



Ergonomics
Programme Approach
For the Ergonomics
Regulations, December 2019.



1. AIM

The aim of this document is to provide employers, self-employed persons, and employees, as well as designers, manufacturers, importers and suppliers, with additional information on how to implement the Ergonomics Regulations through the implementation of a programme approach. This document should be read in conjunction with other applicable legislation and codes published by the Department of Employment and Labour, including, but not limited to:

- Occupational Health and Safety Act, Act 85 of 1993 as amended and relevant regulations promulgated under Section 43;
- Basic Conditions of Employment Act, Act 75 of 1997 as amended,
- Codes of Practice on the Arrangement of Working Time;
- Compensation for Occupational Injuries and Diseases Act, Act 130 of 1993 as amended and Instruction 180;
- Labour Relations Act, Act 66 of 1995, as amended;
- Employment Equity Act, Act 55 of 1998 as amended,
- Code of Practice on the Prevention and Elimination of Harassment in the Workplace;
- Code of Good Practice on Employment of Persons with Disabilities; and
- Other legislation which is applicable to work systems

2. WHAT IS ERGONOMICS

Ergonomics is a multi-disciplinary, human-centred applied science. The terms 'ergonomics' and 'human factors' may be used interchangeably, but for the purpose of this document, the term ergonomics will be used.

Ergonomics takes a systems approach and applies theory, principles and data from many related disciplines to the design and evaluation of work systems (i.e. organisational factors, tasks, jobs, products, environments, individuals, tools, equipment and technology). In the context of applying ergonomics within work systems, the interaction of humans with work systems must address the physical, cognitive and organisational factors which impact on human performance. An explanation of the physical, cognitive and organisational factors, and the interactions of these, is provided below and illustrated in Figure 1.

- **Physical factors** are concerned with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity.
- **Cognitive factors** are concerned with mental processes, such as perception, memory, reasoning, and motor response, as they affect interactions among humans and other elements of a system.
- **Organisational factors** are concerned with the optimisation of sociotechnical systems, including their organisational structures, policies, and processes.

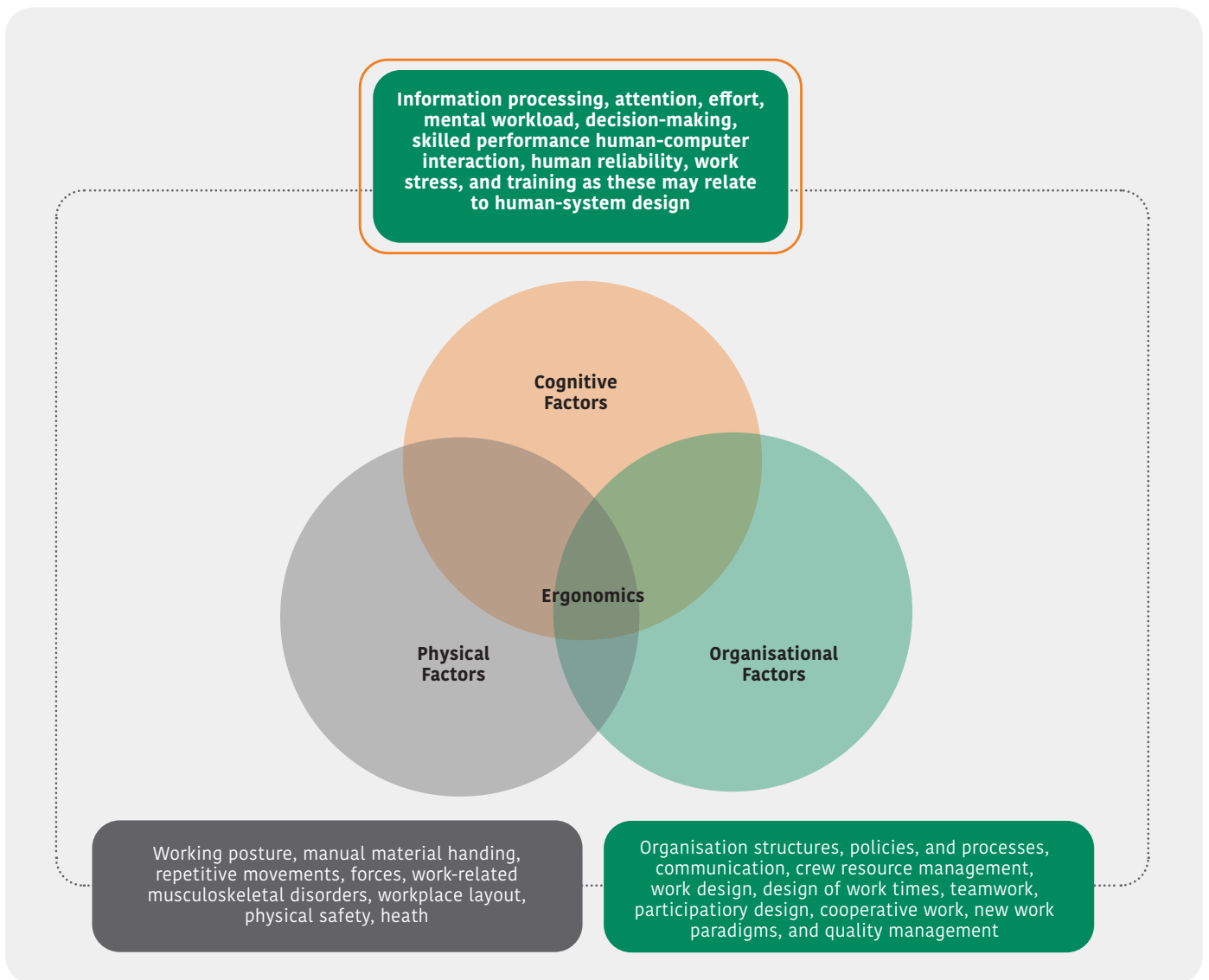


Figure 1: The interaction of the different factors of ergonomics impacting on human performance. (Source: Adapted from International Ergonomics Association. <https://iea.cc/about/what-is-ergonomics/>)

Ultimately, ergonomics is an interaction between the three factors, as well as elements of the system. Therefore, when addressing ergonomics within a workplace, the ergonomics programme must address the factors and the interaction of the factors of ergonomics and not just one or two in isolation.

3. PROGRAMME APPROACH FOR IMPLEMENTING ERGONOMICS REGULATIONS IN WORKPLACES

An ergonomics programme is a proactive approach which takes all applicable legislation and requirements relating to ergonomics and implementing a plan which is tailored to the ergonomic risks in the workplace. It is advisable that the programme:

- is implemented in a planned and documented manner;
- outlines practicable strategies for identifying and correcting ergonomics risks in a variety of workplace settings;
- considers ergonomic risks covering all aspects of the work system, from cradle-to-grave (i.e. tools/equipment, task/jobs, working environment, organisational factors and humans);
- takes a participatory approach, involving all relevant stakeholders (e.g. employers, employees, health and safety professionals, designers, manufacturers, suppliers and importers); and
- integrates with existing occupational health and safety management systems.

