Correcting Poor Seated Posture

A Critical Problem for First-Year Engineering Science Students

Word Count: 1794

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1. Introduction

We discovered that Engineering Science students (EngScis) have poor studying posture despite posture-correcting devices being widely available. We identified that existing products fail to simultaneously: (i) look inconspicuous, (ii) be portable, (iii) correct posture, and (iv) be safe. With these goals, we curated a list of objectives and requirements that a possible solution should meet to address this issue, especially while sitting and studying.

2. Background

According to the Hospital for Special Surgery, back posture correctors should be used to train an individual's "proprioceptive senses" to identify good posture, which later allows the user to replicate the behaviour without assistance [1].

Posture correction is important since it can alleviate health issues for EngScis. Through stakeholder interviews, we gathered that many EngScis do not correct their back posture because it is not a priority. However, long-term slouching causes a person's center of gravity to shift forward, which impairs balance and increases chance of injuries.

Furthermore, good posture improves confidence, energy, and peer interactions [2]. Considering the current mental health epidemic [3], we believe it is crucial to address stressors which may worsen mental health. Although on-the-market solutions exist (see reference designs in section 4), several constraints reduce their adoption by our community, including portability, convenience, and social stigmas. Our goal is to present a viable opportunity that can incorporate numerous features to create a better posture corrector.

3. Stakeholders

Those concerned by this opportunity include:

- First-year EngScis, who are directly impacted by this issue but do not fix it (for reasons mentioned in Introduction). This information was gathered through informal interviews with 11 participants in the EngSci common room (see Appendix A for transcript). Although our surveys were qualitative, the low participation does not disqualify the data. A strong majority of EngScis have sub-optimal posture, as illustrated in *Figures 1* and *2*, making extrapolation justifiable.
- Manufacturers of competing products. If a solution is found to the splartz, competitors will lose market share. Given that the splartz is addressable by a team of first-year EngScis, competitor firms can likely adapt their existing solutions to match any new entrants in the market.
- Other students. Poor posture is not limited to EngScis; by observation, most students have sub-optimal posture. Users of a solution to this problem are not limited to EngScis.
- As mentioned, many orthopedic solutions do not work as patients do not like to wear them. If a solution to the splartz is found that people wear, then orthopedic specialists and other professionals will have a new tool to help treat poor posture and its associated health issues.

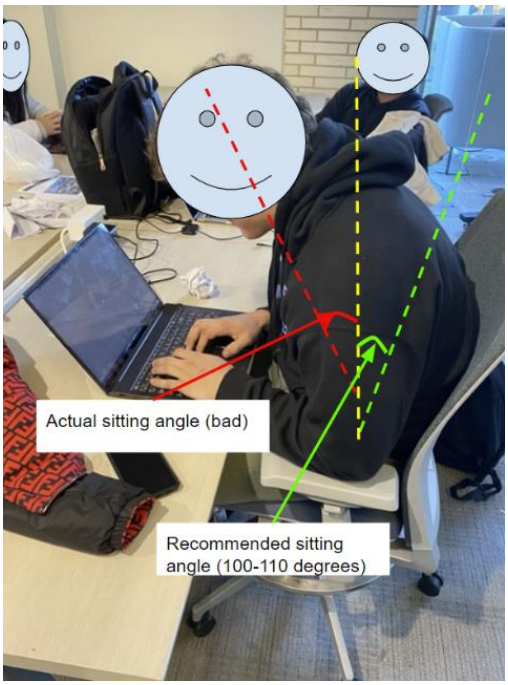

Figure 1 An EngSci student leaning forward in a chair with armrests, which deviates from recommended seating posture. The student is leaning forward to see the screen better.

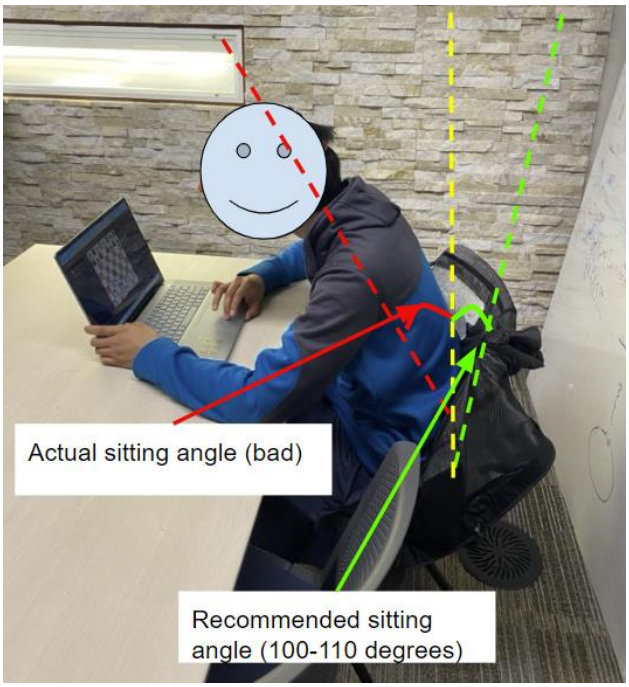

Figure 2 Another EngSci student leaning forward, this time in a chair without armrests. The student is still exhibiting poor posture, leaning forward to see the screen better.

4. Reference Designs

Pre-existing designs aim to correct posture by: (i) physically holding the user in a correct position, (ii) providing reminders to users to correct their posture when it is incorrect, or (iii) improving the ergonomics of a setup which naturally improves posture as a result.

