The Ergonomic Seating Guide

HANDBOOK

HAWORTH®

Statistics and studies reveal that ergonomic seating is something all employers should consider for their office staff. That being said, the goal of this handbook is to show you why ergonomic seating is so vital for workers and how Haworth provides the solution they need.

Why You Need This Handbook …

In 2004, approximately 125.9 million workers received a total of $56.0 billion in workers' compensation costs for injuries that occurred on the job (the latest year for which data were available). Additionally, in 2005, the total number of days lost to workers because of injuries occurring on the job totaled 80 million. Off-the-job injuries can potentially affect a company's productivity even more with days lost totaling about 195 million.[1]

With figures like these, the importance of providing a well-designed work environment with appropriate training which could help lessen costs as well as days lost to injuries is obvious. The possibility of sitting in a chair for a full eight-hour work day can be intimidating, so it is essential that work chairs be ergonomic and healthy. HealthyComputing.com concurs, stating, "Experts agree that your chair is perhaps the single most important component of a healthy working environment."[2]

The right ergonomic chair with the proper ergonomic training can help reduce injuries. Studies also show that work-related injuries can be reduced and productivity increased using an ergonomic chair and proper ergonomic training:

- **"A highly adjustable chair coupled with office ergonomics training reduced musculoskeletal symptom growth over the workday."[3]**
- **In 1990, research found a 17.5% productivity increase in subjects working in an ergonomically optimal setting compared to one which was ergonomically suboptimal.[4]**
- **In 2003, research found a 17.7% productivity increase in participants that received a highly adjustable chair and office ergonomics training.[5]**

All together, these statistics and studies reveal that ergonomic seating is something all employers should consider for their office staff. That being said, the goal of this handbook is to discuss chair features that help improve comfort, support, and productivity in the office.

Table of Contents

Ergonomic Seating Standards

The challenge of designing for the human body is that it comes in so many different sizes and shapes. As a result, a design that may be comfortable for one person can be inappropriate for others. Obviously clothes and shoes come in different sizes to accommodate these differences. Proper fit becomes much more important when it relates to a product that a person will be physically interacting with for hours at a time, for example, an office chair.

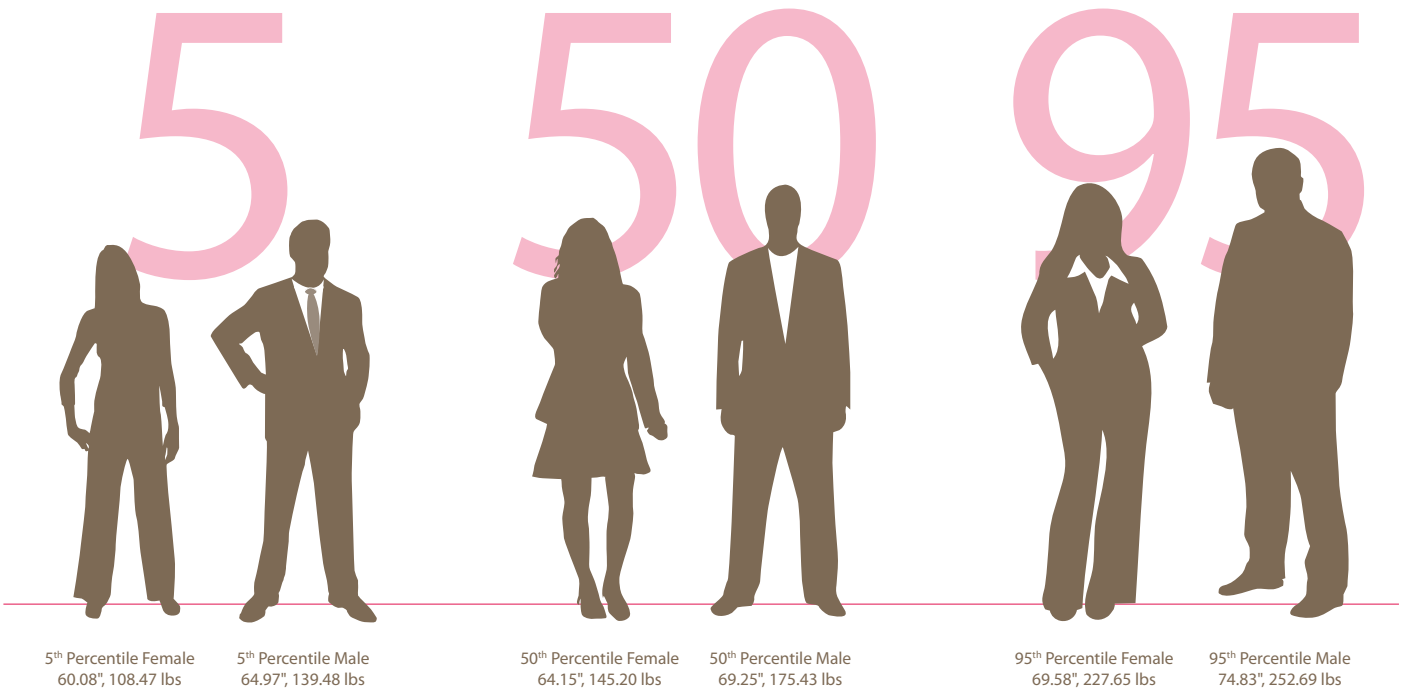
To improve chair designers' abilities to meet the needs of users several organizations have compiled standards. Those in use in North America include the following:

