UNITED STATES ERGONOMICS

Ergonomics Assessment of the Allsteel® Acuity™ Chair

Prepared for:

Allsteel®

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The Evolution of Ergonomics

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Executive Summary

The Allsteel's Acuity work chair was evaluated by a Certified Professional Ergonomist at United States Ergonomics. The results of this evaluation indicate that the Acuity chair offers very good dynamic support, comfort features and provides an effective range of adjustability to meet the needs of diverse users. A summary of the ergonomics benefits are as follows:

Beneficial features

- The adjustable weight balanced recline promotes healthy "free floating" motion, is easy to use, and accommodates users throughout the normal range of working postures.
- Acuity supports a comfortable hip angle of approximately 100°and allows for recline up to approximately 130°.
- Sample pressure mappings indicate a comfortable distribution of pressures and support in key areas. Pressure data indicates the chair will promote proper seated postures and should be comfortable for extended durations.
- The seat back provides good dynamic back support and is available with both mesh (great ventilation) and fabric (added cushioning) options.
- The adjustable armrests provide stable and comfortable support throughout a great range of adjustment. They can be adjusted to prevent clash with the work surface and lowered out of the way if desired.
- The adjustable seat pan depth (standard) will improve the comfort and accommodation of a wide range of users.
- The chair's "topside" controls are well designed, clearly visible, intuitive and easy to operate.

1.0 OVERVIEW

An expert ergonomics review has been completed on the Allsteel Acuity office chair by a Certified Professional Ergonomist (CPE) with over 20 years of product testing experience. The purpose of the assessment was to examine the design and features offered by the chair to determine if it meets with best practices and applicable ergonomic seating standards. The evaluation included a qualitative assessment of the chair features in addition to pressure distribution measurement of the support offered by the seat.

Pressure measurements were obtained from a large male of approximately 75th percentile stature (height=71.0" weight=198 lbs) and a small female approximately 35th percentile stature (height=62" weight=120 lbs).

2.0 EXPERT ERGONOMICS REVIEW

The Acuity model evaluated was the high-back mesh work chair with fully adjustable armrests, and a leather seat pad (see below).

The Allsteel Acuity chair comes as a work chair with a high-back. It is available with a mesh backrest or with an upholstered sleeve that snaps into the standard back rest. The upholstered sleeve possesses an addition 1/2" of foam padding. Armrest options include fully adjustable or fixed "T-Type". We recommend the fully adjustable armrests.

Front Side Back

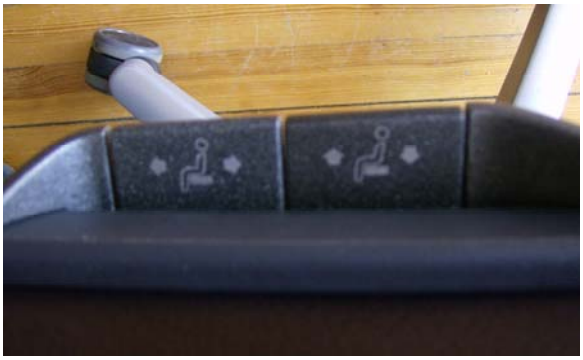
A description of the seat features and results of the ergonomics review are provided in the following sections.

2.1 Controls

The chair provides a full range of adjustability without overwhelming the user. The chair's controls are clearly visible, intuitive and easily accessible while seated. They are conveniently placed topside with clear instructions for use. The control levers present on the chair include:

- Seat cushion height adjust
- Recline lock/release with weight balanced recline resistance setting
- Seat cushion depth adjustment
- Armrest height
- Armrest width and fore/aft
- Armrest pivot adjustment (three detent settings)

The seat height and seat cushion depth controls are comfortably sized levers located on the right side of the seat pan (pictured below). They are easily accessible and operated with one or two fingers.



Seat height & depth levers

Recline resistance is adjusted using a sliding lever located on the left side of the seat cushion (pictured below). The recline tension lever is clearly marked, intuitive, and easy to operate. The slider allows for a continuous range of tension adjustments within the preset range.

Recline tension/lock control

Once set, many of the controls will not require additional adjustment for an employee performing a consistent task.