4.1 Back Braces

Designs support posture consisting of braces, as shown in Figures 3 and 4, are known as scapular braces. A study done by Leung, Kan, Cheng, et al. on university students wearing scapular braces while typing showed less strain in back muscles, suggesting that back braces can help maintain proper posture for longer periods by reducing strain [4].

The disadvantage of scapular braces is that they look awkward and unnatural. First-year EngScis mentioned that braces are undesirable to wear because they look odd, or “nerdy” (see Appendix A). This suggests the solution to poor posture should be concealed, or at least discreet.

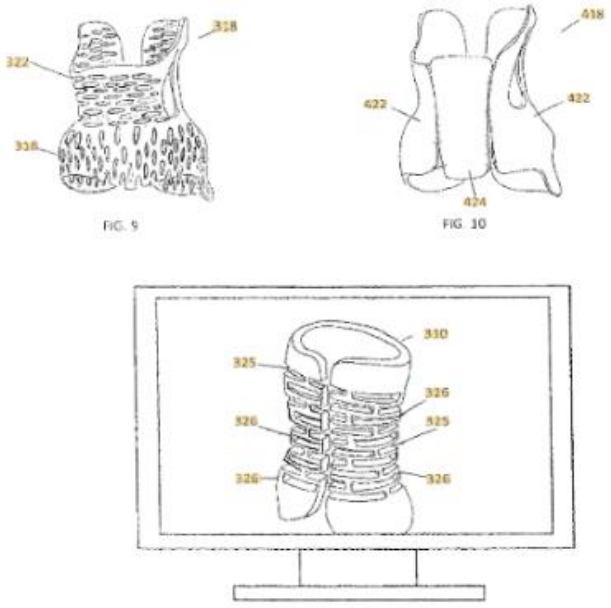

Figure 3: A scapular brace custom fit to someone's body [5]. It forces the user to maintain a straight posture and reduce muscle strain.

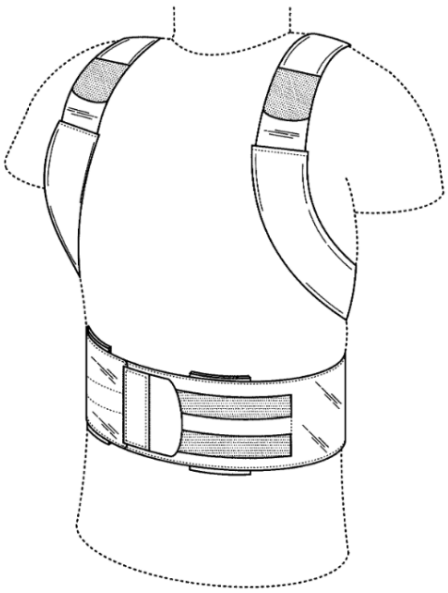

Figure 41: A scapular brace made adjustable using straps [6].

4.2 Sensor-Based Posture Correction

Sensor-based posture correction devices work by checking how much the user's angle differs from some reference initial angle. If it exceeds 15 degrees, it reminds the user to fix their posture [7]. This is advantageous because it is small and concealable, and it trains the user to improve their posture. However, we found little research to support its efficacy.

Figure 5: The Vibe Digital Sensor measures the angle user makes to a reference position, and prompts the user when the tracked angle is unergonomic [7].

4.3 Laptop Stands

Many effective designs improve workspace ergonomics to naturally promote better posture (Appendix B). These are mostly unsuitable for us as they are bulky and stationary, which is inadequate for

the chaotic lifestyle of EngScis. A more portable solution is a laptop stand *(Figure 6)*. They elevate the monitor screen, putting it 20-50 degrees from the horizontal, as specified by ISO standard 9241-392 [8]. This laptop position reduces hunching to encourage better posture, but only works for laptops. Posture corrections while working pen-to-paper remain unaddressed.

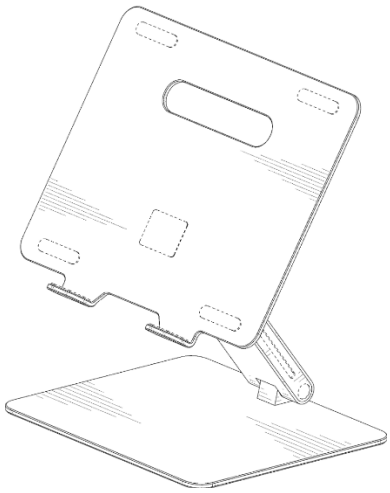

Figure 6. A 2laptop stand design from [9]

4.4 Back Pods

Back pods *(Figure 7)* are portable tools that aim to help improve lie-down back posture by reducing back tension. Due to its lightweight [10] and ergonomic design, the product has been well adopted. Unfortunately, the product is used in non-seated positions, which is not useful for EngScis when they study.

Figure 7: The Original Back pod made to improve back posture. The backpod is relatively small compared to the person, and is not too bright or distracting, deeming it portable and aesthetic (where the notion of "aesthetic" is determined through interviews with EngScis) [11].

5. Product Requirements

The reference designs suggest that the ideal design to correct back posture should be portable, discreet, and should be able to be used in diverse scenarios.

Table 1: Breakdown of the Needs, Goals and Objectives used to Establish the Requirements and Evaluation Criteria of our Opportunity.

