

CASE STUDY - Sanding

TASK TITLE: Sanding

Task Description:	Sanding involves the use of manual (sandpaper, file, etc.) or powered (pneumatic/electric/hydraulic hand sanders) tools to remove or shape material. The work piece is often metal or wood. Additionally, the work piece can be fixed (in a vise) or supported (mounted on a structure). Typical jobs in which sanding is performed include: <ul style="list-style-type: none">• aircraft maintenance• sheet metal repair• facility maintenance• model shop. Sanding may be performed on flat or upright surfaces directly on aircraft, equipment, benchtops, or on a variety of surface shapes.
Job Performance Measures Most Often Impacted by Sanding:	<ul style="list-style-type: none">• Quality of finished surface (consistency, free of defects)• Speed of completion of sanding task.
Typical Employee Comments about Sanding:	Employees typically report discomfort and/or stiffness in the shoulders/neck and hands/wrists/arms. Primary: The primary body parts affected are the shoulder/neck and hand/wrists/arms Secondary: In some cases the back/torso and legs/feet are affected as well.
Suggested Level II Analysis:	Grip Force Measurement, Postural Analysis, Dynamic Task Analysis

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 (see Figure 1.1)  <p>Figure 1.1</p> <ul style="list-style-type: none"> • Work location is too far away 	123. Raise the person <ul style="list-style-type: none"> • use a step stool or ladder • provide an adjustable platform or scaffolding 32. Lower the work piece/work surface 112. Provide support for the arms <ul style="list-style-type: none"> • rest arms on near-by surfaces • provide flexible armrests 38. Move closer to the work location <ul style="list-style-type: none"> • remove obstructions 41. Move work piece closer to body 136. Rotate work piece (benchwork) <ul style="list-style-type: none"> • rotate the work piece manually • provide a fixture to allow the work piece to be rotated 103. Provide extensions for tools	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	med high	med 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
		8. Distribute intensive activities throughout the process <ul style="list-style-type: none"> • perform some activities as bench work rather than on the aircraft/structure 82. Provide adequate workspace <ul style="list-style-type: none"> • add access panels to increase access • increase the size of access ports to increase access 		✓ ✓ ✓	med high high	med med med
2. Arm forces: Repeated contraction of the muscles of the arm or holding/carrying materials	<ul style="list-style-type: none"> • Tool requires high forces to remove material • Large quantity of material must be removed 	66. Provide a power tool <ul style="list-style-type: none"> • substitute a high grit sand paper for remove large amounts of material 133. Replace abrasive or cutting material frequently 76. Provide a tool which requires minimal force to use <ul style="list-style-type: none"> • use power tool whenever possible • obtain a heavier duty tool which reduces forces and time required to remove material 	✓ ✓ ✓	low to med low med	med med med	med med high med

Shoulder/Neck (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On
			✓ Minor Modification	✓ Major Change	Quality Productivity
	• Tool is too heavy	59. Provide a lighter weight tool • provide power tools of minimal weight (particularly for lighter sanding tasks)		✓	med med med
3. High speed, sudden shoulder movements	• Manual sanding requires high speed arm movements	66. Provide a power tool use power tool whenever possible		✓	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	
4. Head/neck bent or twisted	<ul style="list-style-type: none"> • Work location is too low • Work location is too high 	<p>124. Raise the work piece/work surface</p> <ul style="list-style-type: none"> • provide a fixed table to raise the work piece • provide an adjustable table <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 <p>123. Raise the person</p> <ul style="list-style-type: none"> • use a step stool or ladder • provide an adjustable platform or scaffolding <p>32. Lower the work piece/work surface</p>	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	low to med high med	med med med med med	med high med 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 blocked or is in an inappropriate orientation 	136. Rotate work piece(benchwork) <ul style="list-style-type: none"> • turn the work piece • provide a fixture to allow the work piece to be rotated 114. Provide support for the head <ul style="list-style-type: none"> • Provide a cushion to support the head 8. Distribute intensive activities throughout the process <ul style="list-style-type: none"> • perform some activities as bench work rather than on the aircraft/structure 82. Provide adequate workspace <ul style="list-style-type: none"> • add access panels to increase access • increase the size of access ports to increase access 	✓ ✓ ✓	✓ ✓ ✓ ✓	low med low med high high	med med med med med med	med med med med high med