2.2 Seat Back

The Acuity seat back is available with both mesh and upholstered materials. The mesh provides great ventilation and support. The upholstery jacket (not tested) is available in various fabrics and leather options and fits over the mesh and provides an additional 1/2" of cushioning.

The Acuity chair possesses an adjustable weight balanced recline mechanism. The free floating feature promotes healthy motion and is expected to enhance circulation. The recline mechanism operates smoothly and provides good support throughout its range. In the upright position, the chair supports a comfortable hip angle of approximately 100° and allows a recline up to approximately 130°.

A review of the seat back fit and performance are summarized in the following sections:

2.2.1 Seat Back Fit

The size of the seat back is appropriate to accommodate the 5th percentile female to 95th percentile male. The high-back seat back had a 17" width and a 22.5" height (measured from the seat cushion). The seat frame provides a built-in lumbar curvature for lower back support.

Lumbar curvature

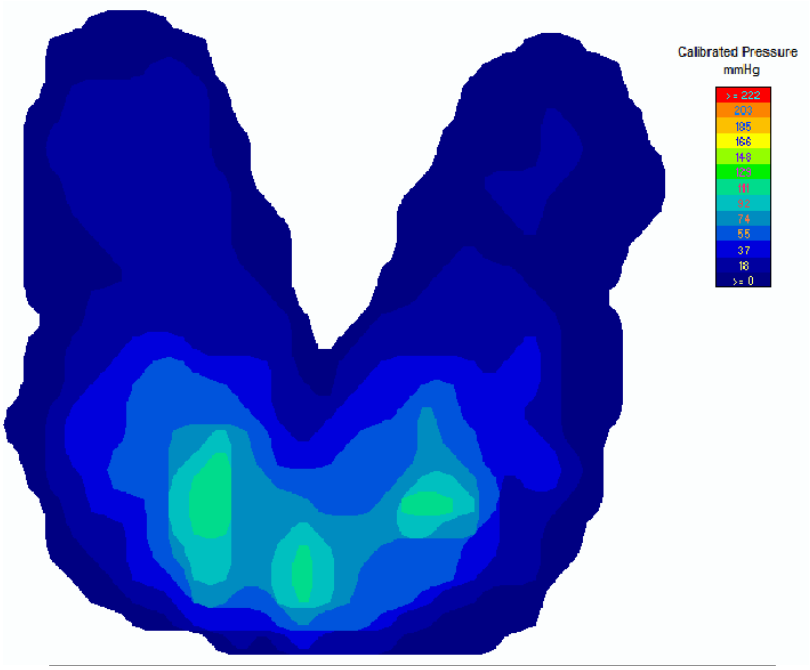
The seat back frame is contoured to effectively provide a smooth transition of pressure between the mesh and the frame. The maximum effective seat back width for a chair with adjustable armrests is 20.25", thereby accommodating beyond the 95th percentile male.

2.2.2 Seat Back Support

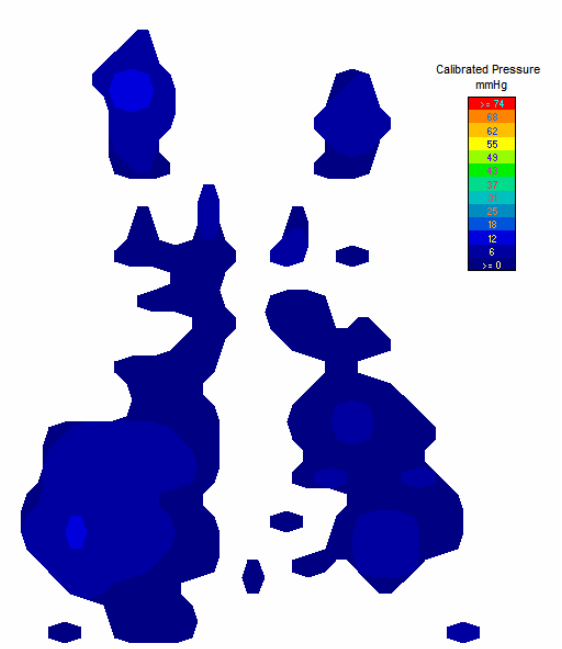
The seat back pressure mapping revealed considerable contact area and comfortable pressure levels (see pressure plots below), a desirable characteristic indicating good seat back support. The flexibility provided by the mesh backing and lumbar curvature contributes to this by keeping the backrest in contact with the user during postural variations. The mesh backrest had provided comfortable pressure levels in both upright and reclining postures.

