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14. ABSTRACT

The purpose of this new study was to confirm the new GVSC, Ground Vehicle Survivability and Protection (GVSP) Seat Index Point Tool (SIPT) would yield similar results, when compared to the SAE H-Point Machine (HPM), as the UMTRI study. Three seats were selected which included an automotive fully cushioned driver style seat, a squad seat with minimal padding for the cushion and the back, and a squad seat with a hard unpadded back and a padded cushion. The results of the three seats confirmed an average of 5mm rearward off-set of the SIPT to the HPM. This off-set is used in the tools being developed for GVSC Advanced Concepts by UMTRI for the Soldier Accommodation Models to position the digital Soldiers in the vehicle environment early in the development stage.

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Seat Reference Point Measurement Tools Comparison

Final Report

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EXECUTIVE SUMMARY

Determining where the Soldier will be sitting within a vehicle environment is critical to determining the driver reach to controls, visibility of monitors, ability to see through vision blocks, and clearance to the interior environment. The Soldier may be wearing Personal Protective Equipment (PPE) and Body Borne Gear (BBG) which will move them forward in the seat compared to wearing uniform clothing only.

In 2011-2013 GVSC (formerly TARDEC) commissioned the University of Michigan Transportation Research Institute (UMTRI) through the Automotive Research Center (ARC) contract to study seated Soldiers in various garb configurations using both crew and squad seats (Reed & Ebert, The Seated Soldier Study: Posture and Body Shape in Vehicle Seats, 2013).

GVSC continues to use information gained during that research to further develop tools that will predict and place the Soldier body shaped manikins in the proper position within the vehicle. Early in the design/development cycle a means to position a seat within the vehicle is needed. The automotive industry uses a standard SAE J826 for this purpose. The heavy off-road equipment uses the ISO 5353 standard. UMTRI performed a study of the two tools to evaluate the seat reference point (SAE H-Point or ISO Seat Index Point) and the off-set between them in the vertical and fore/aft directions. The result of the UMTRI study showed an average 5mm off-set rearward for the ISO Seat Index Point (SIP) as compared to the SAE H-Point.

The purpose of this new study was to confirm the new GVSC, Ground Vehicle Survivability and Protection (GVSP) Seat Index Point Tool (SIPT) would yield similar results, when compared to the SAE H-Point Machine (HPM), as the UMTRI study. Three seats were selected which included an automotive fully cushioned driver style seat, a squad seat with minimal padding for the cushion and the back, and a squad seat with a hard unpadded back and a padded cushion. The results of the three seats confirmed an average of 5mm[1] rearward off-set of the SIPT to the HPM. This off-set is used in the tools being developed for GVSC Advanced Concepts by UMTRI for the Soldier Accommodation Models to position the digital Soldiers in the vehicle environment early in the development stage.

The new physical SIPT is much simpler and easier to use inside vehicles where legs are not needed for reach to pedals or to determine knee clearance.

Future work will include physically measuring all seats acquired with both the HPM and the SIPT to continue gaining data as well as running a direct comparison evaluation between the UMTRI SIPT and the GVSC SIPT.

[1] The specific differential changes based on back angle and amount of padding. This study showed a maximum difference of 9.8mm which is within the tolerance of 12.7mm used for FMVSS 208 Automotive Occupant Crash Protection.

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INTRODUCTION

Determining where the Soldier will be sitting within a vehicle environment is critical to determining the driver reach to controls, visibility of monitors, ability to see through vision blocks, and clearance to the interior environment them. The Soldier may be wearing Personal Protective Equipment (PPE) and Body Borne Gear (BBG) which will move them forward in the seat compared to wearing uniform clothing only.

In 2011-2013 GVSC (formerly TARDEC) commissioned the University of Michigan Transportation Research Institute (UMTRI) through the Automotive Research Center (ARC) contract to study seated Soldiers in various garb configurations using both crew and squad seats. (Reed & Ebert, The Seated Soldier Study: Posture and Body Shape in Vehicle Seats, 2013). GVSC continues to use information gained during that research to further develop tools that will predict and place the Soldier body shaped manikins in the proper position within the vehicle.

Military seats come in a variety of styles and configurations. Early in the design process the seats need to be placed in the vehicle environment in a realistic way to support the requirements within MIL STD 1472G (Department of Defense, 2012). This is similar to the automotive industry. The (Society of Automotive Engineers (SAE), NOV 2008) standard is used to establish the “H-Point” or reference point of a seat. The H-point is then used to match the seat to the vehicle Seating Reference Point which establishes the proper sitting position. The H-Point Machine (HPM), fits well in automotive seats but doesn’t fit well in all Military seat configurations. The HPM becomes unstable in seats with flat, short seat cushions and seat back angles close to vertical. Another tool developed for Earth-moving machinery, tractors, and machinery for agriculture and forestry is called the Seat Index Point tool (SIPT) defined in (International Organization for Standards, 1995). This tool has a short back and no legs which fits better on seats that are not like an automotive seat.

