

# **Hydraulic Overload Protection**

**The Silent Sentinel** 

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# What is HOLP?

<u>Hydraulic Over Load Protection (HOLP)</u> is a system that senses an overload condition in a mechanical press and releases hydraulic pressure in a collapsible cylinder, thereby allowing the slide to be pushed upward by the overload force. The primary purpose of the system is to prevent damage to the press in the event of overload. It is a standard feature on modern, well-designed general-purpose presses.

#### What else does it do?

In addition to protecting the press components, HOLP can at times:

- Help protect a die
- Stop operation in a dangerous condition
- Release a press that is stuck on bottom
- Sense a die that needs sharpening
- Reduce connection clearances
- Sense extreme off-center loads



# Figure #1

# Where can I find it?

HOLP is nearly always located near the lower end of each connection. The upper portion of the HOLP system remains stationary during activation while the lower portion is free to push upward with the slide, thus relieving the overload. (See Figure#1)

#### Why do I need it?

Your press is a major long-term investment and often is operated by someone without extensive training. Overload can happen through unintentional error or by unnoticed change in the die or material. Without HOLP, press overload can result in damage to the press structure, bearings, gears or clutch. At a minimum, uncorrected overload results in reduced press accuracy and service life. Worse, repair of a broken press is expensive and the loss of production can reduce profits or even cost you a contract. The inclusion of an effective HOLP in the press design provides an automatic protection that helps to keep the press in service.

Additionally, HOLP provides a quick and easy method to release a press that has been stuck at the bottom of the stroke. This can happen easily if the shutheight setting is not correct for the die, occurring most frequently during die setup.



#### What causes an overload?

Overload can be caused by many conditions including:

- Setting the shutheight too low
- Loading a die that requires too much tonnage
- Slugs or foreign material lodging in the die
- Misfeed or buckling of the material
- Wear in a die
- Improper positioning of a die
- Using incorrect material
- Changes in material hardness or thickness

It is important to remember that a press overload can occur on one side of a multipoint press and not the other. In fact, this is the most common overload condition. The total tonnage requirement of the die is



Figure #2

not the only measure. For example, a 400ton die will overload a 400-ton press if more than 200 tons of the load are under one connection. (See Figure #2)

## What types of HOLP are there?

HOLP systems can be easily differentiated by the type of actuation mechanism utilized. There are several basic methods:

**CHECK VALVE** – This is the oldest, most inexpensive triggering method in

which a spring-loaded check valve opens and permits oil to drain away when pressure exceeds a set limit. While simple in design, it has performance drawbacks. (See Figure #3)



## Figure #3

- It is difficult to adjust accurately
- It is slow to react
- It must relieve the oil cavity through a small opening
- It can be difficult to actuate HOLP units simultaneously in a multi-point press
- It is prone to leakage as it nears the actuation point, causing sponginess



Figure #4

**SOLENOID VALVE** – The most common method of actuation, this system uses a solenoid valve to open a drain line when the oil pressure limit is exceeded.



(See Figure #4) It relies on a pressure sensor in the valve or a signal from an electronic load monitor for actuation. It is faster triggering than a check valve, is more accurate, does not normally leak if the seals are properly maintained, and can relieve a multi-point slide overload evenly. It still must drain oil through a small orifice, and so is slow acting.



# Figure #5

**DIRECT VALVE** – The Aida HOLP system utilizes a direct-acting, lapped seat valve that is integral to the suspension point. Sensing and relief are directly accommodated by a full 360-degree opening around the base of the ball connection, not requiring an external sensor, a drain line or a restrictive orifice. (See Figure #5) This method provides the fastest reacting and quickest relief of all



Figure #6

the types of HOLP. The design eliminates the possibility of sponginess and is the most suitable for multi-point presses. The Aida HOLP unit is located at the bottom of the connection(s), inside the slide. (See Figure #6) It is designed as an enclosed, self-contained unit to prevent contamination from outside fluids and debris.