Objectives	Requirements/*Evaluation Criteria*	Justification
Goal 1: The device is safe to use		
1. Materials used shall have the least amount possible of carcinogens and allergens	The number of carcinogens and allergens shall conform to the maximum carcinogens and allergens imposed by the OEKO-TEX Standard 100 [12]. *The fewer maximum carcinogens and allergens imposed the better.*	Research has been done to maximize potential users and be the least harmful possible.
2. Shall not be an electrical hazard for the user	The circuits in the materials shall conform to the maximum voltage dictated by UL 60601-1 [13]. *The less voltage required, the better.*	
Goal 2: The device is durable		
1. Shall not break during normal operation	Shall be operational when placed in 3K21 conditions (temperature controlled from 15°C-32°C, but not humidity controlled as specified by IEC 60721-3-3 [14] *The longer the product remains completely operational, the better.*	EngSci students study in many places so the product should withstand daily indoor wear and tear.
2. Shall not be damaged by household cleaning supplies	Shall maintain the same mass, dimensions, and appearance after drying from being immersed in household cleaning supplies (specified in Annex A of ISO 175. Examples include acetic acid, ethanol, and hydrogen peroxide). [15] *The longer the product remains immersed in the cleaning fluid without changing mass, size, or appearance, the better*	EngSci students will clean the product so it will not be damaged by cleaning supplies. We can also extrapolate these results to conclude that body oils and sweat will not damage the product because cleaning supplies are much more basic or alkaline than human sweat/oils [16].
Goal 3: The device is portable		
1. Shall have small dimensions.	Shall have dimensions no bigger than 7 x 7 x 7 inches Shall be able to hold with one hand.	The ideal phone size is 6.1 inches, as it is portable enough to fit anywhere you go but it is not too small to

	The smaller and more compact the product, the better.	function [17]. Based off this, to construct something that can be taken everywhere, almost like a phone, it is fair if it is in similar dimensions.
1. Shall be lightweight 2. Skin-contacting material should be breathable and should not impede the movement of the individual.	The product shall weigh no more than 600g (based of 500g from reference designs). *The lower the mass, the better.* Material should be made of soft silicone, memory foam, cotton/elastic blends, canvas, neoprene or anything with a Thermal Evaporative Resistance (RET) coefficient < 6 (tested using ISO 11092 standard) [18][19]. If fabric is used, it should be composed of nylon, elastic or materials sharing similar properties [20]. *A lower (RET) Coefficient is better*	The original back pod design (pg 7) has a mass of 500g [10], and the ideal phone has a mass of 130g [21] justifying this mass. Lower RET values mean more breathable materials that will keep users comfortable throughout the day. Cotton/elastic blends and similar materials are flexible, allowing for less pressure applied on the back, making it easier to wear the material.
Goal 4: The device is aesthetically pleasing		
1. Shall not be bulky or any weird shapes	The product shall not have sharp corners or radii [22]. *The larger the radii of curvature at corners, the better*	Sharp corners are both dangerous and uncomfortable to have in contact with skin.
2. Hardware shall not be visible or distracting	The colour of the product shall not be any neon colour. *The lower the visibility of the product while in use in public, the better.*	From [23], users of back braces did not wear them for the prescribed times as they thought the hardware being visible had an affect on their confidence.
Goal 5: The device corrects the users posture		
1. Shall encourage the user to sit without hunching or rounded shoulders.	The user shall sit with a symmetrical trunk posture, with a trunk inclination between 100-110 degrees [24], and spine posture as specified by ISO 11226:2000 [25]. *The more time we can comfortably sit in this position, the better.*	Posture research has informed ISO 11226:2000 [25] of optimal seating position for good posture. The user ideally follows this standard.
2. Shall only allow poor posture for some maximum recommended time	The user shall be allowed to sit with poor posture for a *maximum holding time* recommended by ISO 11226:2000, depending on the user's trunk inclination [25].	

6. Conclusion

We needed a solution to correct EngSci's poor postures. After researching reference designs, ergonomics, and interviewing EngScis, we identified that the ideal posture-correcting device should be safe, portable, durable, and be aesthetically pleasing. Existing products fail to meet at least one of these criteria, which is why we made requirements and objectives that the optimal solution should meet.

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Appendices

Appendix A: Complete Interview Responses

Responses from interviews conducted to a sample of 11 students show that even though they are conscious of their poor posture, they do not want to use any of the current designs due to the following factors:

1) Societal expectations: Students do not want to feel like outcasts in society or be seen as “nerds”
2) One of the current designs (lumbar pillow) continuously slips and is uncomfortable
3) Students found it annoying to have to put it on every time
4) Current designs can be annoying to carry around
5) Another design (back braces) is too obvious and visible

Appendix B: Other Effective Yet Stationary Designs

Some other current designs include:

1) Chairs [21]
2) Lumbar support pillows attached to chairs [22]

Source Extracts

How Posture Correctors Work

What all posture correctors have in common is that they are designed to address muscle imbalances that arise when we spend long periods of time in unhealthy, fixed positions. While the muscles in the front of the chest (pectorals) have a tendency to become tight, the muscles in the upper back, including the middle trap and rhomboids, are likely to become overstretched. Correctors can help activate the muscles that haven't been worked enough and give them a guide for where they need to be.

"This is called proprioception, where the body gets sensory feedback in order to feel where it's supposed to be in space," says Rodriguez. Proprioception is what helps you to maneuver freely without having to stop to think about every move. It enables you to touch your finger to your nose with your eyes closed, to walk down a flight of stairs without looking at every step, or sit in a chair without looking under your rear end.

Correctors allow us to build on our proprioceptive senses, providing us with a keener awareness of what good posture feels like and what we need to do to achieve it. "If I start to slouch, the posture corrector will let me know I'm in the wrong position so I can pull my shoulders back or tuck my lower back in," Rodriguez says. Ideally, eventually this correction will become second nature.

