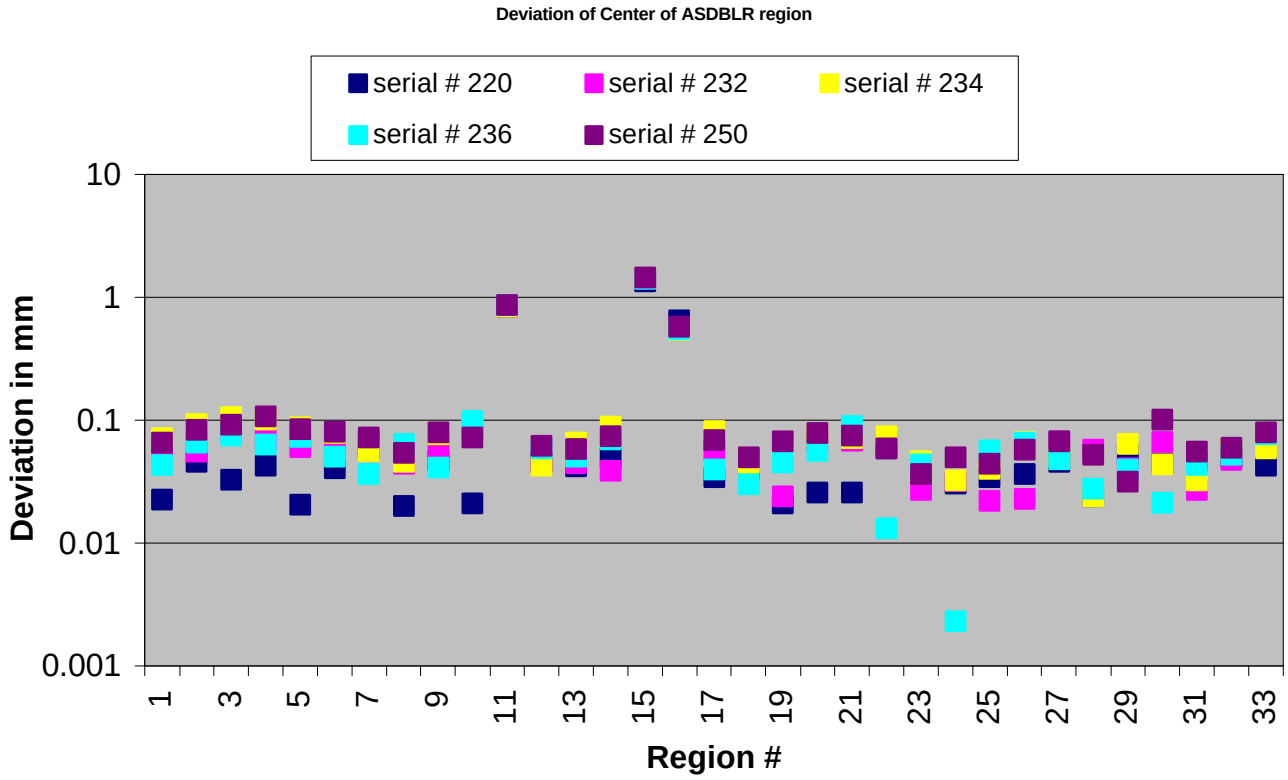

Figure 8 Deviation of center of ASDBLR region from the ideal part. The center position is determined from socket holes 1 and 12. Three regions 11,15 and 16 are inconsistent with the perfect part. The deviation of the rest of the ASDBLR regions is < 0.100 mm.

