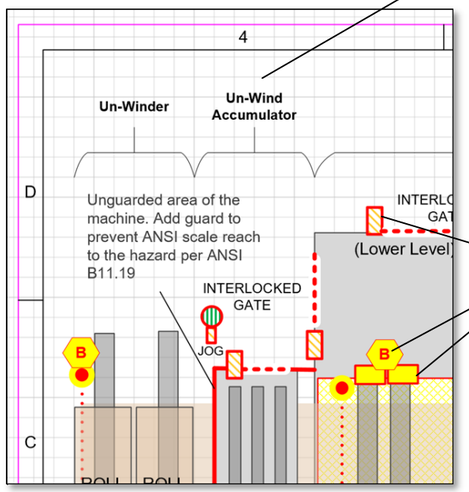
Page Detail



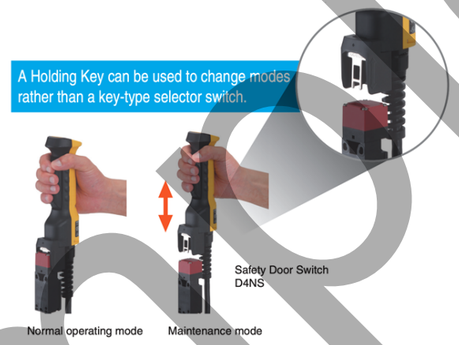
Section corresponds with location in Machine Safety Reports. See reports for additional details with photos and comments.

See Legend for symbol identification. Machine Safety Reports contain detailed recommendations, and additional detail

Guarding Examples

Brake Guard

Telescoping Guard



Enabling

LEGEND

- Point of Operation Guard or Barrier Guard
- Perimeter Guard w/ excellent visibility
- Hinged Guard or Door Interlocked per ANSI B11.19
- OSHA Compliant guard rail w/ gates as needed
- Awareness barrier with ANSI compliant sign.
- A: 

- B: 

- Safety Mat w/ Control Reliability per ANSI B11.19
- E-Stop with Control Reliability per ANSI B11.19
- E-Stop Pull Rope with Control Reliability per ANSI B11.19
- Enabling Switch Pendant w/ Function Noted With Stow Switch per ANSI B11.19 (JOG)
- 3-Position Safety Foot Switch – Safety Limited Speed (JOG)
- Safety Switch Functional Safety per ANSI B11.19
- Area scanner per ANSI B11.19
- Barrier guard per ANSI B11.19

Logic Table

Logic table for Jog switches where access is required to perform a task while the machine is in operation.

LOGIC 1 (Interlocked Area with PSD inside)

Location of Person(s)	Enabling Switch Jog	Line Motion
1. Outside room (Enabling Switch Stowed)	1/0	High speed
2. Inside (after door opened) not in PSD	0	Reduced Speed
3. Inside (after door opened) and in PSD	1	Reduced Speed
3. Inside (after door opened) and in PSD	0	Stopped

LOGIC 2 (Interlocked Area only – No PSD)

Location of Person(s)	Enabling Switch Jog	Line Motion
1. Outside safeguarded area (Enabling Switch Stowed)	1/0	High speed
2. Door opened	1	Reduced Speed
2. Door opened	0	Stopped

LOGIC 3 (PSD's Only)

Location of Person(s)	Enabling Switch Jog	Line Motion
1. Outside of detection area (Enabling Switch Stowed)	1/0	High speed
2. In detection area	1	Reduced Speed
3. In detection area	0	Stopped

Note: 1. Proposed logic to be confirmed after JSA complete and TBRA complete.
2. In all cases listed above, removal of the enabling switch from the stowed position sets line motion to reduced speed.

Note: Machines have multiple configurations that were not observed during this audit. Therefore, additional hazards may exist that are not included in this report.

Client reported that Job Safety Analysis or Job Hazard Analysis (JSA/JHA) documents are incomplete or do not exist. We recommend completion of these documents (by client) as a prerequisite for team-based risk assessments (by client) in accordance with US safety standards.

Written safe working procedures for minor servicing activities (by client) are required. These safe working procedures must require the use of a tools, not hands, when working near or at the point(s) of operation.