[1]

Benefits of Correct Posture

Numerous factors can contribute to poor posture, including tight or weak muscles, stress, obesity, and wearing unsupportive shoes. Poor posture can lead to back pain, breathing problems, and headaches—and it can even impact mood. ((Harvard Health Publishing. "Posture and back health." March 9, 2014. https://www.health.harvard.edu/pain/posture-and-back-health. Accessed: January 26, 2022))

It's important to recognize that posture can have a profound impact on your health and well-being, as well as your ability to thrive at work. Improving your posture may provide the following benefits:

1. Increased Confidence

Correcting your posture can impact the way you feel about yourself. One study found that students who held an upright, confident posture were much more likely to have confidence in their thinking—and performed better on math tests. Feeling more confident in your ideas at work will ultimately help you succeed.

2. More Energy

Poor posture can negatively affect energy levels, resulting in fatigue. Practicing good body alignment may help you remain focused and energized at work. Whether you're delivering packages or caring for patients, correct posture can allow you to power through the day more easily.

3. Greater Self-Esteem and Better Mood

In addition to giving you more energy, better posture can also reduce depressive feelings and improve your self-esteem and mood. Feeling good about your professional life often starts with feeling positive about yourself.

[2]

Mental health

Overview | **Impact** | **WHO Response**

Mental health conditions include mental disorders and psychosocial disabilities as well as other mental states associated with significant distress, impairment in functioning or risk of self-harm.

In 2019, 970 million people globally were living with a mental disorder, with anxiety and depression the most common.

Mental health conditions can cause difficulties in all aspects of life, including relationships with family, friends and community. They can result from or lead to problems at school and at work.

Globally, mental disorders account for 1 in 6 years lived with disability. People with severe mental health conditions die 10 to 20 years earlier than the general population. And having a mental health condition increases the risk of suicide and experiencing human rights violations.

The economic consequences of mental health conditions are also enormous, with productivity losses significantly outstripping the direct costs of care.

[3]

Effects of Using a Shoulder/Scapular Brace on the Posture and Muscle Activity of Healthy University Students during Prolonged Typing–A Randomized Controlled Cross-Over Trial

Melissa Leung [1], Mandy M P Kan [1], Hugo M H Cheng [1], Diana E De Carvalho [2], Shahnawaz Anwer [3], Heng Li [3], Arnold Y L Wong [1]

Affiliations + expand

PMID: 37297695 PMCID: PMC10252399 DOI: 10.3390/healthcare11111555

Abstract

Laptop use appears to contribute to poor working postures and neck pain among university students. Postural braces have the potential to improve upper back/neck posture and therefore might have a role as an ergonomic aid for this population. Therefore, the purpose of this study was to assess the short-term effects of scapular bracing on pain, fatigue, cervicothoracic posture, and the activity of the neck and upper-back muscles in healthy college students. A randomized controlled crossover trial was conducted to evaluate the self-reported pain and fatigue, the amplitude and median frequency of surface electromyography in neck extensors, upper trapezius, and lower trapezius, as well as the neck and shoulder sagittal alignment (measured by inertial sensors and digital photographs) during a 30-min typing task in a sample of young, healthy university students with or without a scapular brace. The brace condition resulted in significantly smaller levels of bilateral trapezius muscle activity ($p < 0.01$). Rounded shoulder posture was slightly better in the brace condition, but these differences were not significant ($p > 0.05$). There were no significant immediate differences in pain or fatigue scores, neck alignment, or the electromyographic activity of the other muscles tested between brace and non-brace conditions (all $p > 0.05$). However, bracing appears to immediately reduce the electromyographic activity of the lower trapezius muscles ($p < 0.05$). These findings shed some light on the possible advantages of scapular bracing for enhancing laptop ergonomics in this group of individuals. Future studies are warranted to evaluate the effects of different types of braces, the importance of matching the brace to the user, and the short- and long-term effects of brace use on computer posture and muscle activity.

Keywords: ergonomics; fatigue; neck and shoulder pain; scapular brace; typing.

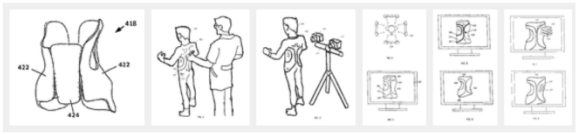
[4]

Flexible braces, casts and devices and methods for designing and fabricating

Abstract

A custom device and method for fabricating the custom device includes marking a body with reference points and/or other indicators. Multiple images of the body from multiple angles are then obtained. The images are used to determine the contours of the body and the other markings are located and used to design the custom device. The custom device can be fabricated as a single piece structure or in multiple pieces that are assembled to complete the custom device.

Images (19)



US10231862B2
United States

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Inventor: Scott Summit, Kenneth B Trauner
Current Assignee : 3D Systems Inc

Worldwide applications
2010 · US 2013 · US

Application US14/083,358 events
2013-11-18 • Application filed by 3D Systems Inc

[5]

Posture correction device

Images (8)

USD818132S1
United States

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Inventor: Amadeo Peter Hille
Current Assignee : Individual

Worldwide applications
2017 · US CA

[6]

Turn the sensor on. Maintain a good posture while setting your standard position. Vibe lets you lean forward more than 15 degrees from your standard position for 5 seconds. A vibration then reminds you to correct your posture. Vibe stops vibrating once you are back in your standard position. To charge Vibe, connect the USB data cable to a USB device.

- Improves your posture
- Vibrations remind you to correct your posture
- An effective, yet discrete, posture coach in a small pocket size.
- Magnetic closure
- Wear on chest or back
- Use all day. Vibrates after 5 seconds in a bad position.

[7]

Figure 1 — Accommodation span and near point in relation to age of user

5.1.3 Design viewing direction

For normal use in which the user moves his or her head, a display shall be legible from any angle of inclination up to at least 40° from the normal to the surface of the display, measured in any plane.

