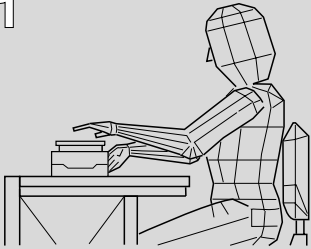


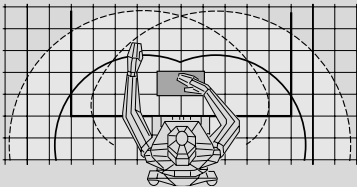
Manual Workplace Systems 7-Step Ergonomic Checklist

A guide to designing a workplace that fits the worker and the work task

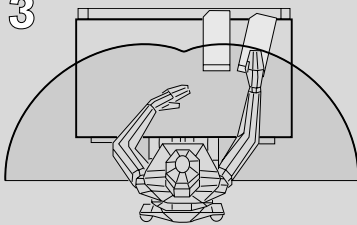
1



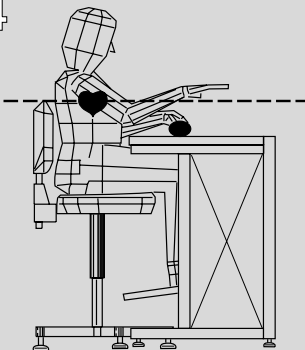
2



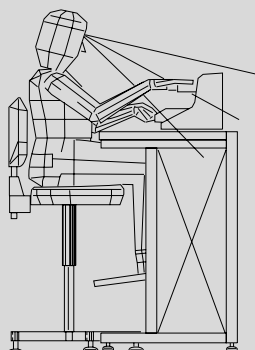
3



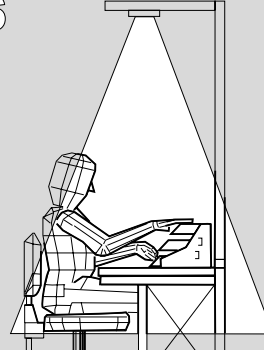
4



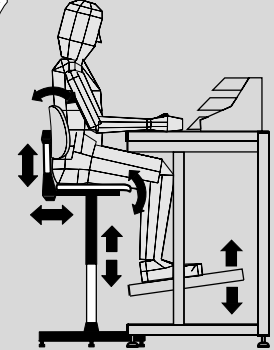
5



6



7



Manual Workplace Systems: 7-Step Ergonomic Checklist

The Importance of Making Workstations Fit Your Tasks and Your Workers

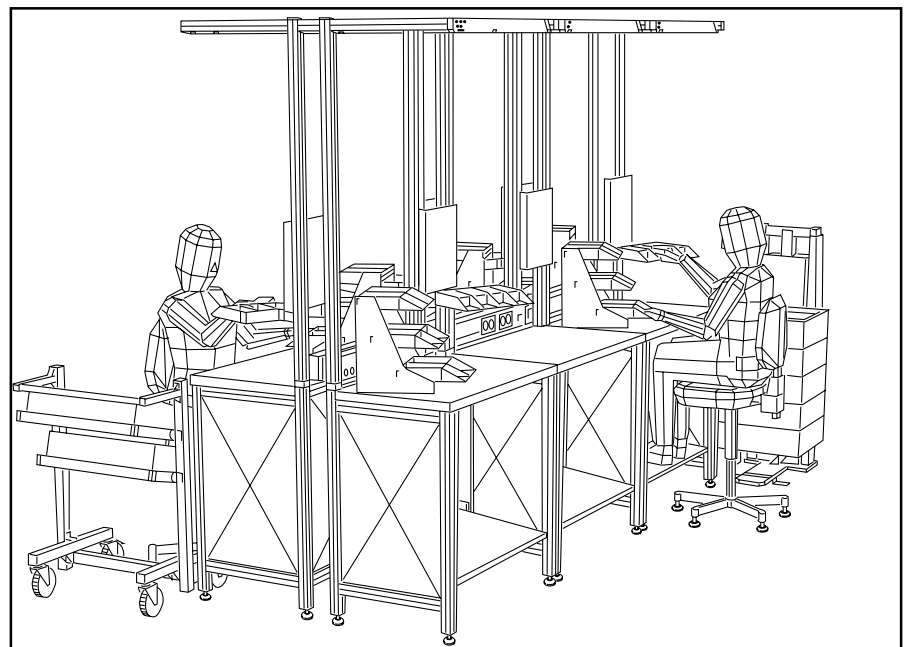
A work surface a little too low, a part slightly out of reach, lighting not quite bright enough. These situations, while seemingly insignificant, can have a detrimental effect on worker efficiency, safety, and morale. In turn, this directly affects productivity and manufacturing costs. In fact, many experts believe more productivity is lost due to these types of situations than to actual physical illness.