The University of Michigan Transportation Research Institute (UMTRI) performed a study for the GVSC Survivability - Occupant Protection group that compared the HPM to the SIPT. (Reed & Ebert, Evaluation of the Seat Index Point Tool, 2014). The “Evaluation of the Seat Index Point Tool for Military Seats” report discusses the measurement of a wide range of seat configurations using both tools. A conclusion was that there is an average of 5mm difference between the HPM and SIPT measurements in the fore/aft cushion direction with no significant difference in the vertical direction. This is significant to understand when using these physical tools and the digital tools being developed by UMTRI for positioning digital occupants into seats early in the vehicle design concept. Digital tools are being developed for occupant position prediction, will reference either the HPM or SIPT reference points and will take into account the offset. These digital tools are not discussed further in this report. Another conclusion from the UMTRI report was for the Army to adopt the SIPT as a measurement tool for all vehicle seats. Measuring every seat would verify the seat was manufactured to design with regard to the placement of the seat within the vehicle environment, using the reference point.

The scope of this report encompasses the acquisition of a SIPT and then the execution of a comparison evaluation with 3 distinctly different Military seats measured by the HPM and the SIPT.

ACQUISITION

Taking the recommendation from UMTRI to adopt the SIPT as a measurement tool brought a special challenge. The SIPT is not manufactured by any companies, unlike the SAE J826 H-Point Machine which is manufactured and can be purchased.

A prototype supplier was sourced to build a SIPT using the ISO 5353 1995-12-01 standard. Three dimensional CAD from the UMTRI design was also used for the surface shape of the tool. Two dimensional drawings were also used for the Back Angle Probe that UMTRI developed because it was missing from the ISO standard. The back angle probe was needed to compare to the SAE H-Point Machine which includes that feature for measuring seat back angle. The intent would be that it match the UMTRI tool and either tool could be used in the future with the same results. There are differences in the shape of the fixture weights however the ISO standard doesn't describe the shape of the weights. The SIPT, when complete, passed a manufacturing quality check to verify it meets the ISO requirements, primarily for mass and measurement points used to determine the seat reference point. The UMTRI SIPT was not available at the time of this study in May 2019, but will be evaluated in the future to the GVSC SIPT.

EVALUATION PROCEDURE

SEAT SELECTION

Three different styles of military seats (Figure 1) were selected for the comparative evaluation.

Seat #1 is floor mounted with a fully cushioned seat cushion and back. The seat cushion is on top of a tubular seat frame with a flexible suspension. The back cushion is thick and has a removable center insert, which was in place during this comparison. This seat is used for drivers or commanders.

Seat #2 is wall mounted with a thin padded seat cushion and back. The seat padding fixes to flat metal seat pan and back. This seat is used for squad members.

Seat #3 is wall mounted with a fully cushioned seat cushion but no padding on the curved seat back. This seat is used for squad members.

Figure 1: Seats used for comparative study

There was no preference for any supplier of seats represented or not represented. These seats were readily available from previous projects. The selection was made to compare observations made by UMTRI, in their study, regarding the effect of little to no padding on the comparative results between the SAE J826 H-point and the ISO SIP reference points.

Target points were selected on the left side of each seat to be used as the origin for FARO arm measurements to the SAE J826 H-Point Machine and the SIPT (Figure 2). These target points are hard points on the seat that do not change. This provides a consistent origin location regardless of which tool is used to determine the seat H-point or seat index point.

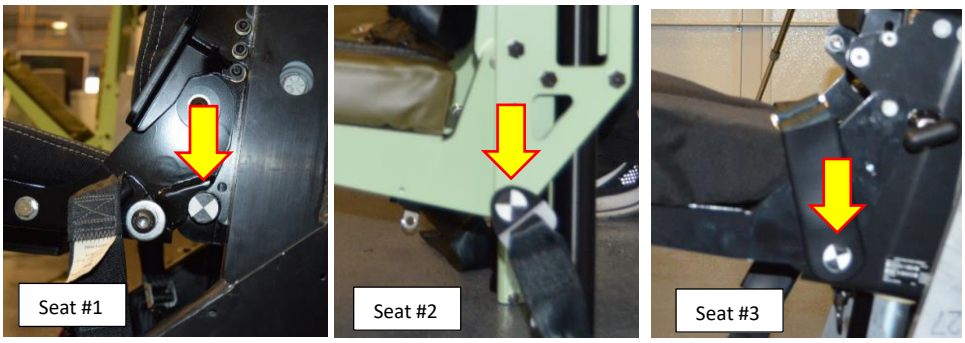


Figure 2: Seats target origin location

MEASUREMENT TOOLS

SAE J826 H-Point Machine (HPM)

The full International Standard was developed for the automotive industry. Excerpts from the standard were used for a seat outside the vehicle environment to evaluate the H-Point of the three seats in this study. Those excerpts can be found in Appendix A. The measurement coordinate system was set up to

match the coordinate system in the standard as viewed in Figure 3. The origin for the measurements was the target location of the seats as viewed in Figure 2. Figure 4 shows the HPM in position on a seat, ready for measurements with the Faro arm.