The success and sustainability of an ergonomics programme will depend on management commitment and employee engagement and participation.

4. OUTCOMES OF AN ERGONOMICS PROGRAMME

The outcomes listed below, are possible outcomes from the implementation of an ergonomics programme, prioritising health and safety as a fundamental right for all employees.

- **Outcome 1:** Proactively ensure employees' health, safety and well-being in the optimisation of work systems.
- **Outcome 2:** Design and manage work systems to ensure organisational and employee alignment, continuous evaluation and learning and sustainability.
- **Outcome 3:** Create a healthy, safe and sustainable work environment from a holistic perspective, understanding and providing for human needs.
- **Outcome 4:** Account for individual differences and organisational contingencies in the design of work systems.
- **Outcome 5:** Make use of collective, multi-disciplinary knowledge and full participation of employees for designing systems, detecting problems and creating solutions for ergonomics in work systems.
- **Outcome 6:** Improve overall work system productivity and quality.

5. IMPLEMENTATION OF THE ERGONOMICS PROGRAMME

An ergonomics programme should be implemented and maintained through a continuous improvement process. The steps listed below may be used as a guideline for the implementation of the ergonomics programme.

- Identify relevant stakeholders to contribute towards developing and managing the programme;
- Identify existing gaps across the organisations' occupational health and safety management systems, including ergonomic risk factors and customise the programme to the needs and identified gaps;
- Use existing employer/employee consultation to assist with planning and developing the ergonomics programme (the health and safety components, as listed in section 6 below "Components of an Ergonomics Programme"), based on the needs of the organisation;
- Develop a proactive plan to get buy-in and management commitment and support and involvement of all relevant stakeholders;
- Implement an ergonomics programme that covers all aspects of the work system, from cradle-to-grave and takes into consideration all employees, including vulnerable employees;
- Create an environment which enables a sustainable, internally controlled/regulated ergonomics programme

It is also important that the Ergonomics Regulations are not read in isolation. Therefore, when designing, implementing and maintaining the ergonomics programme, consideration must be taken of all applicable Acts, Regulations Codes of Practice, Instructions, as mentioned in the aim of this document.

6. COMPONENTS OF AN ERGONOMICS PROGRAMME

An ergonomics programme is an ongoing process, which ideally should be proactive in nature. However, in some circumstances, a reactive response is necessary.

The components of an ergonomics programme include the following as a minimum;

- Ergonomics risk assessment
- Risk control
- Risk based medical surveillance
- Incident and occupational disease reporting and investigation
- Maintenance of control measures
- Information, training and instruction
- Review, monitor and evaluate
- Updating the ergonomics programme

7. UNPACKING THE COMPONENTS OF AN ERGONOMICS PROGRAMME

7.1 Ergonomics Risk Assessment

An ergonomics risk assessment is a holistic, systems-based approach, which helps to ensure the effective identification, analysis and control of ergonomic risk factors. The ergonomics risk factors may result because of any imbalance or incompatibility between the characteristics of the:

- employee capabilities and limitations
- task being performed
- tools or technology being used
- environment they exist in, and
- organisation context

The ergonomics risk assessment must be conducted in line with the requirements of regulation 6 of the Ergonomics Regulations. An ergonomics risk assessment needs to encompass the physical, cognitive and organisational factors, as illustrated in Figure 1, as well as the interactions between these factors, rather than evaluating them in isolation from each other. All ergonomics risk assessments that are conducted, regardless of the reason for the risk assessment (e.g. baseline, issue-based, post-incident risk assessment), should be incorporated into the wider organisation's risk management system.

The risk assessment process can make use of qualitative and or quantitative assessments. These two processes may be linked, in that the information obtained in the qualitative may influence where quantitative assessments are conducted. Conversely, the information obtained from the quantitative may be fed back into the qualitative assessment and therefore influencing risk ratings and possible controls to be implemented.

An ergonomics risk assessment is not necessarily a stand-alone risk assessment. The ergonomics risk assessment may be incorporated into an existing risk assessment but must include ergonomic risk factors. There are a number of different methods to be used when conducting a risk assessment. However, irrespective of the method used, the employer should be able to explain the objectivity and systemic process followed, when conducting the risk assessment.



7.1.1 Ergonomic Risk Assessment Process

Figure 2 illustrates the ergonomics risk assessment process, showing the steps to be followed when conducting the risk assessment. The figure emphasizes the cyclical nature of a risk assessment and management process.