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"> • Light levels are too low 	22. Increase light levels <ul style="list-style-type: none"> • provide light levels at the task of 50-100 fc (500 - 1000 lux) for sanding tasks <ul style="list-style-type: none"> -precision sanding tasks require more light: 100 fc (1000 lux or more) • provide a task light which is easy to adjust • increase room lighting 	✓ ✓ ✓	✓ ✓ ✓	high med med	high med 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"> • Work location is too high • Work location is too low (see Figure 1.2) 	<p>123. Raise the person</p> <ul style="list-style-type: none"> • use a step stool or ladder • provide an adjustable platform or scaffolding <p>32. Lower the work piece/work surface</p> <p>124. Raise the work piece/work surface</p> <ul style="list-style-type: none"> • provide a fixed table to raise the work piece • provide an adjustable table <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 	✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	med high med med med med	med med med med med med	med high med 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
	<ul style="list-style-type: none"> Tool handle orientation causes awkward postures (see Figure 1.3)  <p>Figure 1.3</p> <ul style="list-style-type: none"> Work location is blocked or is in an inappropriate orientation 	<p>77. Provide a tool with an appropriate handle angle orientation for specific tasks</p> <p>136. Rotate work piece (bench work)</p> <ul style="list-style-type: none"> turn the work piece manually provide a fixture to allow the work piece to be rotated <p>82. Provide adequate workspace</p> <ul style="list-style-type: none"> perform activity as bench work rather than on the aircraft/structure add access panels to increase access increase the size of access ports to increase access 	✓ ✓ ✓ ✓ ✓ ✓	med low med med high high	med med med med	med med med high med
6. Repeated manipulations with fingers	<ul style="list-style-type: none"> Rarely occurs 	N/A				

Hands/Wrists/Arms (cont'd)

