Two shift operation power plants

Power stations that were originally designed for "base load" applications are now increasingly being asked to operate on a two shift, stop/start regime; this is more commonly known in the industry as dual shifting. The multiple start/stops that these stations are now experiencing is in some instances causing an increase of operational issues due to the to the constantly changing process parameters. For example dual shift stations will experience additional thermal stress in the headers, drums, high temperature piping, valves plus the auxiliary equipment leading to additional wear and tear of their systems and component parts. This is due to the more frequent use of the plant at severe service conditions. The consequences of the change in plant operation cannot be ignored. If the plant is not operated correctly or more importantly modified properly to handle these changes the lifetime of the components within the plant will decrease enormously.

The changing operational requirements of the plant require that the steam coolers, de-superheater valves, drains, feed water control valves, main steam isolation valves and the turbine quick closing valves are reviewed. These critical pieces of equipment have to be specifically designed to take the new dual shifting process requirements into consideration, once this has been done the operational performance of the plant can be improved and wear and tear of systems and components can be controlled and significantly reduced. Consequently as these pieces of equipment have been specifically designed for the new operating conditions of the station they are no longer a limiting factor to the start up time of the plant. The following paper highlights some of the more common issues found in dual shifting power stations with special regards to steam control.

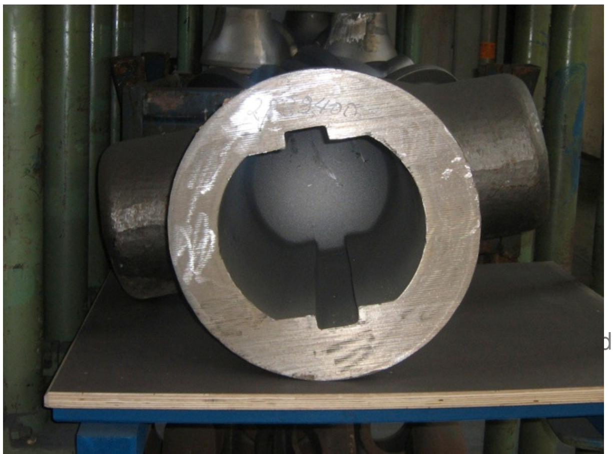
Stop valves

Stop valves do have a crucial role in power stations. They can isolate certain parts of the installation and are operated in an "on-off "mode. In older installations the parallel slide gate valve is popular. This old design is based around two separate discs, guided by the seats during the full stroke, whereby in the closed position the upstream pressure pushes the downstream disc on the seat and creates the seal. An adequate system, however this has a major weak point in that during the opening and closing the disc is in constant contact with the seat potentially "scoring" the seat during the full stroke. By opening the valve intermittently the damage to the seats and discs is limited and it could reach the next outage without any major maintenance.

However, where the valves have to be operated in a dual shift regime, every day opening and closing may be needed which will significantly reduce the life span of a standard valve.

AVS offer a stop valve design which overcomes the issues of wear: a gate valve design based on the features of the parallel slide valve. The sealing is made by the downstream disc on the seat and the valve has the feature of a separate guide rail to guide the set of discs during the stroke of the valve so that the discs only contact the seats at the end of travel in the closed position. This special feature results in "friction free" opening and closing and **no** pressure locking. No wear to the sealing area occurs during travel. We have called this design the **tapered parallel slide valve**: This valve is based on two individual separate discs, a bearing and a spindle with a forged-on hammer head. This valve has a very limited number of parts in the pressure containing body.

Body materials



Starting and stopping an installation every day will lead to thermal stress in a valve body. The thickness of the different parts of the body determines the heat radiance and ultimately the start up time of the installation. The thinner the valve body, the shorter the start up time.

High pressure valves are mainly based on cast materials. For high temperature applications material qualities as A 217 WC 6, A 217 WC9 and C12A (not even approved to PED / EN) are often used. The disadvantage of a casting is the fact that, due to possible material defects, the wall thickness has to be significantly thicker then forged materials. The allowable strengths of a casting are about 40% of the figures which can be applied for calculating a forged valve.

Our forged valves are designed to suit the required pressure and temperature and, unlike a casting, do not require excess material to satisfy the requirements of a particular pressure class. Forged valves are “athletic valves” quick in starting up and cooling down with the thinnest possible wall thickness.

Our valves are available in different materials such as A 182 F1, F12, F22 and P91 / P92.