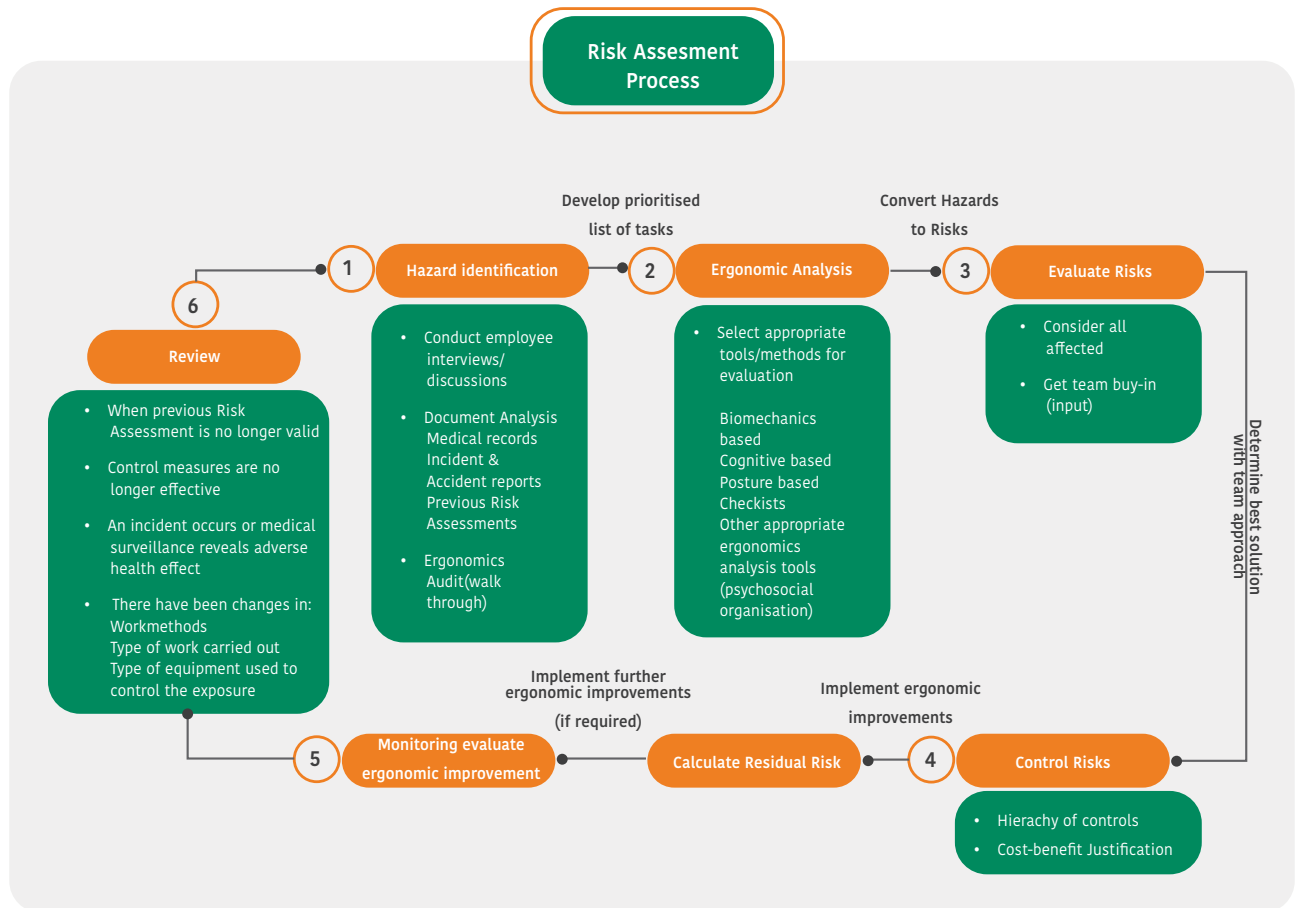


Figure 2: Ergonomics Risk Assessment Process

7.1.2 Ergonomics Risk Factors

Within the workplace, there are actions, tasks and conditions which may result in physical and cognitive adverse health effects. These actions, tasks and conditions are referred to as ergonomics risk factors. When experienced in isolation, or as a result of the interaction between the individual risk factors, reduced overall human well-being, performance and productivity may be observed. Figure 3 below provides some of the examples related to each of the factors and elements of ergonomics.

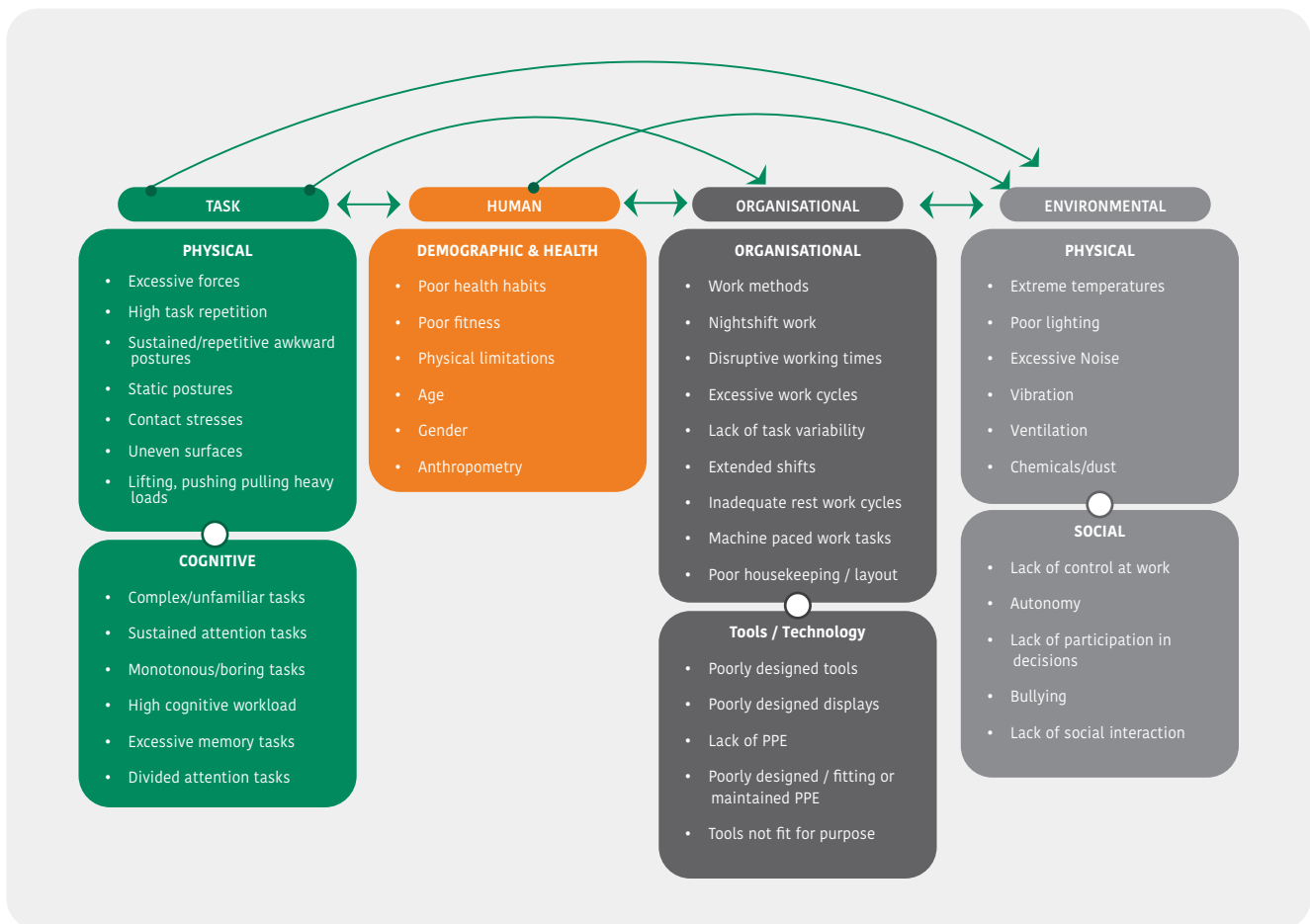


Figure 3: Examples of Ergonomics Risk Factors.

Examples of scenarios with ergonomic risks related to tasks applicable in a number of sectors, have been identified and provided in Annexure 1.

7.1.3 Who should perform the Risk Assessment

To ensure that risk assessments are carried out correctly and to the benefit of the employer and their employees, it is advised that a multidisciplinary team is used, which is led by a competent person (refer to Department of Employment and Labour, Competent Person Guideline, as well as Ergonomics Regulations for a full definition). The multidisciplinary team may be sourced from individuals or employees who have other skills, knowledge and experience relating to ergonomic risk factors and or the workplace.

7.1.4 Tools for the risk assessment

There is no universal risk assessment tool or method that applies to all ergonomic risk factors, tasks, jobs and workplaces. The employer must ensure that a competent person completes the ergonomics risk assessment, ensuring that the appropriate tools or methods are used. Depending on the contexts, qualitative and or quantitative risk assessment tools may be used.

Some examples of tools/methods include:

- Document review/ analysis (e.g. review of employee records, investigation reports, medical statistics, etc.)
- Observation-based methods (e.g. walk-throughs, focus groups and interviews with employees, postural assessments, manual materials handling checklists etc.)
- Direct measurement methods (e.g. heart rate, force measurements, anthropometric measurements, 3-D scanning of the whole body/ segments, etc.)
- Predictive Modelling (e.g. fatigue biomathematical modelling, biomechanical modelling, human body modelling, etc.)

