1.0 Purpose:

The purpose of this work instruction is to define the technique to measure the pocket plate functional draft on the outer strut pocket wall and the outer wall (pocket) rotation using a coordinate measuring machine (CMM) to achieve correlation between customer and supplier inspection results.

2.0 Scope:

This procedure applies to all items that reference this work instruction.

3.0 Responsibilities:

The Design Manager or Director of Design & Test is responsible for the maintenance of this specification.

4.0 Definitions:

4.1 Functional Draft – The functional draft is the angle of the outer strut pocket wall to the center of rotation, ideally the outer pocket wall (see Figure 3) should be parallel to the rotational axis of the pocket plate. It is a composite of draft on the tool and the ID to OD flatness. A convex flange profile “negative flatness” will add to the tool draft and a concave flange profile “positive flatness” will subtract from the tool draft.

4.2 Rotational Axis – The rotational axis of the part is the axis as established by the creation of a cylinder using the minor diameter of the internal spline, unless otherwise specified (the -Z- axis on the CMM). (See section 5.3)

4.3 Tool draft – The draft produced on the tools to aid in part ejection off the tool without part “picking”.

4.4 ID to OD Flatness (see Figure 3) – With the part setting on the skirt and the pockets facing up, positive is up and negative is down. If the flange tilts up or concave, this is a positive ID to OD profile, and it subtracts from the functional draft created by the tool draft. If the flange tilts down or convex, this is a negative ID to OD profile, and it adds to the functional draft created by the tool draft.

4.5 Virtual circle or cylinder - being on or simulated on a computer.

4.6 Outer Wall (Pocket) Rotation – The orientation of the outer pocket wall to the center line of the part.

5.0 Engineering Method:

5.1 Determine a twelve o’clock position on the part, ideally this is an oriented feature that can be referenced every time and traced back to the manufacturing tool.

5.2 Rest the pocket plate on a flat surface with the pockets facing upward. Position the OD of the spline with a known orientation to the twelve o’clock position.

5.3 Define the primary datum “rotational axis” by establishing three virtual datum circles on the ID spline minor diameter (for 10R140 use datum -H-, bushing pilot diameter) and create a virtual condition cylinder between the three virtual datum circles. The number of equally spaced points to establish each of the three virtual circles must be approved by Means Product Engineering.

Virtual circle 1 and 3 are created at a distance approved by Means Product Engineering from either end of the spline, while virtual circle 2 is created equidistant from each spline end.

5.4 Establish the CMM "X" axis as the pocket length.

5.5 Establish the CMM "Y" axis (rotational orientation) by using the two 40° tapered alignment holes and creating an axis plane then rotating the appropriate degrees. This will create the part center line, which is perpendicular to the outer pocket wall. The rotation to twelve o'clock position must be known.

5.6 Establish the CMM "Z" zero depth to zero at each pocket (12 or 14 places) based on the individual target datum -F1-. See Figure 4 for location.

5.7 The outer wall of each pocket shall be measured at the below listed depths with the below listed start and ending points (as measured from the part print center line). The number of data points at each depth must be agreed upon by Means Product Engineering. The goal being to correlate to the Means functional draft measurements. (See Figure 4, detail V)

5.7.1 6T30 and 6T40 program (ALUMINUM) reference data:

Z depth, mm		X length: base, mm		X length: tip, mm	
Z1	-0.9	**Xb1**	-1.05	**Xt1**	7
Z2	-1.18	**Xb2**	-1.09	**Xt2**	7
Z3	-1.45	**Xb3**	-1.13	**Xt3**	7
Z4	-1.73	**Xb4**	-1.17	**Xt4**	7
Z5	-1.9	**Xb5**	-1.21	**Xt5**	7

5.7.2 6T70 and 8F57 program reference data:

Z depth, mm		X length: base, mm		X length: tip, mm	
Z1	-0.9	**Xb1**	1.05	**Xt1**	-8.28
Z2	-1.18	**Xb2**	1.09	**Xt2**	-8.24
Z3	-1.45	**Xb3**	1.13	**Xt3**	-8.20
Z4	-1.73	**Xb4**	1.17	**Xt4**	-8.16
Z5	-2	**Xb5**	1.21	**Xt5**	-8.12