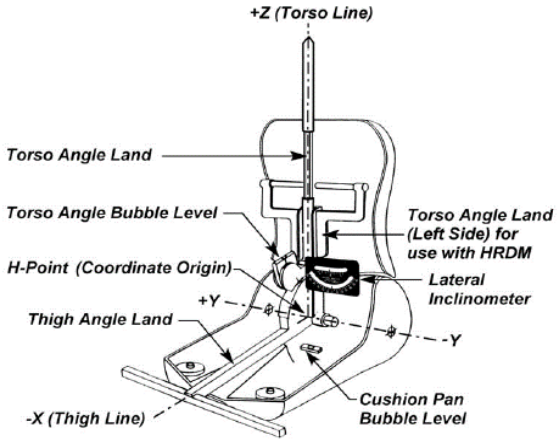


Figure 3: H-Point Machine coordinates

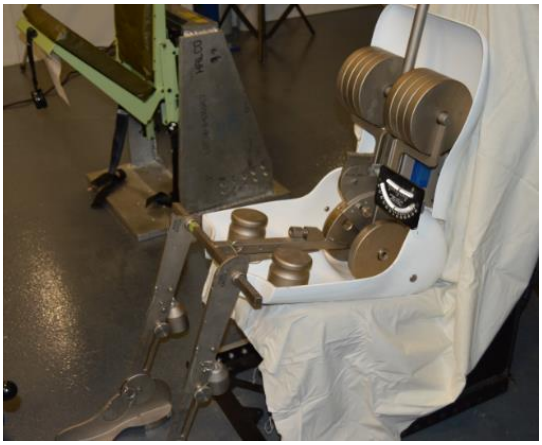


Figure 4: H-Point Machine in position

ISO 5353 Seat Index Point Tool (SIPT)

The ISO 5353 standard was used to position the SIPT and take all the measurements. The coordinate system in the ISO standard has X as lateral and Y as fore/aft. For consistency the SAE J826 coordinate system was maintained during the SIPT measurements. The back angle probe from the UMTRI study was also used. The origin for the measurements was the target location of the seats as viewed in Figure 2. Figure 5 shows the SIPT in position on a seat, ready for measurements with the Faro Arm.

Figure 5: SIPT in position

PROCEDURE

Each tool was positioned three times by the same operator with a half hour seat recovery rest time between each placement for both the HPM and the SIPT. All three seats were measured using the Faro arm and the respective seat target on the left hand side as the origin. The ambient temperature range was 68 to 70°F which is within tolerance for the SAE standard. The relative humidity (RH) was 22% and below the standard for 50%, however the SAE standard requires recording the RH if it is not met.

Measuring points are located on the sides of the HPM through the Y-axis, as seen in Figure 3. The SIPT has similar measuring points on either side. The measuring points were averaged in Fore/aft (X) and Vertical (Z) directions, respectively, each time the tool was placed in the seat. Averaging them provided the theoretical H-Point or Seat Index Point in space along the centerline of the tool. Details of all the measurements are in Appendix B.

RESULTS

A study was conducted to determine if the new GVSP Seat Index Point Tool (SIPT) would yield the same results as the UMTRI SIPT used in their study when compared to the SAE H-point measurement tool. Three seats were tested using two tools, a total of nine tests were conducted, three with each tool on each seat.

Figure 6 below shows the comparative H-point calculation results in the fore/aft (blue bars) and vertical (orange bars) direction for each of the tools in each seat. The data shows the relative average position of

the seat reference point from the target origin on the seat. The data is organized from left to right, starting with seat 1 to seat 3, and H-point to SIP.

The results are illustrated in Figure 6 and the measurements are shown in Table 1.

