Guarding Your Investment – A Guide to Safety Fencing

Reduce Risk with the Correct Safety Fencing

In today's manufacturing environment safety fencing plays an integral role in protecting employees from hazards posed by industrial machinery. Threats to operator safety can be found on automated machinery, process control equipment, robotic work cells, and many other areas on a manufacturing floor.

A physical barrier between hazards and operators is an effective, low-tech solution for significantly reducing the risk of injury and the costly lawsuits or machine downtime that result from these accidents.

Image of GSM System on RND Automation & Engineering's robotic work cell

Before implementing a safety fencing system, the following considerations should be taken into account.

1. **Area Requiring Guarding** – Measure the area around where the hazards exist.
2. **Height of the Fencing** – Determine the required height to safeguard employees from making contact with a hazard if they were to reach over the top.
3. **Operator Safety** – Ensure operators will be safe while working inside of the fencing.
4. **Ease of Install/Modularity** – Understand how the system connects together and the expandability if new panels or doors are required.
5. **Robustness & Longevity** – Select fencing that will be sturdy enough to protect against collisions and withstand the manufacturing environment without rusting or corroding.

In this guide, we will review these considerations and discuss how safety fencing from GSM addresses each one.

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Area Requiring Guarding

The most basic step in selecting a safety fence is determining the size of the area surrounding the hazards that need guarding. Once the dimensions are known, panels and doors can be selected to best fit the area. As shown below, GSM offers 14-panel widths from 250mm to 2000mm. A large variety of panel widths helps with covering areas of all shapes and sizes most efficiently.