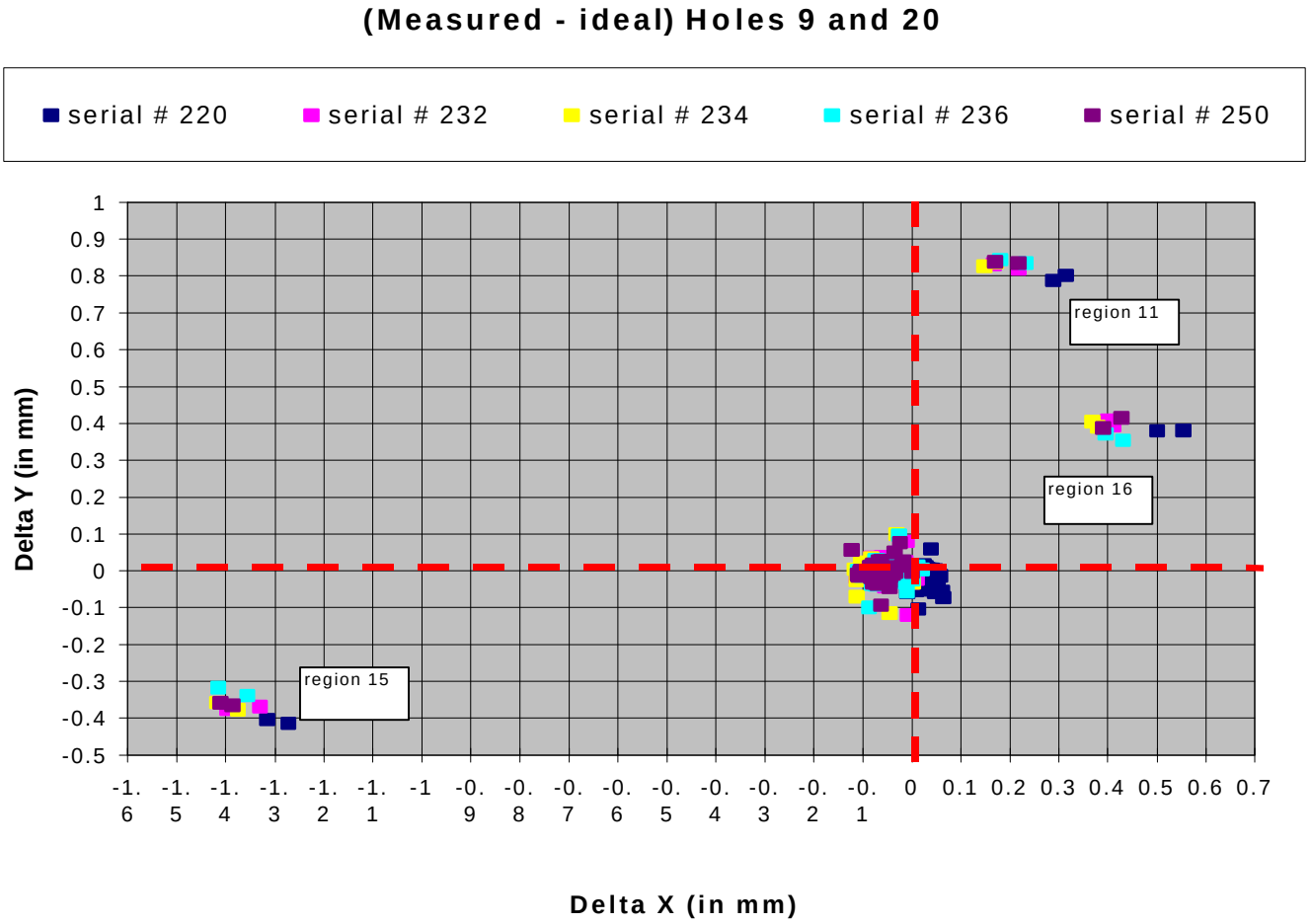

Figure 9 Difference between measured part and ideal part in both the x and y coordinates separately. These two holes were used to determine location of each of the 33 ASDBLR regions. There are three regions that are clearly different. The grouping around 0,0 show the spread the hole positions part to part.

