

Mr. Scott Openshaw
Biomedical Engineer
Allsteel Corporation
2210 Second Ave
Muscatine, IA 52761

RE: Ergonomic Properties of Sum Chair

Dear Scott:

Thank you for the opportunity to review the ergonomic properties of the Allsteel Sum™ chair. The evaluation criteria used were based on the recommendations and requirements for chairs as described in *BSR/HFES 100 – Human Factors Engineering of Computer Workstations*¹ and the BIFMA International - *Ergonomics Guideline for VDT (Visual Display Terminal) Furniture Used in Office Work Spaces*.² These criteria have been summarized in the attached table. All data used are as represented by Allsteel, with the exception of the height of the lumbar support.

The Sum chair has a unique lumbar support system that utilizes an air bladder that conforms to the user's back and provides support to the lumbar region. The lumbar support height (most forward point of the lumbar support) was measured to be about 6.3 inches (16 cm) above non-compressed seat height. Although I was not able to measure the lumbar height with a Chair Measurement Device (CMD), it appears that the lumbar height would fall in the recommended range when measured with the seat compressed, as would occur with use of a CMD.

Consequently, it is my opinion that the Sum™ chair meets or exceeds all the criteria recommended or required by these standards for ergonomic chairs.

Sincerely,

Thomas J. Albin, PE, CPE
Master Consulting Ergonomist
Auburn Engineers, Inc

¹ Human Factors and Ergonomics Society. 2005. *BSR/HFES 100 Human Factors Engineering of Computer Workstations (Canvass Draft)*. Human Factors and Ergonomics Society, Santa Monica, CA.

² BIFMA, 2002. *Ergonomics Guideline for VDT (Visual Display Terminal) Furniture Used in Office Work Spaces. Business and Institutional Furniture Manufacturers Association*, Grand Rapids, MI.

Comparison of Allsteel Sum chair features to Ergonomic Standards

| ELEMENT | SUM | SPECIFICATION | | | |
|--------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------|----|----------------------------------------------------------------------------------|----|
| | | BIFMA G1 | | BSR/HFES 100 | |
| Stability | Yes | Stable (See BIFMA X 5.5) | √ | Stable (See BIFMA X5.5) | √ |
| Seat Height | 15-22.25" | 15.0 – 19.9 inches (Multiple chairs allowed) | √* | 15.0 – 22.0 inches | √* |
| Seat Depth | 15.5 – 18" | ≤ 16.9 inches (fixed), if adjustable, include 16.9 inches in range of adjustment | √ | ≤ 16.9 inches (fixed), if adjustable, include 16.9 inches in range of adjustment | √ |
| Seat Width | 18" | ≥ 18.0 inches | √ | ≥ 18.1 inches | √ |
| Seat Pan Angle | 4° | 0-4° rearward, if adjustable, include some part of 0-4° range | √ | User-adjustable 0-6°, including a 3° reclined position | √ |
| Back Rest Height | 21-24" | ≥ 12.2 inches | √ | ≥ 17.7 inches | √ |
| Back Rest Width | 16" | ≥ 14.2 inches | √ | ≥ 14.2 inches | √ |
| Lumbar Support | 6.3" ** | Height of most forward point of lumbar support should fall in the vertical range of 5.9 to 9.8 inches | √ | 6 to 10 inches above compressed seat height | √ |
| Torso-Thigh Angle (Seat Pan –Back Rest Angle) | 93-116° | ≥ 90°, if adjustable, range ≥ 10°, of which at least 10° should be in the range of 90-115° | √ | ≥ 90°, ≤120° | √ |
| Armrest Height | 7-11" | 6.9 – 10.8 inches | √ | 7.0 – 10.6 inches | √ |
| Distance Between Armrests | 16.5-19" | ≥ 18.0 inches | √ | ≥ 18.1 inches | √ |

* Covers entire range with selection of low and high cylinder chairs. Less height range adjustment on low-height chairs than on high-cylinder chairs.

** Measured above non-compressed seat height.