Upright, the average pressure ranged between 6 mmHg for the small female and 7.5 mmHg for the large male. Peak pressures also indicated comfortable support and ranged between 13.5 mmHg for the small female and 17 mmHg for the large male.

Seat back contact area ranged 474.2 cm^2 for the small female and 850.8 cm^2 for the large male in the upright position. The contact area increased an average of 44.1% in the reclined position with more support added at the upper back.

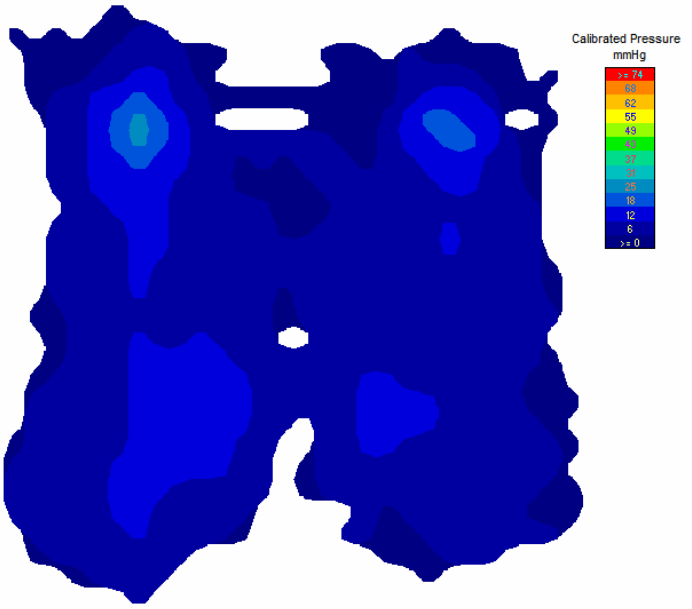


Large Male: Seat back pressure in upright seated posture

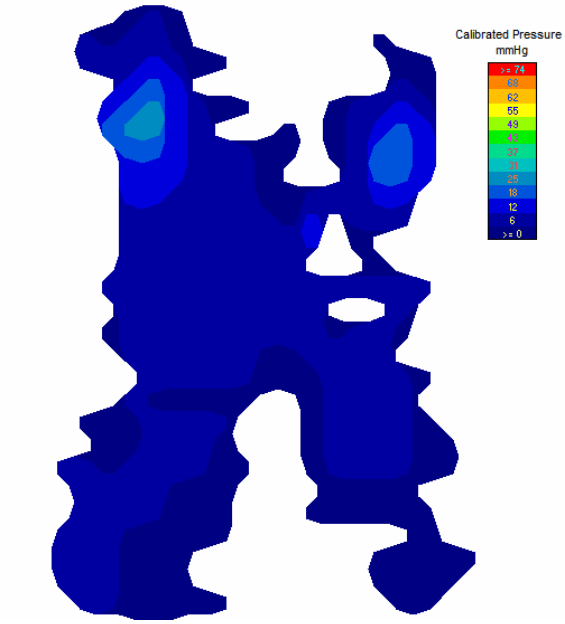


Small female: Seat back pressure in upright seated posture

When reclining, the pressure mapping indicated good support and comfortable pressure levels. The average pressures ranged from 8 mmHg to 9 mmHg and peak pressures ranged from 30 mmHg to 25.5 mmHg to for the small female and large male, respectively. Higher peak pressures for the small female were attributed to a smaller contact area and higher effort to transition the seat to the recline position.



Large Male: Seat back pressure in reclined posture



Small Female: Seat back pressure in reclined posture

With the recline resistance setting set to the lowest resistance, the seat transitions smoothly from upright to reclined. The mechanism can be locked allowing the seat back to remain in the upright position.

2.3 Seat Cushion

The Acuity seat cushion is available with various fabric or leather coverings. The model tested had a leather covering. The seat pan is adequately sized and possesses depth adjustability (standard). The seat cushion moves naturally with the motion of the weight balanced recline. This minimizes the potential for sliding in the seat or slouching, which can occur over time during recline.

