



Ergonomics Assessment of the Allsteel[®] Relate[™] Chair

Prepared for:

Allsteel[®]

January 8, 2008

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Executive Summary

The Allsteel Relate chair was evaluated by a Certified Professional Ergonomist at United States Ergonomic. The results of this evaluation indicate that the Relate chair offers several beneficial ergonomic features. These are summarized as follows:

- Beneficial features
 - Adjustable resistance free floating and lockable tilt feature promotes healthy motion and promotes circulation
 - The pivoting backrest provides freedom of movement and maintains seat back support during partial recline and forward leaning postures.
 - Simple, weight balanced recline is easy to use
 - Adjustable lumbar curvature point allows the chair to fit many body types
 - The asymmetric lumbar adjustment can accommodate individuals with unique support requirements
 - Adjustable seat pan depth
 - Height, width, and length adjustable armrests
 - Mesh back provides ventilation and breathability

The Relate chair provides good dynamic support and provides an effective range of adjustability to meet the needs of diverse users. The weight balanced recline and pivoting seat back accommodate users throughout the normal range of working postures. The asymmetrically adjustable lumbar provides an additional dimension of fit to meet the unique needs of individuals. The chair controls are well designed and intuitive and easy to operate.

1.0 OVERVIEW

An expert ergonomics review has been completed on the Allsteel Relate 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.

2.0 EXPERT ERGONOMICS REVIEW

The Allsteel Relate chair comes as a task chair or work stool with high-back and mid-back options. It is available with a mesh backrest or a traditional upholstered foam backrest, and adjustable or fixed armrests are available as options. The work stool possesses a foot ring. The version assessed was the high-back task chair with adjustable armrests and a mesh seat back (see below).



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 range of adjustability, however, the user is not overwhelmed with controls and knobs. The chair's controls are well designed, intuitively placed, easy to locate and operate. Most of the controls are unique designs for a single function. The paddles are comfortable to grip and require light force to actuate. The controls present on the chair include:

- Seat pan height adjust
- Recline lock/release
- Weight balanced recline resistance setting
- Seat pan depth adjustment
- Independent (left and right side) lumbar support height adjustment
- Armrest height
- Armrest width and fore/aft adjustment

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

2.2 Seat Back Fit

The high-back seat back had a 17" width and a 22.5" height (measured from the seat pan). The size of the seat back is appropriate to accommodate the 5th percentile female to 95th percentile male.



Lumbar protrusion

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

2.2.1 Adjustable Lumbar

The adjustable lumbar provides approximately 5” of vertical adjustment of the apex of the lumbar curve, thereby effectively accommodating a large range of users. This adjustment may be made to each side of the seat back independently, providing asymmetric support of the lumbar spine and lower back musculature. This is in addition to the built in lumbar support provided by the seat back frame contouring.

The adjustment controls are easy to reach, low force, and adjust from a seated position. The flexibility of the lumbar adjustments allows the chair to fit many body types including individuals with unique support requirements.



Asymmetric lumbar adjustment tab

2.2.2 Seat Back Pivot

The seat back can pivot independently of the seat pan, enhancing the support provided by the seat back throughout a range of the user’s postural shifts. The pivot feature (see image below) provides some recline and freedom of movement even when the seat tilt mechanism is locked. Pivoting also enhances the seat back support during recline by naturally balancing the center of pressure throughout the recline motion.



Seat back pivot

The seat back pivot is set at approximately 9.5” over the seat pan and should comfortably accommodate a broad range of users.

2.2.3 Mesh Seat Back Option

The mesh seat back provides good ventilation and breathability while maintaining effective support.

2.3 Seat Pan

The physical dimensions of the seat pan are 19” wide by 19.5 deep. The effective depth of the seat pan is adjustable from a minimum effective length of 16.5” to a maximum of 20”. The adjustment is in approximately 0.5” increments, and the adjustment lever under the center of front edge of the seat pan is intuitive and easy to actuate. This will fit the 5th percentile female to the 95th percentile male.

The front edge of the seat cushion is contoured incorporating a true ‘waterfall’ design. The low-density foam compresses easily, preventing high pressure on thighs, and combined with the highly adjustable seat pan length, the potential of contact stress is low.

At 19” wide, the seat pan will accommodate large individuals (95th percentile male) with ease. The free space beyond the seat pad sides extends to a maximum of 21.5” prior to clashing with the adjustable armrest stanchions. This will provide additional accommodation for individuals beyond the 95th percentile size range.

