

**Steel fabrication/shipyards Table 1: Established alternative processes to avoid/reduce use of vibrating equipment**

Activity or process	Example vibration magnitude (m/s <sup>2</sup> )	Corresponding time to reach:		Alternative methods	Further information (links on HSE website)
		EAV	ELV		
Manual cutting of steel plate and re-working to correct component profile using:  angle grinders  straight grinders  chipping hammers (rarely)  Nibbling machine (hand-fed type)	4 (lowest) 8 (highest)  6 (typical) 15 (highest)  18 (typical)  10 (typical)	3 h 45 m  1½ h 15 m  10 m  30 m	12 h 3 h  5½ h 1 h  40 m  2 h	Expect to see accurate pre-prep, cutting components to correct size, with a minimum of “green”. <i>“Measure twice, cut once.”</i> Significant exposures from re-work using grinders etc. should be challenged.  Select suitable modern, precision processes for cutting out, as appropriate: <ul style="list-style-type: none"> <li>• CNC oxy-fuel flame cutting</li> <li>• CNC machining</li> <li>• laser profiling (up to approx 5 mm plate thickness)</li> <li>• abrasive waterjet cutting (up to 150 mm thickness) – cold process with no heat distortion</li> <li>• submerged plasma cutting</li> <li>• submerged spark erosion (electrical discharge machining)</li> </ul> <p>Note: improving accuracy and minimising manual reworking is also usually cost-effective.</p>	BMT “Noise Reduction in Shipyards” booklet   Example: machining Example: laser cutting  Plasma cutting
Weld preparation and finishing using tools as above	As above	As above	As above	<ul style="list-style-type: none"> <li>• Apply bevelled edges for welding while cutting out to avoid unnecessary grinding</li> <li>• Use single sided welding (with a suitable backing material) to avoid routine back gouging associated with double sided welding (resulting distortion can be managed with “strongbacks”, heat line straightening, etc.)</li> </ul>	Noise reduction in the ship repair industry – research report 1992  Control of noise in heavy fabrication SIM 03/1001/14
Removing fairing aids, lifting lugs, etc. using grinders (see above)	As above	As above	As above	Design fairing and lifting processes to avoid temporary welded aids which must be removed by grinding. <ul style="list-style-type: none"> <li>• Use magnetic, vacuum or screw clamps and anchors instead of welded fairing aids</li> <li>• Bolt fairing aids to welded studs which require less grinding to remove</li> <li>• Design welded lifting lugs that can be left in place</li> <li>• Use lifting clamps instead of welded lifting lugs</li> <li>• Use bolted lugs or shackles instead of welded lifting lugs</li> </ul>	BMT “Noise Reduction in Shipyards” Booklets 1 and 2  Noise reduction in the ship repair industry – research report 1992

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		EAV	ELV		
Surface preparation using:				Cleaning steel surfaces and preparing for painting. Use of scaling tools should be minimised (small and awkward areas only) and modern vibration-reduced tools should be used.	Noise reduction in the ship repair industry – research report 1992
needle scalers	5 (lowest) 18 (highest)	2 h 10 m	8 h 35 m		Control of noise in heavy fabrication SIM 03/1001/14
scaling hammers (piston type)	10 (lowest) 40 (highest)	30 m 2 m	2 h 7 m	Where reasonably practicable an appropriate alternative process should be used, for example:	
deck planers, leaf-type scalers, peening tools	15 (typical)	15 m	1 h	<ul style="list-style-type: none"> <li>• shot blasting</li> <li>• abrasive vacuum blasting</li> <li>• ultra high pressure water jetting</li> <li>• dry ice pellet blasting (non-abrasive, “clean” method)</li> <li>• ice blasting (wet)</li> </ul>	Example: abrasive blasters

Note 1: The vibration magnitudes, and associated trigger times to exceed EAV/ELV, are indicative only and will vary depending on equipment type and conditions of use.

Note 2: Changes of process to eliminate or reduce vibration may introduce other hazards to safety or health or safety (e.g. chemical, fume, spatter, noise, dust) which must be addressed and managed.

Note 3: For shipyards, HSE policy since 1998 has been to serve IN for action plan/control where no progress has been made; PN for old design chipping or scaling tools used for more than 1 hour.