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Triodyne Inc.

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5950 West Touhy Avenue Niles, IL 60714-4610 (847) 677-4730

FAX: (847) 647-2047

e-mail: infoserv@triodyne.com

GENERAL SAFETY

Interlocks – The Baking Industry Experience

by Steven R. Schmid, Ph.D., P.E., C.Mfg.E.[1]

Interlocks have been used successfully in many applications, but have a significant downside which can make them an unattractive design alternative from a safety standpoint. Many of these downsides are associated with maintenance practices and are discussed in the Triodyne Safety Brief "Safety Interlocks – The Dark Side" [1]. The experiences of the baking industry and interlocking of safeguards is summarized here. Interlocks, when given a fair and unbiased trial, were found lacking from a safety standpoint.

HISTORY

In 1971, the American National Standards Institute, on the recommendations of the American Society of Bakery Engineers Z50 committee, passed a new edition of the Z50.1 standard "American National Standard for Bakery Equipment – Safety Requirements". One of the many provisions in the standard is the following [2]:

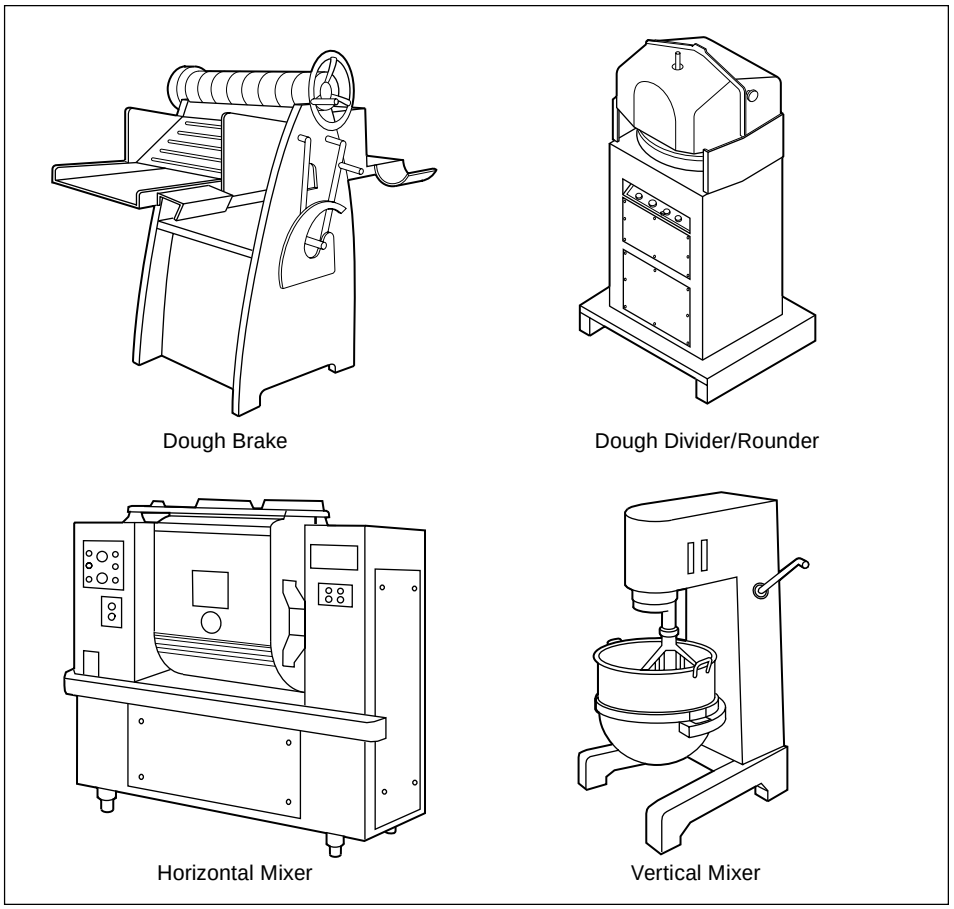

Fig. 1 – Bakery Machines

[1] Assistant Professor, Department of Aerospace and Mechanical Engineering, University of Notre Dame and Senior Consultant, Triodyne, Inc.

