

DOCUMENT TITLE:	MAINTENANCE PROC, 2690 CAROUSEL / CARRIER MECHANISM ALIGNMENT TOOL		
DOCUMENT TYPE:	☐ Calibration	☒ Preventive Maintenance	
TEST EQUIPMENT NAME:	ALIGNMENT FIXTURE, 2690 CAROUSEL/CARRIER MECHANISM		
TEST EQUIPMENT NUMBER:	TE82520		

AUTHOR(S):	MATT BRULE	DATE:	June 17, 2013
REVISED BY:	CHAU NGUYEN	DATE:	March 28, 2018

EQUIPMENT REQUIRED

Quantity	Part Number	Description
1	N/A	Calibrated Depth Micrometer to measure 0-4.000 inches
1	999041265	Square Gauge Block, 3.000 inches with 1/4" through hole at center (<i>Reference to Appendix E</i>)
1	N/A	Calibrated Smart Scope (<i>To inspect angular deviation of 4 holes punctured on paper disk attached to any carousel A to E.</i>)
1	N/A	Calibrated Caliper
1	N/A	Calibrated Computerized Measuring Machine (CMM)
1	990940519	Master Carrier (<i>Reference to Appendix C</i>)
1	999029399	Master Carousel (<i>Reference to Appendix D</i>)
1	N/A	Master Carousel Carrier Drive (<i>A random CCD was set and subjected to numerous tests using three new 269x Alliances and verified to produce consistent results within acceptable range established per TSP 735000431</i>)
1	009025067	Go-NoGo Gauge (<i>Also known as or reference to 999025067</i>)
1	999029388	CCD Test Gauge
1	999043049	Carousel Gauge

DISPOSABLES REQUIRED

Quantity	Part Number	Description
1	WAT270328	A new set of 5 Carousels

REFERENCE DOCUMENTATION

Document Number	Description
730001799	Operating Procedure, Calibration and PM
730000295MP	Quality System Document Control
735004259	Generic Preventive Maintenance Procedure
735003678	Generic PC Maintenance Procedure
WAT271129	Test Specification and Procedure, Alliance Separations Module / Altus a10 Solvent & Sample Module
735000431	Test Proc., 2690 Carousel/Carrier Mech
999029388	CCD Test Gauge
999043049	Carousel Gauge

REFERENCE DOCUMENTATION

Document Number	Description
009025067	Go-NoGo Gauge (<i>Also known as or Reference to 999025067</i>)

DEFINITIONS AND ABBREVIATIONS

Term	Definition/Abbreviation
Calibration	A process to ensure that equipment is capable of producing accurate results. This includes verifying measurements and/or making adjustment(s) to ensure measurement accuracy.
PM	Preventive Maintenance: The servicing, for the purpose of maintaining equipment in satisfactory working order, by performing systematic inspection, detection, and correction of potential failures. PM activities may include tests, measurements, and parts replacement.
PC	Personal Computer
LED	Light Emitting Diode
PCBA	Printed Circuit Board Assembly
CCD	Carousel Carrier Drive
N/A	Not Applicable
UUT	Unit Under Test
TSP	Test Specification and Procedure

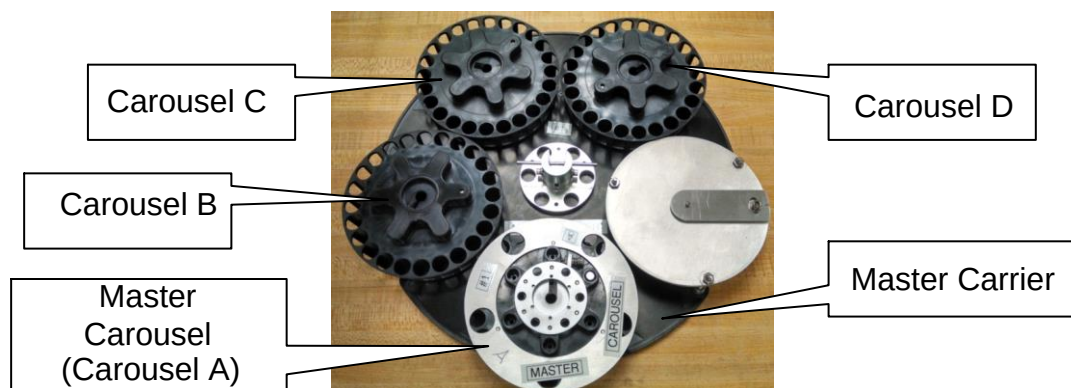
1. VERIFICATION OF MASTER CAROUSEL CARRIER DRIVE (CCD)

- 1.1. Visually inspect the provided Master CCD for any damages, wear and tear, and any broken tamper-proof seals if available.
- 1.2. Paper Puncture Test (Appendix in TSP WAT271129)
 - 1.2.1. Perform a custom CCD Test on 5 designated carousels (A, B, C, D, and E) for puncture test in an Alliance by using the Master CCD. These 5 carousels will be replaced during yearly PM.
 - 1.2.2. Use Carousel Gauge 999043049 to verify that Smart Scope can produce angular deviation within -0.5 to 0.5 degrees 3 consecutive times per Appendix A prior to measuring angular deviation on 5 tested carousels.
 - 1.2.3. Inspect the 5 carousels using the Smart Scope to show that the average angular deviation from carousel A to E will fall in the range of -1.0 to +1.0 degree. *(CCD Test Gauge 999029388 is a backup verification when Smart Scope machine is down.)*
- 1.3. If Master CCD fails to produce angular deviation from carousel A to E in the range of -1.0 to +1.0 degree, notify an engineer. PM cannot be continued until Master CCD meets specifications.
- 1.4. If Master CCD produces the specified angular deviation, repeat the step 1.2 with a new set of 5 carousels.
 - 1.4.1. If puncture test does not meet specification of -1.0 to +1.0 degree when using the new carousel set, notify an engineer to investigate Master CCD, the new carousel set, the Alliance equipment, the Smart Scope, and other reasons. PM cannot be continued until the problem resolved.
 - 1.4.2. If the puncture test meets specification of -1.0 to + 1.0 degree, the new carousel set will be used for all puncture tests until the next PM, discard the old carousel set, and apply a dated label to all 5 new carousels. Proceed to use the Master CCD to perform PM on CCD Tester.