Height (mm) / Width (mm)	1200 (H)	1400 (H)	1600 (H)	1800 (H)	2200 (H)	2700 (H)	3650 (H)	4250 (H)
250 (W) System width	160 (w) x 1050 (h) GPA2M120250	160 (w) x 1250 (h) GPA2M140250	160 (w) x 1450 (h) GPA2M160250	160 (w) x 1650 (h) GPA2M180250	160 (w) x 2050 (h) GPA2M220250	160 (w) x 2550 (h) GPA2M270250	Call out for two 1800mm Panels	Call out for two 2200mm Panels
300 (W) System width	210 (w) x 1050 (h) GPA2M120300	210 (w) x 1250 (h) GPA2M140300	210 (w) x 1450 (h) GPA2M160300	210 (w) x 1650 (h) GPA2M180300	210 (w) x 2050 (h) GPA2M220300	210 (w) x 2550 (h) GPA2M270300	Call out for two 1800mm Panels	Call out for two 2200mm Panels
400 (W) System width	310 (w) x 1050 (h) GPA2M120400	310 (w) x 1250 (h) GPA2M140400	310 (w) x 1450 (h) GPA2M160400	310 (w) x 1650 (h) GPA2M180400	310 (w) x 2050 (h) GPA2M220400	310 (w) x 2550 (h) GPA2M270400	Call out for two 1800mm Panels	Call out for two 2200mm Panels
500 (W) System width	410 (w) x 1050 (h) GPA2M120500	410 (w) x 1250 (h) GPA2M140500	410 (w) x 1450 (h) GPA2M160500	410 (w) x 1650 (h) GPA2M180500	410 (w) x 2050 (h) GPA2M220500	410 (w) x 2550 (h) GPA2M270500	Call out for two 1800mm Panels	Call out for two 2200mm Panels
600 (W) System width	510 (w) x 1050 (h) GPA2M120600	510 (w) x 1250 (h) GPA2M140600	510 (w) x 1450 (h) GPA2M160600	510 (w) x 1650 (h) GPA2M180600	510 (w) x 2050 (h) GPA2M220600	510 (w) x 2550 (h) GPA2M270600	Call out for two 1800mm Panels	Call out for two 2200mm Panels
700 (W) System width	610 (w) x 1050 (h) GPA2M120700	610 (w) x 1250 (h) GPA2M140700	610 (w) x 1450 (h) GPA2M160700	610 (w) x 1650 (h) GPA2M180700	610 (w) x 2050 (h) GPA2M220700	610 (w) x 2550 (h) GPA2M270700	Call out for two 1800mm Panels	Call out for two 2200mm Panels
750 (W) System width	660 (w) x 1050 (h) GPA2M120750	660 (w) x 1250 (h) GPA2M140750	660 (w) x 1450 (h) GPA2M160750	660 (w) x 1650 (h) GPA2M180750	660 (w) x 2050 (h) GPA2M220750	660 (w) x 2550 (h) GPA2M270750	Call out for two 1800mm Panels	Call out for two 2200mm Panels
800 (W) System width	710 (w) x 1050 (h) GPA2M120800	710 (w) x 1250 (h) GPA2M140800	710 (w) x 1450 (h) GPA2M160800	710 (w) x 1650 (h) GPA2M180800	710 (w) x 2050 (h) GPA2M220800	710 (w) x 2550 (h) GPA2M270800	Call out for two 1800mm Panels	Call out for two 2200mm Panels
900 (W) System width	810 (w) x 1050 (h) GPA2M120900	810 (w) x 1250 (h) GPA2M140900	810 (w) x 1450 (h) GPA2M160800	810 (w) x 1650 (h) GPA2M180900	810 (w) x 2050 (h) GPA2M220900	810 (w) x 2550 (h) GPA2M270900	Call out for two 1800mm Panels	Call out for two 2200mm Panels
1000 (W) System width	910 (w) x 1050 (h) GPA2M121000	910 (w) x 1250 (h) GPA2M141000	910 (w) x 1450 (h) GPA2M161000	910(w) x 1650 (h) GPA2M181000	910 (w) x 2050 (h) GPA2M221000	910 (w) x 2550 (h) GPA2M271000	Call out for two 1800mm Panels	Call out for two 2200mm Panels
1250 (W) System width	1160 (w) x 1050 (h) GPA2M121250	1160 (w) x 1250 (h) GPA2M141250	1160 (w) x 1450 (h) GPA2M161250	1160 (w) x 1650 (h) GPA2M181250	1160 (w) x 2050 (h) GPA2M221250	1160 (w) x 2550 (h) GPA2M271250	Call out for two 1800mm Panels	Call out for two 2200mm Panels
1500 (W) System width	1410 (w) x 1050 (h) GPA2M121500	1410 (w) x 1250 (h) GPA2M141500	1410 (w) x 1450 (h) GPA2M161500	1410 (w) x 1650 (h) GPA2M181500	1410 (w) x 2050 (h) GPA2M221500	1410 (w) x 2550 (h) GPA2M271500	Call out for two 1800mm Panels	Call out for two 2200mm Panels
1750 (W) System width	1660 (w) x 1050 (h) GPA2M121750	1660 (w) x 1250 (h) GPA2M141750	1660 (w) x 1450 (h) GPA2M161750	1660 (w) x 1650 (h) GPA2M181750	1660 (w) x 2050 (h) GPA2M221750	1660 (w) x 2550 (h) GPA2M271750	Call out for two 1800mm Panels	Call out for two 2200mm Panels
2000 (W) System width	1910 (w) x 1050 (h) GPA2M122000	1910 (w) x 1250 (h) GPA2M142000	1910 (w) x 1450 (h) GPA2M162000	1910 (w) x 1650 (h) GPA2M182000	1910 (w) x 2050 (h) GPA2M222000	1910 (w) x 2550 (h) GPA2M272000	Call out for two 1800mm Panels	Call out for two 2200mm Panels

While selecting the panel sizes, it is important to think about where the door(s) will be located. With GSM, 10 door widths ranging from 1000mm to 6000mm are available and all mount to the same style post. Other configurable door options to consider when designing the system are Right or Left-Hand Opening, Single or Double Door, and a suitable Handle Type (e.g. Pull handle, Safety Interlock, Knob w/key).

Height of the Fencing

Choosing an appropriate fence height is important to prevent injuries that would occur from reaching over the top. The graphic shown below is from the ISO 13857 standard that mandates the required safety distances to prevent upper and lower limbs from contacting hazard zones.

The ‘Height of the Danger Zone’ and the ‘Height of the Protective Structure’ are used to determine the required horizontal distance the fence should be from the ‘danger zone’. As the graphic shows, a 2200mm tall fence requires a horizontal distance of at least 400mm from a high-risk area.

Since the height requirement varies based on the application, GSM offers eight different heights from 1200mm-4250mm (in the table above). The 2200mm (7.2ft) height is the most popular and covers a wide range of applications.