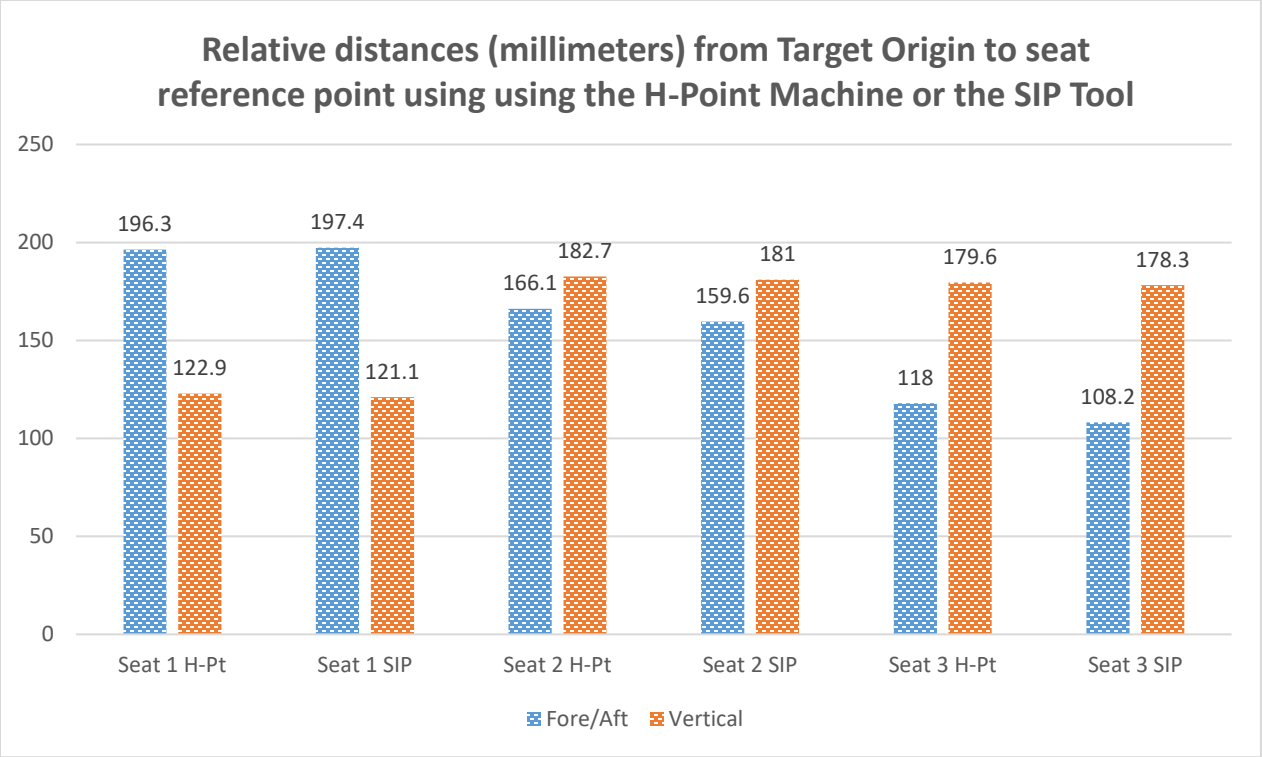


Figure 6: Comparison H-Point to SIP in Fore/Aft and Vertical directions for 3 different seats

Table 1 below tabulates the averaged measurements presented in Figure 6 and gives a dimensional difference between the H-point and the SIP for the Fore/Aft and vertical (Up/Down) directions. A negative Diff (difference) indicates the SIP measured forward in the seat compared to the H-point.

Table 1: Data for comparison of the two tools

	H-pt	SIP	Diff
Seat **#1** H-Pt "**X**" (mm) - (Fore/aft)	196.3	197.4	-1.1
Seat **#2** H-Pt "**X**" (mm) - (Fore/aft)	166.1	159.6	6.5
Seat **#3** H-Pt "**X**" (mm) - (Fore/aft)	118	108.2	9.8
Seat **#1** H-Pt "**Z**" (mm) - (Up/Down)	122.9	121.1	1.8
Seat **#2** H-Pt "**Z**" (mm) - (Up/Down)	182.7	181	1.7
Seat **#3** H-Pt "**Z**" (mm) - (Up/Down)	179.6	178.3	1.3

DISCUSSION

A goal of this study evaluation was to examine if the GVSC SIPT would provide similar results to that UMTRI SIPT generated in the 2014 study; (Reed & Ebert, Evaluation of the Seat Index Point Tool, 2014). In the UMTRI study, using 41 seats, the vertical (Z-direction) location of the H-point and SIP had an average difference of 0.7mm with a Standard Deviation (StdDev) of 4.0mm. This study, using 3 seats, showed the average difference between the HPM and the SIPT in the vertical direction to be 1.6mm with StdDev 0.3mm. The data indicates that when considering a vertical measurement, the SIP predicts a seat reference point location that is comparable to the SAE tool.

The UMTRI report indicated an average difference of 5mm rearward with the SIPT compared to the HPM. This study produced results similar to the UMTRI report when all seats are averaged in the Fore/Aft (X-direction) with an average of 5.1mm. However, caution is in order when looking at the three individual seats.

Seat 1, although a military seat, was styled like an automotive seat with a contoured back and bottom cushions. The SAE J826 HPM tool was designed for automotive seats and therefore fit into the seat appropriately. The SIPT could also be installed easily into the seat back and bottom cushions. The results for Seat 1 measured by the HPM and SIPT were nearly identical with only 1.1mm difference in the seat reference point.

However, Seat 2 with thin flat padding in the back and bottom cushions and seat 3 with a hard back rendered the HPM unstable in the seat. Also the back/buttocks of the HPM tool was pushed forward in the seat due to a lack of cushion in the seat back. The UMTRI report confirms the same issue was discovered in several military style seats. Seat 2 measured a difference of 6.5mm between the HPM and the SIPT, while Seat 3 measured a difference of 9.8mm. Therefore, the style of the seat back does impact the difference between seat reference points using the two measurement tools and must be considered if accuracy is important.