5.7.3 Mazda FZ2/3 program reference data:

Z depth, mm		X length: base, mm		X length: tip, mm	
Z1	-0.9	**Xb1**	1	**Xt1**	-7.45
Z2	-1.125	**Xb2**	1	**Xt2**	-7.45
Z3	-1.35	**Xb3**	1	**Xt3**	-7.45
Z4	-1.575	**Xb4**	1	**Xt4**	-7.45
Z5	-1.8	**Xb5**	1	**Xt5**	-7.45

5.7.4 Ford 10R140 program reference data:

Z depth, mm		X length: base, mm		X length: tip, mm	
Z1	-0.9	**Xb1**	0.416	**Xt1**	-6.636
Z2	-1.125	**Xb2**	0.450	**Xt2**	-6.554
Z3	-1.35	**Xb3**	0.480	**Xt3**	-6.473
Z4	-1.575	**Xb4**	0.510	**Xt4**	-6.389
Z5	-1.8	**Xb5**	0.531	**Xt5**	-6.313

5.7.5 GM 9T45, 9T65, and Ford 8F35 program reference data:

Z depth, mm		X length: base, mm		X length: tip, mm	
Z1	-0.9	**Xb1**	-1.10	**Xt1**	8.23
Z2	-1.175	**Xb2**	-1.15	**Xt2**	8.18
Z3	-1.48	**Xb3**	-1.20	**Xt3**	8.13
Z4	-1.775	**Xb4**	-1.25	**Xt4**	8.08
Z5	-2.0	**Xb5**	-1.3	**Xt5**	8.03

5.7.6 Honda 4G2 program reference data:

Z depth, mm		X length: base, mm		X length: tip, mm	
Z1	-0.9	**Xb1**	-1	**Xt1**	7.45
Z2	-1.125	**Xb2**	-1	**Xt2**	7.45
Z3	-1.35	**Xb3**	-1	**Xt3**	7.45
Z4	-1.575	**Xb4**	-1	**Xt4**	7.45
Z5	-1.8	**Xb5**	-1	**Xt5**	7.45

5.7.7 6T30 and 6T40 program (PM) reference data:

Z depth, mm		X length: base, mm		X length: tip, mm	
Z1	-0.9	**Xb1**	-1.05	**Xt1**	9.36
Z2	-1.18	**Xb2**	-1.09	**Xt2**	9.31
Z3	-1.45	**Xb3**	-1.13	**Xt3**	9.26
Z4	-1.73	**Xb4**	-1.17	**Xt4**	9.21
Z5	-2	**Xb5**	-1.21	**Xt5**	9.17

5.8 Flatness, perpendicularity, and the distance from the center is determined using these probings.

5.9 Establish a best fit plane through all the data points for every pocket and report the functional draft and outer wall rotation angle for every outer pocket wall per part.

5.9.7 Functional draft° = A best fit plane established from all the data points as it is referenced to -Z- axis of rotation. A positive value means the top of the pocket wall is further from the Z axis than the bottom of the pocket wall. (see Figure 4, section B-B)

5.9.8 Outer Wall (Pocket) Rotation) = A best fit plane established from all the data points. Reported as the deviation from 90º orientation to the virtual part center line. (See Figure 5). Example: absolute value of [90º - 91.5º (measured angle of outer wall from part center line)] = **1.5º counter clockwise (CCW) rotation**