2. CCD TEST SYSTEM INSPECTION AND CLEANING

Notify an engineer if any issues or failures are found during the Preventive Maintenance (PM) Process to take corrective action.

- 2.1. Verify that the CCD Tester resides on a firm worktable such as the Series 4500 WorkTable, 30 inches depth by 72 inches wide, from Workplace Modular Systems LLC with Electrostatic Discharge (ESD) or Plastic Laminate Surface without any add-on accessories or an equivalent.
- 2.2. Power OFF the Tester and shutdown PC.
- 2.3. Disconnect and remove any CCD from the Tester, and place it on the worktable.
- 2.4. While careful not to touch and alter the pointed Target Indicator and Tester's performance in any way, gently rotate Mater Carrier residing in the Tester to remove Master Carousel, 3 Carousels and the Master Carrier itself from the Tester.
- 2.5. Generally inspect all parts and connectors for cracks, looseness, wear and tear, and any dropping. Clean and or vacuum all parts.
- 2.6. Thoroughly clean the Top Plate where UUT sits atop and Skid Plate, inspect for wear and tear.
- 2.7. Reinstall Master Carrier, Master Carousel A, and 3 Carousels (B, C, D) in that order into the Tester as shown in **Picture 1**.



Picture 1

3. CCD TEST SYSTEM VERIFICATION

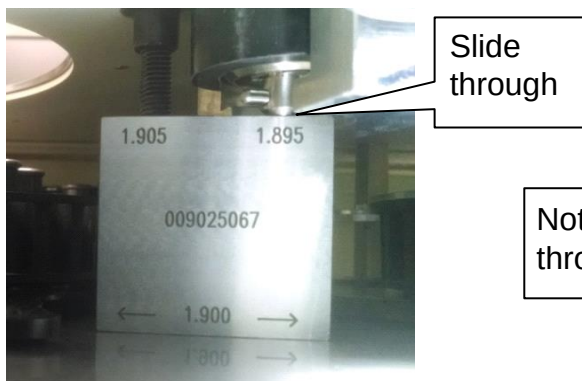
- 3.1. Ensure Master Carousel A and 3 carousels (B, C, D) are placed on Master Carrier in the Tester as shown in **Picture 1**.
- 3.2. **Where applicable and without making any adjustment on the Master CCD, follow all steps in TSP 735000431** to verify alignment of the CCD Tester with respect to the Master CCD. Ensure 2 toggle clamps are tightened and clamping the UUT properly. If the pointed Target Indicator aligning to the Locating Mark on Master Carousel and Target Slot on Master Carrier cannot be easily seen on computer monitor, adjust camera and or lighting per Appendix B.
- 3.3. If CARRIER ALIGNMENT fails, remove the Master Carrier from the Tester, inspect the compartment, skid plate, and other related parts.
- 3.4. Install a new back-up Master Carrier and associated parts into CCD Tester as shown in **Picture 1**, press **HOME ALL MOTORS** and repeat CARRIER ALIGNMENT section, which is Step 4 in TSP 735000431.
 - 3.4.1. If CARRIER ALIGNMENT passes, use the new Master Carrier for production, and verify or adjust the failed Master Carrier per Appendix C at Milford or CM. Go to Step 3.5.
 - 3.4.2. If CARRIER ALIGNMENT fails, repeat Step 3.3 and 3.4 with other new Master Carriers. If CARRIER ALIGNMENT with all new Master Carriers fails, stop PM process and notify an engineer to investigate and take corrective actions.
- 3.5. Press **HOME CARRIER** and **MOVE TO NEXT CAROUSEL** button. Perform CAROUSEL ALIGNMENT section, which is Step 5 in TSP 735000431.
- 3.6. If CAROUSEL ALIGNMENT fails, press **HOME CAROUSEL** button again to verify. If CAROUSEL ALIGNMENT still fails, press **MOVE Z-RAM UP** and **HOME CARRIER** button.
- 3.7. Install a new back-up Master Carousel, press **HOME CARRIER** and **MOVE TO NEXT CAROUSEL** button, and repeat CAROUSEL ALIGNMENT section, which is Step 5 in TSP 735000431.
 - 3.7.1. If CAROUSEL ALIGNMENT passes, use the new Master Carousel for production, and verify or adjust the failed Master Carousel per Appendix D at Milford or CM. Go to Step 3.8.
 - 3.7.2. If CAROUSEL ALIGNMENT fails, repeat Step 3.6 and 3.7 with other new Master Carousels. If CAROUSEL ALIGNMENT with all new Master Carousels fails, stop PM process and notify an engineer to investigate and take corrective actions.
- 3.8. Perform CAROUSEL ID section, which is Step 6 in TSP 735000431 and the remaining of the TSP.

3.9. Verify Z-Ram Height of 1.900 +/- .005 inches with Go-NoGo Gauge 009025067.

*Z-ram height is the linear distance from the bottom of Z-Ram Pin to the top surface of Skid Plate in the Tester or an Alliance System (Reference to **Picture 2 and 3.**)*

3.9.1. Remove Master Carousel A from the Tester, place item on worktable. Press the **MOVE TO NEXT CAROUSEL** button.

3.9.2. Perform Step 3 in TSP 735000431 until **HOME Z-RAM** (Step 3.4 in the TSP) command completely stops, use the Go-NoGo Gauge to verify 1.895" slides through, and 1.905" should not slide through as shown in **Picture 2 and 3**, respectively.



Picture 2



Picture 3

3.9.3. If Z-Ram Height is out of specification, clean the Top Plate where UUT sits atop and Skid Plate, and verify the compartment height per Appendix E.