Depending on the task, other limit values are possible. For example, for tasks requiring privacy, such as display use in crowded environments, the display should be only legible to a maximum angle of inclination between 15° and 20°.

EXAMPLE People in wheelchairs wishing to withdraw cash from an automatic teller machine in privacy are obliged to read the ATM display from a fairly low viewpoint. Their requirements can be met by a display that is only legible to a maximum angle of inclination between 15° and 20° in the horizontal plane, but downwards to a larger angle, of at least 40°, in the vertical plane.

[8]

Posture correction device

Images (8)

USD818132S1

United States

Download PDF | Find Prior Art | Similar

Inventor: Amadeo Peter Hille

Current Assignee : Individual

Worldwide applications

2017 · US CA

[9]

199.90

Cosmetic Backpod Original

Product dimensions

Weight	500 g

Package dimensions

Length	21.50 cm
Width	15 cm
Height	7 cm
Weight	520 g

[10]

About Us

The Backpod® was developed to counteract the back pain and headaches that result from poor posture in our modern lives. Working and spending leisure time on computers and smartphones exacerbate these postural problems.

It all started with a random discussion in 2010 between Steve August, a manual physiotherapist from Dunedin, and Nick Laird, head of the Otago University Design School. Steve August noticed that he was increasingly treating young people who were already struggling with back and neck pain due to their lifestyle. Nick Laird then talked to Andrew Wallace, an industrial design lecturer with over 25 years of professional experience and winner of several international design awards.

The three of them decided to develop something to counteract the pain problem. Thus the Backpod® was developed by Andrew Wallace, according to the therapeutic requirements of Steve August. The Backpod® was to be an effective, profound stretching and self-mobilization tool.

The rest is history - and a lot of hard work!

The Backpod® is manufactured in Christchurch, New Zealand. The first Backpod® in its current form was produced in 2012 and is now distributed in many countries around the world.

Since its introduction, the Backpod® has won numerous international business, innovation and design awards, including the German Red Dot award in 2013. In 2015, it was honored with the German Design Award.

We are very proud to have been able to help so many people around the world.

[11]

Annex 4: Product classes specific limit values according to Annex 4
부록 4: 부록 4에 따른 제품 등급별 제한수치

OEKO TEX®
STANDARD 100

Product Class / 제품 등급	I Baby / 유아	II in direct contact with skin / 피부와 직접적인 접촉	III with no direct contact with skin / 피부와 직접적인 접촉이 없음	IV Decoration material / 장식재료
Colourants / 착색제 [mg/kg]				
Cleavable carcinogenic arylamines / 분리가능 발암성 아릴아민계 [9] [13]	20	20	20	20
Cleavable arylamines under observation / 관찰 중인 분리 가능 아릴아민 [9] [13]	u.o. / 관찰중 [10]			
Cleavable Aniline / 분리가능 아닐린 [9] [14]	20	50	50	50
Carcinogens / 발암물질 [9]	50	50	50	50
Colourants with ≥ 0.1% Michler's Ketone/Base / 착색제 < 0.1% Michler's Ketone/계열 [9]	1000	1000	1000	1000
Allergens / 알레젠 [9]	50	50	50	50
Others / 기타 [9]	50	50	50	50
Navy Blue / 네이비 블루 [9]	not used / 사용금지			

[9] The individual substances are listed in Annex 5 / 개별 물질은 부록 5에 정리되어 있음

[13] The sum of cleavable carcinogenic arylamine and if possible also as chemical residue present free carcinogenic (same) arylamine has to be also 20 mg/kg / 분리가능한 발암성 아릴아민과 아마도 화학 잔류물이 없는 발암성(동일) 아릴아민의 합계도 20mg/kg 미만이어야 함

[10] u.o. = under observation; substance is tested randomly and result provided for information purposes; presently not regulated / u.o.=관찰중; 물질이 무작위로 테스트되며 정보 목적으로 결과가 제공됨; 현재 실제로 규제되지는 않음

[14] The sum of cleavable aniline and if possible also as chemical residue present free aniline has to be also 20 mg/kg (product class I) resp. 50 mg/kg (product classes II till IV) / 분리 가능한 아닐린과 가능한 경우 아닐린 성분이 없는 화학 잔류물 합계도 20 mg/kg 미만(제품 등급 I), 50 mg/kg (제품 등급 II-IV까지)이어야 함

[12]

15 Limitation of voltage and/or energy

a) Not used.

b) EQUIPMENT intended to be connected to the SUPPLY MAINS by means of a plug shall be so designed that 1 s after disconnection of the plug the voltage between the supply pins of the plug and between either supply pin and the ENCLOSURE does not exceed 60 V.

Compliance is checked by the following test:

EQUIPMENT is operated at RATED voltage or at the upper limit of the RATED voltage range.

EQUIPMENT is disconnected from the SUPPLY MAINS by means of the plug with the EQUIPMENT mains switch in the "On" or "Off" position whichever is least favourable.

The voltage between the pins of the plug and between either pin and the ENCLOSURE is measured 1 s after disconnection with an instrument the internal impedance of which does not affect the test.

The measured voltages shall not exceed 60 V.

