

CASE STUDY -Assembling/Repairing (bench work)

TASK TITLE: Assembling/Repairing (bench work)

Task Description:	Bench work involving assembly and repair typically involves performing precise work on small to moderate sized component. This work often involves tasks such as wiring, cutting, crimping, soldering, melting, coating, drilling, bolting/screwing, and gluing. Additional recommendations may be found in the case studies related to these activities. Bench work can be performed in either a standing or seated posture. Consider using this case study to identify postural problems and recommendations in any situation where bench work is performed.
Job Performance Measures Most Often Impacted by Assembling/Repairing (bench work):	<ul style="list-style-type: none">• Time required to complete task• Quality of work (e.g., free of defects)-task specific
Typical Employee Comments about Assembling/Repairing (bench work):	Employees typically complain about discomfort and/or stiffness in the hands/wrists/arms, shoulders/neck and middle back/lower back. The primary body regions of concern are: hands/wrists/arms, shoulders/neck The secondary body regions of concern are: back/torso
Suggested Level II Analysis:	Grip Force Measurement, Postural Analysis, Dynamic Task Analysis, Light Measurement

Shoulder/Neck

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
1. Reaching	<ul style="list-style-type: none"> • Work location is too high • Reaching for components on the back of the work bench • Components/work piece are located too far away • Components/work piece are located too high • Reaching over components/clutter 	<p>120. Raise the chair</p> <ul style="list-style-type: none"> • adjust the chair upward • provide a cushion to raise the person, if the chair will not raise high enough • when the chair is raised, a foot rest may be necessary to support the feet <p>32. Lower the work piece/worksurface</p> <ul style="list-style-type: none"> • modify existing table (best if only one person is using the table) • provide an adjustable height work table <p>41. Move work piece closer to body</p> <ul style="list-style-type: none"> • place frequently used components closer to the person • infrequently used components should be removed from the workstation or placed at arm's length • store smaller quantities of components at the workstation at once 	✓ ✓ ✓	✓ ✓ ✓	low med med high low	med med med med med med	med med med med high high

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> • Tool/workpiece must be manually supported, held or steadied 	<p>32. Lower the work piece/worksurface</p> <ul style="list-style-type: none"> • Lower component storage containers which are frequently used <p>116. Provide support for the tool</p> <ul style="list-style-type: none"> • provide a tool balancer for bench work <p>118. Provide support for the work piece</p> <ul style="list-style-type: none"> • provide a fixture to support the work piece (fixtures which allow the work piece to be rotated into different positions are helpful) <p>112. Provide support for the arms</p> <ul style="list-style-type: none"> • provide adjustable arm supports for high precision or long duration tasks that require the arms to be away from the body 		✓	med	med	high

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> • Work location is too far away • Orientation of work piece or tool handle causes the arm to be held away from the body. (see Figure 1.1) 	<p>41. Move work piece closer to body</p> <p>38. Move closer to the work location</p> <ul style="list-style-type: none"> • remove obstructions <p>136. Rotate the work piece</p> <ul style="list-style-type: none"> • provide a fixture to allow the work piece to be rotated • rotate the work piece manually <p>136. Rotate the work piece</p> <ul style="list-style-type: none"> • provide a fixture to allow the work piece to be rotated • turn the work piece to an upright position <p>77. Provide a tool with an appropriate handle angle</p> <ul style="list-style-type: none"> • provide a tool with an in-line grip when a vertical tool axis is desired • provide a tool which can be angled/bent for different work orientations 	✓	✓	low	med	med
			✓	✓	med	med	med
			✓	✓	med	med	med
			✓	✓	low	med	med
			✓	✓	med	med	med
			✓	✓	low	med	med
			✓	✓	med	med	med
			✓	✓	med	med	med
			✓	✓	med	med	med