- **American National Standards Institute and the Human Factors and Ergonomics Society: ANSI/HFES 100-2007**
- **Business and Institutional Furniture Manufacturer's Association: BIFMA G1-2002**
- **Canadian General Standards Board: CGSB-44.232-2002**
- **Canadian Standards Association: CSA-Z412-2000**
- **International Standards Institute: ISO 9241- Part 5**

The standards are compiled by experts in the fields of human factors and ergonomics in partnership with the leading manufacturers of chairs and office systems. These standards represent the combined cumulative knowledge of these experts for the purpose of improving the accommodation of people, and reducing the risks of injury in the office environment.

The chair standards are intended as a reference and a starting point for design. They are updated periodically to reflect accepted research and best practices. The standards provide design guidance to meet minimum requirements in addition to adjustability ranges to increase the percentage of the population accommodated.

The standards propose dimensional specifications based on body dimensions of the 5th percentile (small) female to the 95th percentile (large) male (refer to graph on page 4). This range covers only 95% of the population and is intended to meet the MINIMUM requirements of users. Haworth's ergonomic seating products are based on state-of-the art research and are designed to exceed standards, meeting the needs of a broad range of users.



5th Percentile Female
60.08", 108.47 lbs

5th Percentile Male
64.97", 139.48 lbs

50th Percentile Female
64.15", 145.20 lbs

50th Percentile Male
69.25", 175.43 lbs

95th Percentile Female
69.58", 227.65 lbs

95th Percentile Male
74.83", 252.69 lbs

[6] Harrison, C.R.; Robinetter, K.M. (2002). CAESAR: Summary statistics for the Adult Population (Ages 18-65) of the United States of America. Wright-Patterson AFB, Ohion: Air Force Research Laboratory. (NTIS No. AFRL-HE-WP-TR-2002-0170).

Seating Comfort

We continue to learn more about the ergonomics of seating through research. The true objective of an ergonomic chair is to provide not only the proper function but to ensure the more subtle yet all important aspects of user comfort. People who are more comfortable in their chairs are more likely to be able to sit and be productive for longer durations. Chairs that do not provide effective support and adjustability can significantly increase the spinal stresses resulting in discomfort and increased injury risk.

Lumbar Support

It's been said that the shape of our spinal columns are as unique as our fingerprints. These include variations in the curvature and length. Our individual spinal length even varies by as much as 2 cm (approx. 0.8") over the course of a day.[7] The seat back plays a critical role in supporting the spine and must adjust to accommodate these differences among people.

