Automatic Overload Protection System

What is an AOPS?

An **automatic overload protection system** (AOPS) is a system fitted to an offshore crane intended to protect the crane from damage in situations where the hook is entangled with the supply boat, which subjects the crane to an unbounded gross overload outside the limits of any operational design condition. This system must be automatically activated and operational for all normal conditions including hoisting, lowering, slewing, luffing and "at rest." This system must be operational for all reeving configurations and all operational hook radii.

Who requires an AOPS?

An **AOPS** is required by **European Standard EN 13852-1** and the **National Regulations of Norway**. Certifying authority rules, such as those of ABS, DNV and LLOYDS do not require an AOPS. API Specification 2C also does not require an **AOPS.**

What is the justification for the requirement of an AOPS?

The proponents of the **AOPS** say several accidents have occurred in the North Sea where cranes have been pulled from their mounts and have fallen into the water because of hook entanglement with supply boats. They also cite other accidents in different parts of the world where cranes have become detached because of overload conditions.

The cranes involved in these accidents complied with all applicable design standards and regulations in effect at the time that these cranes were manufactured. Therefore, the risk of crane separation because of gross overload can be addressed only with additional equipment, such as an **AOPS.**

How does an AOPS work?

The Seatrax system, as well as others, works in a similar manner. These systems are fitted to diesel-hydraulic or electro-hydraulic driven cranes and strip or pull wire rope from the **hoist drums** by using a high-pressure hydraulic relief valve mounted on the **hoists drive motor** to provide a restraining force or drag on the **wire rope** as it is pulled off the **drum** by the overload.

The restraining force is proportional to the pressure setting of a **hydraulic relief valve** directly mounted to the **hoist drive motor**. This setting is adjusted by an electronic signal proportional to the **safe working load (SWL)** of the crane in the appropriate configuration and positioned at the appropriate load radius. This electronic signal is usually obtained from the **software database** contained in the **safe load indicator** or load-moment computer fitted to the crane.

EN 13852-1 requires that this **AOPS** must work with the crane "at rest" or when the control lever is in the neutral or stop position. EN 133852-1 also requires that the **AOPS** respond almost instantly to protect the crane

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structure. To make all of this work, the **hoist automatic safety brakes** (friction brakes) must be disabled or released whenever the **AOPS** is operational.

To minimize the time spent with the safety brakes disabled, the **AOPS** also contains switches or sensors, which turn on the system only when the **hook** is over the water or close to the supply boat deck elevation. These switches or sensors also rely on information within the crane's software database to determine **hook** position. EN 13852-1 also requires the crane's control station be fitted with a keyed lock switch and adjacent warning light, which must be used to prevent placing the **AOPS** in operational mode when lifting personnel.

What new hazards are introduced by an AOPS?

All certifying authorities, national regulators and standards organizations require that all **hoists** on new offshore cranes have a minimum of two load holding means, one of which shall be a **friction brake**, preferably acting directly on the **hoist drum.** The friction brake (**safety brake)** must apply automatically by means of **springs** or other equivalents when the **hoist lever** is moved to the neutral or stop position and when power is lost.

This system is commonly referred to as **fail-safe** braking with **dead-man controls**. Over the years, there have been many instances of accidentally dropped loads because of **hoist** component or control system failures. Therefore, this **fail-safe** system is considered a primary safety feature of all modern offshore cranes.

Using an **AOPS disables the safety brakes** when the system is active or in the operational mode. This means we are potentially holding heavy loads over the supply boat personnel with at least 50% of the load holding means intentionally disabled. The load is supported only by the retention or containment of **hydraulic oil pressure**.

The **AOPS** can also inadvertently drop a heavy load on the supply boat. Consider a crane with a SWL of 50 tons at a 20-meter radius that is fitted with an **AOPS** with a trip point offset 125% above SWL. If the crane operator lowers the boom to a load radius in excess of 25 meters with a 50-ton load, the **AOPS** will activate and drop the load.

Also, the added complexity of the components required for the **AOPS** adds considerably to the number of parts which must be checked, tested and maintained to ensure proper operation of the hoists and control system, which introduces even more chances to create new hazards.

What steps has the offshore crane industry taken to address the crane separation issue (other than AOPS)?

First, let's discuss a little background. The cranes to which the proponents of the **AOPS** refer were "transplanted" **crawler crane** designs, such as those built by Link-Belt and Manitowoc many years ago. These machines were originally designed as gravity-supported machines (**crawler cranes**).

When a **crawler crane** is overloaded, it tips or turns over. Because of this problem, the designers of the connective elements attaching the **rotating superstructure** to the non-rotating crawler assembly had no reason to design these items to transmit load-moments very much greater than those required to tip the machine. Therefore, normal steel building factors of safety were used (1.5 to 2) and were completely suitable for the intended purpose. These basic crane designs were then transplanted to offshore structures by replacing the crawler assembly with a **fixed steel pedestal**, which was a permanent part of the offshore facility. Now, when overloaded, these cranes could no longer tip over. They broke off of the **pedestal** and fell into the water when subjected to a gross overload, which is likely to occur with a supply boat entanglement.

The offshore industry soon recognized that transplanted crawler cranes were not the way to go, so specially-designed cranes tailored to the specific needs of this industry were gradually developed and put into use.

The certifying authorities, national regulators, standards organizations and facility owners take to heart the lessons learned throughout the years and have steadily revised their offshore crane requirements and standards. Today, offshore cranes are far different, stronger and more capable than those machines involved in the major accidents to which the proponents of the **AOPS** refer.

However, the certifying authorities have not completely addressed the issue of crane separation or supply boat entanglement. You can build a crane, meeting ABS, DNV and LLOYDS requirements, which can become detached from its mount and fall into the water when subjected to an unbounded gross overload, such as a supply boat entanglement.

To deal with this perceived deficiency in the certifying authority rules, other standards such as API Specification 2C, EN 13852-1 and many individual facility owners' specifications contain a provision for **progressive failure design** to address the supply boat entanglement issue.

These requirements are similar in nature because they require the crane manufacturer provide a **failure sequence analysis** for each of the crane's major components. This analysis must show, that in the event of an unbounded gross overload, the first component to fail must not be that which contains the crane cabin and operator. If the worst happens, the wreckage with the people in it must remain attached to the facility.

Conclusions

Seatrax believes that any **offshore crane** that can demonstrate a satisfactory **failure sequence** as set forth in API Specification 2C and EN 13852-1 should not be required to have an **AOPS** because:

- The potential loss of life associated with a supply boat entanglement has been adequately addressed by the requirement for a **failure sequence analysis.**
- The additional hazards to supply boat personnel introduced by an **AOPS** far outweigh any incremental benefit in safety over that provided by the **failure sequence analysis**.