To help you achieve maximum worker efficiency, safety, and morale—and, hence, productivity—Bosch Rexroth has prepared this brochure on ergonomics in the workplace. Based on the Seven Fundamental Rules of Ergonomics, this brochure serves as a guide to help you design workstations that are right for each worker and right for each task.

Because when you take care of your workers, your workers will do a better job of helping you take care of business.



Workstations properly designed significantly increase worker productivity, morale, and product quality



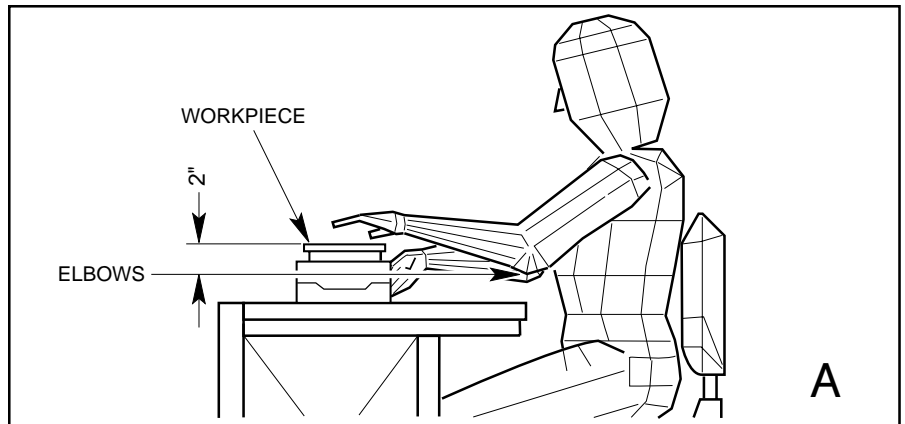
Bosch's AutoCAD-based MASsoft software allows you to design workstations to match your needs quickly and easily

Manual Workplace Systems: 7-Step Ergonomic Checklist

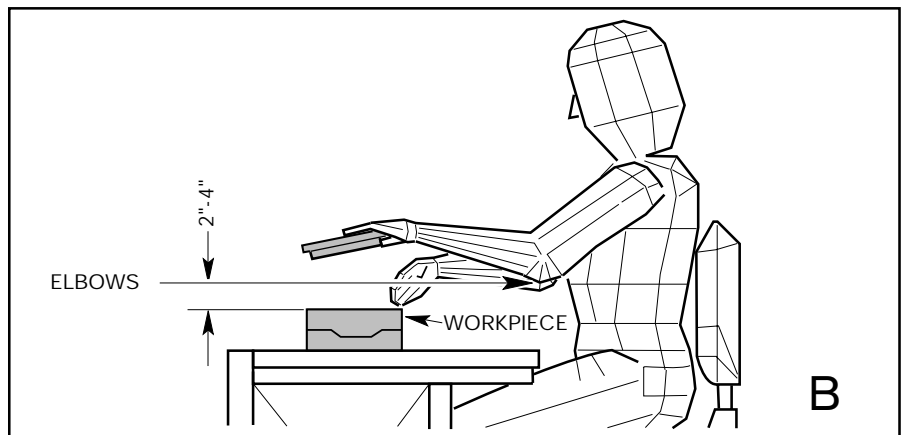
1. Consider Work Height

The worktable surface height must accommodate the postures, movements, and chair heights for a wide range of employee body sizes. Standard Bosch Rexroth workstations are designed to fit body heights from the 5th percentile female to the 95th percentile male workers (custom workstations are also available). When selecting workstation height, consider the following:

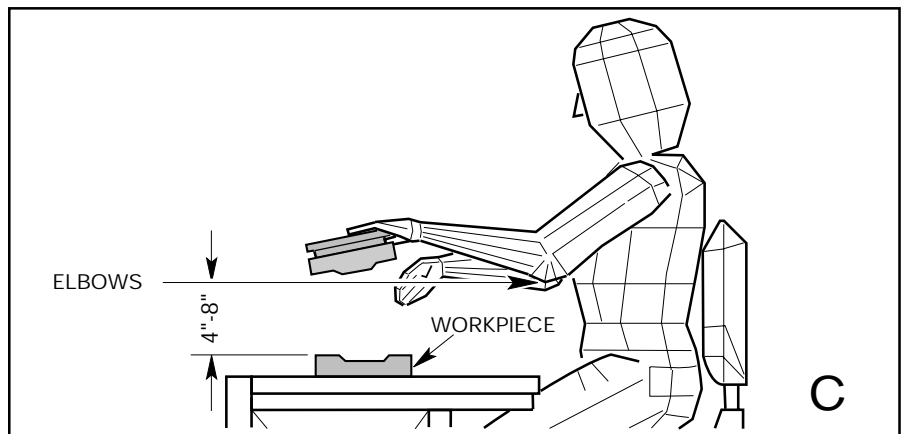
- A worker's arms should be below the shoulders; back and neck should be at less than a 20° to 30° incline.
- Ample leg room underneath the worktable top. Approximately 1" between legs and the bottom of work top. No obstruction, such as drawers, between legs and bottom of the work top.
- Height of the workpiece on top of the worktable is what affects worker's posture.
 - For precision and close inspection, workpiece should be 2" above worker's elbows. (See A)
 - For light assembly tasks (up to 5 lbs), workpiece should be 2" to 4" below worker's elbows. (See B)
 - For heavy work requiring force during assembly (5 to 10 lbs), workpiece should be 4" to 8" below worker's elbows. (See C)



