Inspection and maintenance of the many types of mechanical power presses prevent a number of safety problems, but they present others. Some common maintenance measures for safety will be discussed in this data sheet.

1. Serious incidents can result from malfunctions of mechanical power presses. The best press safety program cannot succeed, nor can efficient production be achieved without regular inspection and maintenance of the press and its related equipment.

2. Inspection, adjustment, and repair of mechanical power presses and related equipment should be supervised and performed only by competent, trained personnel. The employer is responsible for the competence of the work performed by personnel who care for, inspect and maintain mechanical power presses. The manufacturer’s or modifier’s operating and maintenance manuals, which establish guidelines for use and care of presses, should be available to and followed by maintenance personnel. If these manuals are not on file, they should be obtained from the manufacturer or modifier.

3. When press maintenance work is being performed, the area around the press being serviced should be cleared of all personnel that are not directly involved. This maintenance area is temporary, but it must be well defined, both at floor level and on the press. When an overhead crane can operate above the press, the top of the press should also be defined as part of the temporary maintenance area to be avoided whenever maintenance personnel are present. These maintenance areas should be defined by barricades, post and chain fences, flashing lights, a crane-lockout system, or other methods.

4. The employer should establish and follow a schedule of planned inspections as required to ensure that all press parts, including electrical components and power transmission guarding, are in safe operating condition and properly adjusted. Visual inspections should be made at least once per shift by the operator and other qualified personnel. A more thorough examination or inspection by qualified personnel should be made at weekly or monthly intervals, or at some other
reasonable interval related to the level of press use or as recommended by the manufacturer.

5. Necessary maintenance and repair should be performed and completed before the press is allowed to be used for production. The employer should maintain whatever records necessary to accomplish this objective and to identify particular problem areas that may require closer or more frequent inspection. Refer to the current American National Standard B11.1.

6. Safety blocks should be provided and used when working in the die area. Press drive motor and clutch control circuits should be interlocked with a safety block when in its stored position. Safety blocks should not be inserted into the die space until the flywheel motion has stopped.

7. Power-lockout procedures should be followed whenever unintended movement of parts could create a hazard during adjustment or repair work (refer to OSHA 29 CFR 1910.147). In addition to OSHA 29 CFR 1910.147, the following items may need to be considered in an employer’s evaluation of pertinent lockout/tagout procedures.

   a. Ensure that all moving parts are at rest and, when appropriate, that the slide is either at the bottom of the stroke or blocked in position.
   
   b. Check for pneumatic, hydraulic or other pressurized devices or lines such as used in die cushions that could be involved in the operation. If they affect the area under maintenance, bleed, drain or purge them to eliminate pressure, contents, or both.
   
   c. Valves controlling these lines should then be locked open or shut, depending on their function and position in the line. Air systems should be vented to the atmosphere; surge tanks and reservoirs may have to be drained. In any case, residual pressure in the lines should be prevented. If incoming pressure lines are not equipped with lock-out/blowdown valves, it is recommended that such valves be installed.

   d. Check for mechanisms that are under spring tension or compression. Either block, clamp or chain them in position before disassembly.
   
   e. Check for suspended mechanisms or parts that normally cycle through a lower position and could drop. Either lower them to their lowest position or block, clamp or chain them in place.
   
   f. Check for sharp or projecting parts or surfaces that could cut, tear or gouge. Either remove or pad them.
   
   g. Restore to normal conditions all equipment and/or systems that were disabled, vented or otherwise taken out of normal operating position or condition.

8. Mechanical power presses are subject to heavy loads, shocks and vibrations. The employer should refer to the manufacturer’s or the modifier’s maintenance instructions and manuals in preparing for a complete inspection and for developing an inspection format or procedure.

9. The press frame is the backbone of the press. Those press members subjected to the working (die) load are the crown, uprights, bed and tie rods (i.e., the frame), and the slide and connections. These load carrying items require inspections for cracks or fractures, particularly after a known overload. This is particularly true if the press has become stuck at the bottom of the stroke position or if excessive tonnage has been exerted.

