Translation:

Process description of the walking beam furnace.

The walking beam furnace is designed to heat treat stainless steel pipes within an O.D. range from 100 mm through 355 mm and a typical length from 8 m up ot 16 m.

The max. metal temperature is limited to 1250 °C

Included in the design are the following elements:

- Run-in roller segment with an O.D. measuring and control device
- The walking beam furnace with run-in roller system, the charging equipment, walking and stationary beam platforms and roll-out rollers.
- Run-out roller segment including a water spray system for rapid cooling

The complete equipment is designed for recrystallization of material subsequent to cold forming (pilgering, drawing).

How it works:

The pipe on the run-in system passes first the measuring and control station. In this station the exact O.D. is determined. Based on these results the system decides where the pipe will be positioned in the first step and how it will be processed further on through the whole furnace.

There are 3 possibilities caused by the O.D.

- Smallest diameter group (NPS 4” – 6”) means each valley will be filled up with a pipe
- Medium diameter group (NPS 8” – 10”) means every second valley receives a pipe. After each pipe we have 1 step without a pipe, a zero step.
- Large diameter group (NPS 12” – 14”) means that every third valley is loaded with a pipe. The next 2 steps are zero steps.

The variation of the length is calculated from 8 m to 16 m.

In order to have a nearly uniform load in the furnace the pipes are placed such that one layer starts flat right side whereas the next layer starts flush on the left side and so forth. 2 pipes in one line (valley) are not foreseen.

Positioning devices in the furnace, control the valleys and the run-in rollers and only if they are not occupied the next pipe can roll in.

The run-in door is operated by an electro-mechanical device. The charging equipment is lifted by 2 hydraulic cylinders; they lift the pipe from the run-in roller and transport it horizontally in the first predetermined valley of the fixed segments. The supports of the charging devices slow down and move back into the waiting position.

The charging activity is only possible when the movable beams are in a so called sleeping position which is the down position with reference to the run-out system.

The transportation across the furnace is initiated by the movable beams. The bottom of the furnace has a wave like profile with a distance of 250 mm valley to valley.

By lifting of the 10 movable beams, initiated by a hydraulic system installed underneath the working platform, the pipes are lifted approx. 80 – 100 mm and transported 150 mm in the horizontal direction towards the run-out rollers and then placed in the next predetermined valley. The movable beams slow down approx. 50 – 80 mm and remain in this position waiting for the next cycle. The pipe rolls after slow down, based on its weight, into the lowest part of the valley under rotation.

The strokes for horizontal and vertical movements are adjustable. The actions of the cylinders are controlled by a separate electronic and hydraulic circuit.

In case the holding time must be extended the system can be used to move the pipes (rolling) without further transportation. The last step is to lift the pipe from the last valley and transport it to the run-out rollers. This step is initiated only by the operator or in automatic mode by the quench system.

The exit door opens, same as the entry, by electro mechanical system and the run-out table transports the pipe directly to the quench system.

The operator’s terminal shows a virtual picture of the equipment displaying the positon of the load, the status of the burners and the actual temperatures of the heating zones with reference to the set points.

All roller belts have a max. speed of 100 m/min. in both directions. Based on the “off angle” position of the rolls the pipe is forced to rotate during transportation.

The heating of the furnace is performed by the use of 15 recuperation burners placed above the base platform. We have 2 installation zones in working direction, left with 8 burners, right with 7 burners. The temperature control is guaranteed by a software control system in the SPS with a profibus connection to the 15 burner control devices BCU 460.

The burners work in an “on/off” mode.

The exhaust gas leaves the furnace by passing through the recuperation device of the burners.

The actual pressure in the furnace is controlled by an additional device. The SPS includes a controller to adjust the furnace-pressure throttle. The exhaust gas streams into a collector on top of the furnace and from here into the atmosphere.

The required air for the burners is generated by an air compression system with 100 mbar nominal pressure (40 KW capacity). The pressure can be controlled and adjusted by changing the revolutions of the motor continuously.

The gas supply is controlled by a so called Gas Entry Control and Safety System, consisting of a main ball valve, gas filter system, pressure controller, safety shut down valve, overpressure protection device, electromagnetic valves, pressure gauges and pressure switches for max/min adjustments.

The full design is in accordance wit DIN-EN 746-2.

For cooling purposes of the 24 furnace rolls (run-out) and the door frames is cooling water required. Each roll is equipped with a flow meter which gives a signal if flow is too low.

The air tightness of the 10 movable beams is performed by a water barrier underneath the furnace. All 10 systems are connected to each other and the water level is controlled by an overflow system. The water flow is always at a constant rate. The return water is collected and returned by using a pumping system forcing the water back to a cooling system and then back again.

The water level is permanently controlled and connected with the control panel to give a low level signal and an alarm.