A summary of the fit and support of the seat cushion is presented in the following sections.

2.3.1 Seat Cushion Fit

The physical dimensions of the seat cushion are 19" wide by 19.5" deep. The 19" width will accommodate larger individuals (up to 95th percentile male) effectively. The free space beyond the seat cushion extends to a maximum of 21" prior to clashing with the adjustable armrest stanchions. This will provide additional accommodation for individuals beyond the 95th percentile size range.

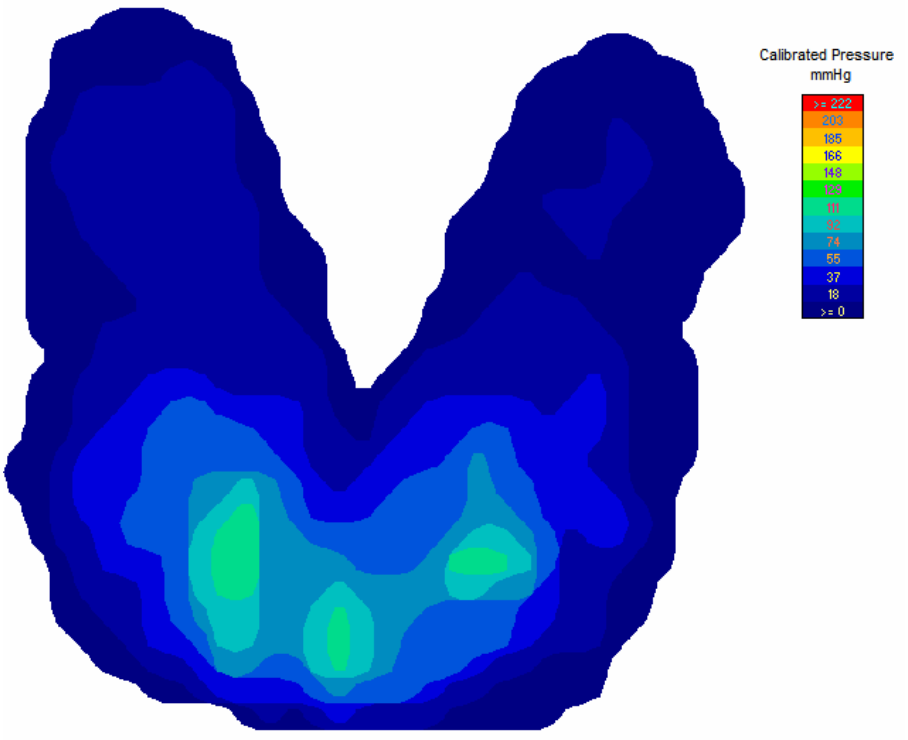
The depth of the seat cushion is adjustable from a minimum effective length of 16.5" to a maximum of 20", in approximately 0.5" increments. This will fit the 5th percentile female to the 95th percentile male.

The seat cushion height was adjustable between 16.25" and 20. 5", measured from the center of the seat cushion. Based on current practice, users typically adjust the seat height to a point approximately 2" above popliteal height (the height of the point behind the knee). The high setting will accommodate the 95th percentile male. The forward edge of the seat cushion compresses to a height of approximately 16" in the low setting. This indicates that the 5th percentile female will be accommodated. There is also a short cylinder option that will accommodate individuals of shorter leg length (smaller than 5th percentile female).