Precise tasks 2" above elbow



Light assembly 2-4" below elbow



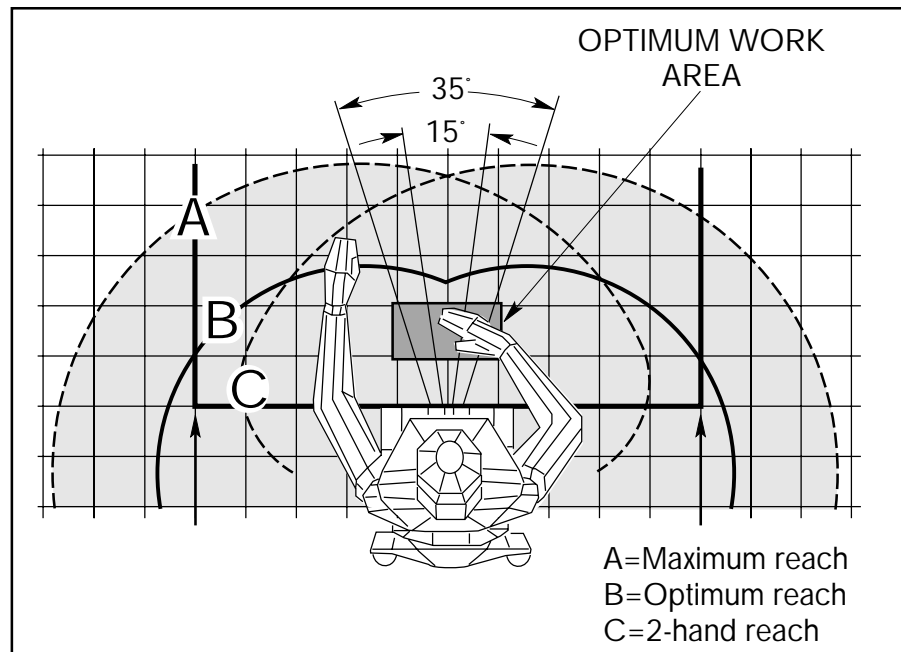
Heavy work 4-8" below elbow

Manual Workplace Systems: 7-Step Ergonomic Checklist

2. Consider Size of Grab Area

There are three grab areas for a worker: maximum, optimum, and two-hand. All parts, supplies, and tools should be placed within easy reach of the worker. Placing items within easy reach helps avoid body and arm twists and continuous wrist flexing when reaching for parts, which in turn reduces repetitive motion injuries.

- Maximum grab area. In general, 25", with worker leaning forward at the trunk, using the shoulder joint as the reference point for the measurement. (See A)
- Optimum grab area. In general, 12", with worker leaning forward at trunk, using the shoulder joint as the reference point. (See B)
- Optimum work area. A 10" x 10" box measured 5" from the front of the workers body.
- Two-hand extended reach with grip. In general, 22.5", with worker leaning forward at the trunk, using the shoulder joint as the reference point for the measurement. (See C)



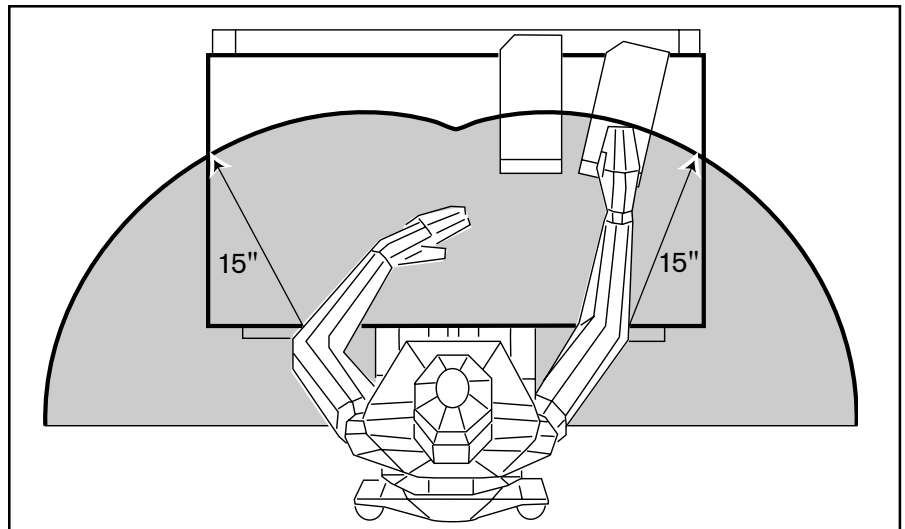
Consider grab area size to minimize worker reach and twist

