UW Physics Student Machine Shop

Standard Operating Procedures

Horizontal Mill

Purpose

The horizontal milling machine is very similar to the vertical milling machine. There are however, key differences. The most obvious difference is the orientation of the spindle Z axis in and out from the front. The X and Y axes are both still perpendicular to the spindle, traveling side to side and up and down across the machine's front plane.

The practical difference between the horizontal and vertical milling machines is enormous. The numerous adjustment points of the standard vertical design make it extremely agile. The horizontal counterpart sacrifices most these adjustments, giving up flexibility and precision for a far more rigid and sturdy frame built for heavy duty metal removal.

Mill machining and material removal is typically made by a rotary cutter held in a spindle. . Some of the common operations that can be performed on the mill include: • Milling– These operations provide a flat surface or spot on a work piece, typically with a specific orientation to other work piece features, surfaces, or another piece. Facing is sometimes used on an irregular shaped workpiece to "true" one surface at a time to ensure that all surfaces have appropriate specific geometric relationships with each other. Slots, flats, or keyways can be cut with proper fixturing.

Limitations

- The beefy rigidity of the Horizontal will not allow adjustment of the ram, rotation of the spindle turret, etc.

- The increased rigidity from sacrificed flexibility allows the Horizontal to take deeper cuts and remove more material with less wear on the cutting tools and machine itself.
- Tooling is always a limiting factor with any shop's Milling Machine. The Milling Machine cannot begin to reach its potential in both range and quality of work without a wide selection of quality accessories and cutting tools.
- Another, and probably more significant limitation of milling machine value is the skill of the operator. The set-up is critical. It should be built around a complete plan, serving the requirements of all operations from start to finish.
- The ability to properly and securely clamp or fixture the work-piece to the machine table. This must be done in such a way that it is secure and the physical shape/size allows for full travel and clearance with all machine components.
- The weight of the workpiece can be a limitation. This can be more problematic on smaller, bench top style mills. Verify manufacturer's specifications in advance.
- At times, a workpiece may extend off of the machine table. In this situation provide safety awareness barriers for other employees working in the shop. Also, beware of pinch point between the overhanging component and other shop equipment.

As always, whenever you have any questions regarding the safe operation of Student Shop equipment, find the Shop Instructor or another Instrument Maker and ask before you act.

Hazards

There are a number of particular hazards associated with the operation and use of tool, including but not limited to:

- Rotating Cutters and Spindle: Large amounts of energy are embodied in rotating parts. Never wear gloves while operating Milling Machine.
- Do not set spindle speed at excessive RPM's. Never start Mill at the extreme top of speed range. Potential for loose clothing, jewelry, hair, or other items can become entangled in rotating parts, potentially drawing the operator close to or into the cutter or spindle.
- Sharp Tooling and Edges on Work Piece • Potential for cuts, lacerations, and puncture wounds. Be careful when handling sharp objects, like workpiece and tooling. Gloves are permitted only during set up and before and after cuts.
- Fresh cuts on the workpiece may produce burrs and other sharp edges.
- Flying or Rotating Objects • Cutting and boring activities can generate sharp flying chips posing skin, facial, and eye injury hazards. Wear safety glasses and/or an OSHA-tested face shield at all times

- Work pieces, cutters and other tooling, or clamps can become disengaged and rotate or be flung across the room. Insufficiently secured work pieces can be rotated at high speed, potentially striking olr crushing fingers, hands, or other close body parts.
- Hot Objects and Components • The friction associated with cutting generates significant amounts of heat that can cause skin burns, flying sparks, and fire hazards. Keep the area clear of rags, flammable liquids, and other fuels.
- Power Feed and Computer Controls • These components introduce additional rotating and moving objects that can create pinch points and blunt object injury. Crush & Drop Hazards • During machine operation the operator usually concentrates their attention towards the cutting action. Usually the machine is in motion and unexpected crush hazards can develop.
- Pinch points/Moving Nip Points: • Pinch Points and in-running nip points can be found between the: o Cutting tool and work piece o Cutting tool and work holding devices • Pinch Points and moving nip points can cause bruising, crushing, and even amputation hazards, and can also offer additional entanglement hazards to clothing and other loose hanging materials.

Required Personal Protective Equipment (PPE)

- Safety glasses and/or an OSHA-tested face shield.
- Closed-toe, sturdy footwear. Sturdy sneakers and other such footwear is the minimum level of allowable foot protection. Proper safety shoes or boots, with steel toes, electrical protections, etc. are preferred. Extremely lightweight sneakers and all sandals and flip-flops are not safe for machine shops in general.
- Hearing protection is recommended in areas which exceed 85 decibels. Higher decibel levels can cause permanent hearing loss very quickly so hearing protection is always recommended in machine shops.
- If sufficient dust is created, a particle mask or respirator is advised.
- Hair ties, hats, etc. to safely contain long hair if needed
- Sturdy, well-covering and comfortable clothing WITH NO LOOSE SLEEVES, SCARVES, etc.

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