2.3.1 Seat Pan Height

The seat pan height was adjustable between 17.25” and 22.25” measured from the center of the seat pan. 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 pan compresses to a height of approximately 16” in the low setting. This indicates that the 5th percentile female will be accommodated. For smaller users a low range seat cylinder is available that adjusts 15” to 18.5”.

2.4 Seat Recline

The Relate chair possesses an adjustable weight balanced recline mechanism. The free floating feature promotes healthy motion and is expected to enhance circulation.

The recline resistance is provided by adjusting the center of balance of the seat pan, controllable by a lever under the right hand side. A total of five (5) resistance settings are

possible. This lever is relatively intuitive, although unmarked, and is easy to adjust. On the left underside of the seat pan is the locking lever, which prevents any recline.

With the recline resistance setting set to the lowest resistance, the seat is more likely to naturally rest in the recline position. It feels as if the seat pivots over center and comes to a stable reclined position. This is a beneficial option for individuals that prefer the reclined position for extended periods.

2.5 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. The adjustments move in approximately 0.5” steps, allowing for great customization.

Adjustment	Minimum	Maximum	Force
Vertical (from center of seat pan)	6.25”	10”	10 lbf
Fore/aft (front edge from seat back)	8”	10”	8 lbf
Width (space between)	17.75”	20.125”	12 lbf

The contours and padding of the armrests minimize the potential for ulnar nerve contact stress at the forearm or elbow (image below). Armrest height is adjusted using a well placed button. The fore/aft and width adjustments are friction adjustments allowing the armrest pad to be pushed into position without the need of a separate release lever. The fore/aft adjustability enables the user to push them full back far enough to pull the chair up to the edge of the worksurface.

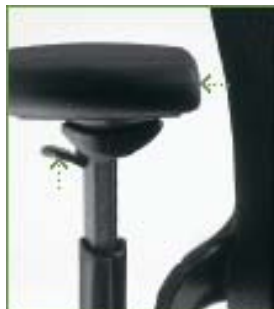
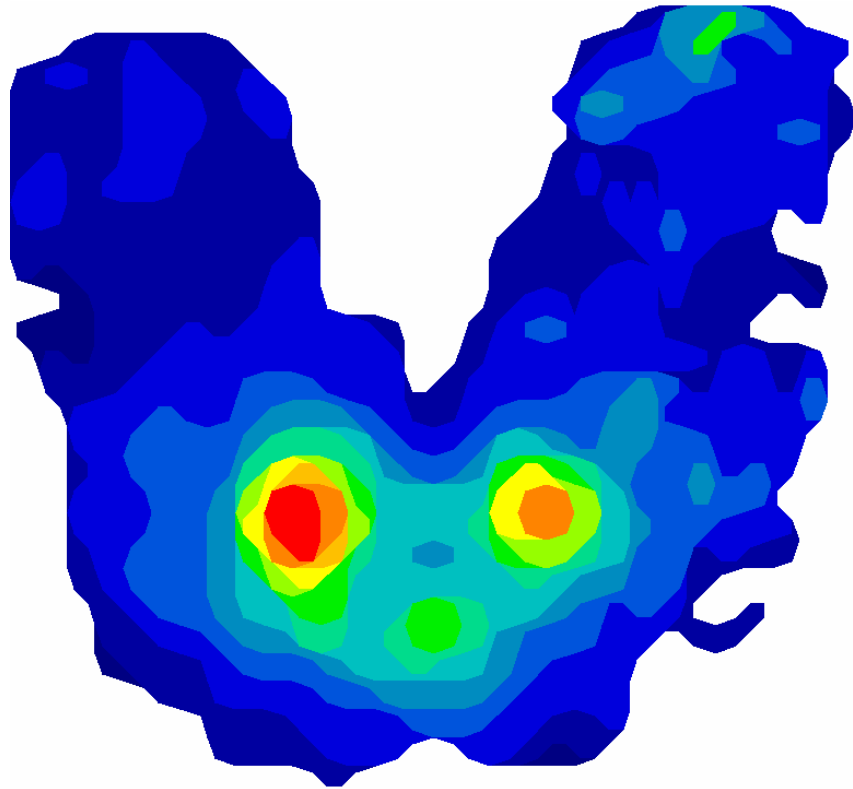