[13]

Table 1 – Classification of climatic conditions

Environmental parameter	Unit					
		3K20	3K21	3K22	3K23	3K24
Low air temperature	°C	+20 [d]	+15	+5	−5	−25
High air temperature	°C	+25 [d]	+32	+40	+55	+55
Low relative humidity [a]	%	20	10	5	10	5
High relative humidity [a]	%	75	75	85	100	100
Low absolute humidity [a]	g/m^3	4	2	1	0,5	0,5
High absolute humidity [a]	g/m^3	15	22	25	29	29
Rate of change of temperature [b]	°C/min	0,1	0,5	0,5	0,5	0,5
Low air pressure [f]	kPa	70	70	70	70	70
High air pressure [f]	kPa	106	106	106	106	106
Solar radiation [g]	W/m^2	No	500	700	700	700
Heat radiation	Not specified	No	[e]	[e]	[e]	[e]
Movement of surrounding air [c]	m/s	0,5	1,0	1,0	1,0	5,0
Condensation	Not specified	No	No [h]	No [h]	Yes	Yes
Water from sources other than rain	Not specified	No	No	No	Dripping water	Dripping water
Formation of ice and frost (including freeze-thaw)	Not specified	No	No	No	Yes	Yes

[a] The low and high relative humidity severities are limited by the low and high absolute humidity and high and low temperature. The extreme severities of relative humidity, absolute humidity and temperature cannot occur simultaneously. See Annex A.

[b] Averaged over a period of time of 5 min.

[c] A cooling system based on non-assisted convection may be disturbed by adverse movement of surrounding air.

[d] These are air-conditioned locations with a tolerance of ±2 °C on the stated temperature value.

[e] Conditions occurring at the location concerned to be selected from Table 2.

[f] If applicable, a special value may be selected from Table 2.

[g] Secondary effects from the solar radiation behave as heating effect.

[h] Limited to no occurrence of condensation.

[14]

4.6 Procedure

4.6.1 Quantity of test liquid

The quantity of test liquid used shall be at least 8 ml per square centimetre of the total surface area of the specimen in order to avoid too high a concentration of any extracted products in the liquid during the course of the test. The test liquid shall cover the specimen completely.

NOTE A different quantity of liquid might, however, be specified in particular International Standards; for example, for rigid PVC and polyolefin pipes, where the amount of extractable substances is known to be very small, a smaller quantity of liquid is specified in the relevant International Standards.

4.6.2 Positioning of specimens

Place each set of test specimens in a suitable container (see 5.2) and completely immerse them in the test liquid (using a weight if necessary). When several materials of the same composition are to be tested, it is permissible to put several sets of specimens in the same container.

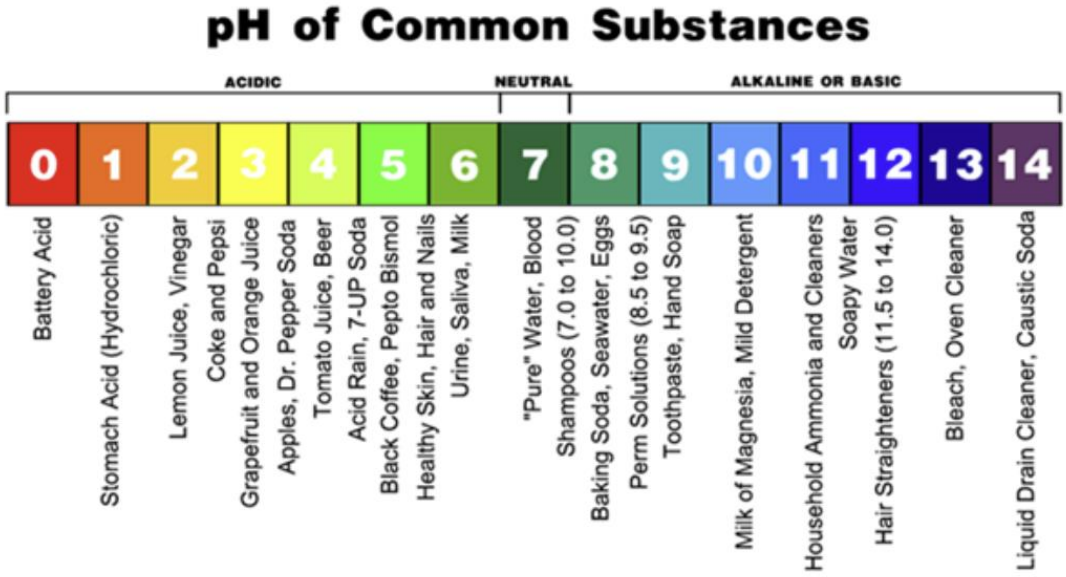
Ensure that, for every specimen, only an insignificant proportion of the surface of the specimen makes contact with the surfaces of other specimens, with the walls of the container or with any weight that is used.

During the test, stir the liquid, for example by swirling it in the container, at least once per day.

If the test lasts longer than seven days, replace the liquid with an equal amount of the original liquid every seventh day (see Note 2 to 4.6.3).

If the liquid is unstable (for example in the case of sodium hypochlorite), replace the liquid more frequently.

[15]



[16]

Here's the good news. We can at long last lay to rest the debate over what's the right size for a phone because I just made up an answer: 6.1 inches. All phones henceforth shall adhere to the new, entirely reasonable standard I have invented and come with a 6.1-inch screen. Take the Google Pixel 6A and its — you guessed it — 6.1-inch screen.

[17]

4 Principle

The specimen to be tested is placed on an electrically heated plate with conditioned air ducted to flow across and parallel to its upper surface as specified in this International Standard.

For the determination of thermal resistance, the heat flux through the test specimen is measured after steady-state conditions have been reached.

The technique described in this International Standard enables the thermal resistance R_{ct} of a material to be determined by subtracting the thermal resistance of the boundary air layer above the surface of the test apparatus from that of a test specimen plus boundary air layer, both measured under the same conditions.