UMTRI is developing analytic accommodation tools to assist in the early design concepts. A selection can be made by placing the Soldier Digital Human Accommodation Model in the digital seat, with offsets for specific body borne gear, using either the HPM or SIPT measurement of the seat. The SIPT value is considered 5mm aft of the HPM value. Will the difference between 9.8mm and 5.0mm average make a difference in the accommodation of the Soldier? That question will best be answered by the engineer and designer for the program, but should be well within the assembly integration tolerance of a full vehicle. The most important point is to understand there may be a difference to consider.

When considering a test with the FMVSS 208 Anthropomorphic Test Dummy (ATD), indicates the H-point tolerance of 12.7mm (0.5 inches) in any direction, the differences between the SIPT and the HPM were 5mm which is considerably less than the FMVSS tolerance.

CONCLUSIONS

1. The GVSC SIPT has similar results to the UMTRI SIPT when compared to the HPM, based on the 2014 UMTRI report.
2. The GVSC SIPT is easier to use because it doesn't have legs, is smaller and therefore less cumbersome. In another lab study, yet to be published, the SIPT had improved Repeatability and Reproducibility over the HPM due to its simple design and installation procedure.
3. The GVSC SIPT should be adopted for use when using the HPM is cumbersome or doesn't fit well into a seat, as referenced in this report.
4. The GVSC SIPT can be used for A/B comparisons between any seats, especially when the HPM is unstable.
5. The SAE J826 HPM should continue to be used if foot pedal location is required.
6. The UMTRI accommodation design tools should still be used with the 5mm rearward offset for the SIPT from the HPM, unless both tools have been used in a physical seat and measurements are known.

FUTURE WORK

1. All new seats coming into the Occupant Protection Lab (OPL) should be measured using the HPM and the SIPT to build a database and increase confidence in the comparison data.
2. OPL official lab procedures need to be developed for ongoing use as referred to in item 1 above.
3. The GVSC SIPT should be directly compared to the UMTRI SIPT either at the OPL or at UMTRI, when the UMTRI tool is available.

APPENDIX A – Excerpts from SAE J826

INSTALLATION INSTRUCTIONS Excerpts taken from SAE J-826, Nov2008, Revised 2008-11

5. H-POINT MACHINE—DESCRIPTION, APPLICATION, AND INSTALLATION PROCEDURE
5.1 Description
The back and cushion pans of the 3-D H-point machine (Figures 3 and 4) are representations of adult male contours. Constructed of reinforced plastic and metal, these separate back and cushion pans simulate the human torso and thigh and are mechanically hinged at the H-point. A graduated sliding probe is hinged from the H-point to measure the head room in the compartment. A quadrant is fastened to the probe to measure the torso angle. An adjustable thigh bar, attached to the cushion pan, establishes the thigh centerline and serves as a baseline for the hip angle quadrant. Lower leg segments, also adjustable in length, are connected to the cushion pan assembly at the knee joining T-bar, which is a lateral extension of the adjustable thigh bar. Quadrants are incorporated in the lower leg segments to measure knee angles. Shoe and ankle assemblies are calibrated to measure the angular relation to the lower leg segment. Positive stops are provided in the thigh and lower leg segments for the 10th, 50th, and 95th percentile of adult male dimensions (Table 1). Two spirit levels orient the device in space. Body segment weights are placed at the center of gravity locations to provide seat penetration equivalent to a 77 kg (169.6 lb) male.