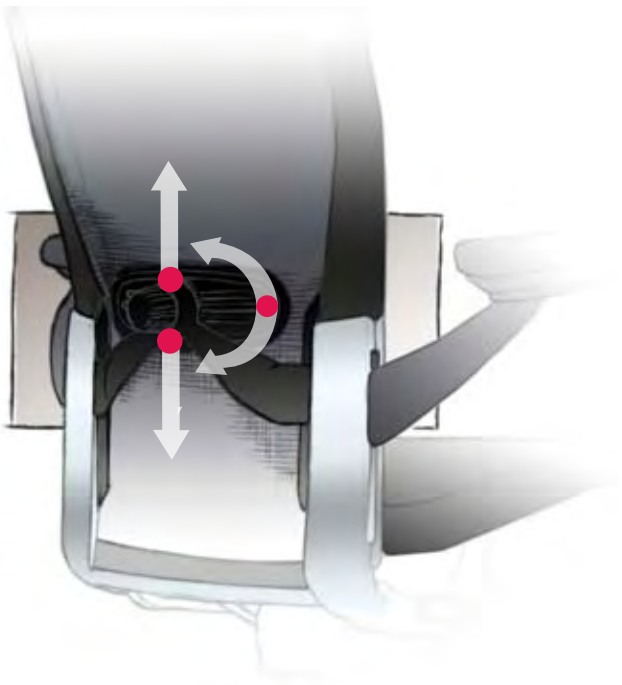
A very important consideration in seating comfort and injury prevention is the proper design of the lumbar support. Lumbar support is provided with different levels of performance as follows:

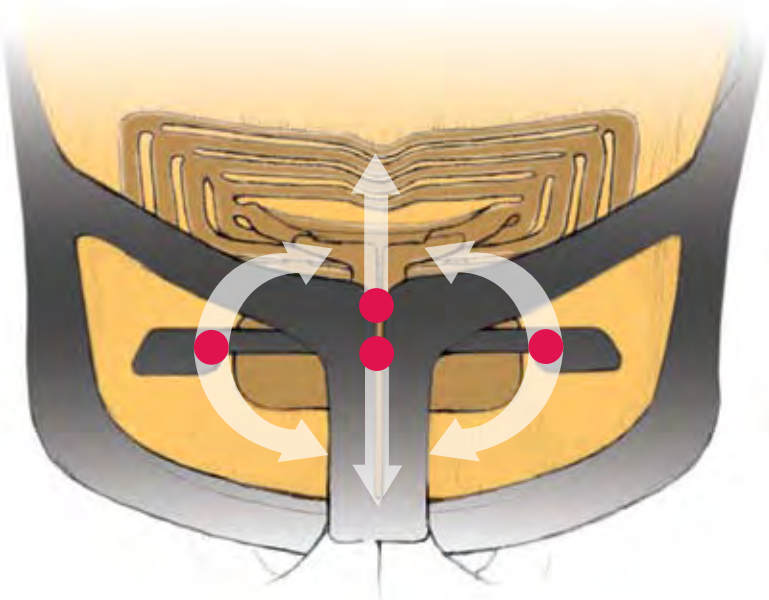
	Performance of Lumbar Support
Minimum	**Fixed Support —** Based on seating standards, a curvature is designed into the lower seat back to support the lumbar spine. Unfortunately, one size does not fit all.
Good	**Single-Axis Adjustable Support —** The lower back seat curvature is adjustable in at least one direction. Typically the curve may be raised or lowered.
Better	**Dual-Axis Adjustable Support —** The lower back seat curvature is adjustable in two directions. This would include 4 inches of height adjustment as well as depth adjustability of the lumbar curve.
Best	**Asymmetric Adjustable Support —** This offers the highest available performance. Comfort is greatly enhanced by allowing users to adjust the height by 4 inches as well as independently adjust support on either side of the spine.

Asymmetric Lumbar Support
Recent independent university research has indicated that over 74% of individuals tend to prefer more support on one side of their lower back than the other.[8]