# What happens in overload if I don't have HOLP?

Without HOLP, an overloaded press will give at its weakest point. This can cause a stretched tie-rod or upright, bent crank or eccentric shaft, crushed bearing, broken connection pin or adjustment screw, cracked bed, slide or crown, or a slipping or damaged clutch. Even if the press survives overload without breaking, its clearances can be increased and parallelism destroyed. If the overload occurs under one connection in a multipoint press, the gibs can be damaged by the cocking of the slide.

# Can hydraulic tie rod nuts act as HOLP?

No. Hydraulic tie-rod nuts make it easier to pre-stress tie-rods during press assembly by eliminating the long and inaccurate process of heating and cooling them. They are not an effective or desirable method of overload protection. They can, however, be useful to relieve a non-HOLP press that is stuck on bottom.



# Is HOLP retrofitable to a non-HOLP press?

For the best performance, the HOLP system should be an integral part of the press connection design and construction. Such systems are not easily and very rarely installed in machines not originally designed for them.

#### Which type is best?

The best HOLP system is the one that actuates the quickest and drains the oil reservoir the fastest. The Aida direct valve, non-orifice system is both the fastest reacting and fastest draining system on the market today.

#### How important is speed in HOLP?

Speed is critical to HOLP in several ways.

Since overload occurs in a dynamic situation with the slide in downward motion, any delay in sensing allows the slide to move closer to the bottom of the stroke, thus increasing the overload. The faster the sensing, the quicker the relief portion of HOLP can start.

Speed is also critical in the dumping of oil in the HOLP cavity. The draining and collapse of this cavity is what gives the slide the extra room to move downward without increasing the load while the brake is actuating. If the cavity is not drained quickly enough, overload force can actually increase as the slide continues downward, even though the system has been activated.

Additionally, in a multi-point press, speed in dumping the non-overloaded HOLP cavities is critical to prevent the slide from tipping when the HOLP is activated under one connection.

#### Can I save my die?

Maybe, but don't depend on it. HOLP is primarily intended to protect the press from overload and may, depending upon many variable conditions, also save a die as a secondary benefit. To have the best opportunity to save a die in overload, specify the fastest acting HOLP available.

#### What is "unstick"?

A press becomes stuck on bottom when the slide encounters the work piece with insufficient force, energy or clutch torque to complete the revolution. The machine crunches to a halt with the punch still in the material. Since the slide is stuck in compression against the tool and bed, the clutch may have insufficient torque to allow the slide to move in either direction. This happens most frequently during setup, when the stroke speed is too slow to permit the press to generate its full energy.

On older design straight-side presses without HOLP, it is usually necessary to heat and release tension on the tie-rods to free a stuck press. This is a long and laborious process that takes the press out of production while the tie-rods cool to regain tension. The use of hydraulic tierod nuts eliminates the need for heating and cooling tie-rods, but it still requires releasing tension that may affect frame alignment when retightened.





#### Figure #7

Since it has no tie-rods, sticking a gap frame press without HOLP often results in the need to use a torch to cut die or press components to unstick the machine. This results in very expensive repairs to the die or press and means substantial loss of production. (See Figure #7)

In a modern press with a HOLP system, releasing a stuck-on-bottom condition is done by pushing the "unstick" button, quickly draining the HOLP cavity. The pressure on the slide is thereby released and the press is unstuck. The press can be back into production as soon as the cause of the sticking condition is removed.

#### How much travel does it have?

The travel range of a HOLP system varies between press sizes. Since the vast majority of overloads take place close to the bottom of the stroke, the travel range of the HOLP does not have to be great. The most critical factor is the speed of actuation.

#### How can I compare HOLP's?

The simplest way to make a raw comparison is to determine how many degrees of crank angle occur between the time the overload is sensed and the time the HOLP pressure goes to zero.