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EXPLANATIONS / LEGEND SAFEGUARDING STUDY

PRELIMINARY	SIZE B	CLIENT DWG NUMBER -	MSS DRAWING 19-0249SG	REV 0
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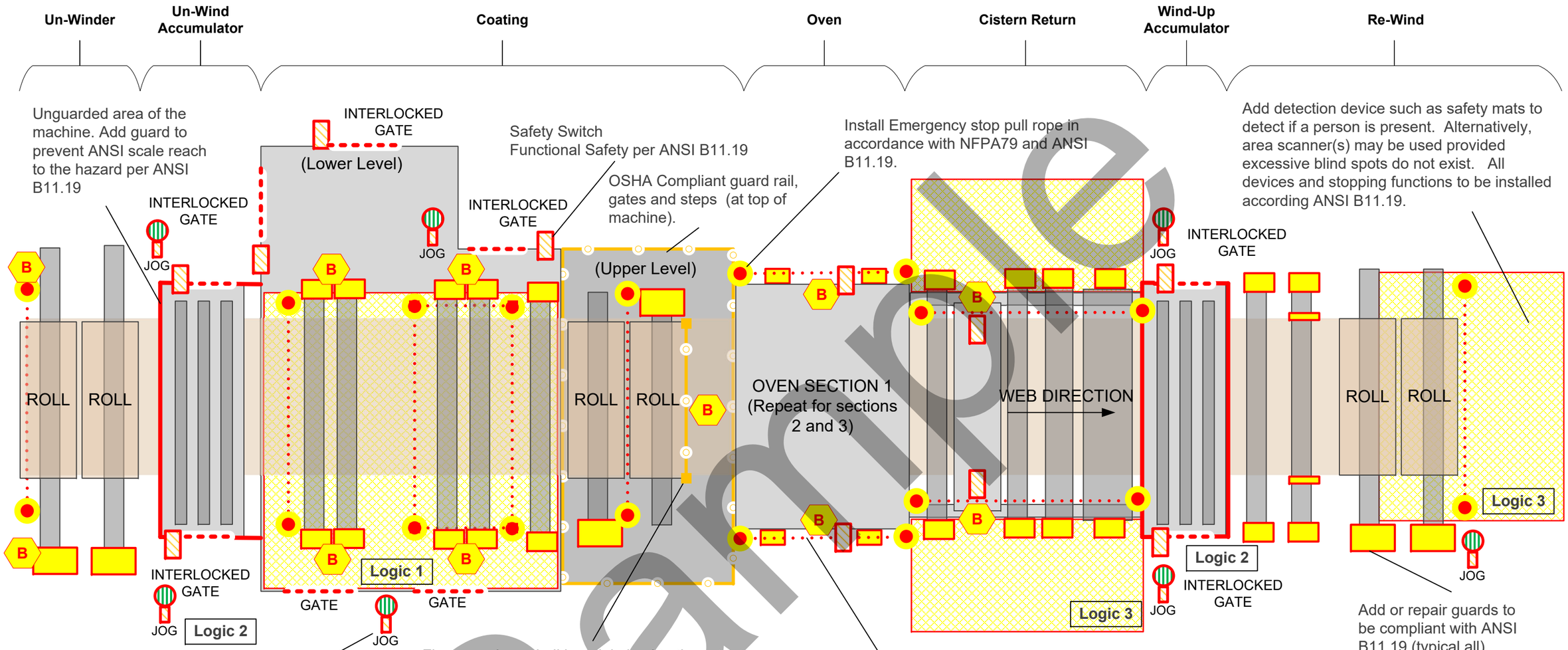
Sample



LINE-80 COATING

TOP VIEW – NOT TO SCALE

General Notes:

1. See Machine Safety Reports and Specifications for details and additional information.
2. This diagram is for illustrative purposes, general in nature, is subject to verification by client, and is not to scale. Do not use for construction.
3. Perform LOTO until JHA’s are completed with Task Based Risk Assessment.

Sample

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LINE-80 COATING SAFEGUARDING STUDY

SIZE	CLIENT DWG NUMBER	MSS DRAWING	REV
B	-	19-0249SG	0
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General Notes:

1. GUARDING

1.1.1. General Specifications - Guarding shall provide protection from the hazards and prevent reach around, under, through, or over ("A.U.T.O. principle"). All new mechanical guarding shall meet the height, sweep and gap requirements of OSHA 1910; ANSI B11.19 Table D and ANSI RIA15.06. Guards shall be free of sharp edges and projections and shall not in themselves create a hazard. For new machines and upgrades to existing machines, barrier guard openings shall be designed to ANSI guard opening requirements (see section 7 below). In no case shall guard openings be greater than the maximum OSHA guard openings (see section 7 below).

