The Associated Press
March 26, 2012
Northeastern, PA—An employee at a northeastern Pennsylvania paper factory is dead following an industrial accident.

Officials at a local paper production plant say a 36-year-old maintenance worker died Saturday afternoon, a little more than an hour after being injured while repairing a machine.

Company officials say the accident happened while production lines were shut down for routine maintenance. The County coroner says the worker died from head trauma sustained while repairing the machine.

The Occupational Safety and Health Administration (OSHA) is looking into the accident along with company officials.

(http://www.therepublic.com/view/story/52c3b4f4afdf4330a8a03bb06380ca1/PA--Industrial-Accident-Death/)

WHITE PAPER
Are You at Risk?
The Role of Lockout/Tagout in Pneumatic Safety
Author: Jerry Scherzinger

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Introduction
A primary cause in many industrial accidents is that equipment that is "under repair" starts or moves suddenly while the worker is in a dangerous position within the machine. This can happen when there is a failure to properly identify, isolate, and eliminate stored energy sources within equipment prior to beginning maintenance tasks. This stored energy (often referred to as "potential energy") can be very dangerous if not dissipated as it can cause unexpected machine movements, even when the machine is "turned off". Residual pressure in hydraulic or pneumatic lines, stored electrical energy, and stored pressure in compressor tanks or accumulators are examples of the potentially hazardous energy.

Proper maintenance protocol should include the dissipation of hazardous energy prior to any maintenance personnel working on the equipment.

Over the past 10 years an average of 5,433 U.S. workers have died in fatal work injuries (see Figure 1).

Primary oversight of safety in the workplace in the United States resides with the Occupational Safety and Health Administration (OSHA). Each year OSHA publishes data on the standards that are most often violated and lead to injuries, as well as a list of the highest OSHA assessed penalties for workplace safety violations (see Figure 2). In 2011 the improper control of hazardous energy (lockout/tagout) standards ranked fifth in the list of most frequent violations and third in the list of the highest penalties assessed to employers for violating these standards.

Most Frequently Cited Standards
The following were the top 10 most frequently cited standards in the fiscal year 2011 (October 1, 2010 through September 30, 2011):

1. Scaffolding, general requirements, construction (29 CFR 1926.451)
2. Fall protection, construction (29 CFR 1926.501)
5. Control of hazardous energy (lockout/tagout), general industry (29 CFR 1910.305)
8. Ladders, construction (29 CFR 1926.1053)
9. Electrical systems design, general requirements, general industry (29 CFR 1910.303)
10. Machines, general requirements, general industry (29 CFR 1910.212)

Most Frequently Cited Standards
The following are the standards for which OSHA assessed the highest penalties in the fiscal year 2011 (October 1, 2010 through September 30, 2011):

1. Fall protection, construction (29 CFR 1926.501)
2. Scaffolding, general requirements, construction (29 CFR 1926.451)
3. Control of hazardous energy (lockout/tagout), general industry (29 CFR 1910.147)
5. Ladders, construction (26 CFR 1926.1053)
6. Excavations, requirements for protective systems (29 CFR 1926.652)
8. General duty clause (Section 5(a)(1) of the OSH Act)
10. Electrical systems design, general requirements, general industry (29 CFR 1910.303)

Figure 1: Number of fatal work injuries, 1992-2010*

Lockout/Tagout
OSHA requires all employers to comply with an energy control program, including training and inspection, to ensure that machines that could unexpectedly start up or become energized or release energy are rendered safe before service and maintenance is performed.

Applicable Standards Specific to Pneumatic Safety

1. ANSI B11.0-2010—Safety of Machinery-General Safety Requirements and Risk Assessment
2. ANSI/PMMI B155.1—Packaging Machinery Standard
3. OSHA 29 CFR 1910.147—Control of Hazardous Energy (lockout/tagout)

One purpose of this paper is to expose the reader to these various standards. The length of this paper does not allow for an in-depth review of each standard. Various topics will be highlighted as they apply with specific focus given to the control of hazardous energy and the use of lockout/tagout procedures. For a complete understanding of each standard it is recommended that the reader obtain the full standard and review it as applicable to their individual industry requirements.

1. ANSI B11.0—Safety of Machinery-General Safety Requirements and Risk Assessment

This general standard applies to all industrial environments. The main focus of this standard is to provide a template for the overall risk assessment process which is the first step in creating a safety program (see Figure 3).

The scope of the standard limits applications to “new, modified or rebuilt power-driven machines, not portable by hand, used to shape and/or form metal or other materials by cutting, impact, pressure, electrical or other processing techniques, or a combination of these processes” (ANSI, 2010C)

2. ANSI/PMMI B155.1—Packaging Machinery Standard

While very similar to ANSI B11.0-2010 this standard is more specific to packaging machinery, as the title implies. One of the key features of ANSI/PMMI B155.1 as it specifically relates to pneumatic safety is the direct reference to the need for an “energy isolation device”.