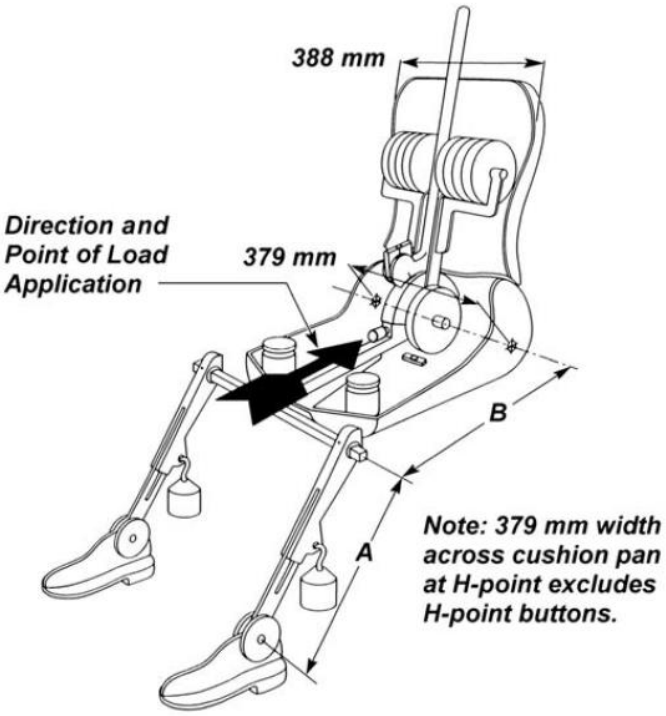


FIGURE 3 - H-POINT MACHINE

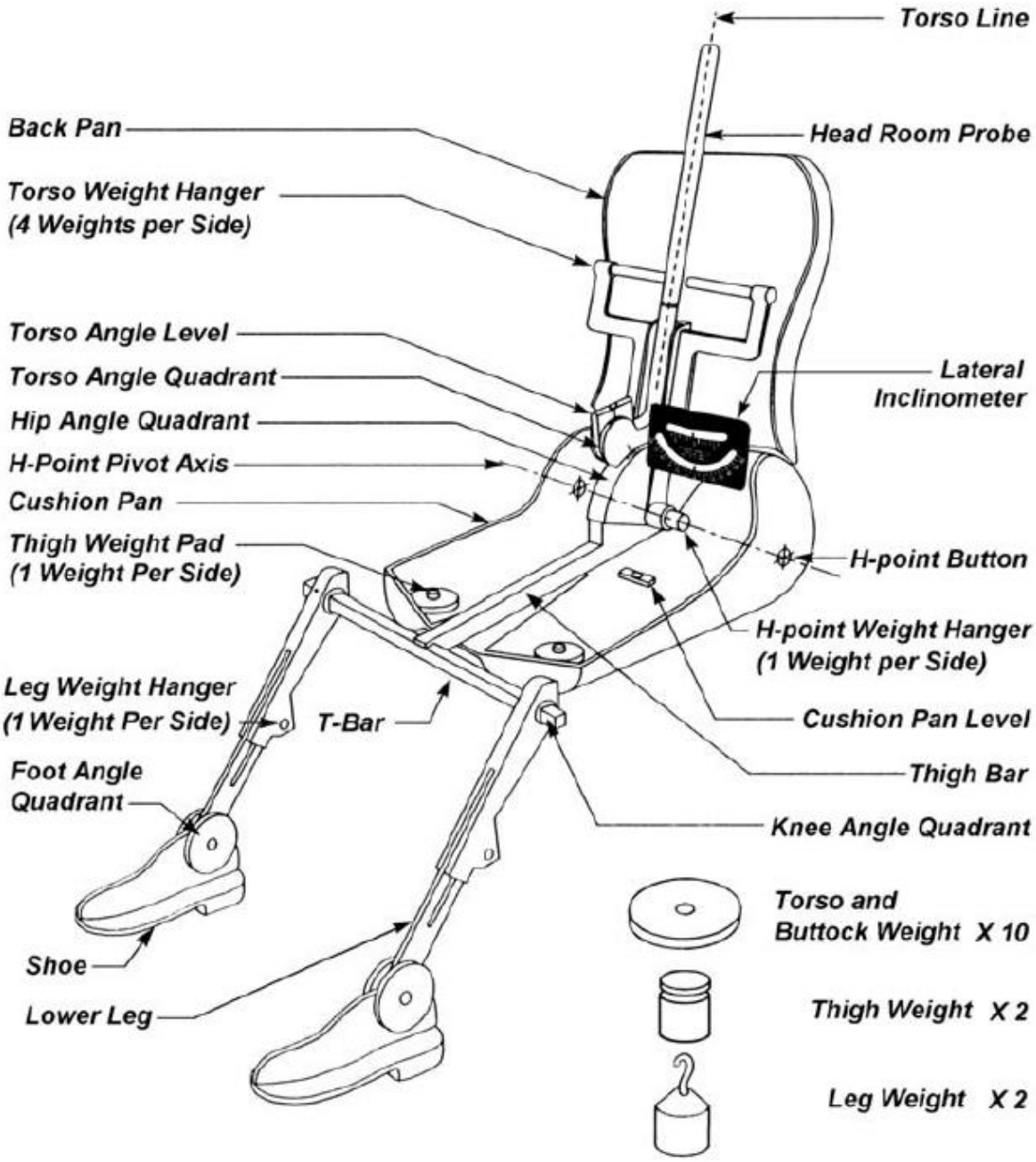


FIGURE 4 - H-POINT MACHINE

5.3.2 Sufficient time (at least 4 h) shall be allowed to ensure that the seat material reaches room temperature. Room temperature shall be 19 to 26 °C (66 to 79 °F). Room relative humidity should be within a range of 50% ± 5%. If this relative humidity is not met, record both relative humidity and room temperature. If the seat to be checked has never been sat upon, a 68 to 79 kg (150 to 175 lb) person shall sit on the seat twice for 1 min to flex the cushion and back. All seat assemblies are to remain unloaded for a minimum period of 1/2 h (1 h preferred) prior to the H-point machine installation.

5.3.3 Place a piece of muslin cotton cloth over the seat area to be checked. The muslin cloth should be of sufficient size to prevent the machine from contacting the seat, approximately 910 mm square. The muslin should be a plain cotton fabric having a thread count and weight typical of a durable, mid-grade, general-purpose muslin that is available from most fabric stores. The muslin should be tucked in a sufficient amount to prevent hammocking of the material.