1.1.2. Construction - Guards shall be constructed to withstand normal operational forces and environmental conditions but may not withstand accidental impact from fork lifts, manufactured parts, tooling etc. Guards may be fabricated using steel, stainless steel, aluminum, vinyl coated mesh, polycarbonate or a combination of materials. Post and panel systems are generally constructed using 2" square posts with 4" square feet. Panels are constructed using 1-1/2" angle (steel) or 1-1/2" square tube (aluminum). Panels may be filled with vinyl coated mesh, coated or painted expanded metal, polycarbonate or welding screen depending on the application.

1.1.3. Color - Steel guard frames should be painted safety yellow. To allow for easily "look through", metal mesh, screen, or expanded metal, etc. within the frame, should be coated or painted black. All other materials, aluminum, stainless steel, may not have a finished coating.

2. FASTENERS

2.1.1. As an alternative to safety switches (interlocks); the use of fasteners is permitted to securely attach guarding. Barriers shall require the use of tools to remove any fixed portion. Interlocked barriers shall be tamper resistant and cannot be defeated intentionally without tools. According to ANSI B11.19-2010 E7.2.6, examples of some types of fasteners that shall NOT be used to mount guards and safety switches (interlocks) are: Slotted or Phillips head screws; wing nuts; magnets; latches & hasps; hooks & eyes.

2.1.2. Bolted or fastened guarding shall only be removed for service and maintenance tasks that require lockout/tag out. Bolts and/or fasteners must be installed immediately following a service, maintenance, or installation task and before the machinery is re-energized. Guarding that requires opening for routine and repetitive tasks shall be equipped with safety switches, not bolts or fasteners.

3. STOPPING TIME AND SAFE DISTANCES

3.1.1. The position safety devices shall be at a minimum distance from the hazards before motion begins and maintain a safe distance after hazardous motion has started. To do this, the safety system supplier shall ensure that all safety devices are installed at the appropriate distances from the hazards according to OSHA 1910; ANSI B11.19 and ISO 13855 Safety of machinery - Positioning of protective equipment with respect to the approach speeds of parts of the human body. These principles apply to all safeguarding devices including: barrier guards, two hand control devices, single control safeguarding devices, presence sensing devices, safety mats, safety edges or any other safety device that limits access to the hazards. If it is not possible to prevent hazards by keeping personnel at a safe distance and stopping the equipment in accordance with the requirements above; then use locking gates or trapped key strategies that prevent access until all hazardous motion has stopped.

3.1.2. All new machines and machine upgrades shall comply with applicable safety distance requirements per ANSI B11.19 Annex D. Engineering drawings shall include the stop time calculations for review and approval prior to construction. All safety stopping times must be measured and verified with a calibrated stop time measurement device before placing the machine into service.

4. GUARD OPENING REQUIREMENTS

4.1.1. For new machines and upgrades to existing machines, barrier guard openings shall be designed to ANSI guard opening requirements as shown in **Table 1 - ANSI Guard Opening Distances.**

Note: For guard openings, greater than 132mm (5.0 inches), a risk assessment shall determine the appropriate distance from the hazard based on the guard design and human movement.

5. SAFETY CONTROLS AND DEVICES

5.1.1. All safety circuits, including guard interlocks and E-Stop circuits shall be Control Reliable. While the requirements of control reliability are not directly comparable to the requirements of ISO 13849-1:1999 or EN/ISO 13849-1:2006, for the purposes of this specification, complying with Category 3 and performance level "d", satisfy the requirements of control reliability.

5.1.2. **Safety Control Systems** - Safety controllers (programmable and non-programmable) shall be control reliable safety rated devices with redundant (dual channel) safety inputs that employ continuous self-checking and are capable of open circuit detection; short-circuit detection and ground fault detection. Monitoring and error checking of peripheral safety output devices (such as safety contactors, hydraulic safety valves, pneumatic safety valves etc.) will be performed at each cycle of the safety system or each time the safety system is interrupted. All safety controllers can be configured for a variety of different functions and inputs such as OSSD and Test Pulse continuous error checking. Outputs are available that are safety rated and non-safety rated (for non-safety functions like indicator lights and stack lights).

5.1.3. **Emergency Stop Devices** - Emergency stop devices may include maintained buttons, pull-ropes or other devices as noted in this specification. New emergency stop devices shall be dual channel, have positive opening contacts, latch in place when depressed or activated and require a manual reset. Emergency stop buttons shall have all the attributes listed above plus be red in color with a yellow background, unguarded, with a mushroom head to meet the requirements of NFPA 79. All emergency stop devices shall be integrated in a dual channel circuit that is control reliable and employees continuous self-checking as per the guidelines listed in ISO 13849-1; NFPA 79; ANSI B11; ANSI RIA 15.06; EN 292 and ISO 13850.