4. VERIFICATION OF A RANDOM UUT

4.1. Select a random production UUT and visually inspect it for any damages, wear and tear.

4.2. Set the random UUT using the Tester.

4.3. Paper Puncture Test (Appendix in TSP WAT271129)

4.3.1. Perform a custom CCD Test on 5 designated carousels (A, B, C, D, and E) in an Alliance by using the random UUT produced in Step 4.2 of this PM.

4.3.2. If Step 1.2.2 is performed on the same PM day, go to Step 4.3.4.

4.3.3. Use Carousel Gauge 999043049 to verify that Smart Scope can produce angular deviation within -0.5 to 0.5 degrees 3 consecutive times prior to measuring angular deviation on 5 tested carousels.

4.3.4. Inspect the 5 carousels using the Calibrated Smart Scope to show that the average angular deviation from carousel A to E will fall in the range of -1.0 to +1.0 degree. (CCD Test Gauge 999029388 is an alternative inspection when Smart Scope machine is down.)

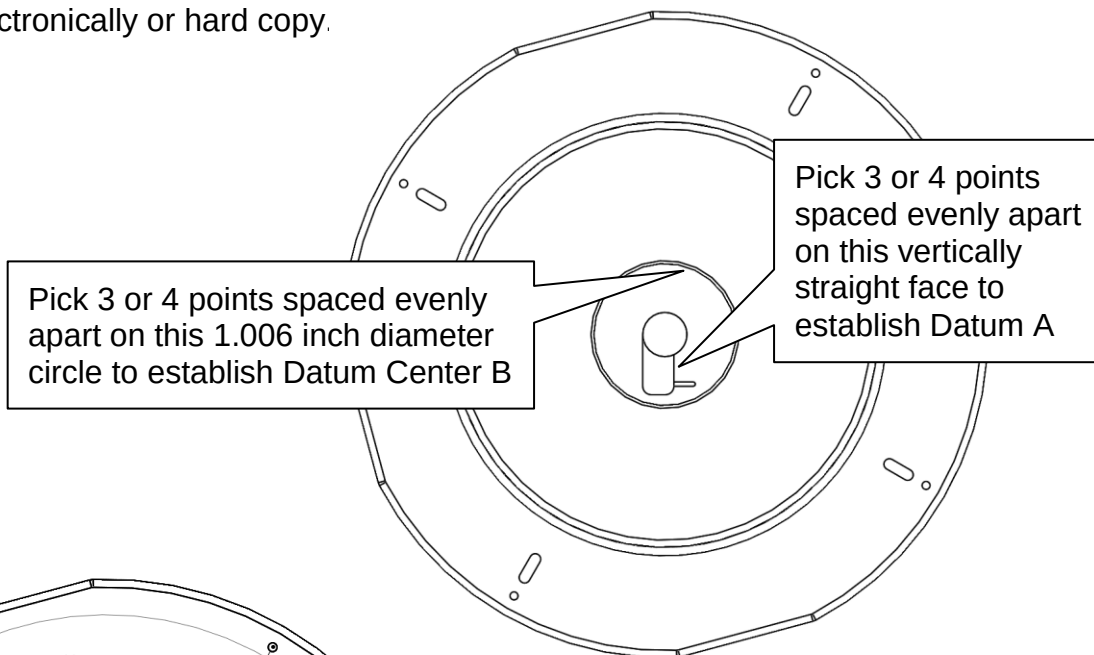
5. PREVENTIVE MAINTENANCE PROCEDURE COMPLETE.