Figure 1.1

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
2. Arm forces: Repeated contraction of the muscles of the arm or holding/carrying materials	• Manual tool requires high forces	66. Provide a power tool • obtain a power tool which reduces forces and time required		✓	med	med	med
	• Tool is too heavy	59. Provide a lighter weight tool		✓	med	med	med
3. High speed, sudden shoulder movements	• See specific case study for more detailed causes and solutions	N/A					
4. Head/neck bent or twisted	• Work location is too low	124. Raise the work piece/worksurface • raise the worktable with blocks • provide an adjustable table • provide a fixture (e.g., table-top riser) to raise the work piece into a comfortable viewing position • lower the chairs.		✓ ✓ ✓	low high med	med med med	med med med
		31. Lower the person • provide a chair/stool to sit on for all or parts of the task • provide adequate leg clearance to allow seated postures (e.g., remove obstructions)	✓ ✓	✓ ✓	low med med	med med med	med med med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Work location is too high	120. Raise the chair <ul style="list-style-type: none"> • adjust the chair upward • provide a cushion to raise the person, if the chair will not raise high enough • when the chair is raised, a foot rest may be necessary to support the feet 	✓	✓	low med	med med	med med
		32. Lower the work piece/work surface	✓	✓	low	med	med
	• Work location is blocked or is in an inappropriate orientation	136. Rotate the work piece <ul style="list-style-type: none"> • provide a fixture to allow the work piece to be rotated • turn the work piece 	✓	✓	med	med	med
	• Light levels are too low	22. Increase light levels <ul style="list-style-type: none"> • provide a task light which is easy to adjust • increase room lighting 	✓	✓	low	med	med
				✓	med	high	med
				✓	high	high	med

Hands/Wrists/Arms

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change		Quality	Productivity
5. Bent wrists/repeated wrist movements or repeated forearm rotation	<ul style="list-style-type: none"> Orientation of work piece or tool handle causes the wrist to be bent 	<p>136. Rotate the work piece</p> <ul style="list-style-type: none"> provide a fixture to allow the work piece to be rotated turn the work piece to an upright position <p>77. Provide a tool with an appropriate handle angle</p> <ul style="list-style-type: none"> provide a tool with an in-line grip when a vertical tool axis is desired provide a tool with a pistol grip when a horizontal tool axis is desired provide a tool which can be angled/bent for different work orientations 	✓ ✓ ✓ ✓ ✓ ✓ 	✓ ✓ ✓ ✓ ✓ 	med low	med med med med med	med med med med med

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> • Component container is too deep • Components are difficult to access 	<p>127. Reduce depth of storage container</p> <p>125. Recess container into worksurface</p> <ul style="list-style-type: none"> • critical components can be placed in recessed storage containers on the worksurface <p>136. Rotate the work piece</p> <ul style="list-style-type: none"> • tilt component containers towards the person to increase access <p>132. Remove obstructions</p> <ul style="list-style-type: none"> • the side of the component container should dip down to allow easier access to components <p>120. Raise the chair</p> <ul style="list-style-type: none"> • adjust the chair upward • provide a cushion to raise the person, if the chair will not raise high enough • when the chair is raised, a foot rest may be necessary to support the feet 	✓ Minor Modification	✓ Major Change	med	med	med
				✓	med	med	med
				✓	med	med	med
				✓	med	med	med
				✓	med	med	med
				✓	low med	med med	med med
				✓	med	med	med

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
		32. Lower the work piece/worksurface <ul style="list-style-type: none"> • modify existing table (best if only one person is using the table) • provide an adjustable height work table 	✓	✓	med	med	med
6. Repeated manipulations with fingers	• Rarely occurs	N/A					
7. Hyperextension of finger/thumb or repeated single finger activation	• Use of power tool with single finger trigger(see Figure 1.2) 	62. Provide a multi-finger trigger <ul style="list-style-type: none"> • provide a tool with a two-finger or a four-finger trigger • extend trigger on existing tool (if feasible and safe) 	✓	✓	med	med	med

Figure 1.2

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
8. Hand/grip forces	<ul style="list-style-type: none"> • Tool or work piece must be manually supported, held or steadied 	118. Provide support for the work piece <ul style="list-style-type: none"> • provide a fixture which places the work piece at the appropriate height and (as needed) allows the work piece to be manipulated. 		✓	med	med	med
		54. Provide a high friction gripping surface <ul style="list-style-type: none"> • provide a tool handle with a compressible, high friction surface 		✓	med	med	med
		116. Provide support for the tool <ul style="list-style-type: none"> • provide a tool balancer 		✓	med	med	med
		113. Provide support for the cable or hose <ul style="list-style-type: none"> • provide a tool balancer to support cables • provide a hook to support hose • 		✓	med	med	med
		116. Provide support for the tool <ul style="list-style-type: none"> • provide a tool balancer for bench work • provide a mobile tool balancer that can be hung overhead for field work 	✓	✓	med	med	med
	<ul style="list-style-type: none"> • Tool is too heavy 	59. Provide a lighter weight tool		✓	med	med	med