10. The press should be secured in a manner that prevents it from “walking.” When resilient floor mountings are used, pipes connecting to the press should be free to move in order to prevent pipe breakage. All fasteners must be kept tight by proper torquing, use of lock washers, wire-locking threaded inserts, plastic thread compound, or as specified by the manufacturer or modifier. When replacing special lock nuts or high-tensile studs or screws, they should be replaced by like, kind and quality.
Drive mechanism

11. Accuracy of slide alignment and movement must be carefully maintained to prevent die misalignment that may result in die fracture or flying parts. Excess clearance at the gibbs or in bearings located in the connections, crankshaft, pitmans, wrist pins, ball and socket, etc., could affect alignment. Proper lubrication of these bearings is essential.

12. Drive belts should be properly adjusted. If they are loose, there may be excess slippage. If they are too tight, overloading of the motor bearings or the shaft may occur, which may result in a premature failure. Properly adjusted belts may slip slightly on the initial start-up of a motor but should not slip during press operation. Tighten and secure all motor-mounting and bracket bolts to prevent the motor from falling. Install safety cables where there is danger of the motor or its mounting base falling.

13. All bearings should be properly lubricated with particular care given to shaft-mounted flywheel bearings. If these bearings should seize, they may cause shaft rotation, shaft failure, or unintended slide movement.

14. Whenever a crankshaft or shaft carrying the flywheel or clutch and brake is removed from a press, it should be inspected for fatigue cracks. For presses used on a regular basis, serious consideration should be given to yearly inspection for cracks, bending or deformation. Fatigue cracks can be detected by numerous inspection methods, including ultrasonic, radiographic, magnetic or dye penetrant.

15. To maintain control over slide movement, keys must fit tightly and gears must be properly timed and in good operating condition. Loose-fitting gears may make it difficult to keep keys tight. If keys cannot be kept tight, the cause should be determined and corrected by recutting keyways, fitting new keys, building up the shaft or reboring the gear as needed.

Slide or ram

16. Inspect the slide/ram-adjusting, screw-locking provisions to be sure die-shut height can be maintained during operation. On a press with a motorized slide/ram adjusting screw, the motor should be checked for loose mounting bolts, loose drive chain or gears, worn or frayed flexible rope and loose electrical connections. Check slide-adjustment limit switches for proper operation and adjustment.

17. When the slide must be moved a small amount on full-revolution clutch presses with “bar” provisions, a spring-loaded turnover bar, should be used after the clutch is tripped instead of jogging the motor.

18. Make sure the bed and bolster plate is level, (see Figure 1) slide movement is perpendicular (angularity) to the plane of the bolster plate and that the die die-mounting surfaces are parallel.

19. If the slide is counterbalanced by springs, the springs should be checked for signs of fatigue or breakage. If the slide is counterbalanced by air, a check restrictions, correct operating pressure, loose piston rods, lubrication, and proper operation of the air-pressure switch. All counterbalance systems support brackets should be tight, with fasteners properly secured. An air-pressure rise on the down stroke should be made for air leaks. Air in the line of the press in excess of 20 percent may indicate a surge tank filling with condensation or lubricant. Periodic draining of all surge tanks is recommended to alleviate this condition. In high humidity areas, sight gages should be considered. Release air pressure before performing any disassembly of air-counterbalance systems.

20. If any part of a knockout mechanism creates a pinch point with other parts of the press and is within reach from the floor, the pinch point should be covered/guarded.

21. Check for fatigue cracks in the slide/ram adjusting screw and its connection. Check for secure fastening of the slide to the slide adjusting mechanism and the connection to the crankshaft. All mechanical power presses are capable of producing an overload force several times the press tonnage rating at the bottom of the stroke. Sudden failure of any of the parts attaching the slide to the crankshaft may cause
an equally sudden and dangerous dropping of the slide/ram. When hydraulic overloads are provided, they should be inspected for damage, broken components, and proper adjustment in accordance with the manufacturer’s or modifier’s recommendations.