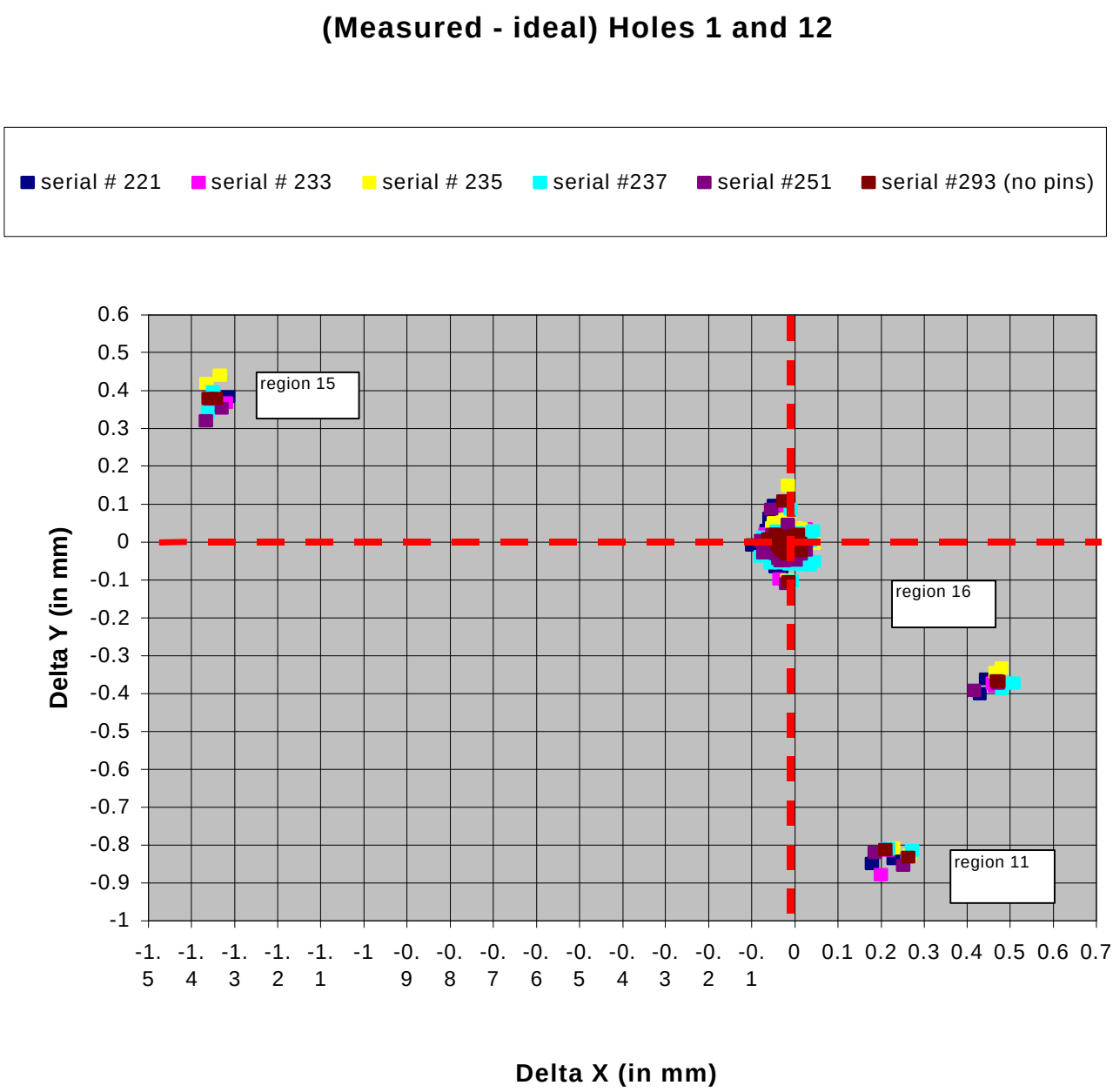

Figure 10 Difference between measured part and ideal part in both the x and y coordinates separately. These two holes were used to determine location of each of the 33 ASDBLR regions. There are three regions that are clearly different. The grouping around 0,0 show the spread the hole positions part to part.