

Protem SAS

On-Site Machining in Power Plants

What components of a conventional or nuclear power plant can be machined on site?

During a maintenance shutdown, every minute is important (whether the power plant is thermal or nuclear). Having dedicated machining equipment available saves a lot of time during these maintenance operations. In the case of nuclear power, on-site machining provides the ability to operate directly in certain sensitive areas of the power plant. On-site machining is, therefore, time and cost effective. A standard 900MW nuclear reactor normally produces 27,000 euros of electricity per hour. Therefore, the shutdown of a power plant results in a great deal of money lost.

Now days, the operators of power plants try to reduce downtime by various means, including, better organization and components that are easily removable and interchangeable. One method of improvement, is to invest in more efficient on-site machining equipment which can prevent the need to replace an entire component by machining the portion of the component that needs to be fixed.

Some maintenance operations that used to last several days, or even weeks or months, can now be shortened and performed in only a few hours. The aim of this article is to list in detail the components of a power plant that can have maintenance done on-site, through the use of specially designed equipment.

Heat exchangers

A heat exchanger is a system commonly found in a nuclear or thermal

power plant. It allows the transfer of the thermal energy of one liquid to another without having them come directly into contact with each other.

In a nuclear or thermal power station, this type of device is the link between the primary circuit, heated by the reactor (oil, nuclear etc.), and the secondary circuit that drives the steam turbine.

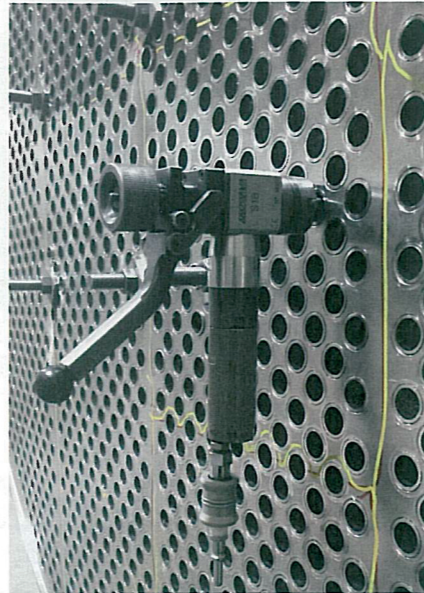
The heat exchangers are generally made of a tube bundle in which one of the liquids circulates. The tubes are held by a tube sheet in which they are welded. The second liquid circulates around this tube bundle and creates the heat transfer.

Maintenance or construction of such exchangers may take time due to the high number of tubes to be machined and welded. The tubular plate must sometimes be machined on-site. In some cases, the tubes must be replaced and then removed from the system. This is called "tube removal". It is therefore necessary to machine the weld that connects the tube to the plate.

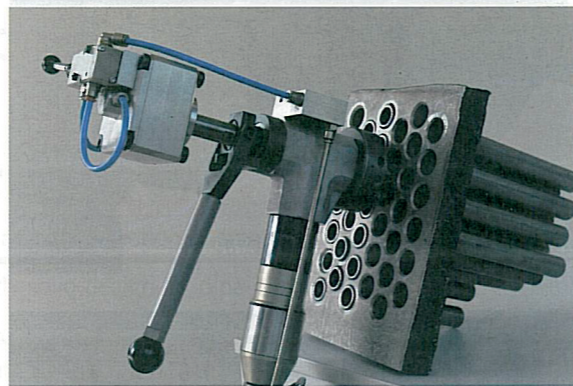
All these operations can be performed on-site thus avoiding the need to move the entire heat exchanger. This machining equipment will be clamped inside the tube or inside one of the plate holes. It will then be able to accurately machine the circumference of the tube or the plate. Some adaptations such as automatic clamping and automatic feed reduce the operation time.

Flanges

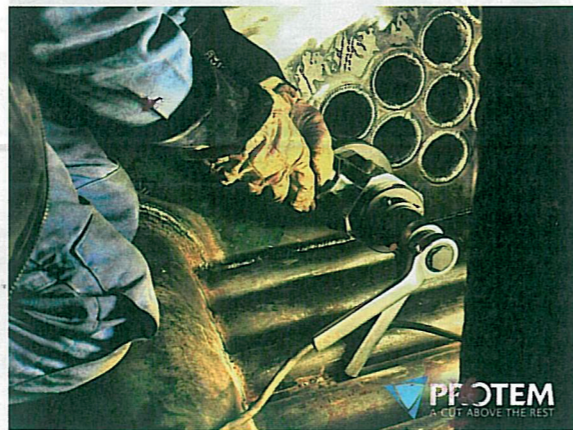
The flanges join the tubes, valves and other piping components together. Flanges are key com-



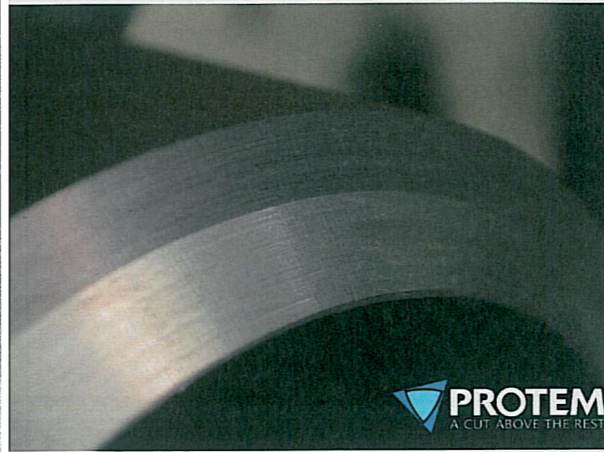
S18 pipe beveling machine on a heat exchanger



US25 pipe beveling machine with automatic clamping



US30 beveler for tube removal.



Compound bevel one a heavy walled tube



US40 pipe beveling machine

will gradually go into the pipe. According to the tools used, this technique makes a bevel (welding preparation) directly on the cut tubes, thus saving a lot of time.

Welding preparation

Welding preparation is a common operation in a power plant but it can be complex. Indeed, high pressures and temperatures require pipes with heavy wall thicknesses (sometimes more than 50 mm (1.97") wall) or pipes manufactured in a very hard material (Inconel, Hastelloy, etc.). In all cases, the welding preparation must be perfect to ensure the penetration of the weld through the entire thickness to avoid any breaks during commissioning. The geometry of this type of preparation is governed by various welding standards. For heavy wall thicknesses or when using an orbital welding process, preparations with specific geometries are required. (J Bevel for orbital welding, Compound Bevel for heavy wall thicknesses.)

The machining of this type of bevel can only be achieved with specific equipment that is sufficiently rigid and accurate to machine the required geometry, whatever the thickness and material. This type of machine must also be able to work under the very difficult and restrictive conditions of on-site machining; lightweight, machining positions, available energy, elbows if any, and/or limited space requirements.

Conclusion

The use of on-site machining equipment during maintenance operations in a power plant is now essential in order for companies to remain competitive in this market. Current technologies make it possible to machine virtually all elements of a power plant directly on-site and avoid costly replacements or transport. The initial investment is quickly recouped by the amount of time saved on the project.

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