6.0 References: none

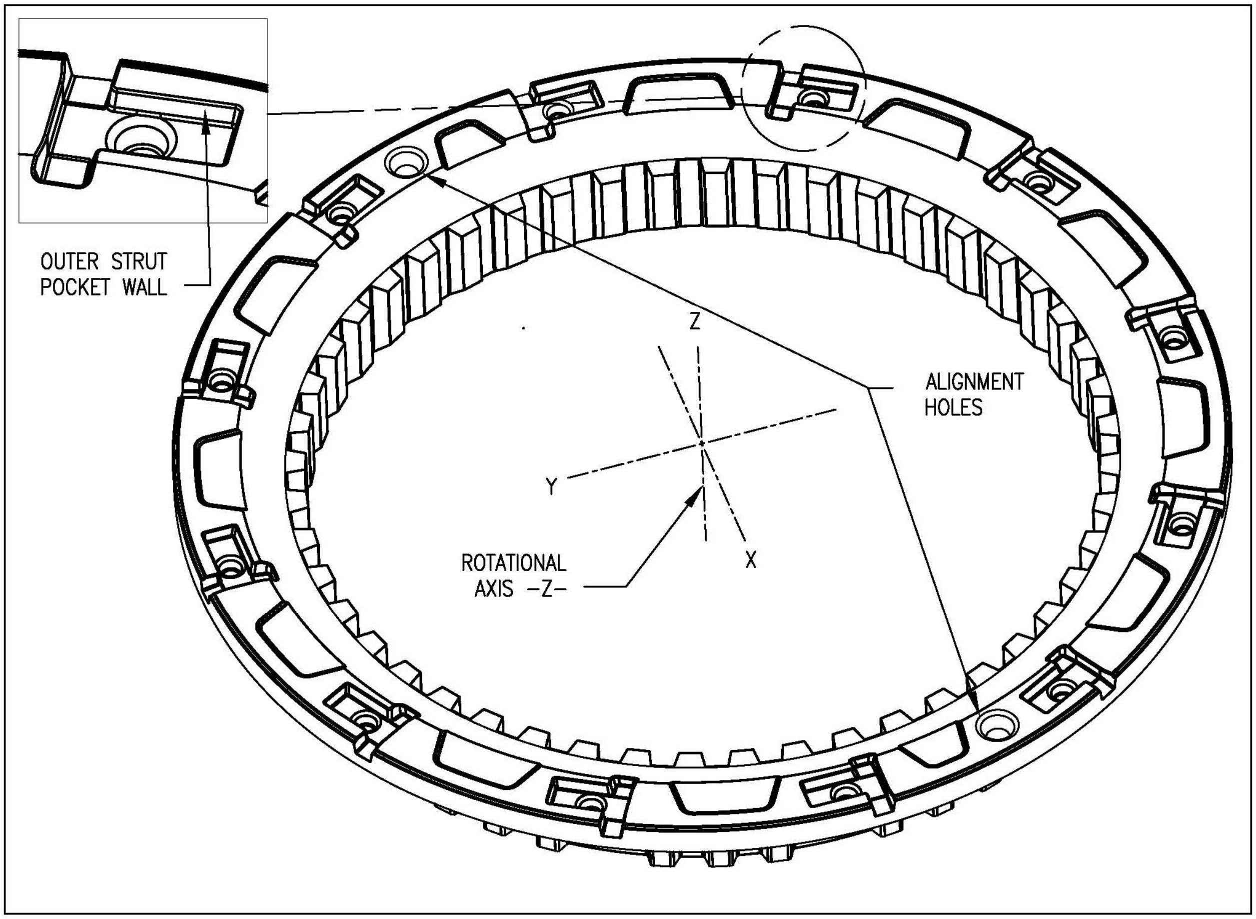

Figure 1

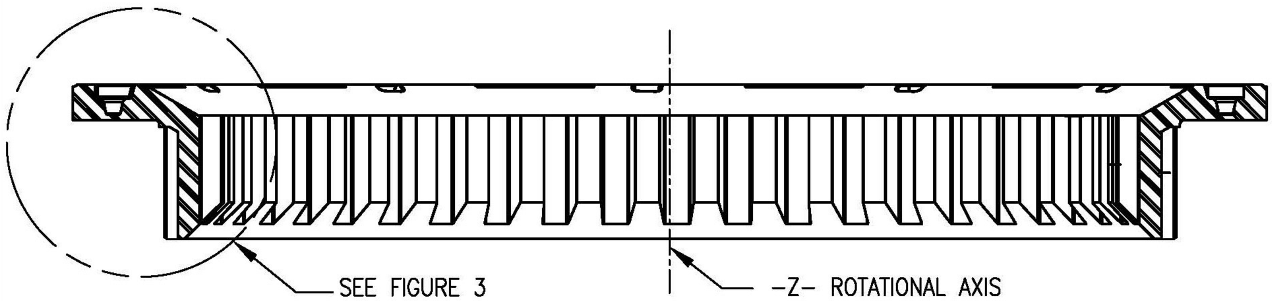

FIGURE 2

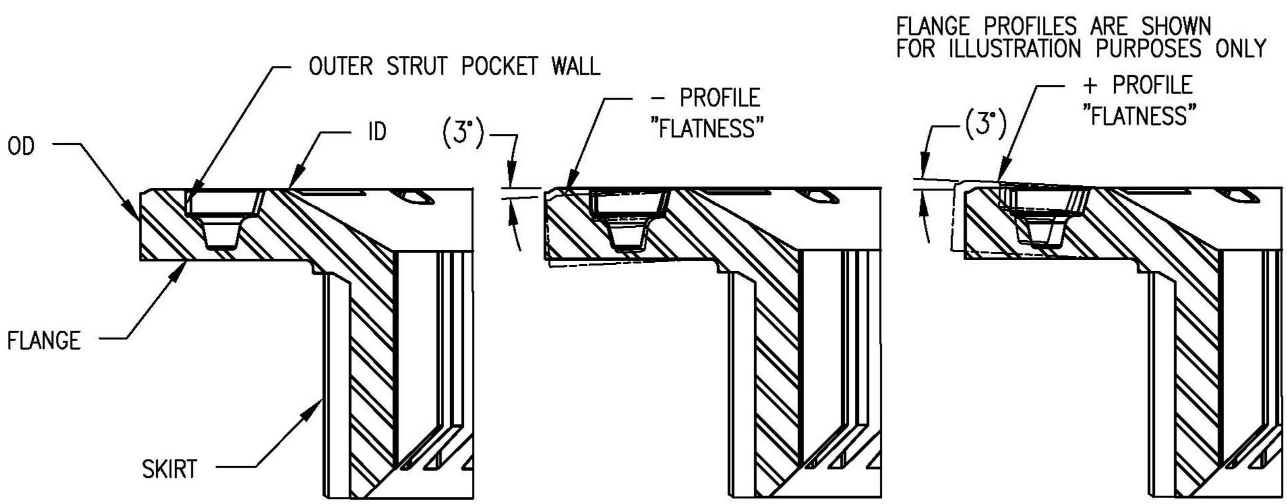

FIGURE 3

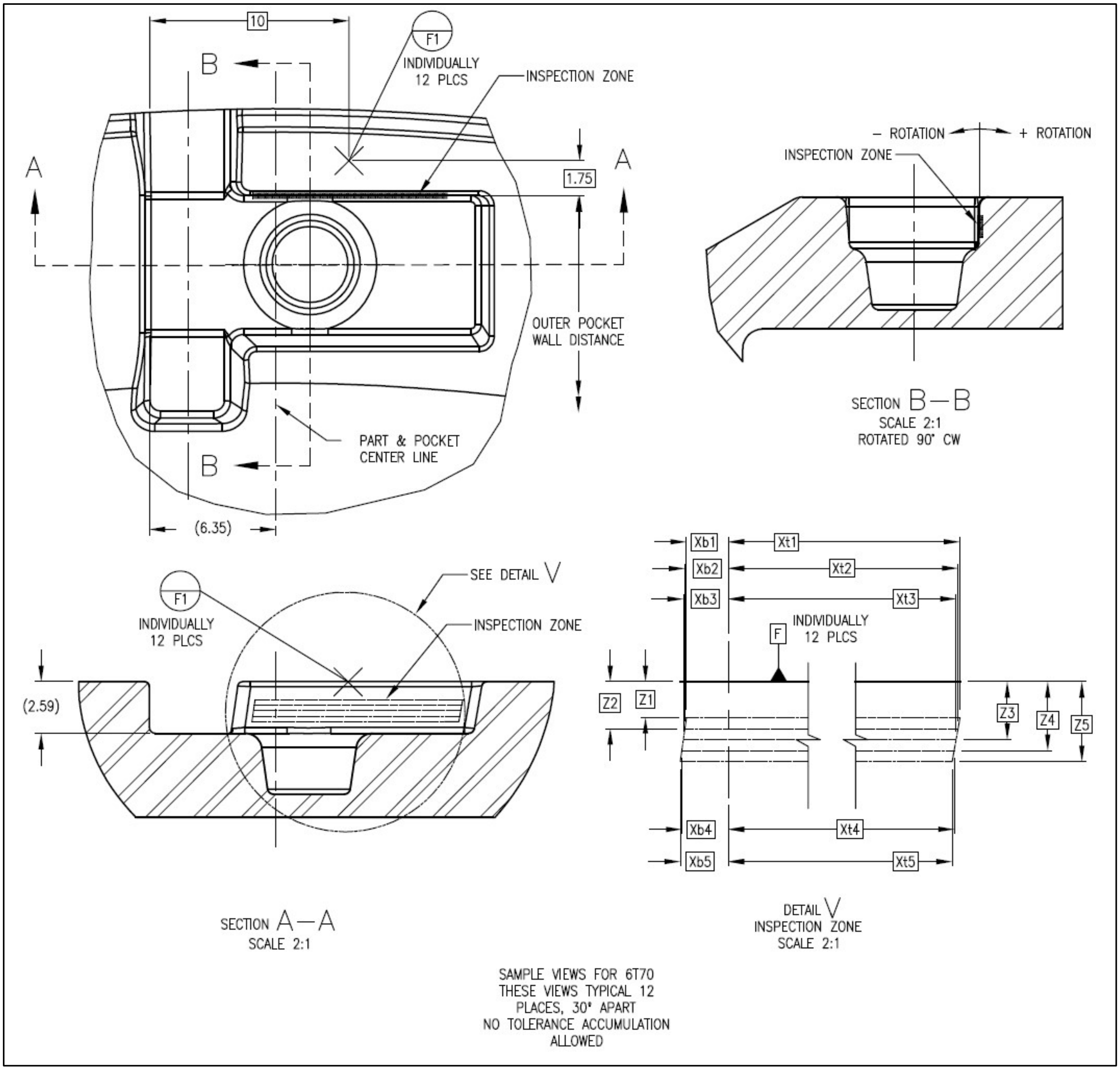
10
F1
INDIVIDUALLY
12 PLCS
INSPECTION ZONE
B
A
A
1.75
OUTER POCKET
WALL DISTANCE
PART & POCKET
CENTER LINE
B
(6.35)
– ROTATION
+ ROTATION
INSPECTION ZONE
SECTION B—B
SCALE 2:1
ROTATED 90° CW
F1
INDIVIDUALLY
12 PLCS
SEE DETAIL V
INSPECTION ZONE
(2.59)
SECTION A—A
SCALE 2:1
Xb1
Xt1
Xb2
Xt2
Xb3
Xt3
F
INDIVIDUALLY
12 PLCS
Z2
Z1
Z3
Z4
Z5
Xb4
Xt4
Xb5
Xt5
DETAIL V
INSPECTION ZONE
SCALE 2:1
SAMPLE VIEWS FOR 6T70
THESE VIEWS TYPICAL 12
PLACES, 30° APART
NO TOLERANCE ACCUMULATION
ALLOWED