7.2 Risk Control

Regulation 7 of the Ergonomics Regulations requires the employer to prevent, or to reduce ergonomic risks to As Low As Reasonably Practicable, using the below prescribed order of priority (hierarchy of controls). The hierarchy of controls is a step-by-step approach to eliminating or reducing workplace hazards. It ranks controls from the most effective to the least effective level of protection. When choosing a control method, start from the top of the inverted pyramid. Assess the feasibility of the first layer of controls (elimination) before moving on to the second layer (substitution). Continue this process until you reach the bottom of the pyramid and have identified as many controls as needed to adequately protect the employee from the ergonomic risk.

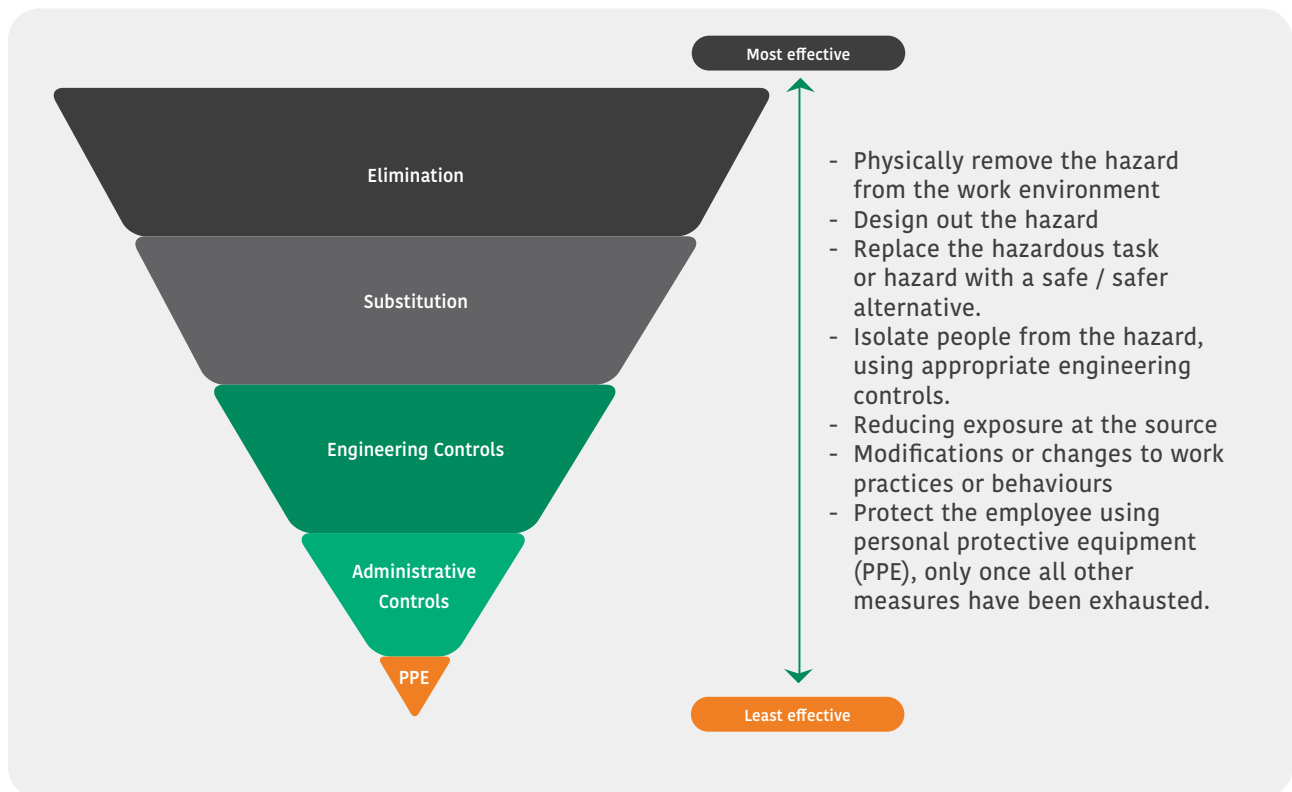


Figure 4: Hierarchy of controls

A holistic, systems-based ergonomics approach remains important in the control of ergonomic risk factors, to ensure that employees' well-being and overall system performance are optimised. For the effective control of ergonomics risk factors, it is likely that a combination of the hierarchy of controls is needed.

When selecting and implementing control measures, emphasis must be placed on:

- management commitment;
- a participatory approach (employee participation);
- systematic implementation, including, but not limited to; trial periods, evaluation of effectiveness, modifications, full-scale implementation and post-implementation re-assessment of risks; and
- consideration of vulnerable employees.

7.3 Medical Surveillance

The Ergonomics Regulations and explanatory notes provide requirements and guidance on who must undergo medical surveillance and when they must undergo it. Ultimately, it is the employer's responsibility to ensure that those employees identified by the ergonomics risk assessment, must undergo medical surveillance. However, the medical surveillance programme is overseen by the Occupational Medicine Practitioner (OMP). The OMP is responsible for drawing up the components of the medical surveillance, but may request for other professionals in

the medical field/s to assist them with the implementation of the medical surveillance programme.

A multidisciplinary approach is central to the success of the medical surveillance programme. Aspects of the programme may include, but not limited to:

- a functional job analysis to determine the inherent physical, mental and psychosocial demands of the job; and
- medical and functional assessment of the individual employee to determine whether they meet the functional job demands in a safe and productive manner.

As with the ergonomics risk assessment, vulnerable employees must also be considered during these processes.

Medical Surveillance, as an ergonomics data and information collection method of employees' medical or health information, is part of and defined in the Occupational Health and Safety Act and Ergonomic Regulations. An important aspect of medical surveillance is screening, which consists of medical test/s or procedure/s of employees for a particular disease to assess the likelihood of them having or developing the disease.

All information obtained from medical screening or surveillance should be fed back into the risk assessment process, in order to review current hazards and control measures. However, medical information must be recorded as confidential personal or human health data or information, in accordance with health care professions ethical and practice guidelines, as well as relevant Acts.

7.4 Maintenance of Control Measures

The maintenance of control measures introduced in the workplace is essential to ensure they function correctly and continue to protect employees from the hazard they were designed to control. Well maintained control measures may eliminate or mitigate the risk of occupational diseases or incidents and reduce downtime or shutdowns. In addition to these, it may also extend the lifespan of the work systems, resulting in cost and time savings.

Employers should ensure that control measures are, and remain effective, by: tracking the progress of the implementation of the control measure/s, regular inspection and evaluation of control measure/s once it has been implemented and ensure regular preventive maintenance practices are followed.

7.5 Information, Instruction and Training

Employees and other persons exposed to ergonomics risk factors are required to be informed and trained on those risk factors they are exposed to, in order to understand ergonomic risks within the work system.

The employer is required to develop an appropriate training programme, specific to their workplace and the ergonomics risk factors within that workplace. It is not only a requirement that the training is provided, but also what is covered in the training. The Ergonomics Regulations provides guidance as to what must be covered by the training programme. The Regulations do not specify the mode of delivery of the training, as this will be determined by specific situations within individual workplaces. The mode of delivery should be taken into account when considering the dynamics of the workplace, workforce and whether the training is understood.