Manual Workplace Systems: 7-Step Ergonomic Checklist

3. Optimize Parts Container Layout

Locate grab containers so grab distances are as short as possible. Following are some quick guidelines:

- Container layout should always be within easy reach and with a minimum motion—no further than 15" from the front edge of the workstation at any angle.
- Heavy parts should be placed in bottom containers on the work table surface. Reason: less exertion is required to move parts from the container in a parallel line to the work surface than would be needed to move parts in a top bin downward to the work surface.
- Position containers with parts used most often as close as possible to the worker.
- Position all containers in the optimum grab area (12" with worker leaning forward at trunk, using the shoulder as a reference point). Containers mounted on adjustable, articulating arms better follow the sweep of the optimum grab range than containers mounted flat at the back of the workstation.



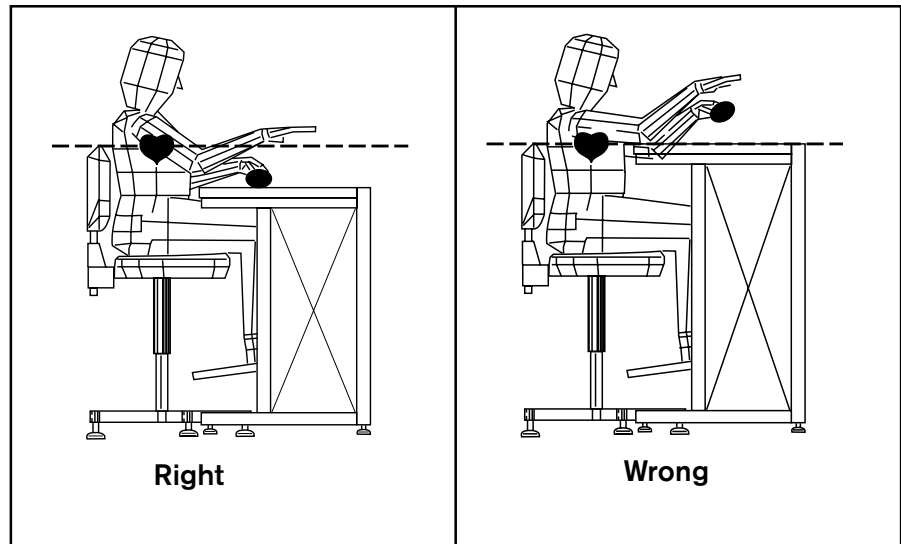
Optimize container layout to reduce wasted motion and speed piecepart throughput

Manual Workplace Systems: 7-Step Ergonomic Checklist

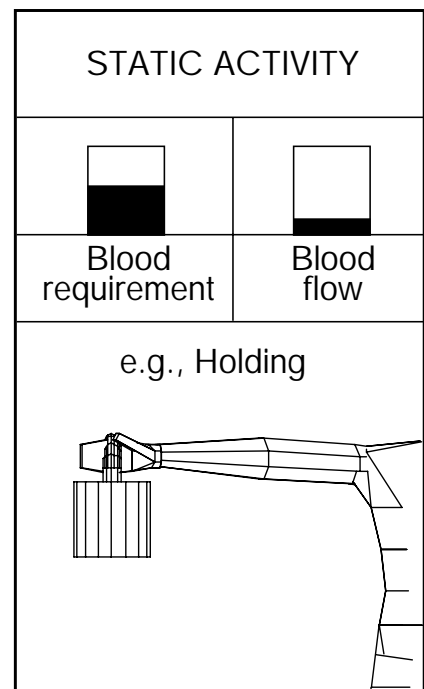
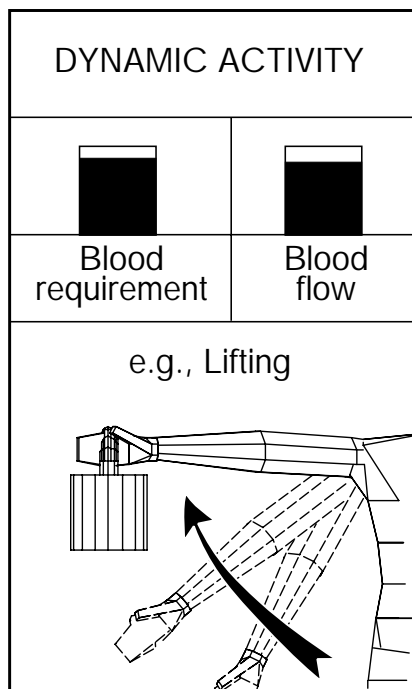
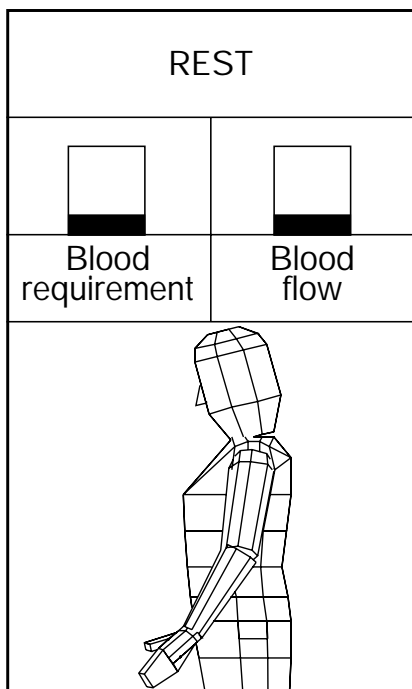
4. No Work Above the Heart