Cushions

22. Hazardous motion can result if air gas or hydraulic die cushions are not de-energized properly. Care must be taken to make sure that all pressure is removed from cushions before any maintenance has begun on any cushion bolster or pin plate associated with the dies. The large cylinder area common in die cushions creates great forces at relatively low air pressure. Because of die cushion locations, it is common that chips, flashings and other scrap can cause them to stick or jam in a depressed position and appear inoperative, thus creating a serious hazard if the situation is not properly assessed and corrected.

23. Pressure pads and die cushions should be examined for foreign or scrap material between the pressure pad and the bolster. A check should also be made for faulty packings, leaks, improper lubrication and loose nuts and screws on the supporting rods or plates. Cushion pins must remain erect to prevent binding of the pins in the bolster holes, which can create a hazard by the sudden release of the cushions. Out-of-round, elongated holes should be redrille to use larger diameter pins.

Part-revolution clutch presses

24. Part-revolution clutch presses may be arranged to function in the inch, single stoke, or continuous modes or in a combination of these. The various operating modes should be checked at regular maintenance periods:

a. In the inch mode, check the inching function of clutch and brake with the operating control button(s). Check for consistent clutch/brake response.

b. In single stroke mode with two-hand control as the method for point-of-operation safeguarding, check that the motor is running correctly in the forward direction, and additionally, verify the following features:
   - Anti-repeat
   - Interrupted stroke
   - Holding time capability on down stroke
   - Automatic return from bottom of stroke to top of stroke.
   - Brake monitoring
   - Proper run-button location from safety distance calculations.
   - Control reliability design
c. In single stroke mode operated by a single run button or a foot switch, check the following features:
- Holding time capability on down stroke
- Automatic return from bottom to top of stroke
- Anti-repeat
- Brake monitoring if press is so equipped (depends on method of safeguarding used).

d. In continuous mode, check the “prior action required” feature of the continuous control, and check the top stop feature. Check that neither single stroke nor continuous will function unless the drive motor is running in the forward direction.
e. Check the (emergency) stop control feature in all modes.

25. Refer to OSHA regulations, Section 29 CFR 1910.217, or appropriate state regulations for clutch-control-reliability compliance.

26. Friction-clutch units are spring released and brake units are spring set. When the clutch and brake are interconnected mechanically (using a common activating means), only one unit can be engaged at a time when properly adjusted. When the clutch and brake are physically separated, each operated by its own activating means, a sequencing means must be employed to ensure that clutch engagement occurs after brake disengagement and that clutch disengagement occurs before brake engagement. Various pneumatic or electrical systems can be used. When servicing the clutch and brake on non-balanced machines, bring the slide/ram to bottom of stroke position, shut off the main drive motor, stop the flywheel, lock out the electrical disconnect, and exhaust the air-counterbalance system. Only after the clutch and brake has been properly adjusted should the proper air pressure be restored to the counterbalance system.

27. The clutch/brake mechanism should be checked for loose bolts and nuts, broken parts, lubrication leaks, air leaks, excessive accumulation of particles of the friction lining, condition of the lining and broken springs. Always refer to the press manufacturer’s or modifier’s specifications, and replace parts with recommended replacement parts. Fasteners should be secured in accordance with manufacturer’s or modifier’s instructions.

28. The top-stop limit switches position should not be adjusted to compensate for brake wear.

29. Refer to the press maintenance manuals for the proper setting of the cycle-top stop. The clutch and brake should operate smoothly and engage and disengage quickly. The press slide should stop quickly when the brake engages.