7.6 Records

In order for employers to have evidence of the implementation of the Ergonomics Regulations, records must be kept of documents stipulated in the Regulations. This includes documents relating to training, risk assessment, risk control, maintenance of controls and medical surveillance. The Regulation does not stipulate in what format (physical or electronic) the records must be kept. Therefore, it is up to the employer to decide, based on the specific situation at that workplace. The employer must ensure that the records are kept for the minimum stipulated period and should be protected against damage or loss or any other circumstance which may affect the records being kept for the stipulated period.

8. REVIEW

An ergonomics programme should be implemented and maintained through a continuous improvement process, keeping in mind the requirements of the Ergonomics Regulations. This would ensure that all elements of the programme have been accurately identified and captured and that the programme fully meets the needs of the organisation and its employees. This is an important step in the overall ergonomics programme, since the work system and or the organisational context may change over time and with it, different ergonomics requirements or needs may emerge. The review should cover all the components of the ergonomics programme, but should pay particular attention to any new work areas, work tasks, equipment and employee needs. The review of the ergonomics programme should be done using relevant stakeholders, with knowledge of the work environment.

The implementation, and continuous review of the ergonomics programme will encourage or facilitate a sustainable, internally driven ergonomics culture within the organisation, which contributes to a successful ergonomics programme.

9. ROLES AND RESPONSIBILITIES OF STAKEHOLDERS

Stakeholders, in the context of ergonomic risks in the workplace, includes employers, employees at all levels and positions; as well as designers, manufacturers, importers or suppliers of machinery, plant or work systems for use at a workplace. Each stakeholder group is assigned legislated duties by among other things, the Occupational Health and Safety Act, Ergonomics Regulations, Basic Conditions of Employment Act, and Labour Relations Act.

In brief summary, employers are under a duty to provide and maintain a working environment that is safe and without unreasonable risk to the health of their employees, by providing the means and resources to identify, evaluate and control potential ergonomic risks in the workplace. Employees are under a corresponding duty to abide by and properly use all measures and safeguards put in place by the employer and to report any risks and incidents. Designers, manufacturers, importers and suppliers are under a duty to reduce or eliminate ergonomic risks at all stages of their product or service lifecycle.

While some stakeholder duties are absolute in nature, other duties are qualified by what is reasonably practicable in the circumstances. Absolute duties must be complied with regardless of the cost, time, or other factors; and includes duties such as conducting risk assessments, reporting risks, keeping records, and obeying lawful instructions. Where legislation requires that a duty must be implemented as far as reasonably practicable, a balance must be found between the cost of removing or reducing the risk and the benefits of doing so, also taking into consideration the severity of the risk, as well as current knowledge and availability of appropriate control measures. Examples of these duties include the implementation and maintenance of control measures; and the design, manufacture, import and supply of machinery, plant, or work systems.

A list of possible stakeholders, as well as some of their roles and responsibilities is provided below in Table 1. The ergonomics programme requires a multistakeholder participation. However, the employer should use what resources it has available in that approach, provided that those resources have knowledge of the workplace.

Table 1: List of stakeholders.

Stakeholder	Roles and Responsibilities
Employer (executive management)	<ul style="list-style-type: none"> duty to provide and maintain a working environment that is safe and without unreasonable risk to the health of their employees, by providing the means and resources to identify, evaluate, and control potential ergonomic risks in the workplace
Employee	<ul style="list-style-type: none"> abide by and properly use all measures and safeguards put in place by the employer, and to report any risks and incidents
Union representatives	<ul style="list-style-type: none"> Motivate employees to comply with ergonomics risk assessment and programme
Health and safety representatives and committee members	<ul style="list-style-type: none"> Contribute to the identification, evaluation, reporting and investigation of matters relating to ergonomics in the workplace Contribute to the development, implementation and review of policies and procedures which affect the management of ergonomics risks
Health and safety professionals	<ul style="list-style-type: none"> Contribute to the identification, evaluation, measurement, monitoring, recording and investigation of matters relating to ergonomics in the workplace Contribute to the development, implementation and review of policies and procedures which affect the management of ergonomics risks
Engineering	<ul style="list-style-type: none"> Incorporate ergonomics considerations in the design plant, machinery, or work systems Ensure assessments include ergonomics considerations or requirements across the whole design lifecycle
Maintenance	<ul style="list-style-type: none"> Provide feedback on issues identified in the workplace which may introduce or exacerbated ergonomic risks Ensure maintenance instructions provided by designers, manufacturers, importer and suppliers are adhered to reduce ergonomic risks exposure to employees
Human resources management	<ul style="list-style-type: none"> Recruitment and selection processes include screening for relevance to the task ergonomics requirements: physical, cognitive and psychosocial requirements Individual variability is considered, as to prevent discrimination Ensure policies and procedures support a just culture within the organisation
Procurement or Supply chain management	<ul style="list-style-type: none"> Procurement should include specifications of plant, machinery and work systems which incorporate ergonomics considerations
Training and development	<ul style="list-style-type: none"> Incorporate specifications from designers, manufacturers, importers and suppliers into training programme
Designers, manufacturers, importers or suppliers	<ul style="list-style-type: none"> under a duty to reduce or eliminate ergonomic risks at all stages of their product or service lifecycle
Risk management	<ul style="list-style-type: none"> Ensure that ergonomic risk management is addressed at all levels of the organisation Risk management approaches are cognisant of the unexpected risks within the work system
Contractor management	<ul style="list-style-type: none"> Adhere to the ergonomics requirements, both as an employer and of the client

RESOURCES AND ADDITIONAL READING

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Annexure 1: Ergonomics Scenarios

A number of workplace scenarios have been provided in the Tables below. Each scenario contains a number of potential ergonomic risk factors, as well as possible control measures using the Occupational hierarchy of Controls. The purpose of these scenario tables is to illustrate to employers and employees that one or more type of control measure (from the Hierarchy of Controls) may be required to effectively control or eliminate any particular ergonomic risk factor. These scenario tables are not exhaustive, and are not intended to replace conducting an Ergonomics Risk Assessment in the workplace.



The below scenarios are in relation to small parts assembly, computer-based work, lifting, packing, quality control and heavy driven machinery operator.

NOTE: If a block is left empty, it does not necessarily imply that a particular type of control measure does not exist.

