

Yale Practices for Tool Safeguarding and Controls¹

26 June 2015

Tool Type	Size/Style	Power	Potential Hazards	Emergency Stopping and Power Controls ²	Shields and Guards	Other Protective Measures
Arbor Press	Bench or Standing	Manual	Caught between – crushing, limited by manual operation			Warning label
Band Saw / Small	Bench	Electric	- Cutting blade – lacerations - Rotating blade pulleys – pinch points, entanglement - Flying objects – eye, face, skin injuries	- E-stop, accessible single action hand switch, or foot switch - Anti-restart for wood	- Blade - Covered pulleys	- Push sticks - Fence
Band Saw / Large	Standing	Electric	- Cutting blade – lacerations, amputation - Rotating blade pulleys – pinch points, entanglement - Flying objects – eye, face, skin injuries	- E-stop, accessible single action hand switch, or foot switch - Anti-restart for wood	- Blade plus extension if needed - Fully encased band saw wheels	Smallest opening in work surface possible
Bead / Shot Blaster (w/ Glove box)	Bench	Electric	- Abrasive shot – skin irritation, abrasion - Rotating / moving parts – blade in fan motor - Flying objects – eye, face, skin injuries	- E-stop, accessible single action hand switch, or foot switch - Door interlocks for large units		
Brake, Metal Bending	Bench or Standing	Manual	Caught between – finger crushing			
Buffer, Wheel	Bench or Standing	Electric	- Rotating parts – entanglement - Flying objects – eye, face, skin injuries - Parts pulled / thrown from hand – flying objects	E-stop, accessible single action hand switch, or foot switch	Rotating shaft and nut guards as feasible	- Clamps for small parts - Faceshield if excessive flying objects expected
Cutting Block	Bench	Manual	Cutting blades – lacerations, amputation			
Die Filer	Bench or Standing	Electric	- Vertical oscillating shaft – minor punctures - Possible flying objects – eye, face, skin injuries	E-stop, accessible single action hand switch, or foot switch	Chip shield as feasible	- Bit vise / clamp - Faceshield if excessive flying objects expected

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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
 All tool use limited to approved / qualified personnel only

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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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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	• Spring-loaded chuck wrenches • Protect collet release handle if exposed

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Lathe – Metal (cont'd)			Heat – burns	– required for student shops) • Anti-restart	- exposed • Bar feeder cover (if present) • Rear shield as needed	
Metal Cutting Saw – Horizontal	Standing	Electric	• Sharp cutting blade – lacerations, amputation • Rotating blade pulley – entanglement, pinch point • Flying objects – eye, face, skin injuries • Heat / sparks – burns, fire	• E-stop, accessible single action hand switch, or foot switch	• Blade guard, upper and lower • Wheel / pulley guards	• Work piece vise / clamp
Milling Machine	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 exerted on work piece – impact injuries	• E-stop, accessible single action hand switch, or foot switch • Anti-restart	• Affixed multi-plane chuck/chip • Drive belt covers • Rear / side shielding as needed	• Spring-loaded chuck wrenches (if used) • Vise – secured • Retractable handles on powered tables
Planer	Bench or Standing	Electric	• Sharp cutting heads – serious lacerations, amputations • Rotating (horiz.) parts –entanglement • Flying objects – eye, face, skin injuries	• E-stop • Anti-restart for wood	• Adjustable entry / feed • Cutting head	• Push sticks • Outfeed support • Hearing protection for high noise planing
Press	Bench or Standing	Manual	• Caught between – crushing • Flying objects – eye, face, skin injuries		• Portable shield or cage for potential shattering object	• Warning label

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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 (tabletop, instructional)	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
Roller, Sheetmetal	Bench or Standing	Manual	• Caught between / pinch points – crushing, limited by manual operation			• Warning label

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Roller, Sheetmetal	Bench or Standing	Electric	Caught between / pinch points – serious crushing, amputation	- E-stop (manual, foot, bump, wire, light curtain) - Anti-restart	Sliding adjustable roller shield	Warning label
Sander, Belt (vertical or horizontal)	Bench or Standing	Electric	- Flying objects – eye, face, skin injuries - Rotating pulleys, belts - entanglement - Pinch points – crushing, bruising	- E-stop, accessible single action hand switch, or foot switch - Anti-restart	- Pulleys - Rollers (both sides) - Area below tool rest	Tool rest
Sander, Disc	Bench or Standing	Electric	- Flying objects – eye, face, skin injuries - Rotating pulleys, belts - entanglement - Pinch points – crushing, bruising	- E-stop, accessible single action hand switch, or foot switch - Anti-restart for wood	- Pulleys - Side	Tool rest
Saw, Cut-Off (abrasive disc and metal cutting)	Bench	Electric	- Sharp cutting blade – lacerations, amputations - Rotating blade –entanglement - Flying objects – eye, face, skin injuries - Heat / sparks – burns, fire	Finger / constant pressure switch	Blade (self-adjusting)	- Auto-return to upright - Fence - Vise – bolted / clamped - Clamps
Saw, Miter / Compound Miter Chop-Style Saw	Bench	Electric	- Sharp cutting blade – lacerations, amputations - Rotating blade –entanglement - Flying objects – eye, face, skin injuries - Heat / sparks – burns, fire	Finger / constant pressure switch	Blade (self-adjusting)	- Auto-return to upright - Fence - Clamps - Laser sighted cut
Saw, Upright Panel Style	Standing	Electric	- Sharp cutting blade – lacerations, amputations - Rotating blade –entanglement - Flying objects – eye, face, skin injuries - Heat / sparks – burns, fire	Finger / constant pressure switch	Blade (self-adjusting)	- Auto-return - Fence - Clamps

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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, amputation • Rotating tool –entanglement • Flying objects – eye, face, skin injuries	• E-stop, accessible single action hand switch, or foot switch • Anti-restart for wood	• 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

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