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Upper limbs – Safety distances (according to DIN EN ISO 13857)

for reaching over

a height of the danger zone
b height of the protective structure
c horizontal distance to danger zone
d protective structure

For determining the relevant safety distances, risk assessment must be carried out in accordance with EN ISO 12100-1 or EN ISO 14121-1. If the values determined for a, b or c are between two of the values given in the table, those values must be applied which ensure a higher level of integrity.

Height of the danger zone a	Height of the protective structure b								
	1000	1200	1400	1600	1800	2000	2200	2400	2500
2600	–	–	–	–	–	–	–	–	–
	900	800	700	600	600	500	400	300	100
2400	100	100	100	100	100	100	100	100	–
	1100	1000	900	800	700	600	400	300	100
2200	600	600	500	500	400	350	250	–	–
	1300	1200	1000	900	800	600	400	300	–
2000	1100	900	700	600	500	350	–	–	–
	1400	1300	1100	900	800	600	400	–	–
1800	1100	1000	900	900	600	–	–	–	–
	1500	1400	1100	900	800	600	–	–	–
1600	1300	1000	900	900	500	–	–	–	–
	1500	1400	1100	900	800	500	–	–	–
1400	1300	1000	900	800	100	–	–	–	–
	1500	1400	1100	900	800	–	–	–	–
1200	1400	1000	900	500	–	–	–	–	–
	1500	1400	1100	900	700	–	–	–	–
1000	1400	1000	900	300	–	–	–	–	–
	1500	1400	1000	800	–	–	–	–	–
800	1300	900	600	–	–	–	–	–	–
	1500	1300	900	600	–	–	–	–	–
600	1200	500	–	–	–	–	–	–	–
	1400	1300	800	–	–	–	–	–	–
400	1200	300	–	–	–	–	–	–	–
	1400	1200	400	–	–	–	–	–	–
200	1100	200	–	–	–	–	–	–	–
	1200	900	–	–	–	–	–	–	–
0	1100	200	–	–	–	–	–	–	–
	1100	500	–	–	–	–	–	–	–

Horizontal distance to danger zone c

Measurements in mm

1) Protective structures with a height of less than 1000 mm are not mentioned as they do not ensure adequate restriction of movements.
2) For danger zones above 2500 or 2700 mm see safety distances for reaching up.
3) For high-risk danger points, protective structures lower than 1400 mm should not be used without additional technical safety measures.
4) The upper values apply to low risk. The lower values apply to high risk or other technical safety measures are applied.

The ISO 13857 standard also includes injury risks from reaching through the fencing. Figure 3 shows a graphic that specifies the required safety distance based on the size of the opening in the panel. For example, the steel mesh panels from GSM have 20mm slots. Based on this opening size, the chart says a safety distance of at least 120mm (4.75”) is required.

By understanding the relationship between height, opening size, and horizontal distance we can select a properly guarded fencing system.

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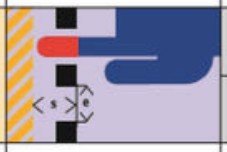
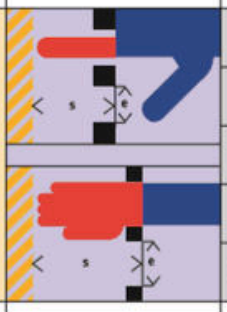
for reaching through

	Illustration	Opening[2] e	Safety distance s slot	square	circle
Finger tip		e ≤ 4	s ≥ 2	s ≥ 2	s ≥ 2
		4 < e ≤ 6	s ≥ 10	s ≥ 5	s ≥ 5
Finger up to knuckle joint		6 < e ≤ 8	s ≥ 20	s ≥ 15	s ≥ 5
		8 < e ≤ 10	s ≥ 80	s ≥ 25	s ≥ 20
		10 < e ≤ 12	s ≥ 100	s ≥ 80	s ≥ 80
		12 < e ≤ 20	s ≥ 120	s ≥ 120	s ≥ 120
		20 < e ≤ 30	s ≥ 850[1]	s ≥ 120	s ≥ 120
Arm up to shoulder joint		30 < e ≤ 40	s ≥ 850	s ≥ 200	s ≥ 120
		40 < e ≤ 120	s ≥ 850	s ≥ 850	s ≥ 850

Measurements in mm

1) Where the length of a slot opening is ≤ 65 mm, access is limited by the thumb and the safety distance can be reduced to 200 mm.

2) The opening width e corresponds to one side in case of square openings, to the diameter in case of circular openings and the smallest dimension in case of slot openings. For openings > 120 mm, the safety distances for reaching over protective structures must be applied.