Ergonomic Factor	Hierarchy of Controls				PPE
	Eliminate	Substitute	Engineer	Administrative	
<ul style="list-style-type: none"> Repetitive actions in upper limbs and hands (e.g., reaching, grasping) 	<ul style="list-style-type: none"> Fully automate highly repetitive manual tasks or activities 	<ul style="list-style-type: none"> Substitute high-quantity small individual items, for low-quantity 	<ul style="list-style-type: none"> Semi-automation of repetitive processes Redesign workstation to reduce reaching distances 	<ul style="list-style-type: none"> Task sharing Task rotation Task variation Increase the number of employees 	
<ul style="list-style-type: none"> Contact pressure or awkward grip in hands or fingertips during materials handling or operation of tools and equipment 			<ul style="list-style-type: none"> Equipment handles of suitable design, relative to size and weight of item handled Cushioned or padded tool handles and buttons Soft-touch tool buttons 		<ul style="list-style-type: none"> Material handling gloves, with sufficient dexterity and padding
<ul style="list-style-type: none"> Exposure to hand-arm vibration (HAV), for example, during use of power-tools 	<ul style="list-style-type: none"> Buy low-vibration emitting tools 		<ul style="list-style-type: none"> Repair and maintain tools to minimise vibration emissions Isolate the tool from the employee 	<ul style="list-style-type: none"> Reduce exposure time, through task rotation or work-rest periods. Implement health and safety standards, and procurement policy requirements for low-vibration tools 	<ul style="list-style-type: none"> Be aware that improperly selected gloves can potentially increase exposure to HAV.
<ul style="list-style-type: none"> Prolonged standing 			<ul style="list-style-type: none"> Sit-stand workstations Ant-fatigue mats 	<ul style="list-style-type: none"> Rest periods Provide seating, for when opportunities to sit may arise 	<ul style="list-style-type: none"> Safety shoe-insoles

Ergonomic Factor	Hierarchy of Controls				
	Eliminate	Substitute	Engineer	Administrative	PPE
<ul style="list-style-type: none"> Awkward postures, e.g., slouching, hunching, or reaching due to mis-matched work-height Sustained muscular effort, for example, operating hand-held tools for prolonged periods in a “raised-arm” position 		<ul style="list-style-type: none"> Design workstation heights to match the nature of the task/s, e.g., precision, light, or heavy work Change the workplace layout Provide steps or platforms for shorter employees Mount frequently handled heavy power tools onto an overhead tool-balancer system 	<ul style="list-style-type: none"> Work rest periods Employee information and training Reduce exposure time to extremes in heat, noise, or chemicals. Maintain roller- conveyors in sound condition Allocate a sufficient number of 	<ul style="list-style-type: none"> Appropriate hearing protective equipment Cooling vests (if exposure to “extreme” heat exists) 	
<ul style="list-style-type: none"> Exposure to environmental factors, such as noise, heat, poor airflow, or airborne chemical agents; poor task lighting Temperature extremes may cause employees to experience physiological stress, job dissatisfaction, increased, stress, or long-term illness. Noise exposure may cause noise induced hearing loss, interference with safety-critical communications, and increased experience of stress Pushing or pulling parts on a conveyor Sustained attention, for example, monitoring and counting machine output parts 	<ul style="list-style-type: none"> Buy low-noise equipment 	<ul style="list-style-type: none"> Ensure sufficient ventilation controls (general airflow, air conditioning, fresh air changes) Acoustic insulation or isolation of noisy equipment Ensure suitable area- and task-lighting Install automated conveyors Angle roller-conveyors at a decline 	<ul style="list-style-type: none"> Automate physically or cognitively demanding processes 	<ul style="list-style-type: none"> Task rotation, or task variation 	
<ul style="list-style-type: none"> Human-system interactions, for example cognitive overload or insufficient information leading to error or incident due to: <ul style="list-style-type: none"> Too many simultaneous alarms Poor prioritisation of alarms 	<ul style="list-style-type: none"> Eliminate alarms which have no defined operator response 	<ul style="list-style-type: none"> Adjust settings on nuisance alarms Adjust repeating alarms 	<ul style="list-style-type: none"> Reduce the number of standing alarms; Set rules for deciding priority levels; Provide operator diagnostic training; Set a standard for maximum alarm rates 		

Ergonomic Factor	Hierarchy of Controls				
	Eliminate	Substitute	Engineer	Administrative	PPE
<ul style="list-style-type: none"> Human-computer interactions, for example, task delays or errors due to slow system performance; or poorly labelled control panel buttons 			<ul style="list-style-type: none"> Ensure computer software and hardware is suitable for the activity being performed. 		
<ul style="list-style-type: none"> Fatigue, due to night shift work, poor shift design, or early morning starts 	<ul style="list-style-type: none"> Eliminate night shifts 			<ul style="list-style-type: none"> Maintain a forward-rotating shift schedule. Rotate shifts either very quickly (e.g., every 2-3 days) or slowly (e.g., every 3-4 weeks). Avoid weekly/fortnightly rotating shift schedules. Limit shifts to 8-hours Provide employee information and training on health, diet, and lifestyle, sleep hygiene, and how to remain alert at work. Implement an employee wellness programme Ensure suitable transport arrangements, for night shift employees. 	
<ul style="list-style-type: none"> Excessive standby or overtime work, leading to fatigue, stress, or disruption of home life or sleep patterns. 				<ul style="list-style-type: none"> Ensure compliance with legislated working hours and overtime limits 	
<ul style="list-style-type: none"> Fatigue, due to insufficient rest periods 			<ul style="list-style-type: none"> Provide sufficient break facilities 	<ul style="list-style-type: none"> Ensure sufficient breaks during work 	
<ul style="list-style-type: none"> Pace of work is set by machines, for example, rapid loading and unloading of parts; or parts are assembled at a rate set by the conveyor line. 	<ul style="list-style-type: none"> Fully automate physically demanding processes 		<ul style="list-style-type: none"> Maintain machine speeds or production rates within employee capabilities Semi-Automate physically demanding processes 	<ul style="list-style-type: none"> Increase the number of simultaneous employees Ensure sufficient work rest periods 	

Ergonomic Factor	Hierarchy of Controls				PPE
	Eliminate	Substitute	Engineer	Administrative	
<ul style="list-style-type: none"> Pace of work is influenced by a piece-rate work system (employees are paid for each item of work completed) 			<ul style="list-style-type: none"> Implement appropriate engineering measures to reduce significant musculoskeletal demands, such as lifting aids, or process automation 	<ul style="list-style-type: none"> Plan workload/s or targets in advance, with employee capabilities in mind Ensure sufficient work rest periods Regulate overtime 	
<ul style="list-style-type: none"> Unmanageable workload Sudden changes in workload are not properly accommodated Insufficient training and information to perform task successfully 				<ul style="list-style-type: none"> Ensure a sufficient number of employees, relative to the demands of the task or operation Ensure sufficient employee training, experience, qualifications, relative to the demands of the task or operation Ensure that work methods are appropriate, clear, standardised where appropriate Ensure that workloads and deadlines are achievable. Facilitate employees' participation in decision making, with respect to optimising workload 	
<ul style="list-style-type: none"> Perceived time pressure, or increased work rate or physical demands to catch-up lost worktime due to production system disturbances, such as machine failures or parts quality. 			<ul style="list-style-type: none"> Ensure that assembly machinery is routinely serviced, maintained, and timeously repaired Provide and use appropriate preventative maintenance management software, to ensure timeous servicing, maintenance, and availability of parts. 		

