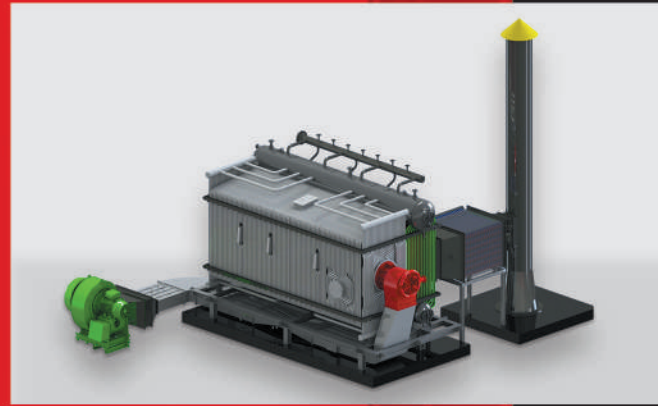


INDUSTRIAL WATER TUBE PACKAGED BOILER D-TYPE



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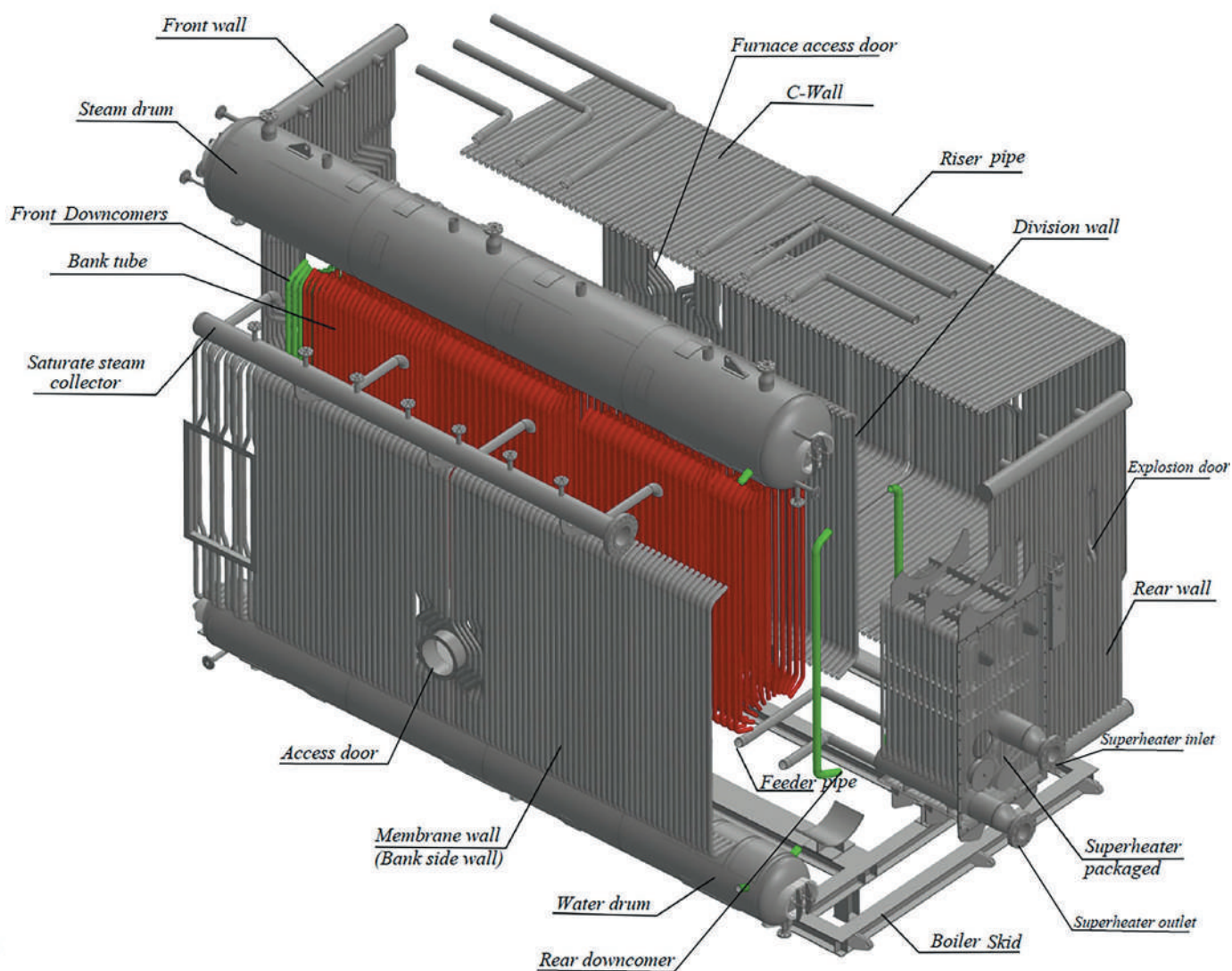
Design and technology