As noted in the OSHA and ANSI standards, the requirement for an energy isolation device and the corresponding use of lockout/tagout procedures is a critical step in the risk assessment and hazard reduction process. It is through these processes that proper levels of worker safety can be attained.

7.11 Packaging machinery shall minimize potential hazards from:
> Overpressure
> Pressure surges
> Pressure loss
> Fluid jet
> Stored energy
> Sudden hazardous movement of a hose resulting from leakage or component failure

7.11.1 Safety shut off and exhaust valve
An energy isolating device shall be provided to shut off and release pressure from the various systems and shall:
> Be capable of being locked in the off (closed) position only
> Be easy to operate (e.g. simple pull/push action for pneumatics)
> Pressure loss
> Have a properly sized exhaust port to exhaust pressure in an acceptable period of time as determined by the risk assessment
> Have a pressure indicator that is visible to the operator to indicate that the line is relieved of pressure

3. OSHA 29 CFR 1910.147—Control of Hazardous Energy (Lockout/Tagout)

The United States Department of Labor through OSHA defines Lockout/Tagout (LOTO) as, specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities.

The standard further explains that, proper lockout/tagout requires that a designated individual turns off and disconnects the machinery or equipment from its energy source(s) before performing service or maintenance and that the authorized employee(s) either lock or tag the energy isolating device(s) to prevent the release of hazardous energy and take steps to verify that the energy has been isolated effectively. (www.osha.gov)
The OSHA website breaks this standard into numerous subsections by industry and offers links to the individual subsections as well as links to interpretations of the standards.

OSHA statistics estimate that approximately 3 million workers service equipment and face the greatest risk of injury if lockout/tagout is not properly implemented. Compliance with the lockout/tagout standard (29 CFR 1910.147) prevents an estimated 120 fatalities and 50,000 injuries each year. Workers injured on the job from exposure to hazardous energy lose an average of 24 workdays for recuperation. In a study conducted by the United States Auto Workers (UAW), 20% of the fatalities (83 of 414) that occurred among their members between 1973 and 1995 were attributed to inadequate hazardous energy control procedures specifically, lockout/tagout procedures. (www.osha.gov)

For complete information on this standard, visit www.osha.gov/SLTC/controlhazardousenergy/index.html

Best Practices for Safely Maintaining Industrial Machinery

Maintenance is essential in any industrial setting for the equipment to operate in a safe and efficient manner. Maintenance can be a costly element of facility operations in terms of budget and impact on operations. Maintenance can also be a potential workplace safety issue if not properly addressed.

There are three common types of maintenance:

1. Emergency repairs when something breaks
2. Preventative maintenance, which is carried out on a piece of equipment at a certain interval
3. Predictive maintenance, which is carried out when tests indicate that maintenance is needed

Regardless of the type of maintenance, a number of important activities must take place if the maintenance is to be carried out in a safe manner:

- Equipment selected to have maintenance carried out must be isolated. This includes ensuring that all sources of energy to the equipment are inaccessible and disconnected and tagged “OFF” (The power source should be tagged “OFF—UNIT UNDER REPAIR” with the date and signature of person authorizing the procedure.) so someone does not turn the power on until work is completed. The equipment must also be isolated from the other equipment in the same system.

- It is important to recognize that simply turning the equipment off is insufficient protection for maintenance workers. Care must be taken to further identify potential energy sources at the “point of use” and to release any potential stored energy in these machine “sub-systems”. An example would be the use of a Pneumatic Isolation Valve capable of exhausting stored pneumatic pressure (energy) for which it is possible to lock and tag in the “off” position.

- Maintenance procedures must be developed for all equipment. These procedures should follow the manufacturer’s recommendations and include all instructions, drawings and list of parts needed.

- Maintenance activities, even emergency repairs, must be planned. The time it takes to plan a job, read the maintenance procedures and get the needed safety equipment will be made up in the safety of the job and the ease in completing the job. A little planning goes a long way in doing safe maintenance. To rush into an emergency repair is to invite disaster.

- Maintenance personnel must be trained on the equipment. The proper equipment must be used to safely carry out maintenance. Proper safety equipment such as gloves, eye protection, foot protection and hard hats should always be used.

- Any safety devices or shields removed during maintenance MUST be reinstalled on the equipment prior to completion of maintenance. Any shields and safety devices originally installed on a piece of equipment must not be left off to “make it easier to fix the next time.”

- Prior to returning the equipment to service, a supervisor who is familiar with the equipment and the maintenance, should check the equipment to insure that the maintenance is complete, the equipment is properly reassembled, all safety equipment and any tools used in the maintenance have been removed.