Single-Axis Adjustable Support

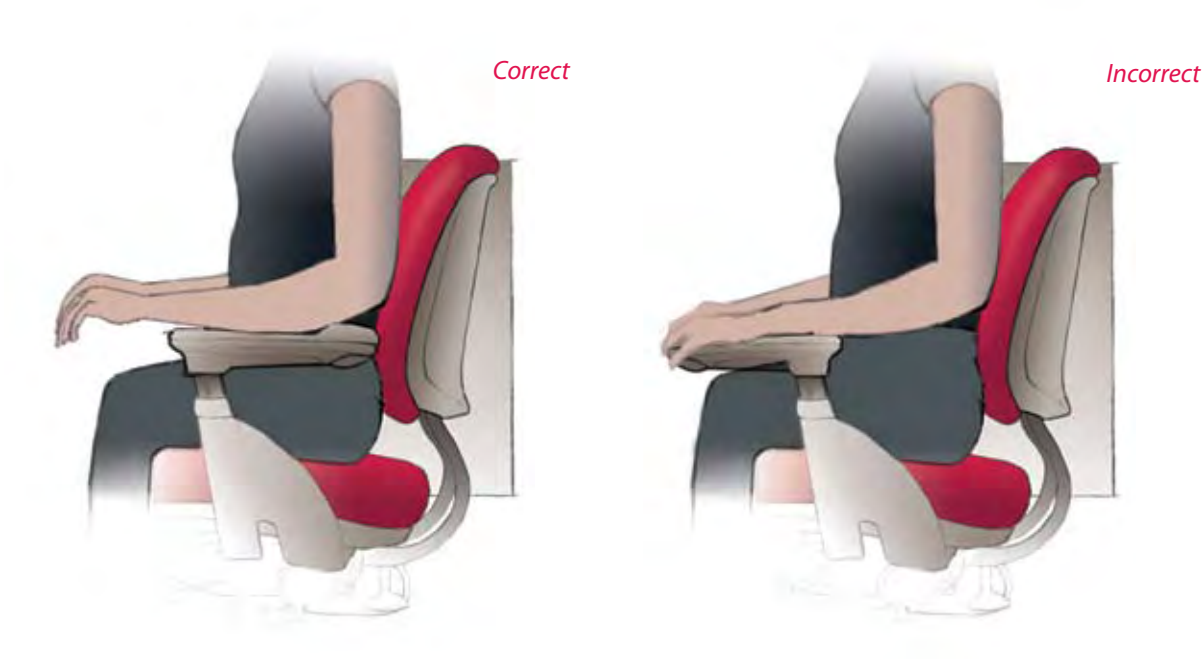
Dual-Axis Adjustable Support





Asymmetric Adjustable Support

Adjustability Features of Ergonomic Armrests



Armrests

The arms represent approximately 10.2% of our total body weight, which can result in considerable exertion in the muscles of the upper back, shoulders, and neck.[10] Static exertions (exertion maintained for extended durations in a fixed posture) dramatically increase the risk of muscle fatigue and are often considered the first threshold to injury. Most people experience fatigue as soreness or discomfort in their muscles.

Supporting arm weight reduces the stress on the spine, however, in order to work they must fit. To minimize the potential for contact stress, armrests should be used intermittently while working. It is also preferable that the armrests are adequately padded.

Armrests that do not adjust and produce contact stress in the vulnerable areas of the elbow and forearm can increase the risks of injuries to these areas. To meet the size range of users, armrests need a considerable range of adjustability.

Armrest Height

Armrest Height — The use of armrests are very effective at reducing the stress to muscles of the upper back, neck and shoulders and is a fundamental requirement for proper fit. There is considerable variation in the resting seated elbow height. The North American standards specify a minimum of approximately 4" of vertical armrest adjustment.

Front-to-Back Adjustability — To fit the variations in people size, task requirements, and desk layout, front-to-back armrest adjustability is essential. This can be accomplished through front-to-back movement or 360° rotation arm caps. Armrests that do not adjust often bump into the desk edge, resulting in greater reaches, and promote perching posture (sitting on the front edge of the seat pan). This is particularly common for individuals working in corner configurations.

Width and Pivot — To effectively accommodate the variation in the width of user size it is necessary to provide adjustment in armrest width and pivot. These adjustments ensure that individuals of wider girth can sit in the chair without clash from too narrow a setting, and allow smaller, narrow girth individuals to use the armrests. Adjustment in pivot can fine-tune the position for the task at hand. In some cases rotation of a full 360° is desirable, allowing the user to reposition the location of support provided.

Front-to-Back

Width

Pivot

Seat Depth Adjustment

Chairs with a fixed seat pan length limit the population that can fit the chair comfortably. Typically a taller person will require more seat pan length and a shorter person will require less. A shorter person sitting on a long seat pan will experience pressure behind the knees, or, if they perch on the edge, will not benefit from the seat back support. A taller person sitting on a short seat pan length will have inadequate support resulting in higher contact pressure under the thighs.