Job Factor	Potential Causes	Corrective Action	Level of Changes	Cost	Impact On	
			✓ Minor Modification	✓ Major Change	Quality	Productivity
7. Hyper-extension of finger/thumb or repeated single finger activation	<ul style="list-style-type: none"> • Use of power tool with single finger trigger concentrates stress on finger (see Figure 1.4) 	62. Provide a multi-finger trigger		✓	med	med
8. Hand/grip forces	<ul style="list-style-type: none"> • Hand sanding causes excessive fingertip forces 	3. Change a pinch grip to a power grip <ul style="list-style-type: none"> • provide a sanding block with an attached handle so that pressure is applied with a full hand grip rather than a finger press 	✓	✓	low to 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"> • Welding 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 vice fixture to support work piece 54. Provide a friction gripping surface <ul style="list-style-type: none"> • provide a tool handle with a compressible grip surface • wrap the handle 116. Provide support for the tool provide a method to support the tool for bench work	✓	✓ med	med	med
	<ul style="list-style-type: none"> • Tool is too heavy 	59. Provide a lighter weight tool <ul style="list-style-type: none"> • provide a sander of minimal weight 116. Provide support for the tool <ul style="list-style-type: none"> • provide a tool balancer for bench work 	✓	low med	med	med
	<ul style="list-style-type: none"> • Handle diameter is too large 	75. Provide a tool that can be used with both hands	✓	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
9. High speed hand/wrist/arm movements or vibration, impact, or torque to the hand	<ul style="list-style-type: none"> • Hand sanding causes high speed movements • Power tools produce hand/arm vibrations 	<p>66. Provide a power tool</p> <ul style="list-style-type: none"> • use power tool whenever possible <p>74. Provide a tool that minimizes exposure to vibration/impact/torque</p> <ul style="list-style-type: none"> • provide a power tool with internal vibration damping • attach vibration damping material to tool handle (Caution: adding to the handle should not cause the tool diameter to be larger than 1.5"(3.8 cm)) 		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	med med med	med med med
10. Exposure to hard edges	<ul style="list-style-type: none"> • Tool handle has hard edges 	<p>9. Eliminate exposure to hard edges</p> <ul style="list-style-type: none"> • provide a tool with a round, smooth handle with no ridges or edges • provide a handle of at least 5" (14.7 cm) in length 		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	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"> • Work station or work piece has hard or sharp edges • Work piece has hard or sharp edges 	9. Eliminate exposure to hard edges <ul style="list-style-type: none"> • provide padding for edges • round off exposed edges 9. Eliminate exposure to hard edges <ul style="list-style-type: none"> • lay a blanket or cushion over hard edges to eliminate hard edges 	✓ ✓ ✓	low low low	med med med	med med med
11. Hands and fingers exposed to cold temperatures	<ul style="list-style-type: none"> • Cold exhaust from air powered tool blows on hand • Work area is too cold 	7. Direct cold air away from the hands <ul style="list-style-type: none"> • provide tool which does not blow cold air on the hands • Add an alternative air hose connection 93. Provide appropriate gloves <ul style="list-style-type: none"> • Caution: gloves of an inappropriate material or size can cause person to increase hand forces to perform task 23. Increase room temperature 105. Provide portable heaters 110. Provide shields or barriers from the wind 93. Provide appropriate gloves	✓ ✓ ✓ ✓ ✓	high med med low 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"> • Work location is too low 	124. Raise the work piece/work surface <ul style="list-style-type: none"> • provide a fixed table to support work piece • provide an adjustable table for work piece 31. Lower the person <ul style="list-style-type: none"> • provide a chair/stool to sit on 	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	med high med med	med med med med	med high med med
13. Twisting of the lower back	<ul style="list-style-type: none"> • Work location is blocked or is in an inappropriate orientation • Work space or access is limited 	136. Rotate work piece (bench work) <ul style="list-style-type: none"> • turn the work piece manually • provide a fixture to allow the work piece to be rotated 117. Provide support for the upper body <ul style="list-style-type: none"> • Provide a device to support the head and upper body while the person is working 	<input checked="" type="checkbox"/> 	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	low med med	med med med	med med med
14. High speed, sudden movements	<ul style="list-style-type: none"> • Hand sanding causes high speed movements 	66. Provide a power tool <ul style="list-style-type: none"> • use power sander whenever possible 		<input checked="" type="checkbox"/>	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
15. Static, awkward back postures	<ul style="list-style-type: none"> • Work location is too low 	<p>124. Raise the work piece/work surface</p> <ul style="list-style-type: none"> • provide a fixed table to support work piece • provide an adjustable table for work piece <p>8. Distribute intensive activities throughout the process</p> <ul style="list-style-type: none"> • perform some activities as bench work rather than on the aircraft/structure <p>82. Provide adequate workspace</p> <ul style="list-style-type: none"> • add access panels to increase access • increase the size of access ports to increase access <p>117. Provide support for the upper body</p> <ul style="list-style-type: none"> • provide a device to support the head and upper body while the person is working 	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	med high med high med med med med	med med med med med med med med	med high med high 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
	<ul style="list-style-type: none"> • Work location is too far away 	38. Move closer to the work location <ul style="list-style-type: none"> • remove obstructions 41. Move work piece closer to body <ul style="list-style-type: none"> 136. Rotate work piece (bench work) <ul style="list-style-type: none"> • rotate the work piece manually • provide a fixture to allow the work piece to be rotated 8. Distribute intensive activities throughout the process <ul style="list-style-type: none"> • perform some activities as bench work rather than on the aircraft/structure 82. Provide adequate workspace <ul style="list-style-type: none"> • add access panels to increase access • increase the size of access ports to increase access 117. Provide support for the upper body <ul style="list-style-type: none"> • provide a device to support the head and upper body while the person is working 	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	low low low med med med med high high med	med med med med med med med med med	med med med med med med med high 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"> Chair or stool provides inadequate back support 	115. Provide support for the lower back <ul style="list-style-type: none"> adjust back rest to support lower back pull chair forward and lean back while working attach a small pillow to back rest to support lower back provide chair with lower back support 	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓	low low low med	med med med med
16. Lifting forces	<ul style="list-style-type: none"> Rarely occurs (If it occurs, see Lifting case study) 	N/A				
17. Pushing or pulling	<ul style="list-style-type: none"> Rarely occurs 	N/A				
18. Whole body vibration	<ul style="list-style-type: none"> 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 appropriate anti-fatigue mat 96. Provide appropriate shoe inserts	✓ ✓	✓ 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 Work station or work piece has hard edges 	64. Provide a padded, compressible surface to sit on <ul style="list-style-type: none"> Use a cushion to eliminate exposure to pressure point 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"> provide padding for edges round off exposed edges lay a blanket or cushion over hard edges redesign work piece or component to eliminate hard edges 	✓ ✓ ✓	low med ✓ ✓	med med low 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	<ul style="list-style-type: none"> • Work location is too low 	124. Raise the work piece/work surface <ul style="list-style-type: none"> • provide a fixed table to support work piece • provide an adjustable table for work piece 31. Lower the person <ul style="list-style-type: none"> • provide a chair/stool to sit on • provide a pad or cushion to kneel on • provide knee pads 8. Distribute intensive activities throughout the process <ul style="list-style-type: none"> • perform some activities as bench work rather than on the aircraft/structure 82. Provide adequate workspace <ul style="list-style-type: none"> • add access panels to increase access • increase the size of access ports to increase access 	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	med high med med med med med med	med med med med med med med	med med med med med med high med
22. Standing foot pedal	<ul style="list-style-type: none"> • Rarely occurs 	N/A					

Head/Eyes

Head/Eyes (cont'd)

Job Factor	Potential Causes	Corrective Action	✓	✓	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
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 <ul style="list-style-type: none"> • periodically look away from screen. 	✓		low	med