5.1. Fill out and apply a yearly PM sticker on the CCD Tester. Store records.

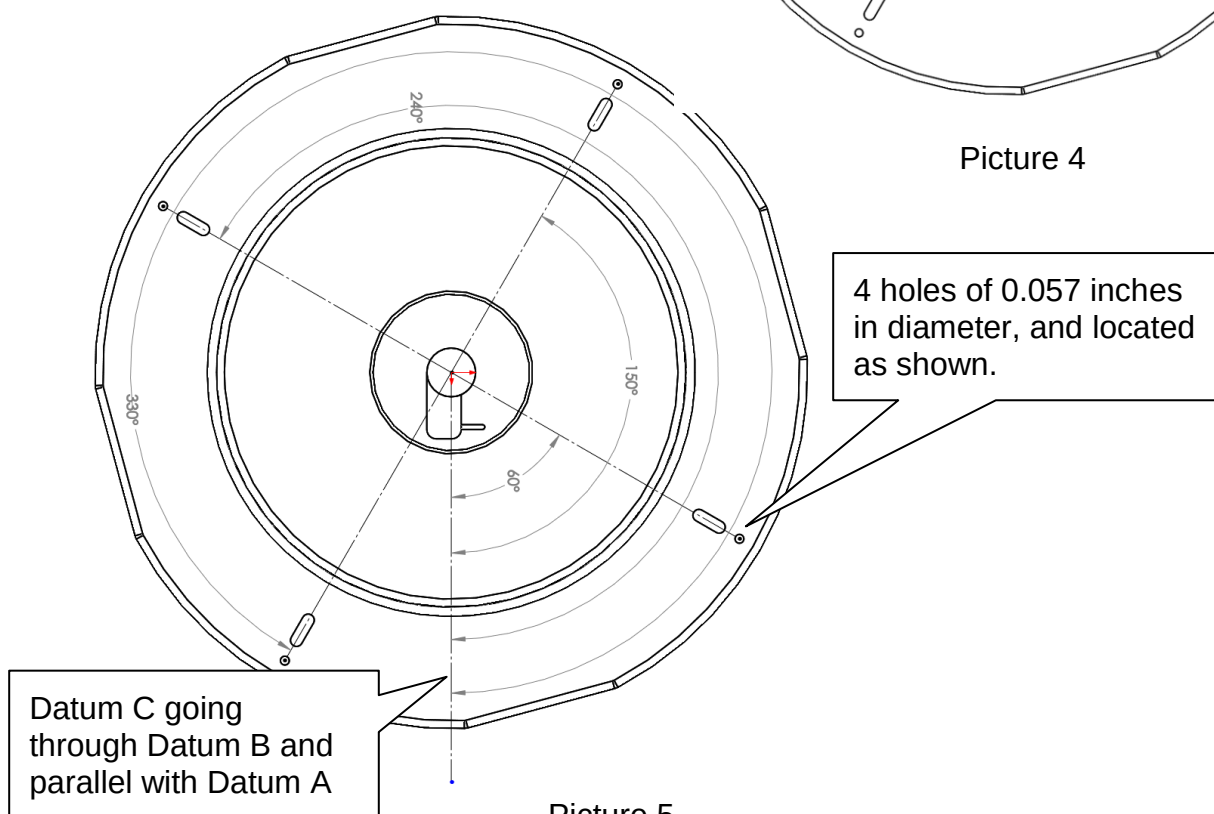
Appendix A

Verification of Smart Scope Performance

- 1) Orientate Carousel Gauge 999043049 on the platform of Smart Scope as shown in **Picture 4**.
- 2) Pick 3 or 4 points on the vertically straight face to establish Datum A as shown in **Picture 4**.
- 3) Pick 3 or 4 points on 1.006-inch circle to establish Datum Center B as shown in **Picture 4**.
- 4) Establish Datum C, starting from Datum B and parallel with Datum A, to measure angular deviation of 4 punctured holes of .057 inches in diameter as shown in **Picture 5**.
- 5) Store results electronically or hard copy.



Picture 4

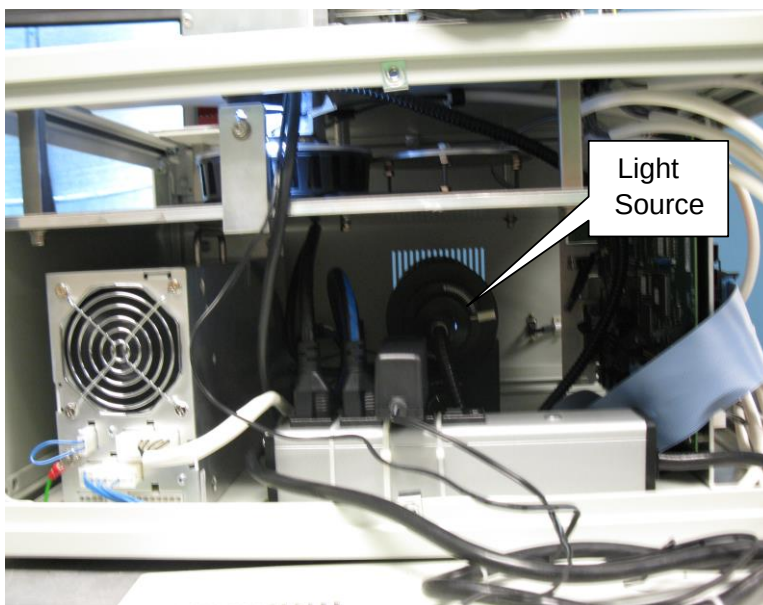


Picture 5

Appendix B

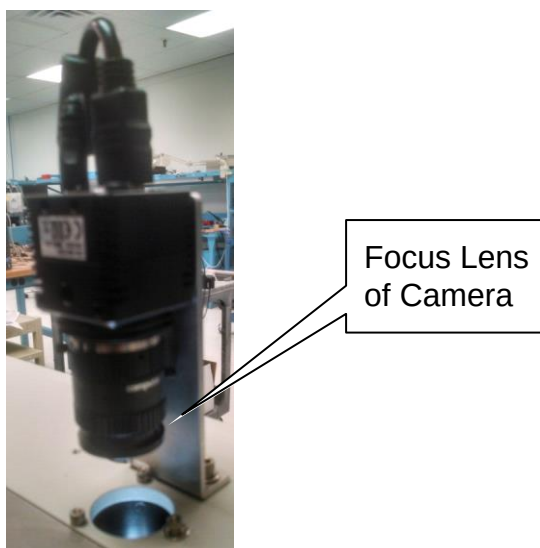
Visual Setup for Target Indicator (Black Pointer)

B.1 When power is still on, proceed with caution to remove Front Panel of the Tester and slightly adjust the black dial on the Light Source as shown in **Picture 6** to ensure adequate light provided so Target Indicator can be easily seen on computer monitor. Reinstall Front Panel. If any internal cleaning is required, power tester down before cleaning.



Picture 6

B.2 **If necessary**, remove the camera's enclosure on the Top Plate of the Tester to adjust the camera's focus by slightly adjusting the focus lens to get clearer display of Target Indicator as shown in **Picture 7**.