Good ergonomic seating incorporates several inches of adjustable seat pan depth. A minimum of 2 inches of adjustability is recommended while 3 inches is preferred.

Design of Chair Controls

By design, ergonomic seating incorporates a range of adjustability. The user must be able to get into a comfortable posture quickly and easily and make adjustments over time. To achieve this, intuitive design and consistency in control placement and function is essential.

Desirable control features include:

- **Low hand and finger forces to operate**
- **Majority of adjustments achievable while seated**
- **Control motion intuitive and indicated by feel**
- **Control location consistent**

The importance of control design and consistency increases as chairs are shared between people. This is a common requirement in multi-shift situations such as customer support operations or call centers.

Forward Tilt

In some cases individuals may tend to sit on the front edge of the chair. Typically, this is associated with certain task requirements and/or an individual's adopted sitting habit. Often referred to as "perching" this is a posture that may increase ergonomic risks due to reduced support from the seat back and seat pan. However, the ergonomics of the posture can be enhanced through proper seat pan adjustment. A forward tilt of the seat pan can support this seating style while promoting a healthy spinal posture. By tilting the seat and back forward it provides an alternative sitting posture and relieves lower back pressure.

Seat Recline

Movement is healthy. As we recline in our chairs we stimulate blood flow and relieve the pressure on our spine. By reclining our chair only 20° degrees (from 90° to 110°) we can reduce the stress on our spinal discs by approximately 40%.[9]

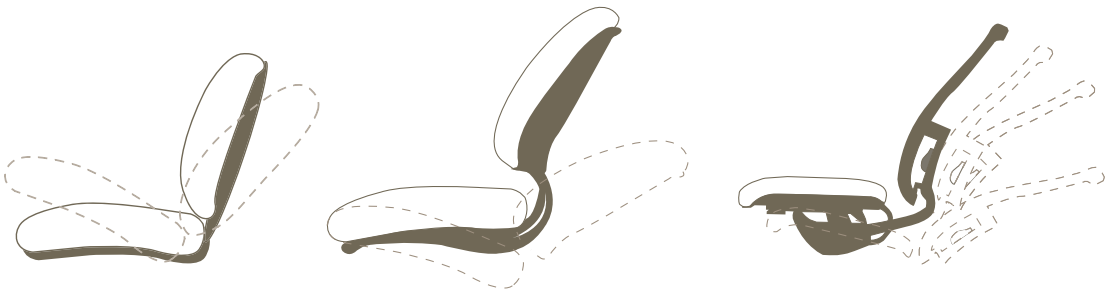
There are different types of seat recline mechanisms and some provide advantages over others. The preferred designs incorporate multiple pivot points integrating the movement of the seat pan and the seat back movement, provide adjustable recline effort as well as lockable settings. Tension control is important so that a chair can be adjusted to accommodate users of different body types and sizes and for different work styles. A summary of recline mechanism performance for a task chair are as follows:

Performance of Seat Recline Mechanisms in Task Chairs

Minimum **Single-Point Pivot —** The seat back reclines approximately 20° in relation to the seat pan. With this type of mechanism, the front edge of the seat pan often rises creating unwanted pressure under the thighs.

Better **Synchronous Tilt —** The motion of the seat back is linked with partial motion of the seat pan to maintain proper lower body and lumbar support throughout the recline motion. For every 2° of seat back recline the rear edge of the seat pan lowers 1°. This minimizes the front edge seat rise and also opens the chest cavity to allow for easier breathing.

Best **3-Point Pivot —** This synchronous style mechanism has all the benefits of a synchronous tilt plus it allows the user to further "fine-tune" the control to find a more comfortable posture. It also allows a deeper recline of the seat back to further reduce back stress while maintaining effective lumbar and thigh support.



Minimum
Single-Point Pivot

Better
Synchronous Tilt

Best
3-Point Pivot

Critical Chair Features

There is a wide range of ergonomics performance among chairs. There is no guarantee that a design meeting the minimum requirements of standards will provide satisfactory performance or even comfort for its user. All Haworth task chairs are designed to meet or exceed ergonomic standards and guidelines.