SCENARIO 2: Computer-based work (Laptop, full-shift)						
Ergonomic Factor	Hierarchy of Controls					
	Eliminate	Substitute	Engineer	Administrative		PPE
Static, poor Posture	Optimal Workspace layout	separate standing workstations	Provide a sit-stand workstation	Take regular breaks; provide training the on importance of changing positions	Conduct risk assessments, medical screening and surveillance, limit exposure, training, maintenance	
Eye strain	Position monitor at correct distance from eyes		Provide adjustable monitor mounting stands; Optimise information displayed on screen	Take regular breaks		Provide blue-light glasses
Contact stresses			Provide ergonomic pads	Take regular breaks; provide training the on importance of changing positions		
Psychosocial stress	Optimal workplace design		Ergonomically sound desk, chair, etc.	Conducive workplace environment, physically and mentally		
Sustained attention				Take regular breaks and physical activity		
High workload	Effective workplace design and workload monitoring and management		Optimise information displayed on screen	Time management, physical activity		
Monotonous tasks			Optimise information displayed on screen			
Tight deadlines						
Work overload				Task rotation		
Pressure to complete KPIs				Negotiate more time		
Workplace culture as a source of psychosocial stress	Participatory workplace design			Better time management		
				Negotiate achievable KPIs		

SCENARIO 3: Packing

Ergonomic Factor	Hierarchy of Controls					
	Eliminate	Substitute	Engineer	Administrative		PPE
Awkward postures (bending, reaching, twisting)	Fully automate the packing process		Optimise shelf position (height, horizontal reach), provide a height-adjustable packing table Semi-automate the packing process	Job rotation, training in safe work body angles and movements	Conduct risk assessments, medical screening and surveillance, limit exposure, training, maintenance	
Manual Materials Handling (lifting, lowering, pulling, pushing) tasks	Fully automate the packing process		Provide mechanical aids (lifting aids, trolley jack) Semi-automate the packing process	Frequent risk assessments, Job rotation, training in correct lifting techniques, education in lifting is safe, provide sufficient number of packers		Provide Non-slip shoes
High task repetition	Fully automate the process		Semi-automate the packing process	Job rotation;		
Psychosocial stress	Optimise workplace			Social support, job autonomy and control, satisfaction		
Monotonous/boring tasks	Fully automate the process		Semi-automate the packing process	Job rotation		
Disruptive working times			Provide sufficient bright lighting at night	Provide sufficient rest between shifts, have an optimal shift rotation roster		
Insufficient staff numbers to handle volumes	Recruit sufficient resources			Provide adequate staff training.		
Extended working times				Optimise work/rest ratios		
Lack of PPE (gloves and boots)		Substitute heavier materials, for lighter weight materials	Reduce the size of the packing crates/containers to reduce the weight being carried.	Training in correct wearing of gloves		Provide gloves and boots for hand and foot protection

SCENARIO 4: Lifting					
Ergonomic Factor	Hierarchy of Controls				
	Eliminate	Substitute	Engineer	Administrative	PPE
One employee bends to pick up boxes from a pallet from the ground	<ul style="list-style-type: none"> Fully automated packing process by redesigning the production line to better link the delivery of boxes and placement onto the conveyor 	<ul style="list-style-type: none"> Change the product packaging characteristics and dimensions (weight, handles) to reduce the loading and repetition exposures. 	<ul style="list-style-type: none"> Use adjustable hydraulic pallet lifting device to keep the height around elbow height 	<ul style="list-style-type: none"> Assign more personnel to the lifting task to reduce workload and exposure on each employee Provide longer rest breaks and/or allow employees to self-pace so that they have sufficient recovery Rotating employees so that they only unpack a limited amount of pallets a day Screen employees who are experiencing health effects linked to the risks in this task during recruitment, medical surveillance etc. 	<ul style="list-style-type: none"> Assign employees an exoskeleton that is effective in minimising the loading on the musculoskeletal system during lifting (e.g. electric exoskeleton that can enhance strength capability) or when awkward postures are adopted
Employee places the box, still in twisted posture, on the conveyor belt which is at a 1.2m height			<ul style="list-style-type: none"> Redesign the conveyor belt height so that it is at approximately elbow-height, to allow employees to work upright. 	<ul style="list-style-type: none"> Write and adopt a procedure on lifting techniques that employees must consider, to mitigate lifting demands Train employees on strategies they can adopt to minimise the impact of awkward postures 	
Employee offloads 60 of the boxes onto the conveyor starting with highest at 1.6m high (excessive reaching and working above shoulder height) to the lowest at 30 cm from the ground and maximum reach distance of 80 cm			<ul style="list-style-type: none"> Use adjustable hydraulic pallet lifting device to keep the pallet height at around elbow-height 		

SCENARIO 5: Quality Control					
Ergonomic Factor	Hierarchy of Controls				
	Eliminate	Substitute	Engineer	Administrative	PPE
Take a sample of completed garments and lay it out on the worktable (hip height)	<ul style="list-style-type: none"> Re-design the process flow so that all the garments are laid out on the workstation, so the employee does not have to fetch and place individual garments 	<ul style="list-style-type: none"> Provide seat-stand workstation options 		<ul style="list-style-type: none"> Write and adopt procedures that assist with better integrating user requirements into workstation, task and organisational design Train employees on strategies they adopt to minimise the impact of awkward postures Provide longer rest breaks and/ or allow employees to self-pace so that they have sufficient recovery Job enlargement to improve the diversity of task requirements and to minimize exposure to the control task hazards 	
Check garment style and colour against an approved sample/ specifications	<ul style="list-style-type: none"> Automated scanning of garments (AI-powered and use of technology to check the quality of the garment) 	<ul style="list-style-type: none"> Design the workstation so that the tools are within the zone of comfortable reach Improve the lighting in the room so that visibility improves and does not negatively impact working postures 	<ul style="list-style-type: none"> Simplifying the garment design so there are fewer quality control points to check and lower error rates in the making of the garment 	<ul style="list-style-type: none"> When volumes of garments are high, rotate employees and/ or provide longer rest times 	<ul style="list-style-type: none"> Assign employees an upper-body exoskeleton that can assist with effectively minimising postural loading (stooped posture and working with the arms in an unsupported posture) experienced by the employee
Use a measuring tape to measure 6 different dimensions to confirm that the size and stitching is according to specifications	<ul style="list-style-type: none"> Automated measuring of garments (AI-powered and use of technology to check the dimensions of the garments) 	<ul style="list-style-type: none"> Quality checks to be done on a mannequin instead of the table (i.e. garment is placed upright in front of the employee to reduce awkward postures and excessive reaching 			

Ergonomic Factor	Hierarchy of Controls				PPE
	Eliminate	Substitute	Engineer	Administrative	
Place a sticker on the inside of the garments that are confirmed to be aligned with the specifications before sending samples to the next station (fit checking and other tests)	<ul style="list-style-type: none"> Design and implement a digital quality check/defect identification system that allows checked items to be scanned to confirm that specifications were checked 	<ul style="list-style-type: none"> Design and use stickers that are easier to peel and stick to minimise pinch and repetition-related musculoskeletal loading on the upper extremities and torso and to reduce handling time 	<ul style="list-style-type: none"> Design the workstation so that the tools are within the zone of comfortable reach 	<ul style="list-style-type: none"> Adjust the work schedule/work rest ratio to provide longer and or more frequent rest breaks, particularly when the volume of garments that have to be checked is high or when work is conducted under high time pressure 	
Use a measuring tape to measure 6 different dimensions to confirm that the size and stitching is according to specifications	<ul style="list-style-type: none"> Automated measuring of garments (AI-powered and use of technology to check the dimensions of the garments) 	<ul style="list-style-type: none"> Quality checks to be done on a mannequin instead of the table (i.e. garment is placed upright in front of the employee to reduce awkward postures and excessive reaching 	<ul style="list-style-type: none"> Simplifying the garment design so there are fewer quality control points to check and lower error rates in the making of the garment 	<ul style="list-style-type: none"> Assign employees an upper-body exoskeleton that can assist with effectively minimising postural loading (stooped posture and working with the arms in an unsupported posture) experienced by the employee 	
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SCENARIO 6: Heavy driven machinery operator (continued...)