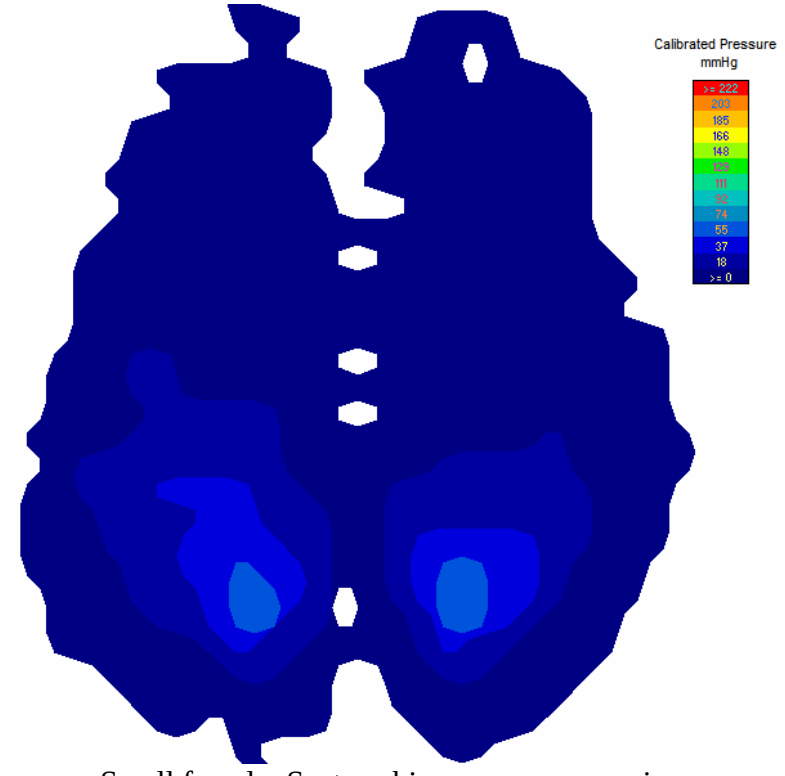
2.3.2 Seat Cushion Support

The seated contact pressure was measured in the upright seated posture. The pressure profiles revealed effective seat cushion support (see pressure profiles below). The average pressures ranged between 16 mmHg and 35 mmHg for the small female and large male, respectively. The peak pressures where recorded at the ischial tuberosities and ranged between 68mmHg and 120.5mmHg for the small female and large male, respectively.

The front edge of the seat cushion is contoured, providing effective thigh support. Pressure levels were even across the edge of the seat indicating no contact stress.



Large male: Seat cushion pressure mapping



Small female: Seat cushion pressure mapping

2.4 Armrests

The armrests are well cushioned and are highly adjustable. The adjustment range will accommodate beyond the 5th percentile female to the 95th percentile male. Adjustment controls are low force and intuitive to operate. The force of the pivot adjustment is set at a higher level to prevent inadvertent movement of the armrests. The pivot adjustment is achieved by simply gripping the armrests and pulling them inward or pushing them outward. There is a 3 position setting for the armrest pivot.

Illustration of Armrest Adjustment

A summary of the adjustable armrest range are provided below:

Armrest Adjustability Range	
Adjustment	**Range**
Vertical (from center of seat cushion)	7”-11.6”
Width (space between w/o internal rotation)	16”-18.75”
Internal rotation	Approx. 30°
Front to back (fore/aft)	2.6” independently +2” height dependent

The benefits of the adjustable armrests include:

- The contours, adjustability and padding of the armrests minimize the potential for ulnar nerve contact stress at the forearm or elbow.

- The armrest vertical height adjusts low enough to allow the arms to hang free and can be raised high enough to accommodate the 5th to 95th percentile range comfortably. Armrest height is adjusted in approximately 0.5” increments using a well placed paddle button.

- The fore/aft adjustability enables the user to set the armrest far enough back to prevent clash with the work surface. Without this feature, the potential for

armrest clash can occur when working close to the workstation (common for smaller stature users).

- The internal/external rotation feature of the armrests allows for a closer placement of the armrest which can be useful for petite user populations. This feature also reduces the abduction necessary to reach the armrest, thereby aiding in keeping the limbs closer to the torso, minimizing the potential for shoulder stress.

3.0 CONCLUSIONS

The Acuity chair provides good dynamic support and provides an effective range of adjustability to meet the needs of diverse users. The geometry and range of adjustability of the chair will accommodate the 5th percentile female through the 95th percentile male effectively. The benefits of the Acuity include:

- The dynamics of the chair should promote a range of healthy working postures.

- The pressure analyses revealed effective support provided by the seat back in both the upright and reclined positions.

- The chair controls are well designed and intuitive and easy to operate. The topside design of the controls and the printed instructions practically eliminate any confusion regarding operation. Simplifying the chair control system should improve the likelihood of proper use.

- The adjustable armrests allow for a wide range of adjustment to accommodate more petite as well as large populations.

While the Acuity chair is simple to use, users of all types of seating should be educated in the adjustment features and the principles of healthy seated postures.