ANSI B11.20–2017

American National Standard –

Safety Requirements for Integrated Manufacturing Systems

ANSI-Accredited Standards Developer and Secretariat:

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FOREWORD

(This Foreword is not part of the requirements of American National Standard B11.20-2017)

Overview

Each integrated manufacturing system (IMS, 1.1) can be very different in terms of size and complexity, and can incorporate different technologies that require diverse expertise and knowledge. An integrated manufacturing system should be considered as a whole new and different machine rather than simply the sum of its parts combined. Hazards are frequently unique to a particular IMS. The number and types of hazards are directly related to the nature of the automation process and the complexity of the installation. The risks associated with these hazards vary with the type of machinery used, their purpose, and the way in which they are installed, programmed, operated, and maintained.

As individual machines and equipment are incorporated into an IMS, new hazards arise and new risks are introduced. In particular, combining individual machines intended by the supplier to operate independently into an IMS for coordinated operation typically introduces new or additional hazards not foreseen by each OEM. This standard deals only with those safety aspects that are important for the safety relevant interconnection of the machinery and equipment. Therefore, it is not intended to cover safety aspects of individual machines and equipment that may be covered by machine-specific "base" safety standards.

This standard relies on other standards to determine which risk reduction measures are required or allowed to control identified hazards or hazardous situations, and is intended to be used in conjunction with the ANSI B11.0 standard on general safety requirements and risk assessment of machines, the ANSI B11.19 standard on performance requirements for risk reduction measures, and any other machine-specific "base" safety standard for the given machinery incorporated into an IMS.

Designing and integrating an IMS with acceptable risk depends on the cooperation of a variety of "stakeholders" – those entities that share in a responsibility for the ultimate purpose of providing a safe working environment. Stakeholders may be identified as suppliers (see 4.1), users (see 4.2), modifiers (see 4.3), or personnel (see 4.4), but all share the common goal of an IMS with acceptable risk. The requirements in this standard may be assigned to one of the stakeholders, but overlapping responsibilities can involve multiple stakeholders in the same requirements. While using this standard, the reader is cautioned that all of the requirements identified may apply to them, even if not specifically addressed by "assigned" stakeholder tasks.

The supplier or modifier of an IMS needs the cooperation of entities who, individually, may know only a part of the whole. Where there are requirements for frequent manual interventions to parts of the IMS (e.g., inspections, maintenance, set-up, observation), it can be impractical or unnecessary to stop the whole IMS. This standard presents requirements to provide for the safety of individuals who perform these tasks. Risk reduction for these tasks relates to the concept and use of "task zones."

Objective

The primary objective of this standard is to eliminate or control hazards to personnel associated with integrated manufacturing systems by establishing requirements for the construction, operation and maintenance of these machine systems. To accomplish this objective, responsibilities have been assigned to the supplier (e.g., manufacturer, rebuilder, reconstructor, installer, integrator), the user, the modifier, and personnel in the working environment.

Historically, terms have been used in the B11 community to describe requirements for the safety of machinery. With the globalization of standards and the need to harmonize requirements language, the ability to translate terms has become increasingly important. In addition, some terms are commonly used but not necessarily with common meanings. As a result, this edition of B11.20 has transitioned to certain new terms, including:

Previous term	Current term
Safeguarding	Risk reduction measures / Engineering controls
Guards and safeguarding devices	Engineering controls - Guards / Engineering controls - Devices
Awareness devices	Awareness means
Complementary equipment	Term no longer used
Safeguarding methods	Part of risk reduction measures

The words “safe” and “safety” are not absolutes. Safety begins with good design. While the goal of this standard is to eliminate injuries, it is recognized that risk factors cannot be practically reduced to zero in any human activity. This standard is not intended to replace good judgment and personal responsibility. Operator skill, attitude, training, job monotony, fatigue and experience are safety factors that must be considered by the user.

Automation technology is continuously evolving. This standard reflects the best industry practice and time-tested state of the art at the time of its approval. The inclusion or omission of language relative to any evolving technology, either in the requirements (normative) or explanatory (informative) area of this standard, in no way infers acceptance or rejection of such technologies. This standard allows effective solutions to be developed using risk assessment as justification.

History of this American National Standard

This is the third edition of the ANSI B11.20 standard, and it is generally considered as a type-B standard (see Introduction). The original ANSI B11.20 standard was approved in 1991, reaffirmed in 1996 and revised in 2004. The second edition was reaffirmed in 2009 and again in 2015.

In this revision, the concepts of various “zones” have been elaborated. In addition to the existing terms “zone” and “hazard zone,” the term “task zone” has been incorporated and harmonized with ISO 11161 (also a standard on integrated manufacturing systems), and the term “control zone” has been introduced. The idea of “span of control” has been updated and harmonized with ISO 11161. These terms are used to expand the concept of layout analysis as a process to determine zones and define spans of control for safety-related control devices, including minimum level of safety performance for each device. A new Annex D has been developed which details the layout analysis process.