Figure 4

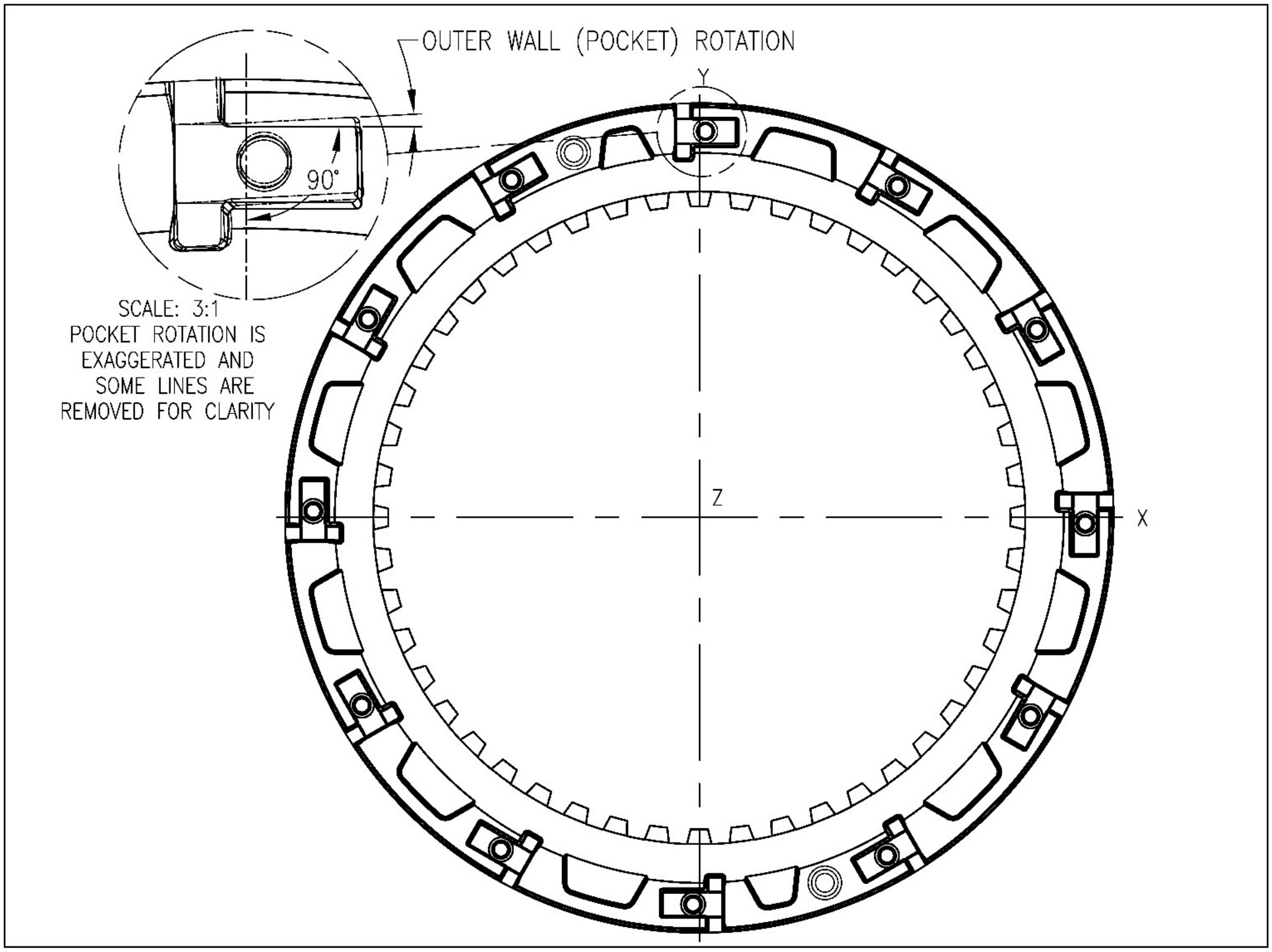
OUTER WALL (POCKET) ROTATION
Y
90°
SCALE: 3:1
POCKET ROTATION IS
EXAGGERATED AND
SOME LINES ARE
REMOVED FOR CLARITY
Z
X