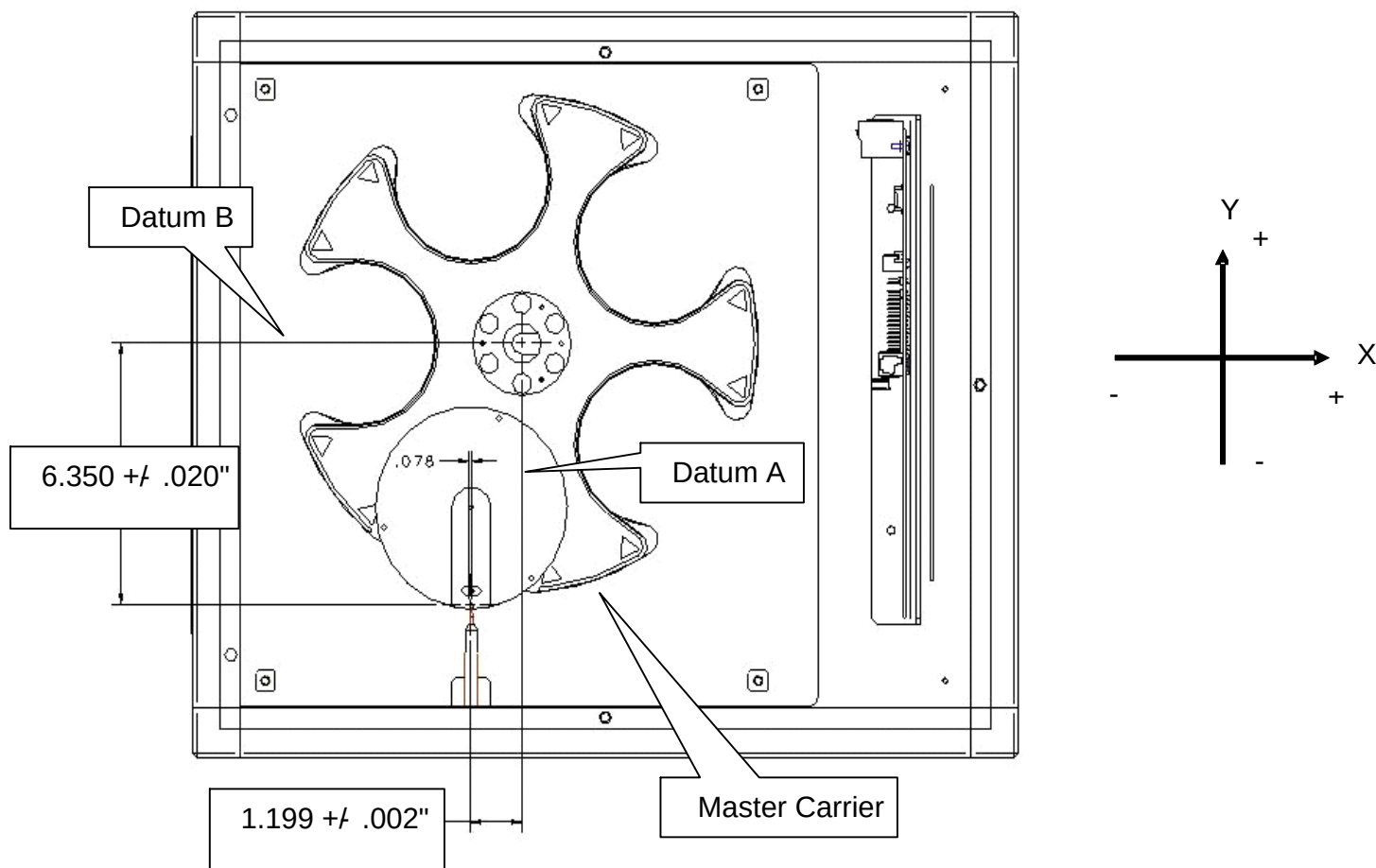


Picture 7

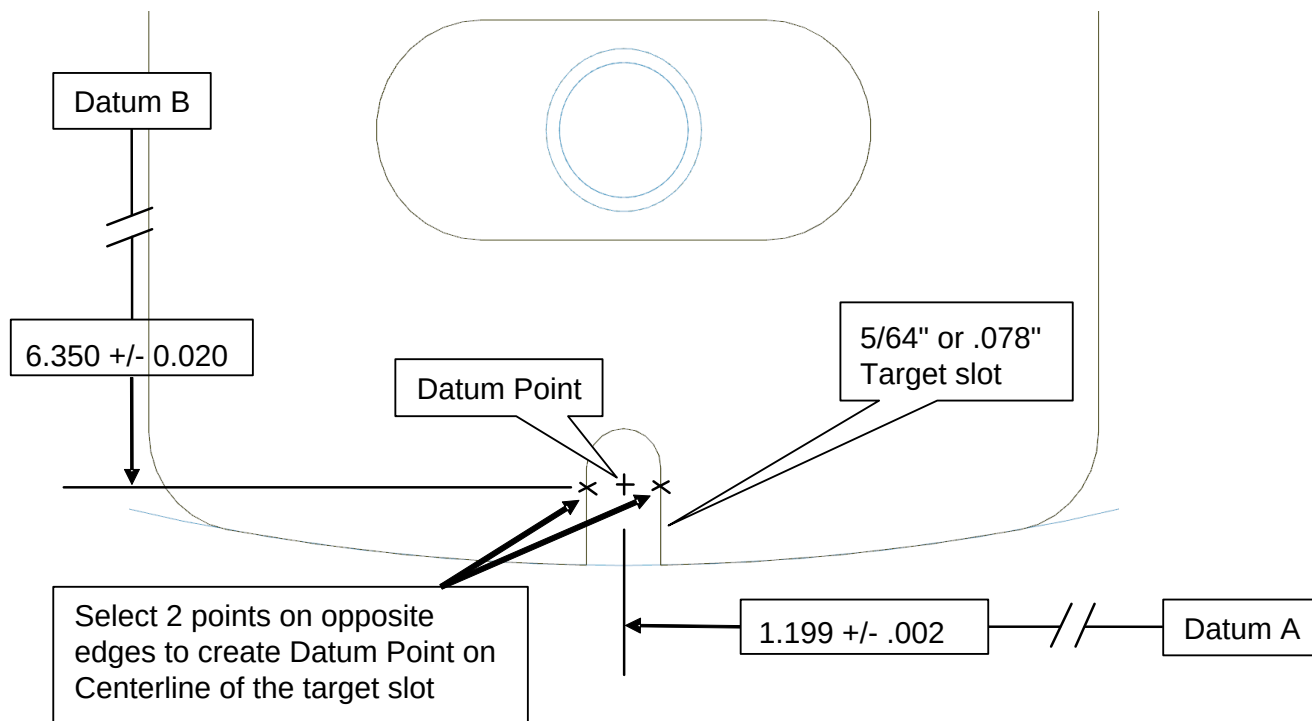
Appendix C

Verification of Master Carrier

- C.1 Use a calibrated Computerized Measuring Machine (CMM) to establish Datum A and B to verify that a Datum Point located on the Centreline of 5/64" or .078" Target Slot of the Master Carrier is off Datum A by 1.199" +/- .002 in the **negative** X-direction, and off Datum B by 6.350" +/- .020 in the **negative** Y-direction as shown in **Picture 8 and 9**. These measurements should be repeated at least 2 times to show consistency.
- C.2 If meeting the two dimensional specifications **and** no failure during CARRIER ALIGNMENT (Step 4 in TSP 735000431 when performing Step 1.5 of this PM 735002998), go to Step B.5.