A summary of the recommended features considered critical to achieve acceptable levels of ergonomics performance across a broad range of users are as follows:

Minimum suggested "standard" features:

- **Appropriate lumbar (lower back) support with at least one axis of adjustment**
- **Vertically adjustable armrests with adequate padding**
- **Synchronous recline with tension adjustment and back/lock settings**
- **2" seat depth adjustment**
- **5" seat height adjustment**

Desirable features include:

- **Adjustable lumbar support (height and amount of support)**
- **Fully adjustable armrests (pivot and width or 360° rotation)**
- **3" seat depth adjustment**
- **Forward tilt**

Special Accommodation

Most chairs will accommodate 95% of the population, however, for that 5% there are additional chair options to improve fit and comfort. These are usually variations on existing chair models and may include:

- **Low height bases**
- **Extra large chairs to accommodate up to 500 lbs.**
- **Table stools for various applications**
- **Defeatured chairs for conferencing**

User Support and Education

The principles of ergonomic chair adjustments are very simple. However, even the best ergonomic chair can be used improperly. To ensure that users are familiar with the proper adjustments some basic educational support is recommended. This may be in the form of hang tags on the chair, or, preferably, electronic documentation available on-line. This enables representatives from the user's company (e.g., health and safety, facilities, human resources, or management) to easily distribute links promoting ergonomics setup.

Critical Features Matrix

Chair Element	Measurement	Zody	Improv HE/Tag	X99	LOOK
Forward Tilt (seat and back move together; allows user to vary posture during day)	Required Option	X	X	X	X
Easy-to-use Adjustments (located where the user can reach easily and simple to change)	Low Force to Adjust	X	X	X	X
	Similar Control Placement	X	X	X	X
Low Position/Standard Position Pneumatic Cylinder (provides greater range for smaller users with low and majority of range with standard)	Required Option	X	X	X	
Synchronous Tilt Mechanism (seat and back move together at varying degrees to provide support through recline)	Required	X	X	X	X
3-point Pivot Mechanism (provides comfortable, relaxed posture; user's feet remain on floor)	Required	X		X	
Seat Depth Adjustment (supports different sized users' thighs and allows users to use backrest for support)	>=2"	X	X	X	X
	>=3"	X	X		
Pivot Arm (for keying and mousing)	>=30˚	X	X	X	X
Depth Adjustable Arm (allows user to get close to worksurface and still use the backrest)	>=2"	X	X	X	X
	>=3.5"	X	X		
Width Adjustable Arm (ensures comfortable resting and support position for arms and easy entry/exit from chair)	>=1.5"	X	X		X
	>=2"	X	X		X
Height Adjustable Lumbar (allows user to locate where they need support)	>=3"	X	X	X	X
	>=4"	X	X	X	
Depth Adjustable Lumbar (allows user to choose strength of support for lower back)	Required	X	X	X	
Asymmetrical Lumbar (maintains natural curve of spine while allowing users to choose support for their body)	Required	X			
Pelvic Support (rotates pelvis forward to maintain natural shape of spine)	Required	X			

Note: Zody is the only chair in the industry endorsed by the American Physical Therapy Association.

Product Endorsed by
American Physical Therapy Association

Compliance Matrix BIFMA G1-2002

Chair Element	Measurement	Zody	Improv HE / Tag	X99	LOOK
Seat Pan Height	15 – 19.9"	X	X	X	X
Seat Pan Depth Adjustment	<16.9"	X	X	X	X
Seat Pan Width	>18"	X	X	X	X
Seat Pan Angle Adjustment	0° (horizontal to 4°)	X	X	X	X
Seat Pan Front Edge "Waterfall" Contour	Required	X	X	X	X
Seat Back Minimum Tilt Adjustment (a minimum of 10° to fall within the vertical range of 90-115° torso to thigh angle of >	>10°	X	X	X	X
Seat Back Height	>12.2"	X	X	X	X
Seat Back Width	>14.2"	X	X	X	X
Armrest Length	>6"	X	X	X	X
Armrest Width	>2"	X	X	X	X
Armrest Vertical	6.9" – 10.8"	X	X	X	X
Inside Distance Between Armrest	>18"	X	X	X	X
Armrest Comprised of a Padded Material	Required	X	X	X	X
Lumbar Support Height Adjustment (must include part of this range if adjustable)	5.9" – 9.8"	X	X	X	X
Chair Casters Compatible with Floor Surface	Required	X	X	X	X
Chair has Five Legged Base of Support	Required	X	X	X	X

Notes: • **Specific Configuration may apply.**

• **LOOK chairs comply with fixed arms only.**

References

[1] National Safety Council. (2007). Injury Facts. Itasca, IL: National Safety Council, 47-83.