Operator Safety

It is important to plan for the safety conditions required for when operators must enter the guarding system (e.g. to perform maintenance, resolve E-Stop conditions, etc.). A common practice to keep operators protected is a safety interlock door handle and push buttons mounted on the post (e.g. E-Stop, Reset, Request to Enter). The signals from these are used to shut down power to potentially hazardous components while operators are in the work cell.

For many fencing systems, the end user is responsible for installing the safety interlock door handle, push buttons, and connector that runs the signals back to the safety controller. To offload this task from the end user, GSM has a standard 'AZM' option that includes a pre-wired and mounted Schmersal safety interlock door handle, push buttons, and Harting connector to run the signals back to the safety controller.

This handy option (in the pictures below) is popular because of the reduced installation time and overall convenience a pre-wired and pre-mounted solution offers.

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Ease of Install/Modularity

Most safety fencing systems are held together with a large number of nuts, bolts and joining brackets. While simple, the installation of these systems can be tedious and time-consuming. Ever single bolt has to be tightened and it can be a pain to keep the corners square. Additionally, if the system has to be expanded or re-arranged, the process of removing the hardware can be daunting.

To modernize the installation procedure, GSM has developed an innovative mounting system that requires no tools. The panels snap securely in place via quick connect fittings located on the posts. All size panels work with the quick connect fittings on the posts, making GSM a truly modular system that can be tailored to any fencing layout.

Systems that have a fast and simple connection method can be much easier to work with, especially if the system has to be expanded upon or altered.

GSM mounting clips

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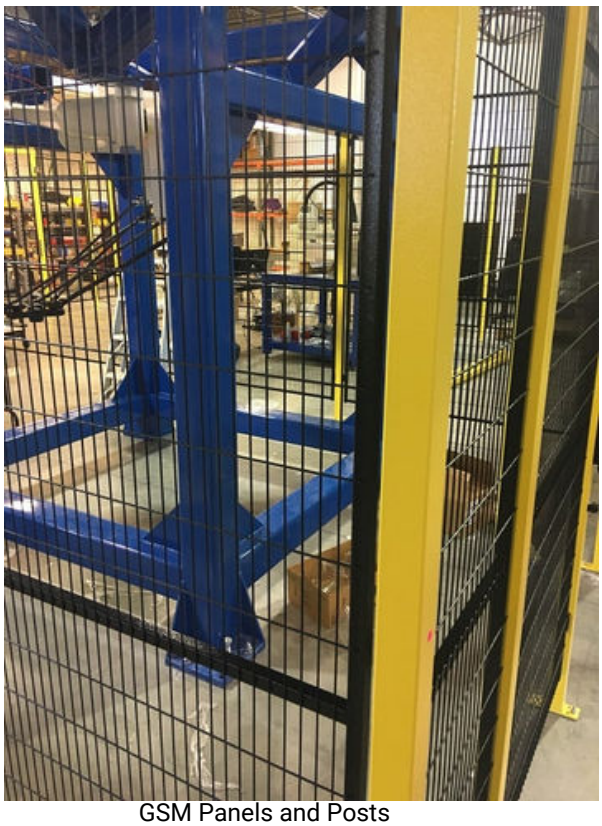
Robustness & Longevity

Guarding systems need to be strong enough to handle unexpected collisions from personnel, carts, and even the occasional forklift. They also need to be able to last in a manufacturing environment without degrading. To maintain a beefy frame, the GSM2000 system (shown below) uses 50mm square steel tubes for posts rather than aluminum. The panels are made of steel and use a 2mm wire mesh with multiple middle supports welded at all junctions. This prevents panels from flexing, which is a common issue in traditional angle iron systems.



GSM Panels and Posts

An enemy to the longevity of a safety fencing system is the presence of chemicals and harsh conditions found in some manufacturing environments.

Long-term exposure to these can degrade a fencing system. To prevent degradation, GSM powder coats all panels and doors to ensure they will last even in the harshest environments. Powder coated steel serves as a great combination of strength and durability for a safety fencing system.

Following the steps in this guide can help you deploy a safety fencing solution that is appropriately sized, ensures operator safety, and will hold up in the environment. If you have any questions about implementing a safety fencing system, contact Cross and we'll be glad to help. With the basic dimensions and a few simple questions, we can develop a BOM for the panels, doors, posts, hardware, and accessories.