Illustration of Armrest Adjustment

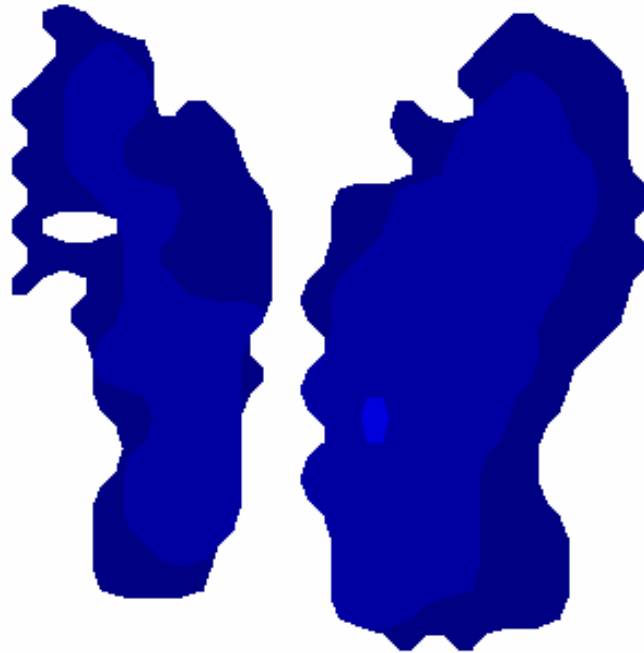
2.6 Contact Pressure

Sample pressure measurements were obtained from a single male subject of approximately 70th percentile stature (height=71.0" weight=182 lbs). The contact pressure was measured in the upright and reclined positions. The pressure profiles revealed pressure concentrations on the seat pan under the ischial tuberosities (see image below). The peak pressures were measured at an average of 78 mmHg in the ischial region and 37 mmHg in the thighs, indicating a good distribution of pressure peaks. Mean contact pressure levels were 35mmHg in the ischial region and 19mmHg at the thighs.



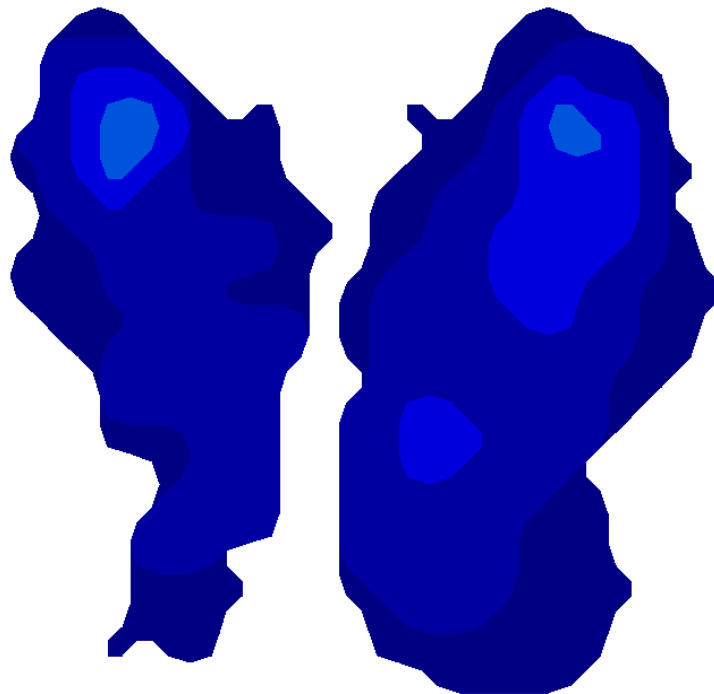
Seat pan pressure mapping

The seat back pressure mapping revealed considerable contact area, a desirable characteristic indicating good seat back support. The flex provided by the mesh materials and the pivoting backrest contributes to this by keeping the backrest in contact with the user during postural variations. The mesh backrest had good pressures distribution in both upright and reclining postures. Upright, the average pressure was 9mmHg, with a peak pressure of 13mmHg



Seat back pressure in upright seated posture

Reclining, the mean pressure was 11mmHg, with a peak of 28mmHg. This level does not indicate a risk for pressure concentration issues.



Seat back pressure in reclined posture

3.0 CONCLUSIONS

The Relate chair provides good dynamic support and provides an effective range of adjustability to meet the needs of diverse users. The weight balanced recline and pivoting seat back accommodate users throughout the normal range of working postures. The asymmetrically adjustable lumbar provides an additional dimension of fit to meet the unique needs of individuals. The chair controls are well designed and intuitive and easy to operate.

The pressure analyses revealed effective support provided by the seat back in both the upright and reclined positions. The pressure levels were within desirable thresholds for good ergonomic performance.

While the Relate 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.