For the determination of water-vapour resistance, an electrically heated porous plate is covered by a water-vapour permeable but liquid-water impermeable membrane. Water fed to the heated plate evaporates and passes through the membrane as vapour, so that no liquid water contacts the test specimen. With the test specimen placed on the membrane, the heat flux required to maintain a constant temperature at the plate is a measure of the rate of water evaporation, and from this the water-vapour resistance of the test specimen is determined.

The technique described in this International Standard enables the water-vapour resistance R_{et} of a material to be determined by subtracting the water-vapour resistance of the boundary air layer above the surface of the test apparatus from that of a test specimen plus boundary air layer, both measured under the same conditions.

[18]

What is the coefficient of evaporative resistance?

Breathability is measured using the Thermal Evaporative Resistance (RET) coefficient. It measures the capacity of a fabric to stop water vapour getting out. The lower this resistance (i.e. the lower the coefficient), the more breathable the fabric!
(The test method is defined by the ISO 11092 standard).

How to choose breathable clothing

The RET score uses a numerical index:

- RET < 6: The material is extremely breathable, keeping you comfortable during your most intense physical activities
- RET between 6 & 12: The material is very breathable, making it suitable for moderate efforts
- RET between 12 & 20: The fabric is moderately breathable, and therefore not particularly pleasant to wear during a physical effort
- RET > 20: The fabric is not very breathable and therefore not suitable to be worn during physical exercise

[19] RET > 40: The fabric is considered non-breathable

Flexible orthoses are made of a soft material, such as cotton/elastic blends, canvas, and/or neoprene (a type of synthetic, flexible rubber). These braces include corsets, lumbar belts, and sacroiliac belts.

Flexible lumbar belts or corsets typically come in a variety of sizes and designs. A corset brace looks similar to a woman's corset, and allows for some limited bending. Corsets typically include vertical metal or plastic stays at the front, back, and/or sides of the brace that provide stability and some motion restriction.

Lumbar belts and sacroiliac belts provide somewhat more restriction in movement, and are typically made of a sturdier fabric without stays.

Flexible corsets and belts can help relieve lower back pain by:

- Applying light pressure to the torso to help adjust posture and shift weight off of the spinal column
- Providing some added spinal support to take pressure off of weakened or injured muscles
- Moderately limiting range of motion to allow for some bending and twisting. For instance, while wearing a flexible brace, it may be possible to bend forward enough to touch the top of the knee, but not past the knees

[20] - Reducing micro-motion at a loose or weakened joint through compression of the torso

Several identical prototype shells of a new telephone handset design were weighed in different ways to produce five different overall weights, ranging from 130 to 340 g, and three different balance conditions: transmitter-heavy, receiver-heavy, and balanced. Fifty-two subjects drawn from working people of both sexes and a range of ages participated in pair-comparison tests in which each subject gave a preference judgment for one handset over another for all possible pairs of handsets. They also rated each handset as acceptable or unacceptable. The best overall handset weighed 176 g with the weight equally distributed between transmitter and receiver. The lightest handset (130 g, balanced) was actually preferred by a majority of people over the balanced 176-gram set but twice as many people rated it unacceptable (31% vs 14%). All handsets weighing 176 g or less and the balanced handset weighing 224 g were rated as acceptable by at least two-thirds of the subjects. It is recommended that designs aim at a balanced handset weighing approximately 176 g. It would not be worthwhile to add weight to an unbalanced 176-gram set to bring it into balance.

[21]

8. Avoid sharp corners; use generous fillets and radii. This is a universal rule applicable to castings and molded, formed, and machined parts. Generously rounded corners provide a number of advantages. There is less stress concentration on the part and on the tool; both will last longer. Material will flow better during manufacture. There may be fewer operational steps. Scrap rates will be reduced.

[22]

Concerns

Draw Attention: "Draw attention" was obtained as the first subcategory of this category. The adolescents expressed worries about wearing braces to school, as well as worried about what their classmates might think, feel, or say about them. Explaining their new situation to peers was detected as one of their primary concerns that resulted in being ashamed. Before attending school, they guessed that peers would ridicule them if their braces were seen and were concerned about how they would be seen. Additionally, all adolescents preferred that only their close friends were aware of their brace use and intended to hide it from other classmates. Some students were concerned about being questioned at school because other brace-wearing students had already faced this issue. Additionally, parents who spoke on behalf of their children confirmed this concern.

[23]

Although this subject often invites differing opinions, most ergonomic experts suggest maintaining a **slightly reclined posture**, with an angle of approximately **100°-110° between your legs and back**.

This posture helps **distribute your body weight evenly across the chair and backrest**, easing the burden on your spine. Furthermore, it promotes a relaxed and alert state that is ideal for productivity and maintaining focus.

[24]

Table 1 — Trunk posture

Postural characteristic	Acceptable	Go to step 2	Not recommended
1) Symmetrical trunk posture [a]			
No			X
Yes	X		
2) Trunk inclination α [b]			
$> 60°$			X
$20°$ to $60°$ without full trunk support		X	
$20°$ to $60°$ with full trunk support	X		
$0°$ to $20°$	X		
$< 0°$ without full trunk support			X
$< 0°$ with full trunk support	X		
3) For sitting: convex lumbar spine posture [c]			
No	X		
Yes			X

[a] With a symmetrical trunk posture, there is neither axial rotation nor lateral flexion of the upper part of the trunk (thorax) with respect to the lower part of the trunk (pelvis) (see Figure 1).

[b] Posture during task execution (dark body segment, solid line) with respect to the reference posture (white body segment, broken line) when viewed from the side of the trunk (for α see Figure 2, where forward inclination is given a positive sign). Annex A describes the procedure for determining trunk inclination.