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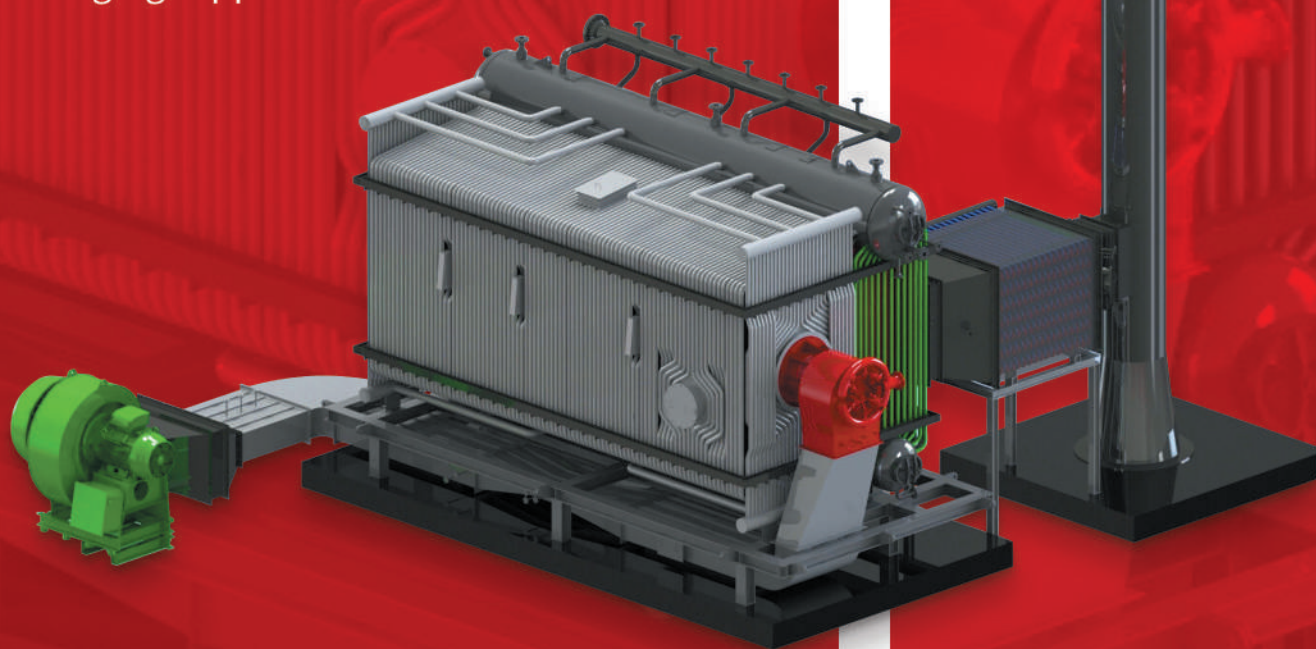
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Industrial water-tube package boiler (Steam generator) at a glance