3.1.4 Guards. All guards which are hinged, readily removable, or removable, shall be provided with safety interlock switches which cause the machine drive motor to be de-energized when these guards are *opened* or *removed.*

This edition was published in December 1971 and is the first and only blanket endorsement of interlocks known. The ANSI Z50 committee meets once a year, at the American Society of Bakery Engineers annual meeting in February. On February 27, 1973, just over a year after the above standard's publication, an addendum, Z50.1a – 1973 was passed, which reads [3]:

On page 10, replace 3.1.4 with the following:
3.1.4 Guards. All guards or covers, which enclose hazardous, moving parts and which must be opened during normal operation, shall be provided with an interlocking device which prevents the machine from being operated when the guard or cover is opened or removed. [emphasis added].

The number of guards which must be opened during normal operations is extremely small; guards are commonly opened during maintenance or sanitation, but hardly ever during operation. This addendum marks the retreat of the baking industry from general interlocking requirements, although interlocks have been called for occasionally for specific applications.

ANALYSIS

In 1972, a number of large bakeries attempted to comply with the interlocking requirement promulgated in the previous year. The result was an immediate and noticeable **increase** in the accident frequency rate at those bakeries. There are special concerns in the food processing industry which are incompatible with interlocking, and which lead to a number of incidents solely because of the incorporation of interlocks. Some of the most common examples are the following:

- Guards are commonly placed in food contact or food splash zones of bakery equipment. When this occurs, there is a tendency for liquids and batters to collect at nonconformal junctions. Upon solidifying or drying, these liquids and batters can cement any surface in place. This is normally not sufficient to prevent removal of a guard, but commonly will defeat an interlock. Operators depending on the interlock to turn off a machine are jeopardized by the failure of the interlock.
- Maintenance and sanitation operations must be performed in a zero mechanical state (ZMS). The use of interlocks causes a statistically significant number of users to perform maintenance and sanitation with power connected, an inherently dangerous situation.
- Many bakeries consist of hundreds of yards of conveyors. Access panels to the interior of the conveyor are spaced every few feet, and according to the 1971 standard would require interlocks. When this was attempted, it was found that a conveyor would occasionally shut itself down. Operators would call for the maintenance department, and would wait until the maintenance crew arrived. The maintenance crew would initially attempt to troubleshoot the difficulty, but would eventually conclude that an interlock switch had tripped due to vibration or some other source. They would open and close access panels until the machine could be restarted. Of course, the product which had been on the conveyor had to be discarded.

  After a number of such service calls, the maintenance team would arrive and start punching and kicking the access doors in order to reset the interlocks. This abuse led to further interlock failures and increased downtime. All of the product on the conveyor for each service call had to be discarded, and the profitability of the conveyors was compromised.

  Interlock proponents would suggest that an access panel be provided for troubleshooting assistance. Whenever an interlock is thrown, a relay closes another switch which turns on a light at a control panel indicating the location of the actuated interlock. The added sophistication to the electrical circuitry and the large number of additional components needed quickly makes this solution overly burdensome.
- Interlocks which are tied down or defeated for setup purposes, or intentionally by operators, can lead to accidents on subsequent shifts where the defeated state of the interlock is not known.

SUMMARY

Given these experiences, it is not unreasonable that the addendum to the standard was promulgated. What is surprising is the speed with which the addendum was passed, especially given the tendency of many consulting experts to depict interlocks as a safety panacea.

The current standard still uses the language of the 1973 addendum, and is careful to differentiate between operation, sanitation, and maintenance procedures. The number of guards which must be opened during normal operation is very small in modern bakeries. To this day, the baking industry is extremely wary of interlocking as a path to accident frequency rate reduction. Currently training is being reemphasized, with the realization that practically no machine in a bakery is reasonably safe without proper training, and practically all are reasonably safe with proper training.

REFERENCES

1. Hall, Frank F., "Safety Interlocks – The Dark Side," Triodyne Safety Brief, v.7 n.3, June 1992.
2. "American National Standard Safety Requirements for Bakery Equipment," ANSI Z50.1 – 1971. New York: American National Standards Institute, approved October 6, 1971.
3. "American National Standard Supplement to Safety Requirements for Bakery Equipment," ANSI Z50.1a – 1973. New York: American National Standards Institute, approved February 27,1973.