When designing a workstation, avoid placing workers in the following conditions:

- Work positions above the heart. This reduces blood circulation, which causes a worker's performance to rapidly decline.
- Static holding during assembly. This reduces blood flow to the muscles, which increases muscle fatigue. This in turn, reduces coordination, which is a leading cause of poor product quality.



Keep all work below the heart to enhance blood circulation

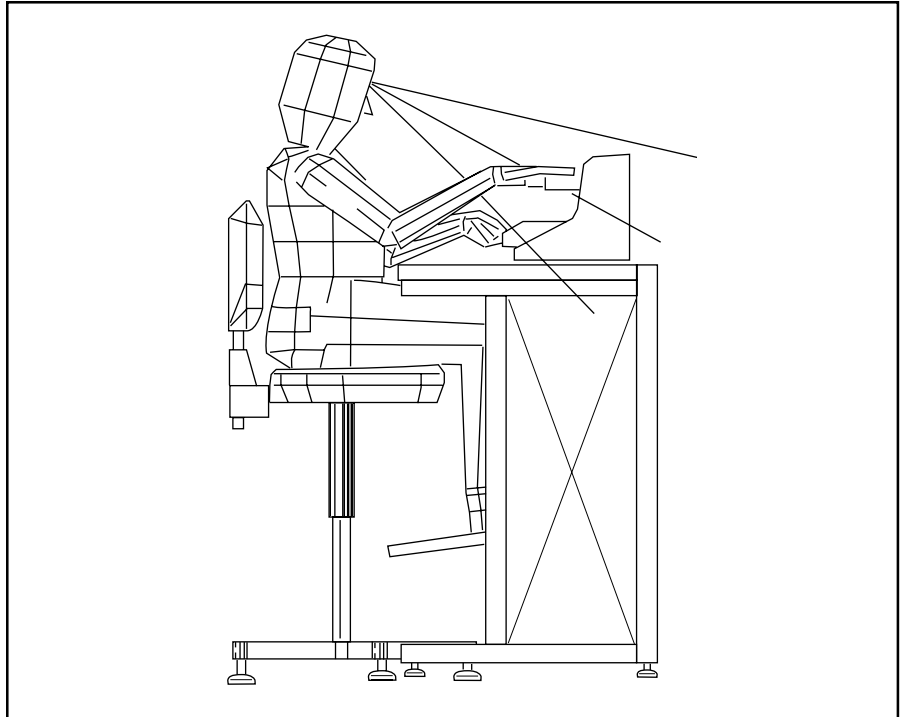


Avoid static holding activity to prevent restricted blood flow

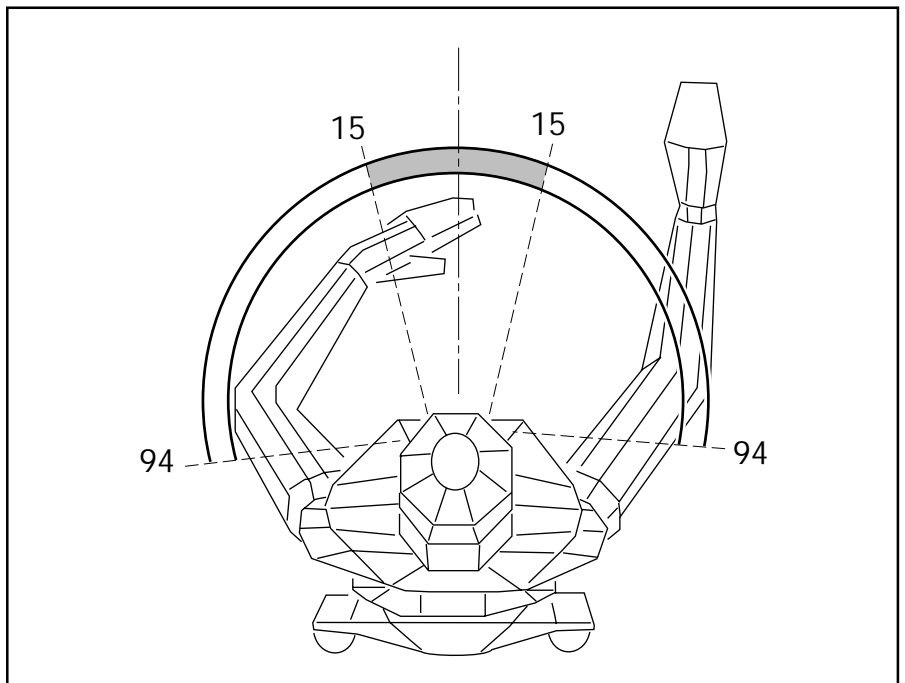
5. Consider Fields of Vision

The surroundings taken in by a worker's eyes, when the eyes and head don't move, is defined as the field of vision. It is desirable to minimize movement of the eyes and head during assembly or inspection operations. Reason: it takes approximately 3 seconds for the head to rotate and the eyes to rotate and refocus. During this process, piecepart throughput is reduced. When locating grab containers on the work top, consider the following:

- A 15° view angle requires no worker head or eye movement to grab parts. As a result, piecepart throughput should be at a maximum.
- A 35° view angle requires only the worker's eyes to move to grab parts. As a result, piecepart throughput is only slightly reduced.
- Position grab containers at equal vision range. This makes it unnecessary for a worker's eyes to adjust to varying distances every time he/she shifts viewing angles.



View work without turning head or eyes

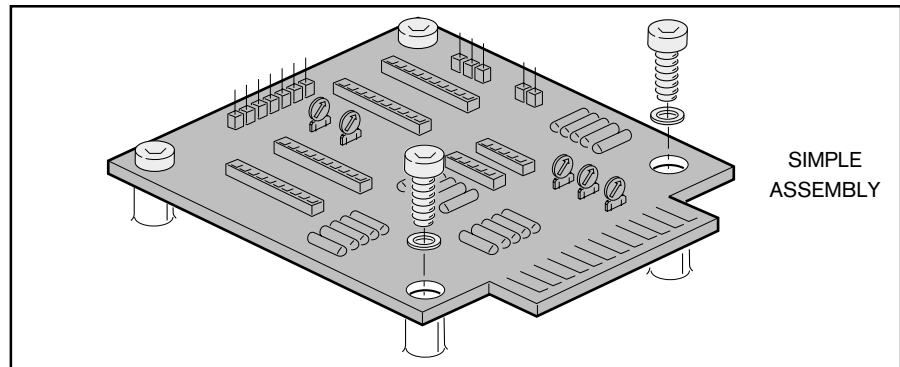


Minimize view angles to less than 35°

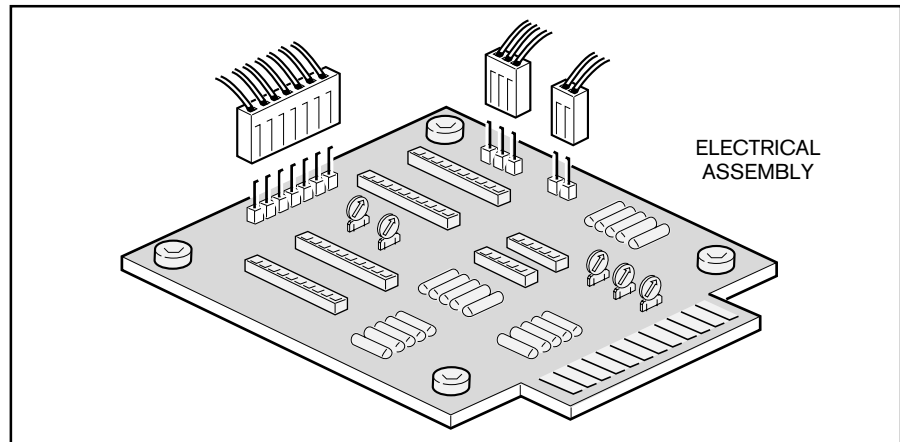
6. Match Light Intensity to the Work Task

Proper lighting is extremely important. The correct lighting for a task reduces errors and increases worker performance. Here are a few guidelines for matching the light intensity to the task.