5.3.4 Place cushion and back assembly of the H-point machine at the centerline of occupant (C/LO). C/LO is also the centerline of H-point machine and is located in vehicle per manufacturer specifications. If specifications are not available, locate C/LO as follows:
- for bucket front seats, seats with defined bolsters, or individual auxiliary seats, C/LO is the centerline of the seat.

5.3.5 Use 95th percentile leg and thigh segments

5.3.6 Attach shoe and lower leg assemblies to the cushion pan assembly, either individually at the knee joint or by using the T-bar lateral segment and lower leg assembly.
The T-bar lateral segment should be parallel to the ground and perpendicular to the Y-plane of the vehicle unless otherwise specified by the manufacturer.

5.3.7.3 *Position H-point machine in seat*
The H-point machine is installed at the C/LO as described in 5.3.4. The two shoes are placed together, or up to 127 mm (5 in) to either side of C/LO.

5.3.8 Apply lower leg and thigh weights and level the H-point machine.

5.3.9 Tilt the back pan forward against the forward stop and draw the H-point machine away from the seatback using the T-bar. Reposition the H-point machine on the seat by one of the following methods:

5.3.9.1 If the H-point machine tends to slide rearward, use the following procedure: Allow the H-point machine to slide rearward until a forward horizontal restraining load on the T-bar is no longer required due to the cushion pan contacting the seatback.

5.3.9.2 If the H-point machine does not tend to slide rearward, use the following procedure: Slide the H-point machine rearward by a horizontal rearward load applied at the T-bar until the cushion pan contacts the seatback.

5.3.10 Apply a 10 kg (22 lb) load twice to the back and pan assembly positioned at the intersection of the hip angle quadrant and the T-bar housing (Figure 3). The direction of load application should be maintained along a line from the above intersection to a point just above the thigh bar housing. Then carefully return the back pan to the seatback. Care must be exercised through the remainder of the procedure to prevent the H-point machine from sliding forward.

5.3.11 Install the right and left buttock weights and then alternately the eight torso weights. Maintain H-point machine level.

5.3.12 Tilt the back pan forward until the stop is contacted. Rock the H-point machine from side to side over a 10 degree arc (5 degrees to each side of the vertical centerline) for three complete cycles to release any accumulated friction between the H-point machine and the seat. During the rocking, the T-bar of the H-point machine may tend to change from the specified horizontal and vertical alignment; therefore, the T-bar must be restrained and properly aligned by applying an appropriate lateral load during the rocking motions. Care shall be exercised in holding the T-bar and rocking the H-point machine to minimize inadvertent exterior loads applied in a vertical or fore-and-aft direction. The H-point machine's shoes are not to be restrained or held during this step, and if the shoes change position, they should be allowed to remain in that attitude at this time.

Due to the movement of the shoes during the H-point machine rocking operation, the shoes are repositioned as follows: Alternately lift each shoe off the floor the minimum necessary amount until no additional forward shoe movement is obtained. During this lifting, the shoes are to be free to rotate and no forward or lateral loads are to be applied. When each shoe is placed back in the down position, the heel is to be in contact with the floor and the ball (sole) of the foot is to be in contact with the floor.

If the cushion pan is not level at the completion of this step, apply a sufficient lateral load to the top of the back pan to level the H-point machine cushion pan on the seat.

5.3.13 Holding the T-bar to prevent the H-point machine from sliding forward on the seat cushion, proceed as follows:
a. Return the back pan to the seatback.
b. Apply a rearward force perpendicular to the torso angle bar just above the torso weights using the smaller of the following forces:
    1. Force sufficient to increase the hip angle by 3 degrees, or
    2. 66 N (15 lb).

Alternately apply and release this force until the hip angle readout indicates that the back pan has reached a stable position after the applied force has been released, that is, repeated identical hip angle readouts. Care shall be exercised to minimize exterior downward or side forces applied to the H-point machine. If an H-point machine level adjustment is necessary, rotate the back pan forward, re-level, and repeat the H-point machine back rocking.

5.3.14 If a rerun of the H-point machine installation is desired, the seat assembly should remain unloaded for a minimum period of 1/2 h prior to the rerun. The loaded H-point machine should not be left on the assembly longer than the time required to perform the test.

