# Yale Practices for Tool Safeguarding and Controls

26 June 2015

<table>
<thead>
<tr>
<th>Tool Type</th>
<th>Size/Style</th>
<th>Power</th>
<th>Potential Hazards</th>
<th>Emergency Stopping and Power Controls²</th>
<th>Shields and Guards</th>
<th>Other Protective Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arbor Press</td>
<td>Bench or Standing</td>
<td>Manual</td>
<td>• Caught between – crushing, limited by manual operation</td>
<td></td>
<td></td>
<td>• Warning label</td>
</tr>
<tr>
<td>Band Saw / Small</td>
<td>Bench</td>
<td>Electric</td>
<td>• Cutting blade – lacerations</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td>• Blade</td>
<td>• Push sticks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Rotating blade pulleys – pinch points, entanglement</td>
<td></td>
<td>• Covered pulleys</td>
<td>• Fence</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Flying objects – eye, face, skin injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Band Saw / Large</td>
<td>Standing</td>
<td>Electric</td>
<td>• Cutting blade – lacerations, amputation</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td>• Blade plus extension if needed</td>
<td>• Smallest opening in work surface possible</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Rotating blade pulleys – pinch points, entanglement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Flying objects – eye, face, skin injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bead / Shot Blaster</td>
<td>Bench</td>
<td>Electric</td>
<td>• Abrasive shot – skin irritation, abrasion</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(w/ Glove box)</td>
<td></td>
<td></td>
<td>• Rotating / moving parts – blade in fan motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Flying objects – eye, face, skin injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brake, Metal</td>
<td>Bench or Standing</td>
<td>Manual</td>
<td>• Caught between – finger crushing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bending</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Buffer, Wheel</td>
<td>Bench or Standing</td>
<td>Electric</td>
<td>• Rotating parts – entanglement</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td>• Rotating shaft and nut guards as feasible</td>
<td>• Clamps for small parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Flying objects – eye, face, skin injuries</td>
<td></td>
<td></td>
<td>• Faceshield if excessive flying objects expected</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Parts pulled / thrown from hand – flying objects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting Block</td>
<td>Bench</td>
<td>Manual</td>
<td>• Cutting blades – lacerations, amputation</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td>• Chip shield as feasible</td>
<td>• Bit vise / clamp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Faceshield if excessive flying objects expected</td>
</tr>
<tr>
<td>Die Filer</td>
<td>Bench or Standing</td>
<td>Electric</td>
<td>• Vertical oscillating shaft – minor punctures</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Possible flying objects – eye, face, skin injuries</td>
<td></td>
<td></td>
<td></td>
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¹ For all tools: Bench models affixed with bolts / clamps; standing / pedestal models bolted / secured to floor (except high mass units such as mills and lathes) After-market E-stop placement at critical operator locations, installed in consultation with shop manager Tool lights protected by covers or safety coated bulbs; low voltage (< 24 V) preferred Safety glasses / goggles worn for all tools inside shop proper; no loose clothing, jewelry, or hair All tool use limited to approved / qualified personnel only

² Anti-restart: Required by OSHA for woodworking tools (Yale best practices - for all tools where accidental re-start would likely be unnoticed and pose risk of injury; also all new tools as available)
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| Drill Grinder/Sharpener | Bench or Standing | Electric | • Rotating shaft and wheel – pinch points, abrasions  
• Flying objects – eye, face, skin injuries  
• Heat / sparks – burns, fire | • E-stop, accessible single action hand switch, or foot switch | • Wheel  
• Chip shield as feasible | • Bit vise / clamp  
• Faceshield if excessive flying objects expected |
| Drill Press / Small  | Bench      | Electric | • Sharp cutting bit – minor lacerations, punctures  
• Rotating chuck and bit –entanglement  
• Flying objects – from parts working or centrifugal throw (chuck key, part) – eye, face, skin injuries  
• Torque exerted on work piece – impact injuries | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart for wood | • Covered pulley head  
• Portable chuck / chip  
• Rear shielding as needed | • Vise – secured  
• Spring-loaded chuck key  
• Work / tool rest |
| Drill Press / Large  | Standing   | Electric | • Sharp cutting bit – minor lacerations, punctures  
• Rotating chuck and bit –entanglement  
• Flying objects – from parts working or centrifugal throw (chuck key, part) – eye, face, skin injuries  
• Higher torque on work piece – impact injuries | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart for wood | • Covered pulley head  
• Affixed multi-plane chuck/chip  
• Rear shielding as needed | • Vise – secured  
• Spring-loaded chuck key  
• Hearing protection for high pitch metal cutting |
| Foam Cutter         | Bench or Standing | Electric | • Hot wire – burns, fire  
• Smoke – inhalation exposure | • E-stop  
• Anti-restart  
• Key or code access | • Interlocked cover / access | • Local exhaust |
| Grinder (hard wheels) | Bench or Standing | Electric | • Rotating shaft and wheel – pinch points, abrasions  
• Flying objects – parts or wheel shatter - eye, face, skin injuries  
• Heat / sparks - burns, fire | • E-stop, accessible single action hand switch, or foot switch | • Wheel enclosure  
• Upper tongue  
• Chip shield  
• Rear shielding as needed | • Work / tool rest  
• Warning label with gap tolerances  
• Depth / feeler gauge  
• Faceshield as needed |