Above left and right: *Hollow forged valve bodies.*

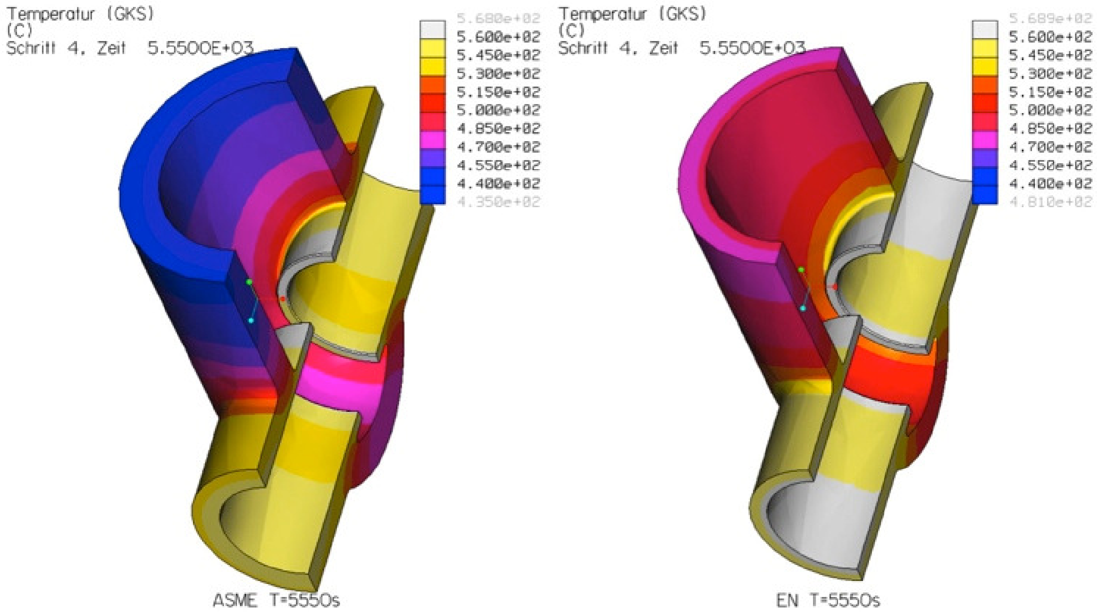
Block valves

In case valves are needed in very high pressure classes and odd sizes Persta manufacture a complete line of valves based on machined forgings.
Variations are unlimited.

Right:
Gate valve based on forged blocks

Thermal cycling

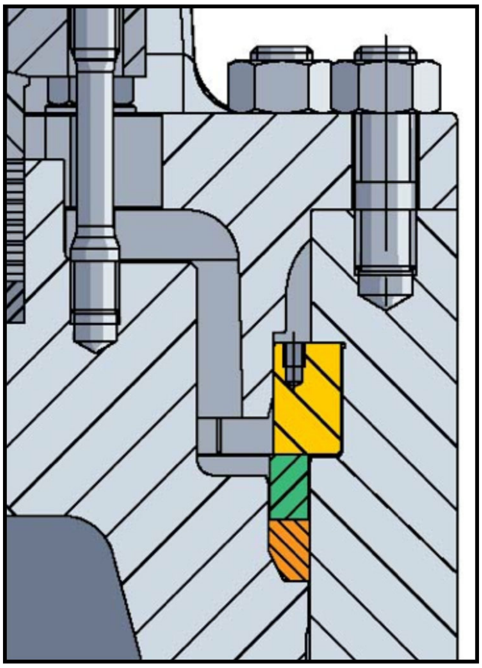
New rules for cycling valves and the calculation of thermal stress due to heating radiant are described in the **EN12592-3** and the **EN 12516-2**. Persta is one of the first manufacturers who has delivered valves to these design criteria.



*Comparison of a valve to **ASME 16.34** with a valve designed to **EN 12516-**2 is available on request.*

Maintenance pressure seal bonnet

After being successfully in operation for several years even a Persta tapered parallel slide gate valve needs inspection.
This is much easier in a Persta valve because the pressure seal design of Persta is different to the regular designs.



In our experience a regular pressure seal is hard to open. The split ring is held in place by the bonnet, and the bonnet has to be driven down to remove the split ring. Due to corrosion, magnetite and the tolerances this is not always easy.

The Persta design is superior. The fitting of the split ring is done by a ring as part of the yoke.

This means that to carry out maintenance only the bonnet has to be lifted. Opening this valve can be done quickly.

Persta valves are therefore very maintenance friendly.