- C.3 If not meeting the dimensional specifications, notify an engineer to investigate and take corrective actions, which might require CMM adjustment on Master Carrier.
- C.4 If meeting the dimensional specifications **and** fail CARRIER ALIGNMENT, notify an engineer to investigate and take corrective actions, which might require adjustment of the indicator on Tester.
- C.5 Print out the final measurement of the specs from CMM system for PM record. Clean and or vacuum all parts. Verification completed.



Picture 8

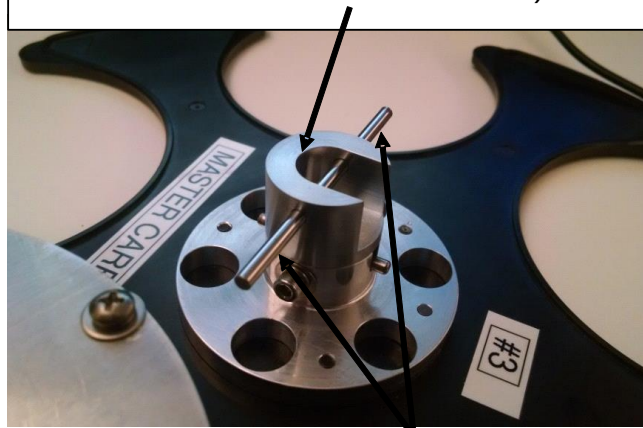


Set up CMM to inspect Master Carrier



Master Carrier positioned on CMM

Trace this edge of the semi-circumference to establish Datum B (At the center of Master Carrier and normal to Datum A)



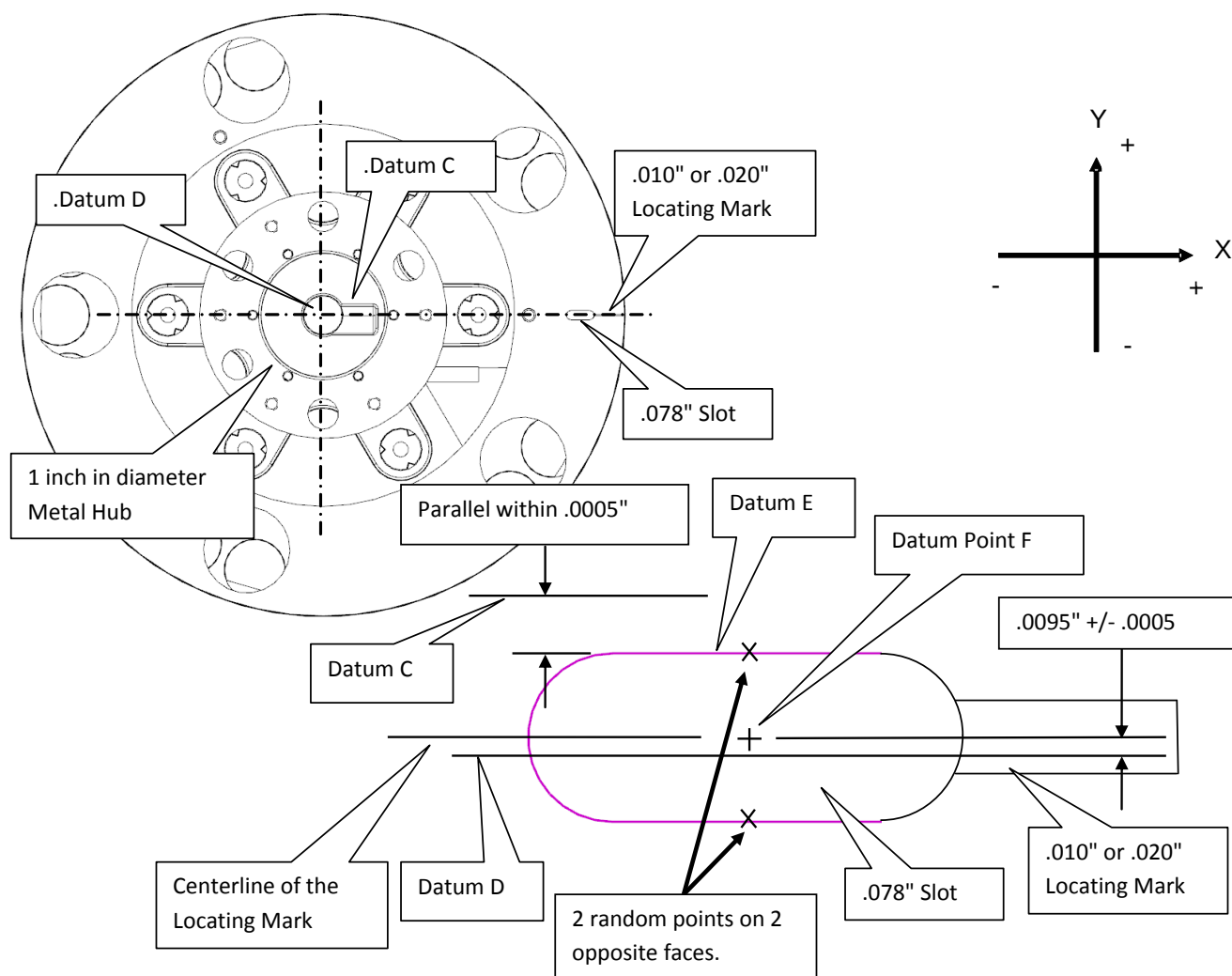
Trace the top half of circumference at both ends of the pin to establish Datum A

