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Target Audience
FOD Inspectors

SAFEGUARDING HYDRAULIC PRESS BRAKES - LASER-BASED ACTIVE OPTO-ELECTRONIC PROTECTIVE DEVICES

This SIM provides information to inspectors on the application of laser-based active opto-electronic protective devices (AOPDs) for safeguarding the tools of hydraulic press brakes. These devices are intended as a possible alternative to conventional light curtain arrangements which are normally used to safeguard hydraulic press brakes. These devices are **not** designed to be applied to mechanical press brakes.

INTRODUCTION

1 Hydraulic press brakes are normally guarded using conventional light curtains and a combination of fixed and/or interlocked guards at the sides and rear of the machine. A new type of active opto-electronic protective device(s) (AOPD) which utilises laser technology is now being supplied and fitted to hydraulic press brakes. At present there are two products on the market. It is claimed that these new systems overcome some of the alleged difficulties of using conventional light curtains. The devices act as a trip device at the leading edge of the moving tool(s) (see **Figs 1** & **2**).

2 The devices have been developed to provide an alternative to two-hand controls which are used extensively on hydraulic press brakes in other European member states. For newly supplied machines, the recently published EN standard for hydraulic press brakes (BS)EN 12622 no longer permits the use of two-hand controls as a means of safeguarding the operating position during normal production work. However, two-hand controls may still be applied during setting activities when used in conjunction with slow speed (<10mm/sec). These new devices and their application to hydraulic press brakes have **not** been considered in (BS)EN 12622. Work is currently being undertaken to prepare an amendment or revision of this standard to include this kind of device.

3 Machines fitted with this device are still relatively rare in the UK but they are now being fitted as original equipment by some press brake manufacturers. They are more common in other European countries as the device is being retrofitted to replace two-hand controls. At the present time inspectors are likely to encounter devices from two manufacturers. These are:

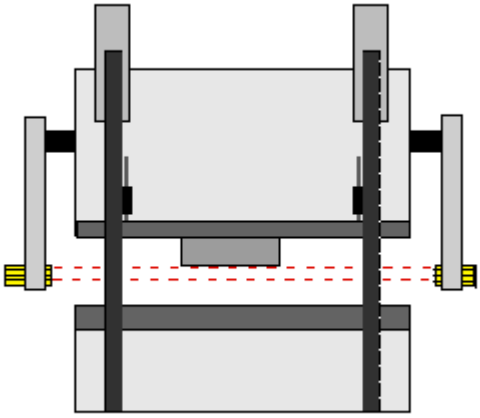
- 'AKAS' manufactured by Fiessler Elektronik, a German company; and
- ' LZS-003' manufactured by Lazer Safe Pty Ltd, an Austrailian company.

These products are being actively marketed throughout Europe including the UK.

4 These AOPD devices have been evaluated by HSE (*Technology Division (TD) and the Health and Safety Laboratory (HSL*)). It has been concluded that as 'safety components' the devices appear to satisfy the relevant essential health and safety requirements of the Supply of Machinery (Safety) Regulations 1992 (as amended). Both of the systems referred to above have also been type approved by Notified Bodies within the EEA.

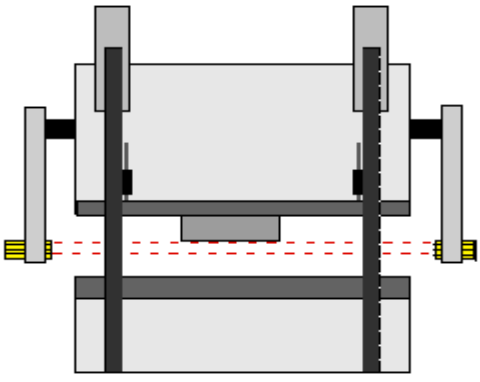
Laser-based AOPD moves down with press brake beam

Fig 1



Mute position - beam then moves at slow speed

Fig 2



OPERATING PRINCIPLES

5 Conventional infrared light curtains work on the principle that they are set at a sufficient distance from the danger zone to enable the machine to respond to a signal from the light curtain and stop the moving parts before the danger zone can be reached by the operator. The appropriate separation distances are calculated using formula contained in (BS)EN 999:1998 *Safety of machinery - The positioning of protective equipment in respect of approach speeds of parts of the human body*. When the operator is obstructing the light curtain the machine will not operate unless the light curtain is muted and/or the machine is

limited to a slow speed of less than 10 mm/sec. The fundamental safety principle is that the operator is kept away from the danger zone while the tools of the press brake are descending at high speed.

6 These new laser based AOPDs have been designed on the assumption that the operator may be in the danger zone whilst the machine is being operated. The intention is to allow the operator to work closer to the tools particularly when bending small components. It is also claimed that there are advantages where larger components may interrupt a conventional light curtain during the bending process. **The calculation of safety distances as set out in (BS)EN 999 cannot be applied to these types of AOPDs when installed in this manner**. Instead, safety should be achieved by ensuring that the laser based AOPD, its installation and the operating characteristics of the press brake are compatible to prevent hazardous movement of the tools.