[c] Convex curvature of the lumbar part of the spine (see Figure 3). This posture is more likely to occur

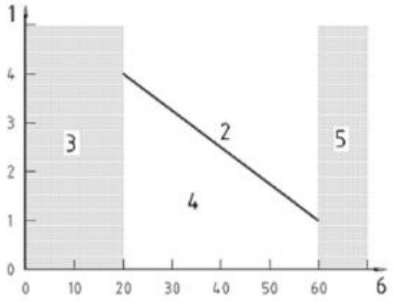
— when the lumbar spine is not supported by a backrest, and

— when a small hip angle is adopted (see 3.7).

Table 2 — Holding time for trunk inclination

Holding time	Acceptable	Not recommended
$>$ maximum acceptable holding time [a]		X
$\leqslant$ maximum acceptable holding time [a]	X	

[a] Taken from Figure 4.

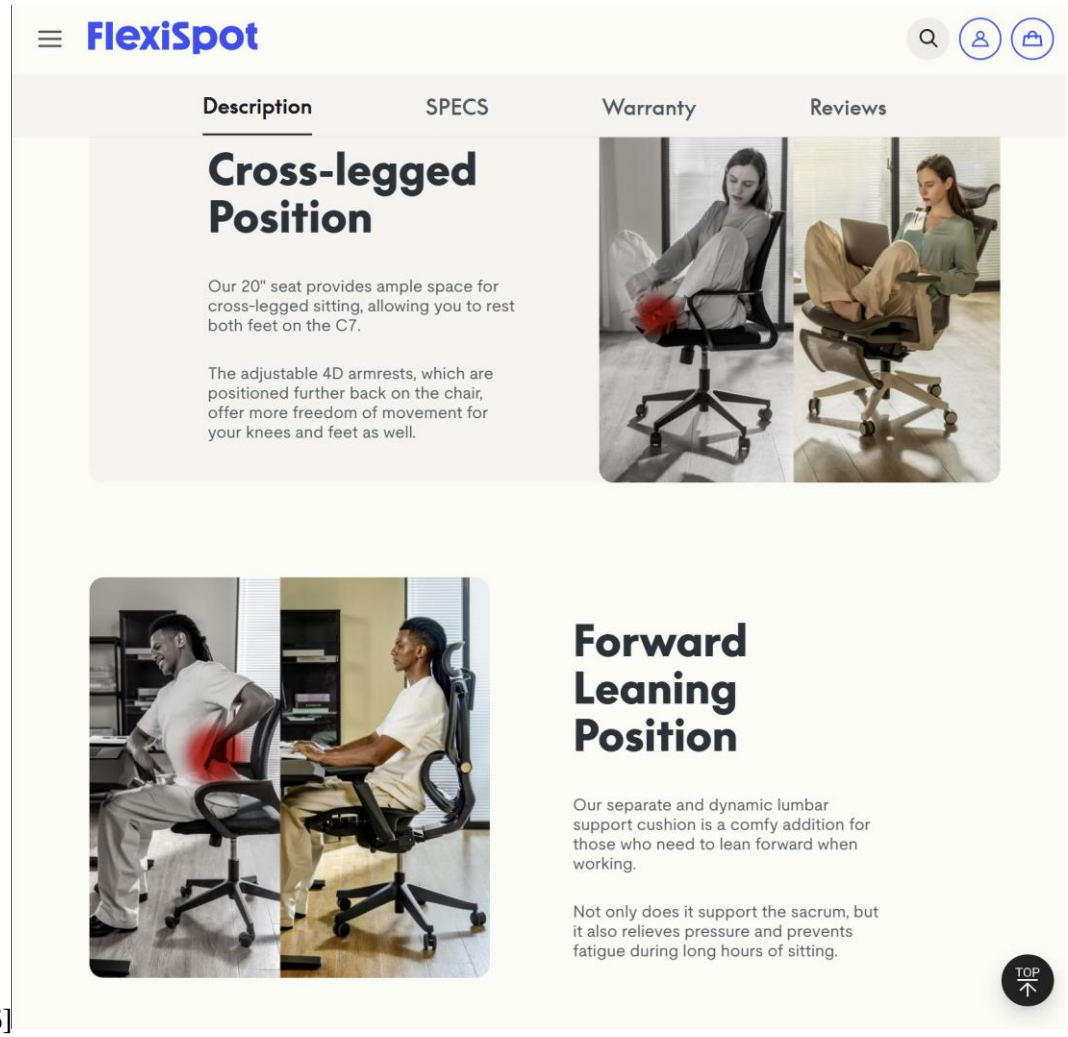


Key

1 Maximum acceptable holding time (minutes)
2 Not recommended
3 See 3.4.1, step 1
4 Acceptable
5 See 3.4.1, step 1
6 Trunk inclination α (degrees vs. reference posture)

Figure 4 — Maximum acceptable holding time vs. trunk inclination

[25]


FlexiSpot
Description
SPECS
Warranty
Reviews
Cross-legged Position
Our 20" seat provides ample space for cross-legged sitting, allowing you to rest both feet on the C7.
The adjustable 4D armrests, which are positioned further back on the chair, offer more freedom of movement for your knees and feet as well.
Forward Leaning Position
Our separate and dynamic lumbar support cushion is a comfy addition for those who need to lean forward when working.
Not only does it support the sacrum, but it also relieves pressure and prevents fatigue during long hours of sitting.
TOP

[26]


Perfectly Molds to Your Body's Conours
Relieve Lumbar Pressure-Simulate the S curve of human boday,
Perfectly fit the lumbar
Back Support Area
A
Cervical Support Area
B
C
Lumbar Support Area
A
B
C

[27]