Picture 9

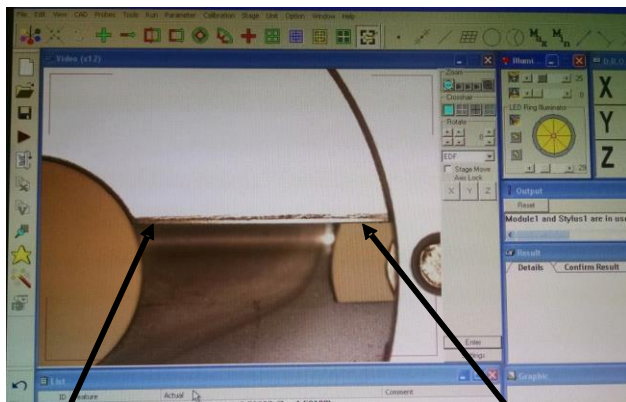
Appendix D

Verification of Master Carousel

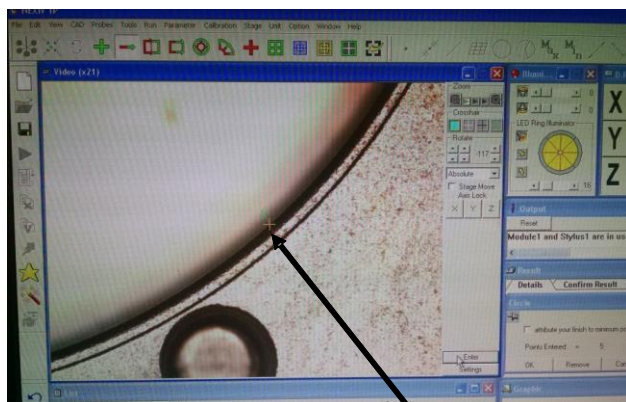
- D.1 Use a calibrated Computerized Measuring Machine (CMM) to establish Datum C, D, and E. Verify that Datum E parallel to Datum C within 0.0005", and a random Datum Point F located on the centreline of the .010" or .020" Locating Mark connected .078" Slot is off Datum D by 0.0095" +/- 0.0005" in the Y-direction as shown in **Picture 10 and 11**. These measurements should be repeated at least 2 times to show consistency.
- D.2 If meeting the dimensional specification and no failure during CAROUSEL ALIGNMENT (Step 5 in TSP 735000431 when performing Step 1.5 of this PM 735002998), Go to Step C.5.
- D.3 If not meeting the dimensional specification, notify an engineer to investigate and take corrective actions, which might require CMM adjustment on Master Carousel.
- D.4 If meeting the dimensional specifications and fail CAROUSEL ALIGNMENT, notify an engineer to investigate and take corrective actions, which might require adjustment of the indicator on Tester.
- D.5 Print out the final measurement of the specs from CMM system for PM record. Clean and or vacuum all parts. Verification completed.



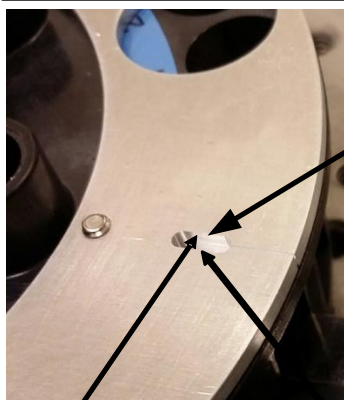
Picture 10



Use 1 mm probe to trace horizontally between 2 points on the vertical face of the Metal Hub to establish Datum C



Trace the probe along the circumferential face of the Metal Hub of 1" in diameter to establish Datum D.

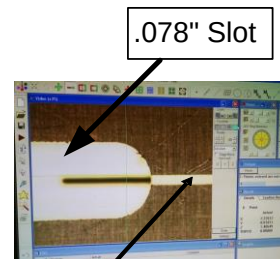


Horizontally trace along this vertical face of .078" Slot to establish Datum E

Select 1 random point on each Vertical Face of 0.078" slot to construct a Datum Point F on the centerline of the 0.010" or 0.020" Locating Mark.



Vertical Face on the Metal Hub

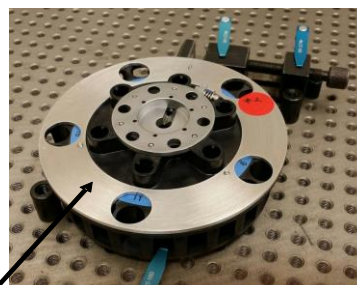


.078" Slot

.010" or .020" Locating Mark



Position the Master Carousel on a Vision System to verify alignment of the .010" or .020" Locating Mark to .078" slot on center within 0.0000" +/- .0001".