30. Dual, monitored, clutch/brake air valves must be used on all machines. They should operate smoothly, without sticking or leaking. Use of air line filters and lubricators (if required) is essential to prevent valves from sticking due to dirt or scale from the air line. Leaky valve seals should be replaced. Valves should be inspected, cleaned and adjusted in accordance with manufacturer’s or modifier’s recommendations. Be sure that exhaust ports are kept clear. The exhaust muffler should be of a type recommended by the valve manufacturer and should be no smaller than the exhaust port size. Mufflers should be cleaned and inspected frequently to prevent deterioration of stopping performance. Air-line filters, lubricators and moisture traps will increase the life of seals and contribute to proper operation of the clutch and brake. Traps and strainers should be included in scheduled maintenance and be checked and serviced frequently. Plastic oil reservoirs and air-line lubricators should be checked for cracks and never cleaned with solvents that may adversely affect plastic. Use only lubricants recommended by the valve manufacturer that are compatible with the valve seals. Metal bowl guards are recommended to be used with pressurized reservoirs. Schedule regular lubricator maintenance.
31. Proper performance of the electrical and electronic controls affects the operation of the system. Push-buttons, limit switches, relays and contactors should be inspected for excessive wear broken springs, loose parts, loose or broken wires, peened solenoid-magnet surfaces, badly burned contacts and dirt. Device or circuit grounding connections should be checked for continuity. Badly worn contacts should be replaced in accordance with the manufacturer’s or the modifier’s recommendations. Any electrical contact or circuit should not be jumpered to defeat its original function. Particularly, inspect the rotary limit-switch drive and its drive failure detection system; failure of these mechanisms may result in press stopping malfunction. Make sure the rotary limit-switch cover is in good repair and in place to minimize damage and wear to the limit switch.

32. A wet-type (oil), air-actuated friction clutch/brake mechanism has much the same type of maintenance requirements as the dry friction clutch/brake type. Refer to manufacturer’s or modifier’s recommendations for special care.

33. The eddy current electrical clutch/brake mechanism has no friction surfaces to maintain, but it does have slip rings and a special electrical control to maintain the torque and slip characteristics. Refer to the manufacturer’s recommendations for special care. If a mechanical holding brake is incorporated into the system, refer to paragraphs 25, 26 and 27 for proper maintenance.

**Full-revolution clutch presses**

34. Positive clutches are almost always full-revolution types. Usually, a tripping device releases a previously retracted engaging member, permitting it to engage with its counterpart. A full revolution of the crankshaft must then occur before the engaging member is retracted as it approaches the trip mechanism.

35. The full-revolution clutch should be examined for cause of abnormal noise, loose parts, worn clutch disengagement mechanisms, broken or weak springs, damaged lubrication seals and excessive wear in the bearings. Proper seating or positioning of the clutch latch or cam mechanism is extremely important. Full latch or cam contact must be made to disengage the clutch and keep it disengaged. The engaging surfaces must not become worn or irregular. No looseness or uncontrolled movement of the latch mechanism can be permitted. All fasteners and keys should be installed properly and checked for tightness, including those that retain the flywheel or gear in its proper position on the crankshaft. Worn or broken parts should be replaced with manufacturer’s replacement parts. The clutch must be maintained and adjusted to conform to the information provided by its manufacturer or modifier.

36. Unless a full-revolution press is dedicated to continuous stroking using automatic feed exclusively, it should be equipped and operated with an anti-repeat system or a mechanical single-stroke mechanism. If an electro-pneumatic, anti-repeat system is used, it should be checked in a method similar to that described in paragraph 30. Care should be taken to provide appropriate air pressure and length of travel to the pull-rod operating cylinder to avoid damage to the clutch mechanism or excessive clutch wear.

37. On some full-revolution presses, the press cycle may over travel its top-stop position because the brake is incapable of stopping the
slide quickly. If severe enough, this over-travel can damage the mechanism and may cause clutch reengagement. It is characteristic of many mechanically actuated clutch and brake mechanisms that the press may appear to be functioning properly while actually malfunctioning. All braking mechanisms must effectively stop and hold the crank in its top-stop position. Care must be taken through preventive maintenance to evaluate and correct poor braking before failures and malfunctions occur.

38. Operators must be trained to notice any change in the performance or sound of the press. Any change should be reported to supervision immediately. Do not continue operation until the press has been carefully inspected and necessary repairs are completed.

Modifications

39. Modifications to a press should not be undertaken without understanding the impact such modifications may have on press performance and safety. There are construction features that may relate to safety that are not readily seen. Modifications should be discussed with the original manufacturer or the modifier before proceeding.

Sources of information


29 CFR 1910.217 Mechanical Power Presses

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