The main use of steam generators or boilers is the production of steam at high pressure and temperature. In these boilers, the combustion gases emitted from the burner flow from the outside of the thermal surfaces in two radiation and convection areas, and the boiler feed water flows through the pipes of the heat transfer surfaces.

Industrial water-tube packaged boiler are developed from a capacity of 5 t/h to 130 t/h to produce steam at high pressure and temperature as a boiler package, as well as higher capacities up to 1500 t/h to produce a superheated steam with high pressure such as the boilers of thermal power plants are designed and built as a hanging support.





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Description of the Industrial water-tube packaged boiler components

01 Steam drum: This is main part of the water tube boiler. In this drum, the feed water will be distributed to down comers, chemical injected to feed water, separation of saturated steam from saturated water, remove moisture from saturated steam by chevron dryer or demister pad.

01-01 Saturated Steam Pipe and Nozzles: The transition of steam from steam drum to collector.

01-02 Horizontal / Vertical Separator: Separation of saturated steam from liquid.

01-03 Chemical Dosing Line (Chemical Distribution Line): Distributes the chemicals in steam drum. (Mainly Phosphate chemicals)

01-04 Feed Water Distribution: Distribute feed water into steam drum.

01-05 Demister Pad / Chevron dryer: scrubber of water droplet from saturated steam.

02 Riser Pipe: It is used for transition of saturated steam from rear and front wall to steam drum.

03 Emergency gas outlet (manually open and close): It is used to exit hot flue gas from inside of the furnace in sudden shut down time.

04 Furnace explosion door: Opening the gate when the pressure of the furnace increases. (considering that the boiler operates under pressure)

05 Fan: Working as forced draft fan and providing the combustion air from the atmosphere. It forces the air into the furnace after preheating the air in the preheater. These fans are located at the inlet of the boiler to push high pressure fresh air into combustion chamber, where it mixes with the fuel to produce positive pressure.

06 Air duct: Air crosses over the air duct from the F.D Fan to the Burner.

07 Skid: Supporting for boiler installation.

08 Furnace access door: Access to the furnace for inspection and maintenance.

09 Burner Opening: Location of burner installation.

10 Stack: Transition of flue gas to atmosphere.

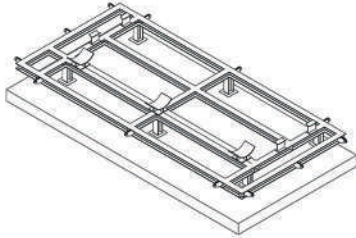
11 Economizer: A boiler economizer is a heat exchanger, installed on exit flue gas duct and heats the feed water. It is designed to recover heat that would otherwise be wasted through flue gas. The utilization of economizer will rise up the thermal efficiency.

- 12 Saturated Steam Collector:** Collects steam from the boiler, distributes the steam for using saturated steam to the super heater and maintains steam stability for the user equipment.
- 13 Steam Air Pre heater:** It's a shell and tube heat exchanger that is installed on air duct. It's used to improve the thermal efficiency of boiler and to absorb air humidity. In this equipment, air is heated by steam produced by boiler.
- 14 Feeder Pipe:** It is used for the transition of water from water drum to rear wall and front wall.
- 15 Wind Box:** Wind box is used to transport balanced air flow from air duct to the burner(s), which then will be mixed with fuel for efficient combustion in boiler.
- 16 Burner:** It's providing the heat necessary for converting water in the boiler into steam and is attached to the boiler.
- 17 Flue Gas Expansion Joint:** Flue gas expansion joints are typically expansion joints designed to relieve stress caused by thermal expansion and vibration in handling systems.
- 18 C wall (Water Wall):** The biggest wall of the boiler that has maximum radiation heat surface area in furnace. This section includes the roof, wall and bottom of the furnace (it's in radiation zone).
- 19 Rear Wall:** The end wall of the boiler facing the burner (it is in radiation zone).
- 20 Front Wall:** The front wall of the boiler where the burner is installed (it is in radiation zone).
- 21 Eyeglasses door:** It's used to see inside the furnace, especially for flame of burner.
- 22 Water Drum:** It's used for the storage, collection and distribution of the feed water in the water wall of boiler.
- 23 Membrane Wall:** The outside wall of the boiler that is between the ambient and bank tubes.
- 24 Down comer:** Are tubes that start from the drum and lead water to furnace walls and boiler banks. It is important to keep the flow velocity in the downcomers low to avoid problems in circulation design. Often velocities between 4 and 6 m/s are chosen.
- 25 Flue gas damper:** Flue gas dampers are installed at the beginning of the flue gas duct, this equipment trims flue gas of boiler to adjust boiler pressure.
- 26 Gas duct:** Flue Gas Duct is used to convey flue gas from boiler to stack. This includes the flue gas damper, economizer and flue gas expansion joint.
- 27 Bank tubes:** bank tubes absorb heat from the flue gas by convection heat transfer.
- 28 Division wall:** Wall panel is an important part of boiler heating surface. It is made of some tubes and placed on furnace inner wall to absorb radiant heat from combustion chamber and convection heat from hot flue gases. It is between radiation and convection zones.
- 29 Superheater:** It's used to produce superheated steam from saturate steam in accordance with the consumers requirement.
- 30 Buck stay:** It's used to prevent bulking of boiler water wall.