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	• Handle diameter is too large	88. Provide an appropriate handle diameter • provide a tool with a handle diameter between 1"-1.5" (2.5-3.8 cm)		✓	med	med	med
9. High speed hand/wrist/arm movements or vibration, impact, or torque to the hand	• See specific case study for more detailed causes and solutions	N/A					
10. Exposure to hard edges	<ul style="list-style-type: none"> • Tool handle has hard edges • Workstation has hard or sharp edges 	9. Eliminate exposure to hard edges <ul style="list-style-type: none"> • provide a handle which is round and smooth with no ridges or edges • provide a handle of at least 5" (12.7 cm) in length • wrap the tool handle 9. Eliminate exposure to hard edges <ul style="list-style-type: none"> • provide padding for edges • round off exposed edges 	✓ ✓	✓ ✓	med med low	med med med	med med med

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
11. Hands and fingers exposed to cold temperatures	<ul style="list-style-type: none"> • Cold exhaust from air powered tool blows on hand • Tool handle conducts heat away from hand • Work area is too cold 	<p>7. Direct cold air away from hands</p> <ul style="list-style-type: none"> • provide tool which does not blow cold air on the hands • attach an air diverter <p>104. Provide handles with insulating material</p> <ul style="list-style-type: none"> • cover metal handles with insulating material <p>23. Increase room temperature</p> <p>105. Provide portable heaters</p> <p>93. Provide appropriate gloves</p> <ul style="list-style-type: none"> • (Caution: gloves of an inappropriate material or size can cause person to increase hand forces to perform task) 	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓	med med low med med med med	med med med med med med med	med med med med med med med

Back/Torso

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On	
			✓ Minor Modification	✓ Major Change	Quality	Productivity
12. Repeated forward or sideways bending movements	<ul style="list-style-type: none"> • Reaching for components on the back of the work bench • Components/work piece are located too far away • Components/work piece are located too high 	<p>41. Move work piece closer to body</p> <ul style="list-style-type: none"> • place frequently used components closer to the person • infrequently used components should be removed from the workstation or placed at arm's length • store smaller quantities of components at the workstation 	✓ ✓ ✓	med med low	med med med	med med med
13. Twisting of the lower back	<ul style="list-style-type: none"> • Work location is blocked or is in an inappropriate orientation 	136. Rotate the work piece <ul style="list-style-type: none"> • provide a fixture to allow the work piece to be rotated 		✓	med	med
14. High speed, sudden movements	<ul style="list-style-type: none"> • Rarely occurs 	N/A				

Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On		
			✓ Minor Modification	✓ Major Change	Quality	Productivity	
15. Static, awkward back postures	<ul style="list-style-type: none"> • Work surface/work piece is too high • Work is too low 	<p>32. Lower the work piece/worksurface</p> <ul style="list-style-type: none"> • lower component storage containers which are frequently used <p>124. Raise the work piece/worksurface</p> <ul style="list-style-type: none"> • raise the table on blocks • provide an adjustable table • provide a fixture (e.g., table-top riser) to raise the work piece into a comfortable viewing position • lower the chairs. <p>31. Lower the person</p> <ul style="list-style-type: none"> • provide a chair/stool to sit on for all or parts of the task • provide adequate leg clearance to allow seated postures (e.g., remove obstructions) 		✓ ✓ ✓ ✓ ✓ ✓	med low high med low med	med med med med med med	high med high med med med

Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> • Work is too far from the employee • Inadequate lower back support while sitting • Inappropriate chair adjustment. • Inappropriate chair design 	<ul style="list-style-type: none"> 38. Move closer to the work location <ul style="list-style-type: none"> • remove obstructions 41. Move work piece closer to body 136. Rotate the work piece <ul style="list-style-type: none"> • rotate the work piece manually • provide a fixture to allow the work piece to be rotated 115. Provide support for the lower back <ul style="list-style-type: none"> • adjust back rest to support lower back • adjust the height of the chair to allow person to lean back in the chair while working • provide a foot rest to support the feet • pull chair forward and lean back while working • attach a small pillow to back rest to support lower back • provide a chair with adequate lower back support 	<ul style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ 	<ul style="list-style-type: none"> ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ 	<ul style="list-style-type: none"> med low low med low low med low med 	<ul style="list-style-type: none"> med med med med med med med low med 	<ul style="list-style-type: none"> med med med med med med med med med