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# Yale Practices for Tool Safeguarding and Controls

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| Jig and Scroll Saws | Bench or Standing | Electric | • Sharp cutting blade - lacerations  
• Flying objects – eye, face, skin injuries | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart for wood | • Blade | • Faceshield if excessive flying objects expected |
| Jointer           | Bench or Standing | Electric | • Sharp cutting heads – serious lacerations, amputation  
• Rotating (horiz.) parts – entanglement  
• Flying objects – eye, face, skin injuries | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart for wood | • Cutter shield | • Push sticks and blocks |
| Laser Cutter      | Bench or Standing | Electric | • Laser – ocular injury, burns  
• Heat - burns, fire  
• Moving laser head – physical injuries | • E-stop  
• Anti-restart  
• Key or cord access | • Interlocked cover / access | • Local exhaust |
| Lathe - Wood      | Bench or Standing | Electric | • Rotating parts – serious entanglement  
• Flying objects – from parts working or centrifugal throw (chuck key, part) – eye, face, skin injuries  
• Sharp cutting tools - lacerations  
• Pinch points – crushing, bruising | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart | • Chuck  
• Workpiece / point of operation | • Tool rest  
• Faceshield if point of operation shield not possible |
| Lathe – Metal     | Mini Bench   | Electric | • Rotating parts – entanglement  
• Flying objects – eye, face, skin injuries  
• Sharp cutting tools - lacerations  
• Pinch points – minor crushing, bruising | • E-stop, accessible single action hand switch, or foot switch | • Portable shield |                      |
| Lathe – Metal     | Bench or Standing | Electric | • Rotating parts – serious entanglement  
• Flying objects – from parts working or centrifugal throw (chuck key, part) – eye, face, skin injuries  
• Sharp cutting tools - lacerations  
• Pinch points – crushing, bruising | • E-stop, accessible single action hand switch, or foot switch  
• Emergency foot brake / power stop (geared by factory new equipment) | • Fixed or portable chuck shield  
• Cross-slide shield  
• Lead screw if exposed |                      |