5.1.4. **Safety Contactors** - Safety controllers are not generally capable of switching high current electrical loads, so safety contactors are used to isolate loads with current draws greater than 3A (and sometimes as low as 1A). For redundancy, safety contactors are provided in pairs and will be equipped with force guided contacts as per EN 50205. To ensure control reliability (as per ISO 13849) , the safety contactors shall be energized with separate outputs from the safety control system and be monitored by the safety controls to ensure proper operation. On contactors with ratings of 50A or higher, surge suppressors shall be installed on the coils to reduce the risk of false triggering.

5.1.5. **Non-Locking Safety Rated Switches** - Also known as "interlocks" shall be dual channel safety rated switches that meet Performance level "E" according to ISO 13849 and category 4. These devices are non-contact Radio Frequency Identification (RFID) which makes them less susceptible to mechanical failure and difficult to defeat or bypass. All non-locking safety rated switches have OSSD outputs and shall be integrated in a dual channel circuit that is control reliable and employees continuous self-checking as per the guidelines listed in ISO 13849-1; NFPA 79; ANSI B11; ANSI RIA 15.06; EN 1088; EN 292 and ISO 13850.

5.1.6. **Safety Reset** - Safety reset button(s) and circuitry will be provided so that following an interruption of the safety system, a manual reset shall be required. The safety system shall not return to normal run mode until all monitored safety devices have been checked for proper operation and a safety reset button is pressed. To be in compliance with NFPA-79 and other standards, safety reset buttons must be installed in such a position that the operator has a clear view of the point of operation (line-of-sight); resetting a safety interlock and/or safety device shall not directly initiate an automatic cycle; safety reset buttons must be blue, black, white or grey in color and a reset must take place after an emergency stop event.

5.1.7. **Enabling Devices** - Also known as "Hold-To-Run" devices. These devices are generally used when machinery motion is required in setup mode with the gate(s) or guard(s) opened. When machinery motion must be undertaken with the gates/guards opened, there are special requirements that must be met. A supervisory selector switch shall be provided that can be locked in the "setup mode" with a removable key. Hold-to-run operator stations and/or pendant stations shall have a three-position enabling switch and an Emergency Stop button. The three-position enabling switch must be held in the center position in order for the machine to run. If the enabling switch is released or fully depressed, machinery motion will stop. Non-portable hold-to-run devices will be permanently fixed in such a position that the setup person has a clear view (line-of-sight) of the point of operation. Portable hold-to-run devices shall be integrated in such a manner that the setup person will have limited access to the machinery while in the setup mode i.e. only one gate/guard opened at a time. While in the setup mode, machinery speed shall be limited to 10 inch/second (250 mm/sec) or less, subject to the risk assessment, and some functions shall not be allowed to operate i.e. pneumatic circuits or other actuators that move at speeds greater than 10 inch/second, subject to the risk assessment. Customer must ensure that qualified personnel are trained in hold-to-run operations and shall provide adequate clearance between the moving machinery and any barrier guarding or obstructions that could cause crushing injuries as per the requirements of ANSI-RIA 15.06. The enabling switch shall be connected in a dual channel circuit that is control reliable and rated at Category "3", Performance level "D" according to ISO 13849.

5.1.8. **Emergency pull ropes** - All new and rebuilt equipment requiring emergency pull ropes, cords, or cables, shall be equipped with a constant tension type safety device. Existing pull cords without constant tension sensing capability must be replaced with constant tension type devices as soon as possible.

5.1.9. **Pneumatic and hydraulic systems** - Subject to a risk assessment, pneumatic and hydraulic valves are required to be control reliable and safety rated by the manufacturer or vendor. Existing machines shall be upgraded to control reliable pneumatic and hydraulic values if/when the system presents a high level of risk, or when the machine undergoes a major upgrade. New systems requiring high levels of risk reduction shall include control reliable pneumatic and hydraulic systems.

Table 1: ANSI Guard Opening Distances

Distance of opening from hazard		Maximum width of opening	
Inches	**Millimeters**	**Inches**	**Millimeters**
Less than 0.5	Less than 13	Not permitted	
.50 to 2.49	13 to 63.9	0.250	6
2.5 to 3.49	64 to 88.9	0.375	11
3.5 to 6.49	89 to 164.9	0.625	16
6.5 to 17.49	165 to 444.9	1.250	32
17.50 to 35.99	445 to 914.9	1.875	49
36 and over	915 and over	5.0 and up	132 and up

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SPECIFICATIONS

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