Back/Torso (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
16. Lifting forces	• Rarely occurs (If occurs, see Lifting case study)	N/A					
17. Pushing or pulling	• Rarely occurs	N/A					
18. Whole body vibration	• Rarely occurs	N/A					

Legs/Feet

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On
			✓ Minor Modification	✓ Major Change	Quality Productivity
19. Fixed position, standing	<ul style="list-style-type: none"> • Standing surface is hard 	86. Provide an appropriate anti-fatigue mat 96. Provide appropriate shoe inserts 87. Provide an appropriate chair/stool 1. Alternate between sitting and standing tasks	✓ ✓ ✓ ✓	✓ ✓ ✓ low	med med med med
20. Exposure to hard edges on legs, knees, and feet	<ul style="list-style-type: none"> • Front edge of seat is hard or square • Workstation has hard edges 	64. Provide a padded compressible surface to sit on. <ul style="list-style-type: none"> • to reduce exposure to front edge of seat 87. Provide an appropriate chair/stool <ul style="list-style-type: none"> • provide chair with rounded front edge of seat 9. Eliminate exposure to hard edges <ul style="list-style-type: none"> • remove obstructions under bench • round off exposed edges 	✓ ✓ ✓	low med med med	med med med med

Legs/Feet (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
21. Awkward leg postures	• Rarely occurs	N/A					
22. Standing foot pedal	• Rarely occurs	N/A					

Head/Eyes

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
23. Difficult to see/light levels too low/too high	<ul style="list-style-type: none"> • Glare directly from a light source: looking towards an overhead light • Glare from an overhead light reflected off equipment or worksurface. • Glare directly from a light source: looking towards an uncovered window • Glare from an uncovered window reflected off equipment or worksurface. • Glare directly from a light source: looking towards a task light • Glare from a task light reflected off equipment or worksurface. 	<p>109. Provide protection from glare from overhead lights/task lights</p> <ul style="list-style-type: none"> • position work between overhead lights. • remove glossy or shiny surfaces from work area • place the work station so that it faces a wall or partition. • install parabolic louvers to direct light down on the surface. <p>108. Provide protection from glare from natural light</p> <ul style="list-style-type: none"> • orient work station so that the person faces perpendicular to the window. • adjust window coverings • provide window coverings <p>109. Provide protection from glare from overhead lights/task lights</p> <ul style="list-style-type: none"> • adjust the task light to reduce glare. • turn off the task light. • shield task light to prevent it from shining into eyes. 	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	low low med high	med med med med	med med med med

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes		Cost	Impact On	
			✓ Minor Modification	✓ Major Change		Quality	Productivity
	<ul style="list-style-type: none"> • Light levels too high. • Light levels too low: • Uncorrected visual disorders cause the person to lean forward to see work • Text too small to read. • Text is difficult to read (poor quality) 	<p>27. Lower the light levels</p> <ul style="list-style-type: none"> • remove pairs of fluorescent light bulbs from overhead fixtures. Note: this should be done with the appropriate technical assistance and the agreement of co-workers in the area. <p>22. Increase light levels</p> <ul style="list-style-type: none"> • provide task light • increase overall light levels to meet the needs of tasks <p>14. Encourage person to have visual disorders corrected</p> <p>18. Improve visual access to work</p> <ul style="list-style-type: none"> • increase size of text • increase the legibility of text 		✓ ✓ ✓ ✓	low to med med med med med	med med med med med	med med med med med
24. Intensive visual tasks, staring at work objects for long periods	<ul style="list-style-type: none"> • Length of work task without a change of position for the eyes. 	<p>8. Distribute intensive activities throughout the process</p> <ul style="list-style-type: none"> • perform intensive visual tasks for short periods throughout the day (as opposed to in one continuous session). 	✓		low	med	med

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On	
			✓ Minor Modification	✓ Major Change	Quality	Productivity
		20. Incorporate rest pauses • periodically look away from screen.	✓		low	med

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