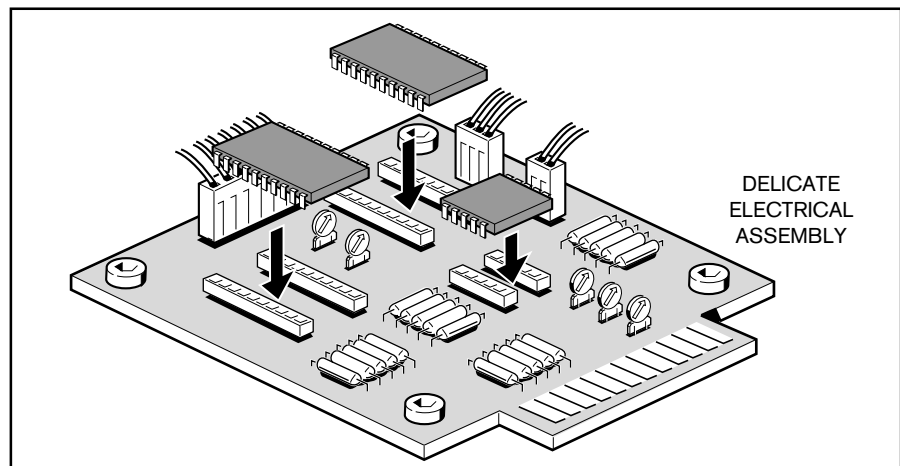
- 500 lux for simple assembly tasks such as telephones, small motors, printers, and automotive components.
- 1000 lux for testing electrical equipment and for assembling delicate electronics such as TVs and printed circuits.
- 1500 lux for adjusting and testing electrical equipment, assembling delicate electronics, and sorting assemblies for quality.



Standard light level-500 lux for most tasks



Better work definition at 1000 lux



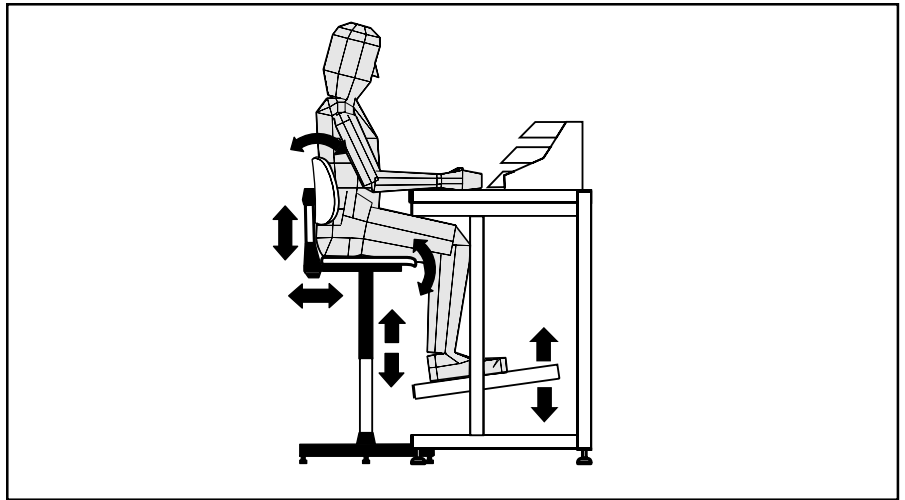
For critical work-1500 lux is required

Manual Workplace Systems: 7-Step Ergonomic Checklist

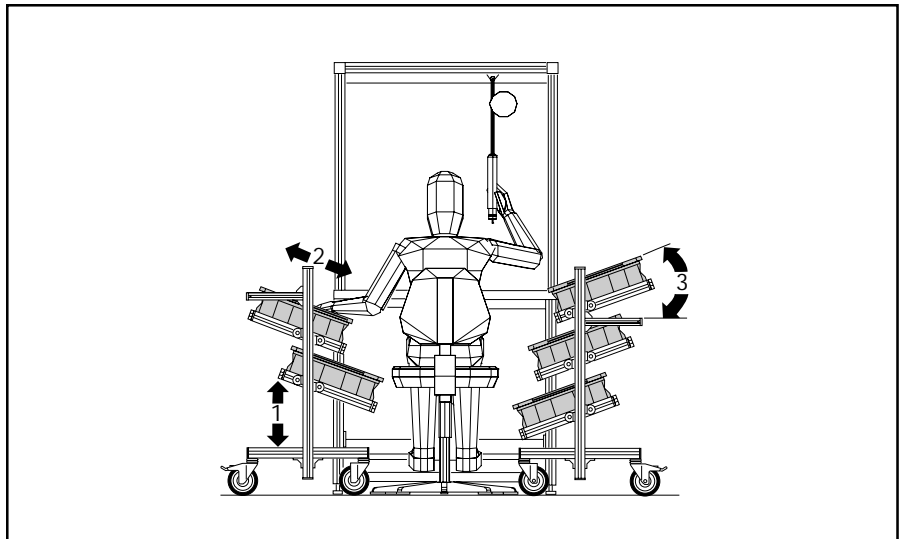
7. Properly Adjust Work Equipment to the Task