Hierarchy of Controls					
Ergonomic Factor	Eliminate	Substitute	Engineer	Administrative	PPE
Seated task	<ul style="list-style-type: none"> Design seats to be adjustable Seat belts 	<ul style="list-style-type: none"> Build in adjustability of seats 	<ul style="list-style-type: none"> Adjustable seats to accommodate different types of users 	<ul style="list-style-type: none"> Provide backrest support pads Introducing stretching exercises for rest breaks Education & training 	
Access and egress of vehicles	<ul style="list-style-type: none"> Design according to anthropometrics 		<ul style="list-style-type: none"> Handrails Steps Steps with grip / anti slip Minimise gap between ground and first step 	<ul style="list-style-type: none"> Toolbox talks for 3-point contact Education & training for safe access in and out of vehicles 	<ul style="list-style-type: none"> Gloves (where applicable)
Repetitive action of sitting	<ul style="list-style-type: none"> Eliminate sitting for long periods 	<ul style="list-style-type: none"> Alternate sitting with standing when taking rest 	<ul style="list-style-type: none"> Design driving tasks to have short frequent breaks to allow for changes in posture Seat design affords comfortability and adequate circulation 	<ul style="list-style-type: none"> Introduce stretching exercises Limit long driving periods e.g. for every 2 hours rest for 30mins Educate and train employees on how repetitive sitting can impact performance 	<ul style="list-style-type: none"> Back support pads
Physical fatigue			<ul style="list-style-type: none"> Build in alert monitoring systems or introduce alert monitoring systems to register signs of fatigue 	<ul style="list-style-type: none"> Introduce stretching exercises Limit long driving periods e.g. for every 2 hours rest for 30mins Encourage walking when not driving Increase supervision and check-ins with drivers Educate and train employees on how fatigue can impact performance 	
Heat and cold temperature exposure	<ul style="list-style-type: none"> Design built in temperature control systems 		<ul style="list-style-type: none"> Allow for windows of vehicles to open 	<ul style="list-style-type: none"> Educate and train employees on how temperature can impact performance 	
Noise	<ul style="list-style-type: none"> Build into design 		<ul style="list-style-type: none"> Build out anti vibration noise contributions 	<ul style="list-style-type: none"> Rest breaks 	

Ergonomic Factor	Hierarchy of Controls				PPE
	Eliminate	Substitute	Engineer	Administrative	
Whole Body Vibration	<ul style="list-style-type: none"> Build into design 		<ul style="list-style-type: none"> Ensure adherence to proper maintenance schedules of vehicles Maintain workplace floor and roadway surfaces 	<ul style="list-style-type: none"> Rest breaks; task rotation 	
Reach to tools	<ul style="list-style-type: none"> Build into design centred on anthropometrics 		<ul style="list-style-type: none"> Adjustable seat design for forward and backward movement Adjustable steering wheel (where applicable) 		
Offloading / loading of goods			<ul style="list-style-type: none"> Use of forklifts / hoists / lifting aids 	<ul style="list-style-type: none"> Policies, procedures, standards and guidelines 	<ul style="list-style-type: none"> Gloves
Exposure to hazardous chemical substances				<ul style="list-style-type: none"> Safety Data Sheet Policies, procedures, standards and guidelines 	<ul style="list-style-type: none"> Gloves Masks Overalls
Prolonged concentration and attention			<ul style="list-style-type: none"> Build in alert monitoring systems or introduce alert monitoring systems to register signs of fatigue 	<ul style="list-style-type: none"> Introduce stretching exercises when taking a break Limit long driving periods e.g. for every 2 hours rest for 30mins Encourage walking when not driving Increase supervision and check-ins with drivers Educate and train employees on how fatigue can impact performance 	

Ergonomic Factor	Hierarchy of Controls				PPE
	Eliminate	Substitute	Engineer	Administrative	
Distraction	Design controls to minimise distraction / ease of use	Hands free communication	<ul style="list-style-type: none"> Fatigue / alert monitoring devices/ systems Cell phone use to be Bluetooth or hands free 	<ul style="list-style-type: none"> Implement a check-in system Policies, procedures, standards and guidelines 	
Mental fatigue			<ul style="list-style-type: none"> Build in alert monitoring systems or introduce alert monitoring systems to register signs of fatigue 	<ul style="list-style-type: none"> Introduce stretching exercises when taking a break Limit long driving periods e.g. for every 2 hours rest for 30mins Encourage walking when not driving Increase supervision and check-ins with drivers Educate and train employees on how fatigue can impact performance 	
Monotonous / repetitive work			<ul style="list-style-type: none"> Adequate labels Maintenance of controls labelling and brightness 	<ul style="list-style-type: none"> Introduce stretching exercises when taking a break Limit long driving periods e.g. for every 2 hours rest for 30mins Encourage walking when not driving Increase supervision and check-ins with drivers Educate and train employees on how fatigue can impact performance 	
Control and display designs	<ul style="list-style-type: none"> Design according to HF design principles (importance, frequency of use, sequence of use) 		<ul style="list-style-type: none"> Fatigue monitoring systems 		
Lone working			<ul style="list-style-type: none"> Fatigue monitoring systems 	<ul style="list-style-type: none"> 2 driver system for long distances Check-in system Radio 	

Ergonomic Factor	Hierarchy of Controls				PPE
	Eliminate	Substitute	Engineer	Administrative	
Shift work				<ul style="list-style-type: none"> design rosters according to shift work principles 2 driver system for long distances Check-in system Adequate rest breaks 	
Work: rest ratio	<ul style="list-style-type: none"> Design routes with adequate breaks 			<ul style="list-style-type: none"> design rosters according to shift work principles 2 driver system for long distances Check-in system Adequate rest breaks 	
Security threats			<ul style="list-style-type: none"> Guard rails around windows Bullet proof / smash and grab windows Communication devices in case of assistance 	<ul style="list-style-type: none"> Safe planning of routes for stoppages Rest breaks Stretching Back rest support 	
Design of vehicle (comfort)	<ul style="list-style-type: none"> Design according to anthropometrics requirements 	<ul style="list-style-type: none"> Adequate and comfortable seating and reach to controls 			



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