In addition, this revision has expounded on the concept of “special mode” as any additional mode required to operate equipment when integrated into an IMS that is not necessary when the equipment is operated independently. A new Annex E has been developed to address considerations before adding a new “special mode.” This annex is an extension of the “process observation” topic addressed in both ISO 11161 and ISO 10218-2 (a standard on industrial robot systems and integration).

Furthermore, this revision incorporates the B11 Accredited Standards Committee’s (ASC) initiative to apply standardized processes and common language to the entire B11 series of ANSI standards through a stratified approach to standardization (this so-called type-A, type-B and type-C standards). Consequently, many definitions for common terms contained in the previous edition of B11.20 can now be found in the ANSI B11.0 and ANSI B11.19 standards. This initiative also significantly impacted clauses 4, 5, 7, and 9. New content to address training has been incorporated in a new clause 10 and Annex F, and a new clause 11 on the decommissioning process has been added as well. Furthermore, the concepts of layout analysis and span of control developed by the B11.20 Subcommittee have been included in the B11 ASC standardized process and common language for incorporation into the ANSI B11 Type-C standards.

The B11 standards for machines/machine tools were first approved beginning with safety requirements for power presses in 1922. Since that time, safety standards and requirements for a variety of machines have been developed and continually updated and revised to become a series of nearly 40 B11 standards and technical reports. This series contains type-A standards such as ANSI B11.0 and ANSI/ISO 12100 on broad/general safety requirements, type-B standards such as ANSI B11.19, B11.20 and all of the B11 technical reports dealing with broad safety aspects such as risk reduction measures (safeguarding), ergonomics, lean/safety integration and noise, and type-C standards addressing specific machine types or groups or like machines. This B11.20 standard is intended to be used with ANSI B11.0, ANSI B11.19, and any applicable machine-specific standards. The requirements of all standards must be met as applicable to a particular IMS.

Effective Date

This B11.20 Subcommittee recognizes that some period of time after the approval date on the title page of this document is necessary for suppliers, integrators, modifiers and users to develop new designs, or modify existing designs or manufacturing processes in order to incorporate the new or revised requirements of this standard into their product development or integrated manufacturing system.

This B11.20 Subcommittee recommends that suppliers complete and implement design changes for new integrated manufacturing systems within 30 months of the approval of this standard.

This B11.20 Subcommittee recommends that users evaluate whether existing integrated manufacturing systems have acceptable risk within 30 months of the approval date of this standard using generally recognized risk assessment methods. If the risk assessment shows that modification(s) is necessary, refer to the requirements of this standard to implement risk reduction measures for appropriate risk reduction.

Harmonization

The requirements of this standard have been harmonized with the international standard ISO 11161 on the same subject matter, as well as selected U.S. standards. Harmonization means that the requirements have been aligned in essence to achieve a similar level of risk reduction. Harmonization does not mean duplication of exact requirements.

Considerable effort has been made to avoid conflicting requirements, however, the task is quite challenging because the standards do not map directly in scope, requirements, approaches and revision dates. ISO safety standards tend to be very directive in nature, thus possibly limiting solutions for particular applications. In addition, ISO 11161 only applies to the suppliers of integrated manufacturing systems and is unable to include any requirements for users. ISO 11161 also only applies to new systems and excludes existing systems. ANSI B11.20 differs from ISO 11161 in that it specifically includes requirements for suppliers, integrators, modifiers, and end users, and it also addresses both new and legacy systems.

Differences between ANSI B11.20 and ISO 11161 result from different analytical methods or approaches. However, the differences between the requirements are generally considered inconsequential to the achievement of acceptable risk or to compliance with the EU Machinery Directive 2006/42/EC, OSHA (specifically, 29 CFR 1910.212(a)(1)), or other legal requirements. As a result, using risk assessment as described by ANSI B11.0 and complying with the requirements of machine-specific "base" safety standards, ANSI B11.20 and ANSI B11.19 will enable a machine supplier to meet the essential safety and health requirements contained in Annex I of the EU Machinery Directive 2006/42/EC when used as alternate technical specifications to EU harmonized standards.

Inquiries

Inquiries with respect to the application or the substantive requirements of this standard and suggestions for its improvement are welcomed, and should be sent to the B11 Standards, Inc., POB 690905, Houston Texas, 77269; Attention: B11 Secretariat or www.b11standards.org.

Development

This standard was prepared by the B11.20 Subcommittee, processed for comment/balloting by the B11 Accredited Standards Committee, and submitted for ANSI approval by the Secretariat. At the time of approval as an American National Standard, the ANSI B11 ASC was composed of the following Members:

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