(www.nonprofitrisk.org/tools/workplace-safety/public-sector/topics/bm/maintenance-ps.htm)

Lockout/Tagout and the Use of Pneumatic Isolation Valves (PIV)

Pneumatic Isolation Valves are typically the first valve following the FRL components in the line supplying compressed air to pneumatic equipment.

The PIV is a critical component in any safety lockout/tagout system, by providing quick means of shutting off the supply of air and exhausting the downstream lines.

Available sizes range from 1/4” inlet/outlet ports with 3/8” exhaust ports up to 1-1/2” inlet/outlet ports with 2” exhaust ports.

Available accessories include air mufflers, pressure switches, and air pressure “visual” indicators.
**Lockout/Tagout Programs**

Studies have shown that an effective lockout/tagout program can reduce accidents by 30-50%, and some insurance companies even offer lower premiums to companies with demonstrated, effective lockout programs. The failure to recognize the importance of a proper lockout/tagout program can cost employers dearly as settlements for workers compensation claims can reach into six figures for injuries and seven figures for accidental deaths when the employer is found to be negligent.

**How the PIV Works**

With a short push of the red handle inward, the flow of supply air is blocked and downstream air is exhausted via the exhaust port at the bottom of the valve.

The PIV valve should be padlocked in this position to prevent the handle from being pulled outward inadvertently where potential for human injury exists or while servicing machinery.

When the red handle is pulled out, supply air flows freely from inlet to outlet and flow to exhaust is blocked. A detent keeps the handle in the open position. The handle is not designed to be locked in this position, thereby providing for ready shut-off when necessary.

In an effort to support worker safety, specific design requirements are provided within ANSI B11.0-2010 to guide machine designers to include specific safety components within their systems.

**Section 7.11.1 states:**

- An energy isolating device shall be provided to shut off and release pressure from the various systems and shall:
  - Be located outside of the hazardous area
  - Be capable of being locked in the OFF (closed) position only
  - Be easy to operate (e.g., a simple push/pull action for pneumatics)
  - Have a properly sized exhaust port equal to or greater than its supply port
  - Have a pressure indicator (i.e. gauge), that is visible to the operator to indicate that the line is relieved of pressure

**Common Non OSHA/ANSI Approved Isolation Valves**

It should be noted that some commonly used methods of isolating pneumatic energy are not approved by OSHA and ANSI standards. For example it is common to use ball valves as the means of isolation. However ball valves are not an approved method of isolating hazardous energy for the following reasons:

- Ball valve shut-off is not “positive”; it has infinite positions
- Ball valves do not have full exhaust port (CSA Z142, PMMI B155)
- Some can be locked in the ON position
- Some can be tampered and bypassed
- Ball valves are not easily identifiable as isolation valves in an emergency
- Ball valves have a small bleed off port and can create a false sense of safety
- Inability to install a muffler on a ball valve presents a concentrated exhaust with eye hazard concerns

Other examples of shut off valves that are commonly used but do not satisfy OSHA and ANSI include:

- Slide type shut off valves:
  - Does not have full sized exhaust port

- Rotary style shut off valves:
  - Can be locked in partially “ON” position
  - Is not simple push/pull style
Audit your Lockout/Tagout Procedures

This paper has taken a broad look at the importance of risk assessment and specifically the role of proper lockout/tagout procedures as they contribute to an overall safety conscious workplace. Both OSHA and ANSI standards and statistics support the importance of proper control of hazardous energy.

It is recommended that all companies perform an audit of their current lockout/tagout procedures to insure they are providing the highest level of protection to the workers responsible for operating and repairing the various pieces of industrial equipment and machinery in their facility.

If you cannot answer yes to all of the following questions, adjustments to current procedures need to be enacted immediately.

> Is all machinery or equipment (capable of movement) required to be de-energized or disengaged and locked out during cleaning, servicing, adjusting, or setting-up operations?
> Is it prohibited to lock out control circuits in lieu of locking out main power disconnects?
> Are all equipment control valve handles provided with a means of lock out? Does the lockout/tagout procedure require that stored energy (i.e., mechanical, hydraulic, air) be released or blocked before equipment is locked out for repairs?
> Are appropriate employees provided with individually keyed personal safety locks?
> Are employees required to keep personal control of their key(s) while they have safety locks in use?
> Is it required that employees check the safety of the lockout by attempting to start up after making sure no one is exposed?
> Where the power disconnecting means for equipment does not also disconnect the electrical control circuit:
  - Are the appropriate electrical enclosures identified?
> Are means provided to assure the control circuit can also be disconnected and locked out?

(www.oshatrain.org/pdf/audit1)
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Reference List


ANSI B11.0-210 – Safety of Machinery-General Requirements and Risk Assessment

ANSI/PMMI B155.1 – Packaging Machinery Standard

OSHA 29 CFR 1910.147 – Control of Hazardous Energy (lockout/tagout)