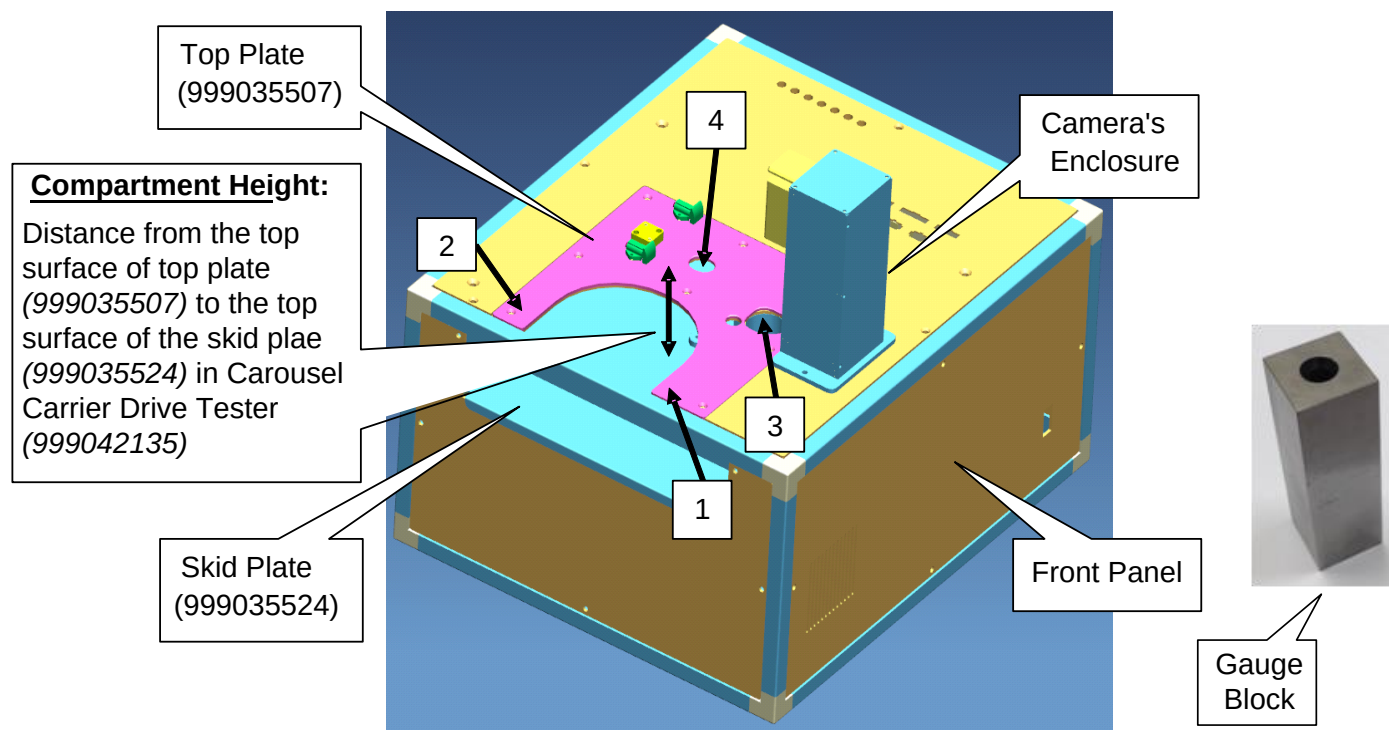
Master Carousel positioned on CMM

Picture 11

Appendix E

Verification of Compartment Height 3.375 +/- .005 inches at Z-Ram Location

- E.1 Home all motors, power tester down, remove Master CCD and all carousels and master carrier from tester and place them on worktable.
- E.2 Use pin gauge of 3 – 4 inches in length and the Depth Micrometer (*and Gauge Block*) to verify Compartment Height at Location 1 to 4 as shown in **Picture 12**.
- E.3 If 3.375 +/- .005 inches measured at Location 3, which is the *Z-Ram Location*, record values measured at 4 locations in Table 1.
- E.4 If failed to reach 3.375 +/- .005 inches at Location 3, notify engineer to take corrective actions which may require to add plastic shims with appropriate thickness to 4 standoffs to get measurement at Location 1 to 4 as close as possible to the initial setting in Table 1 for appropriate Tester to achieve 3.375 +/- .005 inches at Location 3, and record values at 4 locations in Table 1.
- E.5 Clean and or vacuum all parts and surfaces touched during the verification process.



Picture 12

Table 1: COMPARTMENT HEIGHT OF 3.375 +/- .005 in at Z-Ram Location (Location #3)

Location	TE82520-01		TE82520-02	
	Initial Setting	PM Date: _____	Initial Setting	PM Date: _____
1	3.340		3.374	
2	3.365		3.373	
3	3.374		3.372	
4	3.38		3.379	

WATERS CORPORATION 2690 CAROUSEL / CARRIER MECHANISM ALIGNMENT TOOL PREVENTIVE MAINTENANCE RECORD

Date:	Performed By:	
Equipment I.D.	Location:	
Due Date:	Interval (Months):	Next Due Date:

Test Equipment Used	Serial Number/Identification Number	Calibration/PM Date
Smart Scope		
Master Carousel Carrier Drive (CCD)		
Go-NoGo Gauge	009025067	
Carousel Gauge	999043049	

SECTION 1: VERIFICATION OF MASTER CCD	RESULT
Step 1.1: General Inspection	PASS ☐ FAIL ☐ SEE NOTE ☐
Step 1.2.2: Smart Scope Performance	PERFORMED ☐ SEE NOTE ☐
Step 1.2.3: Master CCD Performance	PERFORMED ☐ SEE NOTE ☐

SECTION 2: CCD TEST SYSTEM INSPECTION AND CLEANING	RESULT
Step 2.3 and 2.5: Mechanical Inspection	PASS ☐ FAIL ☐ SEE NOTE ☐
Step 2.5: Wiring/Connector Inspection	PASS ☐ FAIL ☐ SEE NOTE ☐
Step 2.6: Top Plate and Skid Plate Inspection	PASS ☐ FAIL ☐ SEE NOTE ☐

SECTION 3: CCD TEST SYSTEM VERIFICATION	RESULT
Step 3.3: Carrier Alignment Verification	PASS ☐ FAIL ☐ SEE NOTE ☐
Step 3.4: Carousel Alignment Verification	PASS ☐ FAIL ☐ SEE NOTE ☐
Step 3.5: Z-Ram Height Verification	PASS ☐ FAIL ☐ SEE NOTE ☐

SECTION 4: VERIFICATION OF A RANDOM UUT	RESULT
Step 4.1: General Inspection	PASS ☐ FAIL ☐ SEE NOTE ☐
Step 4.3.2: Smart Scope Performance	PERFORMED ☐ SEE NOTE ☐
Step 4.3.3: UUT Performance	PERFORMED ☐ SEE NOTE ☐

NOTES