APPENDIX B – Data collected

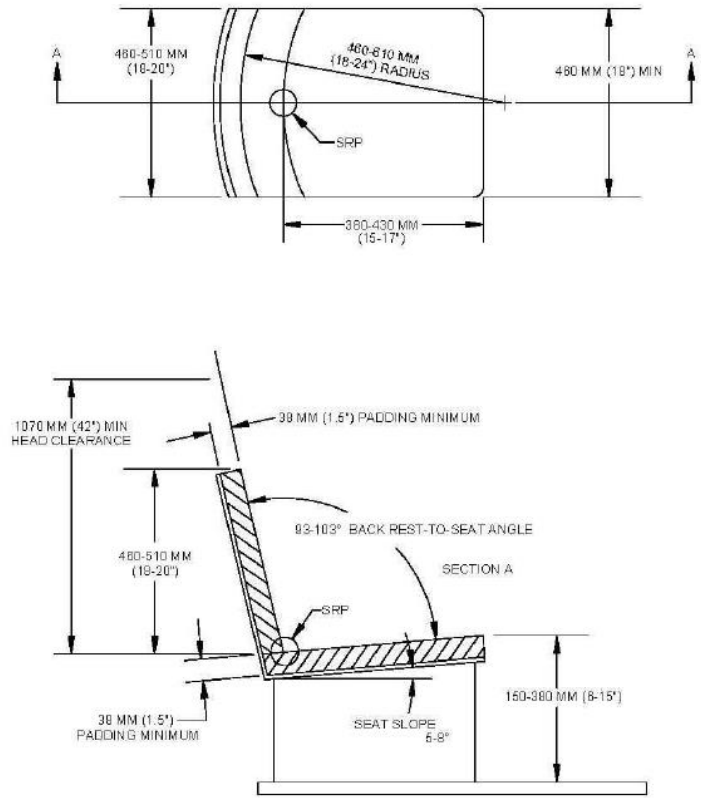
Using SAE J826 H-Point Machine

	Left side				Right side				At C/L of seat thru H-Point			
	1 of 3	2 of 3	3 of 3	*Std Dev*	1 of 3	2 of 3	3 of 3	*Std Dev*	Ave 1 of 3	Ave 2 of 3	Ave 3 of 3	*Std Dev*
Seat **#1** H-Pt "**X**" (mm) - (Fore/aft)	-197.1	-194.8	-197.1	*1.3*	-193.8	-195.8	-199.4	*2.8*	**-195.4**	**-195.3**	**-198.3**	***1.7***
Seat **#2** H-Pt "**X**" (mm) - (Fore/aft)	-167.4	-171.4	-164.5	*3.5*	-165.3	-162.1	-165.7	*2.0*	**-166.4**	**-166.7**	**-165.1**	***0.9***
Seat **#3** H-Pt "**X**" (mm) - (Fore/aft)	-117.8	-120.1	-119.5	*1.2*	-118.6	-115.9	-116.3	*1.5*	**-118.2**	**-118.0**	**-117.9**	***0.2***
Seat **#1** H-Pt "**Z**" (mm) - (Up/Down)	126.6	125.8	127.0	*0.6*	120.9	118.2	118.9	*1.4*	**123.7**	**122.0**	**122.9**	***0.9***
Seat **#2** H-Pt "**Z**" (mm) - (Up/Down)	181.3	185.0	185.0	*2.2*	179.3	182.8	182.8	*2.0*	**180.3**	**183.9**	**183.9**	***2.1***
Seat **#3** H-Pt "**Z**" (mm) - (Up/Down)	182.3	180.2	181.9	*1.1*	178.6	179.0	175.7	*1.8*	**180.5**	**179.6**	**178.8**	***0.8***

Using Seat Index Point (SIP) Tool

	Left side				Right side				At C/L of seat thru SIP			
	1 of 3	2 of 3	3 of 3	*Std Dev*	1 of 3	2 of 3	3 of 3	*Std Dev*	Ave 1 of 3	Ave 2 of 3	Ave 3 of 3	*Std Dev*
Seat #1 SIP "X" (mm) - (Fore/aft)	195.8	197.5	193.6	*2.0*	198.6	198.5	200.7	*1.3*	**197.2**	**198.0**	**197.1**	***0.5***
Seat #2 SIP "X" (mm) - (Fore/aft)	158.2	158.0	159.1	*0.6*	161.9	160.3	160.3	*0.9*	**160.0**	**159.1**	**159.7**	***0.5***
Seat #3 SIP "X" (mm) - (Fore/aft)	109.8	109.7	110.5	*0.5*	105.2	110.0	108.7	*2.5*	**107.5**	**109.9**	**109.6**	***1.3***
Seat #1 H-Pt "Z" measurement (mm)	124.0	126.5	124.8	*1.3*	116.8	116.6	118.1	*0.8*	**120.4**	**121.5**	**121.4**	***0.6***
Seat #2 H-Pt "Z" measurement (mm)	182.0	181.7	184.8	*1.7*	178.3	177.3	181.7	*2.3*	**180.2**	**179.5**	**183.3**	***2.0***
Seat #3 H-Pt "Z" measurement (mm)	182.2	178.8	174.8	*3.7*	178.0	176.3	182.7	*3.3*	**180.1**	**177.6**	**178.7**	***1.3***

APPENDIX C – MIL-STD-1472G Section 5.6.2 Figure 41



NOTE:

1. SRP = Seat Reference Point.

FIGURE 41. Dimensions for vehicle operator's seat.