7 These devices work on the principle that if an operator's finger/hand remains in the danger zone between the tools it will be detected and the machine will stop before injury can occur. The application of these devices is, therefore limited to machines which have:

(1) an appropriate stopping performance (distance) in relation to the speed of movement of the machine; and

(2) control system arrangements which provide the necessary level of integrity to perform the safety functions under a high demand rate and foreseeable fault conditions.

8 The devices comprise an emitter and receiver mounted at either side of the press brake moving beam assembly (see **Figs 1** & **2**). The emitter produces either a band or series of single beams of visible laser light. The arrangement of the beams is designed to detect obstructions as the beam descends down to the point where the device is muted - normally just above the work piece. There are special features provided to mute individual beams when bending tray shaped components which would otherwise cause a 'trip' condition.

9 Unlike conventional light curtains the position of the ADOP beam(s) is required to be reset each time the tools are changed. This is necessary because the depth of the tools will vary and the laser beams must be positioned at a suitable position in advance of the tools as it descends. Depending on the particular device being used this is performed either manually, using a gauge, or automatically using built in tool position detection and motor arrangements.

TRAINING

10 Machine operators (and those supervising) must have received suitable training in the correct use of these devices. This should include in particular:

(1) **Correct setting of the laser beams relative to the top tool**

AKAS: Setting of the top beam relative to the tool so that the tool tip can be seen to just obstruct the beam. This can be checked by looking at the top receiver or by placing a piece of white card at the end of the tool and looking at the image.

LZS-003: Setting of the laser beams 9 mm beneath the top tool tip using a setting card. The beam should be within the window of the card. There is a risk of trapping if the distance is too small.

(2) **Checking the stopping distance is within specification**

AKAS: A test rectangular test piece 39 mm x 30 mm in section should be provided by the machine supplier. The user should be able to demonstrate that when the test piece is placed between the tools in accordance with the instructions and the press brake operated the top tool should stop before contacting the test piece. The user should be able to demonstrate that this test is being carried out at least at the beginning of every shift.

LZS-003: A 12 mm diameter test piece should be placed between the tools and the press brake operated. The top tool should come to stop and retract by 6 mm without contacting the test piece. The user should be able to demonstrate that this test is being carried out at the beginning of every shift. This test is not so critical on this device because the stopping distance is automatically monitored every cycle.

(3) **Correct setting of the mute point**

From a safety perspective the actual mute point is not critical. However, it should be ensured that when the device is muted the speed of closure of the tools is less than 10 mm/sec.

AKAS: The mute point is set manually in a similar manner to a conventional light curtain. It should be set at a point where the lower two beams of the laser device are just above the workpiece which should be about 23 mm below the top tool.

LZS-003: The mute point is set automatically by driving the top tool down to the workpiece in setting mode. When the beam is broken by the light beam the tool stops and the mute point automatically calculated at a distance of 6 mm above the workpiece.

(4) **Interconnection to the press brake control system**

AKAS: A muting unit (referred to as LSUW N1) is used to interconnect the device to the press brake control system in the same configuration as a conventional light curtain. This arrangement requires that that the press brake and its control system should achieve or be capable of the following:

(a) a maximum stopping distance of 10 mm where stopping performance monitoring is provided for at least the first cycle;

(b) access for dual-channel monitored outputs of the muting unit to be interconnected with the downward movement solenoids of the press brake;

(c) cross-monitoring of the muting signal from the press brake control system and the signal corresponding to actuation of the slow speed solenoid (or the contactors controlling these solenoids).

LZS-003: This device is interconnected into the press brake control system in a similar manner to a conventional light curtain. This arrangement requires that the press brake and its control system should achieve or be capable of the

following:

(a) a maximum stopping distance of 8.5 mm;

(b) interconnection to the control system via a control units dual-channel cross-monitored outputs to the downward movement solenoids of the press brake.

OTHER SAFEGUARDS

11 The sides and rear of the press brake should be safeguarded in the conventional manner using fixed and interlocked guards. The side mounting brackets for these laser devices may present a shearing/crushing hazard where they move past fixed parts of the machine. Suitable fixed guards should be provided to prevent risk of injury.

RETROFITTING

12 Where these devices have been fitted as original equipment to a hydraulic press brake the machine (including the device) should have been subject to a type approval by a notified body. In circumstances where the device has been retrofitted to an older machine it is unlikely that any kind of independent assessment will have been carried out. At the present time it is unclear exactly what arrangements the manufacturers/suppliers of these devices have put in place to confirm the suitability of a machine for retrofitting. It can be assumed that any machine equipped with one of these devices that was manufactured before 2001 has been retrofitted.

ACTION BY INSPECTORS

13 The aim of this SIM is to inform inspectors of a new development in the safeguarding of hydraulic press brakes. As there is limited experience of these devices in the UK, the sector intends to monitor the way in which they are being marketed, applied and used in service. Cases where machines have been retrofitted are of particular interest and **inspectors are requested to notify the sector when they 'encounter' any of these devices.**

FURTHER INFORMATION AND CONTACTS

14 If inspectors require further information or technical support concerning these devices they should contact the Sector in Birmingham in the first instance.

15 Nick Hitchcott (Sector) and David Arnsby (Midlands SG) are the contacts for this topic.

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