#### Figure #8

A typical comparison is shown in Figure #8 where two presses were overloaded at the same point in the stroke. This illustration shows the value of a faster HOLP system. Under equal conditions, the faster Aida HOLP relieved the pressure in 10 milliseconds allowing only four degrees of crankshaft rotation. The conventional solenoid valve type required 70 milliseconds or twenty-eight degrees of rotation to go to zero pressure under the same conditions. The Aida HOLP system succeeded in relieving the overload condition while the press was still on the downstroke, preventing damage to the press. The slower conventional system allowed the slide to travel through the bottom of the stroke before going to zero pressure, effectively offering the press no relief until it was too late.





## Figure#9

A more detailed analysis can be developed by comparing the load curves that occur during the HOLP activation cycle. A typical chart is in Figure #9.

Since the Aida HOLP does not rely on a solenoid relief valve, it begins dumping pressure immediately upon sensing an overload and goes to zero pressure in 10 milliseconds. The slower conventional type HOLP actually allows pressure to increase until it finally drains enough oil to relieve the press. The difference in speed can mean the difference between continued production or a damaged press or die.

#### Does it work with Link Motion?

HOLP is even more effective in a Link Motion press than in a conventional crank motion press. Because the slide travels downward as much as 35% slower near the bottom of the stroke in a Link Motion press, it moves a shorter distance during the HOLP actuation and means that the rise in overload force will be slower than in a conventional machine, giving the HOLP more time to function and offering less opportunity for damage to occur.

# Is HOLP adjustable?

Yes. It is normally preset at the factory and remains at that setting, usually 110% of nominal press capacity divided by the number of connections. For those that have a requirement for frequent changing of the setting, an optional user access to the adjustment can be usually be provided.

## Is it spongy?

An improperly designed or maintained HOLP can become spongy for several reasons including:

- If a spring-load check valve system is employed, the spring can weaken and allow leakage as loads increase, even though no overload has occurred.
- An improperly seated check valve or leaking solenoid valve seals can result in spongy conditions.
- If the oil pressure in the overload cavity is not maintained at the proper level, sponginess can develop. This can be caused by a weak pump or leaking cavity seals.
- If the oil in the overload cavity contains air, sponginess will occur.

Because the Aida HOLP is designed as an enclosed system with a direct acting valve, there are no check valves or seals to weaken or fail. Because the system is closed, it is difficult for air to enter. This virtually eliminates the possibility of the patented Aida HOLP system developing sponginess. In fact, as an additional protection, the Aida HOLP system is designed to dump pressure if sponginess does somehow occur so that the press will not be operated with a cocked slide.



**How much pressure is maintained?** The Aida HOLP system maintains 5kgf/cm<sup>2</sup> (71 psi). This pressure is provided by a continuously operating airover-oil pump. The system pressure forces the ball cup upward into contact with the top of the oil cavity, making the metal-to-metal seal (See Figure #10).



FORCE PUSHING UP ON THE BALL CUP.  $F = 5x(\pi D^2/4)$ 

#### Figure #10

#### How do I reset it?

Resetting the Aida HOLP is easy. If it actuates, the press will stop. Simply inch the slide to the top of the stroke and the HOLP will automatically reset in one minute or less. Remove the condition that created the overload and continue operation of the press.

#### Will the slide cock?

No. On machines with more than one connection, the Aida HOLP units are interconnected and all will dump their oil simultaneously if overload is detected on any unit.

## Unique Aida patented design.

The patented Aida HOLP design is unique in the industry. Not only is it the fastest activating by a wide margin, it is also the most reliable, having no rubber seals or electronic components to maintain or fail. It is integral to the ball socket base at the bottom of the connection, not an added-on afterthought. The valve is a large diameter, lapped, metal-to-metal seal that provides nearly instantaneous dumping of oil throughout a full 360° circumference.

The Aida HOLP system is field proven, providing automatic and trouble free protection for many years in more than 10,000 machines worldwide. While all modern general-purpose press designs include some form of overload protection, Aida offers the most effective and efficient HOLP system available.