Table, chairs, grab container tool shelves, material shuttles, and parts case lifters should be adjusted to fit the worker and the work task. Properly adjusted equipment reduces worker stress thus lowering absenteeism, while increasing worker productivity and performance. Bosch Rexroth ergonomic workplace equipment is a coordinated modular system with the flexibility to quickly and easily make all required adjustments. Here's how:

- Worktable frames and material shuttles have longitudinal T-slots to adjust accessories or container shelves to the desired position.
- Work chairs have a height adjustable range to properly fit the 5th percentile female to the 95th percentile male seated worker at the workstation.
- Material shuttles have wheels to move parts around the workstation for easy part accessibility and quicker piecepart throughput.
- Grab container tool shelves let workers quickly adjust parts grab containers to fit the task.
- Case lifters have operator selectable height ranges between 25" and 43" to lift heavy parts to the desired work height.



Properly adjust workstations to worker



Properly adjust material shuttles to worker. 1 to raise, 2 to adjust in and out, and 3 to adjust desired angle.

Manual Workplace Systems: 7-Step Ergonomic Checklist

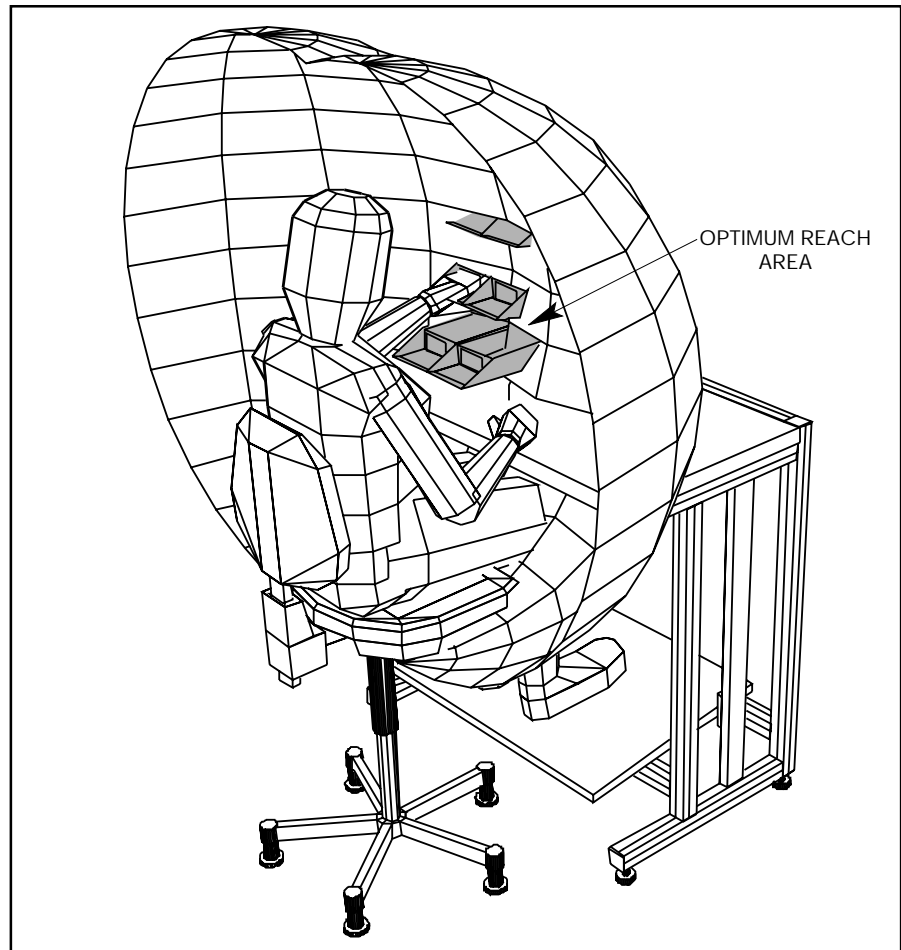
MASsoft Ergonomic Workplace Planning Software

Bosch Rexroth can provide systems integrators, equipment distributors, and end-users a powerful 3D AutoCAD based software package which provides better project visualization, reduced specification time, and increased ordering accuracy for workstation designs. MASsoft (Manual Assembly Systems software) uses icons or digitizer menus and parametric programming to quickly insert components, 3D mannequins, or individual modules of the Bosch Rexroth Ergonomic Workstation Equipment into a 2D or 3D drawing. Because parametric programming allows you to specify key dimensions, the MASsoft geometry is accurate in "real-world" coordinates.

Using MASsoft, workplace designers can adapt the workplace to any body height for reliable planning of grab areas and work flow.

Your authorized Bosch Rexroth distributor will be happy to provide technical assistance or deliver a copy of MASsoft to your facility. For the name and number of your local distributor call:

1-800-REXROTH
(1-800-739-7684)



Grab area for 5'5" woman

