

Guidelines for Safety Distance Calculations When Using Light Curtain Blanking Functions

The following is Wintriss Controls and Production Resources recommendations for establishing safety distance with the use of blanking functions:

Three types of blanking systems exist and vary depending on the Shadow light curtain model. Shadow II, IV, V, and VI systems allow individual channel blanking by the use of master and slave blanking windows. Shadow V, VI, VII, and Shadow 8 systems support floating blanking functions and Shadow VII, and Shadow 8 support programmable blanking.

When you add a blanking window or enable channel blanking functions you are effectively changing the MOS (minimum object sensitivity) of the light curtain. MOS defines the smallest object that can always be detected anywhere in the sensing field. MOS in turn determines a light curtains Dpf (depth of penetration factor). Dpf is the distance you can potentially reach into the light curtain field before being detected. For Shadow systems the MOS is 1.18" without the use of blanking. For a Shadow without blanking this equates to 3.1". Dpf is added to safety distance at the end of the ANSI safety distance formula as follows:

$$Ds = K (Ts+Tc+Tr+Tspm) + Dpf$$

There is a formula for determining Dpf when MOS is known

$$\begin{aligned} Dpf &= 3.4 (MOS-.275) \\ &\text{For Shadow} \\ Dpf &= 3.4 (1.18-.275) \\ Dpf &= 3.1'' \end{aligned}$$

Each blanking window or the use of a floating window increases minimum object sensitivity by .87". The floating blanking function on Shadow systems increases the object sensitivity by .87" anywhere in the sensing field.

Example application:

1 blanking window is required

Hand speed constant (K) is 63 in/sec

Press stop time (Ts) is 170msec

Control response time (Tc) is 15msec

(note: Wintriss clutch/brake controls include response time in the stop time measurement display)

Light curtain response time (Tr) is 30msec

Additional time allowed by the stopping performance monitor (brake monitor) (Tspm) is 40msec

MOS is 2.05". This is the standard 1.18 plus an additional .87" allowed by the first blanking window. Therefore Dpf = 3.4 (2.05-.275) = 6.0"

$$\begin{aligned} Ds &= 63 (.170+.015+.030+.040) + 6.0 \\ Ds &= 22.06'' \end{aligned}$$

If we add a second blanking window to this example the only thing that will change is Dpf.

$$\begin{aligned} Dpf &= 3.4 (2.92-.275) \\ Dpf &= 9.0'' \\ Ds &= 63 (.170+.015+.030+.040) + 9.0'' \\ Ds &= 25.06'' \end{aligned}$$

STOP

Once you get beyond two blanking windows the MOS is big enough that an entire arm could penetrate the light curtain field without being detected. So if there are more than two you'll need to add 36" to the safety distance! In OSHA the Dpf graph stops at an MOS of 2.75". In ANSI the graph stops at 2.5"

It's also important to note that if the blanked area is completely filled there is no need to add to the safety distance see explanation as follows:

Typically blanking is used to accommodate slug or parts removal conveyors/chutes. The conveyor(s) seldom completely fill the blanked area. This creates a need to add a physical obstruction in the unblanked area so that safety distance is not compromised or increase safety distance as discussed above. Fixed blanking and floating blanking simply create a “blind” area and have no means to determine whether the conveyor/chute or other obstruction is actually in place. Accordingly some sort of “obstruction in place” sensor should be used and appropriately interlocked with the press control. Programmable beam blanking available with Shadow VII and Shadow 8 recognize an obstruction in place and will not allow operation if the programmed obstruction is not in place.

Example:

Width of the conveyor is 12” and its side profile is 3” high.

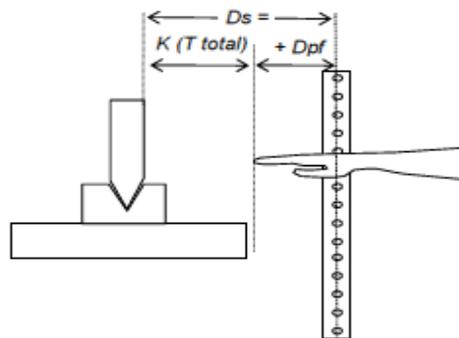
Separation distance between the light curtain transmitter and receiver is 60”

Unblanked area = 48” wide x 3” high

Solution: increase safety distance or add an obstruction (angle iron, etc.) to fill the balance of the blanked area.

It is the employer’s responsibility to properly train employees how to properly use and maintain light curtains including blanking provisions. The employer must insure that safety devices and guards are properly used and maintained.

Figure C.1 – Penetration Factor, Dpf, for presence sensing devices used in a vertical application with Object Sensitivity less than 64mm (2.5 inches)



NOTE - Where individuals can place themselves between the safeguarding device and the hazard zone and remain undetected, additional measures must be taken.

Figure C.2 – Example of guarding with object sensitivity less than 64 mm (2.5 inches)

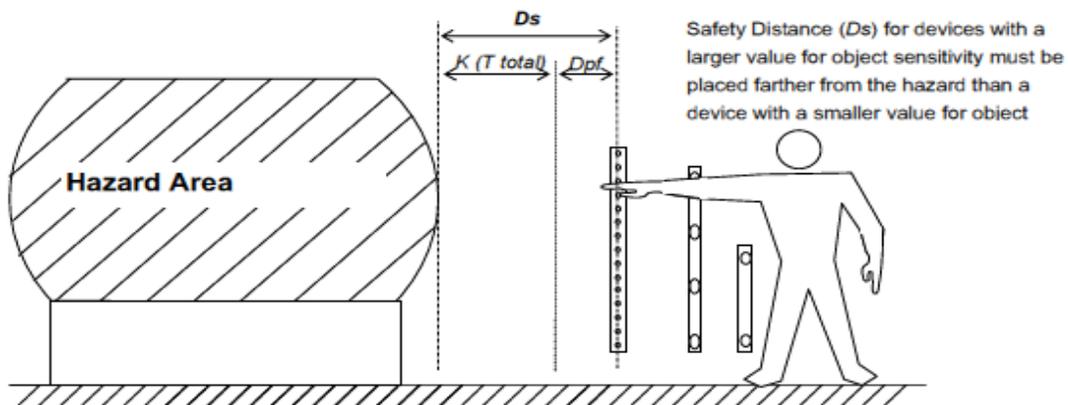


Figure C.3 – Example of guarding with various object sensitivities