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[3] Amick, B.; Robertson, M.; DeRango, K.; Bazzani, L.; Moore, A.; Rooney, T.; & Harrist, R. (2003). Effect of office ergonomics intervention on reducing musculoskeletal symptoms. Spine, 28(24), 2706-2711.

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Ergonomic Seating Evaluation Form

Evaluator Name: _____

Title: _____ **Date:** _____

EVALUATION CRITERIA
A. Chair Features
1. Seat height adjusts at least 4.5.
2. Standard seat pan depth adjusts at least 2.
3. Seat pan has a waterfall or flexing front edge.
4. The backrest to seat pan angle allows the user to keep his/her torso-to-thigh angle at 90° or greater.
5. The tension for the chair's recline can be adjusted.
6. The chair has a back stop or back lock.
7. The chair has forward tilt or has the option for forward tilt where the seat and backrest move with each other to maintain back support while in the forward tilt position.
8. The chair has a lumbar support.
9. Lumbar support is adjustable up and down.
10. Lumbar support can be adjusted to provide different levels of support.
11. Lumbar support can be adjusted to provide asymmetrical support.
11. The chair has a self-adjusting pelvic support.
12. The armrest height adjusts at least 4.
13. The armrests/caps adjust side to side.
14. The armrests/caps pivot at least 15° towards the body and away from the body.
15. The armrests adjust forward and backward.
16. The armrests are soft/padded (i.e. gel, foam).
A: Total Chair Features
B. Aesthetics
17. The chair's aesthetics are appealing.
18. The chair looks comfortable.
19. The chair controls integrate well into the overall design of the chair.
B: Total Aesthetics
C. Chair Comfort
20. The chair's backrest does not interfere with the movement of the arms/shoulders when reaching for something.
21. The shape of the backrest fits the back.
22. The chair's lumbar support provides the appropriate amount of support.
23. The chair's pelvic support provides the appropriate amount of support.
24. The chair's backrest is comfortable.
25. The chair's seat pan is soft around the edges.
26. The shape/contour of the chair's seat pan fits and does not create any pressure points.
27. Sitting in the chair, does NOT cause any pain/numbness in the buttocks or legs.
28. When reclining in the chair, the front edge of the seat does not rise and the feet remain flat on the floor.
29. This chair allows for comfortable sitting in a variety of postures.
30. The chair can be adjusted to an individual's ideal comfort position.
C: Total Chair Comfort
D. Ease of Use
31. The chair is easy to adjust from a seated position.
32. The chair adjustments/controls are easy to find.
33. The chair adjustments/controls are easy to use.
34. The symbols/pictures on the adjustment lever/controls are easy to understand.
35. The chair's adjustment levers/controls have enough clearance room around them for the user's hands.
36. The chair's tension can be easily adjusted.
37. The lumbar support can be adjusted from a seated position.
D: Total Ease of Use
E. Body Support
38. While working, a person's back is firmly pressed against the backrest.
39. The chair is stable when sitting in a reclined posture.
40. The chair has consistent lumbar support when reclining.
41. The armrests can be adjusted to support the forearms in a variety of postures and angles.
42. The armrest length allows an individual to sit close to the work surface while maintaining contact with the backrest.
E. Total Body Support
TOTAL SCORE [A (NUMBER OF YES'S) + B (NUMBER OF YES'S) + C + D + E] =

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Manufacturer: ____________________ Manufacturer: ____________________ Manufacturer: ____________________

Model#: ____________________ Model#: ____________________ Model#: ____________________

	Check Yes or No		Check Yes or No		Check Yes or No	
	Yes	No	Yes	No	Yes	No

	Strongly Disagree			Strongly Agree		Strongly Disagree			Strongly Agree		Strongly Disagree			Strongly Agree	
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