Figure 5

7.0 **Approvals:** none

8.0 Revision Record:

WO#	ECR	ERN	Rev	Revision Change Description	Chng	Appr	Date
none	none	none	A	Preliminary release for supplier review	J. Jurek	R. Fetting	09/01/11
1855	00528	00366	B1	Revised subject & purpose section 1.0	J. Jurek	R. Fetting	05/18/12
			B2	Added pocket rotation to definitions section 4.6			
			B3	Added figure 5 pictorial of pocket rotation			
			B4	Revised table 5.7.2 was -.09	J. Jurek	R. Fetting	06/03/13
			B5	Revised line 5.6 removed -F2- and -F3- datum targets			
			B6	Revised Figure 4 – removed -F2- and -F3- datum targets			
none	00870	00755	C1	5.7.1 was 9.36, 9.31, 9.26, 9.21, 9.17 added symbolic alpha characters	J. Jurek	J. Prout	08/10/20
			C2	5.7.2 added 6T70 and 8F57 table			
			C3	5.7.3 added Mazda table			
			C4	Figure 4 revised Detail V with symbolic alpha characters			
			C5	Figure 4 revised Section B-B added draft angles			
			C6	5.9.1 and 5.9.2 replaced maximum material condition (MMC) with best fit and added meaning of positive value sentence			
			C7	3.0 was Design & Test Lab Manager			
4214	01596	00890	D1	5.7.4 added Ford 10R140 table	J. Jurek	J. Prout	06/20/22
			D2	5.3 added 10R140 datum -H- note			
			D3	4.2 added unless otherwise specified			
4649	01823	00923	E1	Rotated Figure 4 90° and updated views	J. Jurek	J. Prout	02/08/24
			E2	Added 5.7.5 and 5.7.6 tables			
			E3	Revised 5.7.1 8.28 was 8.12, 8.24 was 8.16, 8.16 was 8.24, 8.12 was 8.28, 1.17 was 1.16, 1.21 was 1.2			
			E4	Revised 5.7.2 -8.28 was- 8.12, -8.24 was -8.16,- 8.16 was -8.24, -8.12 was -8.28, -1.17 was -1.16, -1.21 was -1.2			
none	01890	0935	F1	Revised 5.7.1 6T30 & 6T40 data table and added ALUMINUM	J. Jurek	J. Prout	08/06/24
			F2	Added 5.7.7 6T30 & 6T40 PM data table			
			F3	Removed references to figures in section 4.0			
			F4	Removed Figure 2 and replaced with Figure 3 and removed “see section 4.4” in section 4.1			
			F5	Removed Ø7.57 from section 5.5			
			F6	Added “or 14” to section 5.6			