Large Valves

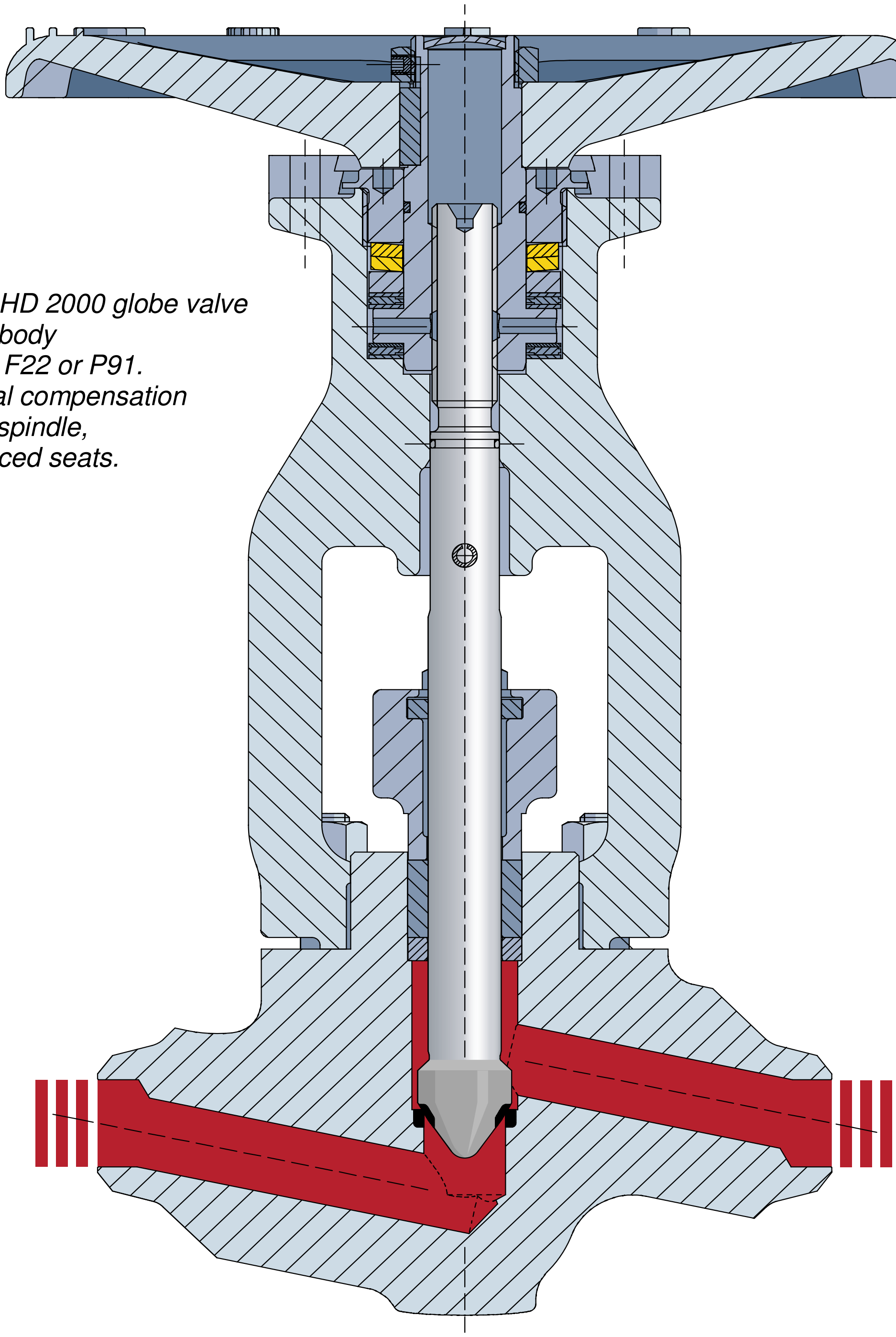
Large valves, such as the hot reheat shut off valves often are 24, 28 or even 32" in size. To comply with the requirement to follow the heat radiant design criteria in the high pressure part of the boilers new valves have been developed.

These valves are fabricated, based on P91 hot forged sheets, brought together in a special procedure.

The ultimate result is a valve with a wall thickness almost equal to the pipe material, light and easy to operate and present no problem for the new design requirements.

Valve built of forged plate, large sizes possible.

One of the installed valves in the UK in a HRSG reheat application has performed 100.000 cycles without any problems.



Persta HD 2000 globe valve forged body in F11, F22 or P91. Thermal compensation on the spindle, hard faced seats.

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