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<tr>
<td>Lathe – Metal (cont’d)</td>
<td></td>
<td></td>
<td>• Heat – burns</td>
<td>– required for student shops)</td>
<td>exposed</td>
<td></td>
</tr>
<tr>
<td>Metal Cutting Saw</td>
<td>Standing</td>
<td>Electric</td>
<td>• Sharp cutting blade – lacerations, amputation</td>
<td>• Anti-restart</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Horizontal</td>
<td></td>
<td></td>
<td>• Rotating blade pulley – entanglement, pinch point</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milling Machine</td>
<td>Standing</td>
<td>Electric</td>
<td>• Sharp cutting bit – minor lacerations, punctures</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td>• Blade guard, upper and lower</td>
<td>• Work piece vise / clamp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Rotating chuck and bit –entanglement</td>
<td>• Anti-restart</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td>• Flying objects – from parts working or centrifugal throw (chuck key, part) – eye, face, skin injuries</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Higher torque exerted on work piece – impact injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planer</td>
<td>Bench or</td>
<td>Electric</td>
<td>• Sharp cutting heads – serious lacerations, amputations</td>
<td>• E-stop</td>
<td>• Adjustable entry / feed</td>
<td>Push sticks</td>
</tr>
<tr>
<td>Standing</td>
<td></td>
<td></td>
<td>• Rotating (horiz.) parts –entanglement</td>
<td>• Anti-restart</td>
<td></td>
<td>Outfeed support</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Flying objects – eye, face, skin injuries</td>
<td></td>
<td></td>
<td>Hearing protection for high noise planing</td>
</tr>
<tr>
<td>Press</td>
<td>Bench or</td>
<td>Manual</td>
<td>• Caught between – crushing</td>
<td>• Portable shield or cage for potential shattering object</td>
<td></td>
<td>Warning label</td>
</tr>
<tr>
<td></td>
<td>Standing</td>
<td></td>
<td>• Flying objects – eye, face, skin injuries</td>
<td></td>
<td></td>
<td></td>
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</thead>
</table>
| Printer, 3-D               | Bench or Standing| Electric  | • Moving head – physical injuries  
• Ink aerosol – inhalation exposure                                                                                                                    | • E-stop  
• Anti-restart  
• Key or code access              | • Interlocked cover / access       |                                                                            |
| Printing Press             | Bench or Standing| Electric  | • Rotating parts, pulleys, wheels - entanglement  
• Caught between - crushing  
• Possible flying objects – eye, face, skin injuries  
• Pinch points – crushing, bruising  
• Ink and cleaning solvents - chemicals                                                                 | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart                                                             | • Pulley(s)  
• Feeds  
• Rollers                                                   | • Gloves (nitrile exam) for incidental chemical handling and cleaning  
• Chemical substitution                                              |
| Punch                      | Bench or Standing| Manual    | • Caught between – crushing, bruising  
• Possible flying objects – eye, face, skin injuries                                                                                               |                                       |                    |                                                                                          |
| Radial Arm Saw             | Bench            | Electric  | • Sharp cutting blade – serious lacerations and amputations  
• Flying objects – eye, face, skin injuries  
• Rotating shaft / blade –entanglement                                                                                                               | • Finger /constant pressure switch, E-stop, accessible single action hand switch, or foot switch  
• Anti-restart                                                                                                                                  | • Top enclosed blade cover  
• Blade (self-adjusting)                                                                                                                        | • Auto-retraction  
• Fence (kerfed to avoid restricting blade guard)  
• Clamps  
• Faceshield if excessive flying objects expected                                   |
| Robotics Devices           | Bench or Standing| Electric  | • Various moving parts – physical injuries  
• Possible flying objects – eye, face, skin injuries                                                                                               | • E-stop  
• Anti-restart  
• Key or code access                                                             | • Enclosure as feasible  
• Interlocked cover / access as feasible                                               | • Marked exclusion zone                                                                                                                      |
| (tabletop, instructional)  |                  |           |                                                                                                                                                    |                                       |                    |                                                                                          |
| Roller, Sheetmetal         | Bench or Standing| Manual    | • Caught between / pinch points – crushing, limited by manual operation                                                                                     |                                       |                    | • Warning label                                                                                                                                   |

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After-market E-stop placement at critical operator locations, installed in consultation with shop manager  
Tool lights protected by covers or safety coated bulbs; low voltage (< 24 V) preferred  
Safety glasses / goggles worn for all tools inside shop proper; no loose clothing, jewelry, or hair  
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<tr>
<td>Roller, Sheetmetal</td>
<td>Bench or Standing</td>
<td>Electric</td>
<td>• Caught between / pinch points – serious crushing, amputation</td>
<td>• E-stop (manual, foot, bump, wire, light curtain)</td>
<td>• Sliding adjustable roller shield</td>
<td>• Warning label</td>
</tr>
<tr>
<td>Sander, Belt (vertical or horizontal)</td>
<td>Bench or Standing</td>
<td>Electric</td>
<td>• Flying objects – eye, face, skin injuries</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td>• Pulleys</td>
<td>• Tool rest</td>
</tr>
<tr>
<td>Sander, Disc</td>
<td>Bench or Standing</td>
<td>Electric</td>
<td>• Flying objects – eye, face, skin injuries</td>
<td>• E-stop, accessible single action hand switch, or foot switch</td>
<td>• Pulleys</td>
<td>• Tool rest</td>
</tr>
<tr>
<td>Saw, Cut-Off (abrasive disc and metal cutting)</td>
<td>Bench</td>
<td>Electric</td>
<td>• Sharp cutting blade – lacerations, amputations</td>
<td>• Finger / constant pressure switch</td>
<td>• Blade (self-adjusting)</td>
<td>• Auto-return to upright</td>
</tr>
<tr>
<td>Saw, Miter / Compound Miter Chop-Style Saw</td>
<td>Bench</td>
<td>Electric</td>
<td>• Sharp cutting blade – lacerations, amputations</td>
<td>• Finger / constant pressure switch</td>
<td>• Blade (self-adjusting)</td>
<td>• Auto-return to upright</td>
</tr>
<tr>
<td>Saw, Upright Panel Style</td>
<td>Standing</td>
<td>Electric</td>
<td>• Sharp cutting blade – lacerations, amputations</td>
<td>• Finger / constant pressure switch</td>
<td>• Blade (self-adjusting)</td>
<td>• Auto-return</td>
</tr>
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### Footnotes:

1. For all tools: Bench models affixed with bolts / clamps; standing / pedestal models bolted / secured to floor (except high mass units such as mills and lathes)
   After-market E-stop placement at critical operator locations, installed in consultation with shop manager
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| Saw, Wet Abrasive | Bench or Standing  | Electric      | • Sharp cutting blade – lacerations, amputations  
• Rotating blade – entanglement  
• Flying objects – eye, face, skin injuries  
• Heat / sparks – burns, fire  
• Water / electrical – shock | • E-stop, accessible single action hand switch, or foot switch | • Blade                          | • GFCI outlet / plug adapter  
• Fence  
• Clamps  
• Faceshield as needed |
| Shaper / Inverted Router (Table) | Bench or Standing  | Electric      | • Sharp cutting tool – lacerations, amputations  
• Rotating tool – entanglement  
• Flying objects – eye, face, skin injuries | • E-stop, accessible single action hand switch, or foot switch | • Cutting tool guard | • Fence  
• Pushsticks |
| Shear / Cutter   | Bench or Standing  | Manual        | • Sharp cutting blade – serious lacerations, amputations  
• Caught between – crushing | | • Blade                          | • Warning label |
| Shear / Cutter   | Bench or Standing  | Electric      | • Sharp cutting blade – serious lacerations, amputations  
• Caught between – crushing | • E-stop or foot switch  
• Anti-restart | • Blade and hold down guard  
• Rear access prevention | • 2-hand controls as interim |
| Surface Grinder  | Bench or Standing  | Electric      | • Rotating shaft and wheel – pinch points, abrasions, entanglement  
• Flying objects – parts or wheel shatter – eye, face, skin injuries  
• Heat / sparks – burns, fire | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart | • Wheel guard  
• Shielded table | • Faceshield if excessive flying objects expected |
| Table Saw        | Standing            | Electric      | • Sharp cutting blade – serious lacerations or amputation  
• Rotating blade – entanglement  
• Flying objects – eye, face, skin injuries | • E-stop, accessible single action hand switch, or foot switch  
• Anti-restart for wood | • Blade (self-adjusting) | • Fence and miter  
• Splitter / riving knife  
• Anti-kickback pawls  
• Pushsticks  
• Featherboards / jigs  
• SawStop required for student shops |

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| Water Jet Cutter| Bench or Standing| Electric| • High pressure water – lacerations  
• Moving spray head(s) – physical injuries | • E-stop  
• Anti-restart  
• Key or code access | • Interlocked cover / access | • GFCI outlet / plug adapter |
| Wire Wheel      | Bench or Standing| Electric| • Rotating shafts and wheels – abrasions, lacerations, entanglement  
• Flying objects – eye, face, skin injuries  
• Pinch points – crushing, bruising  
• Heat / sparks - burns, fire | • E-stop, accessible single action hand switch, or foot switch | • Wheel enclosure as feasible | • Tool rest if needed  
• Clamps for holding small parts  
• Faceshield if excessive flying objects expected |

1 For all tools: Bench models affixed with bolts / clamps; standing / pedestal models bolted / secured to floor (except high mass units such as mills and lathes)  
After-market E-stop placement at critical operator locations, installed in consultation with shop manager  
Tool lights protected by covers or safety coated bulbs; low voltage (< 24 V) preferred  
Safety glasses / goggles worn for all tools inside shop proper; no loose clothing, jewelry, or hair  
All tool use limited to approved / qualified personnel only

2 Anti-restart: Required by OSHA for woodworking tools (Yale best practices - for all tools where accidental re-start would likely be unnoticed and pose risk of injury; also all new tools as available)