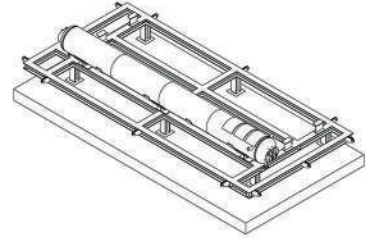
Water tube boiler

package fabrication & erection

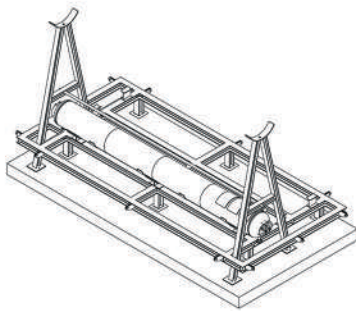
Skid loading on the foundation



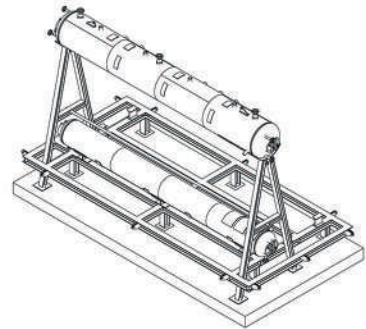
Water drum loading on the skid



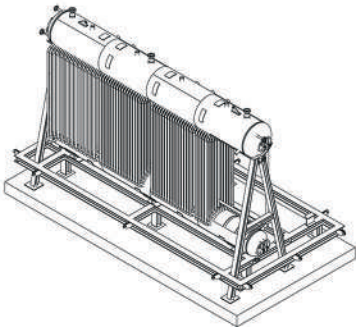
Temporary structure loading, installation, on the foundation



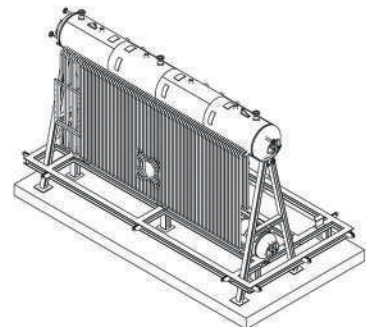
Steam drum loading on the temporary structure



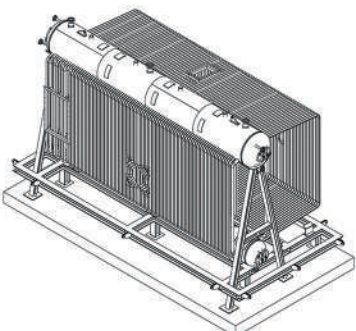
Assembly of left and right bank tubes into drums



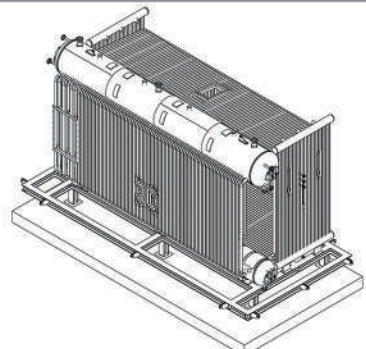
Assembly of Division wall tubes into drums/
Assembly of Membrane wall tubes into drums



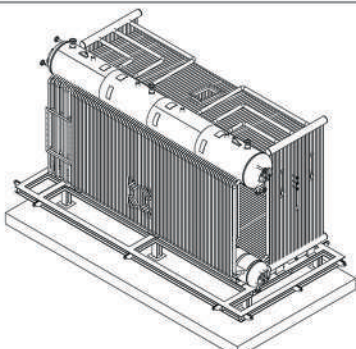
Assembly of Downcomer pipe into drums
Assembly of Water wall (C Wall) into drums and fin welding



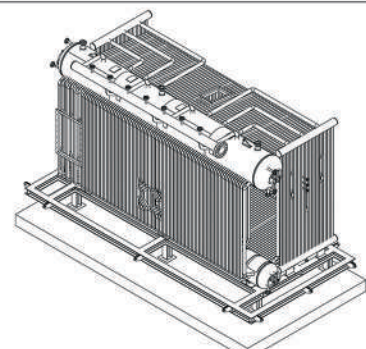
Separation of Temporary structure



Assembly of Front wall to water wall
Assembly of Rear wall to water wall



Assembly of Saturate steam collector to Steam drum saturate steam nozzles



Special advantages of design, supply of materials, manufacturing, installation and operation of Packman Co's water tube boiler package

- 01** In order to prevent any operational inconsistencies in the peripheral equipment of the Industrial water-tube packaged boiler package, this equipment includes: burner, fan, pump, deaerator, blowdown tanks, chemical injection system, control system for pollutants from boiler exhaust gases (CEMS), control system (PLC) as it is fully integrated and it will be Received and presents certificate of each equipment from the subcontractor delivered to the client.
- 02** By using the steam separator equipment from the mixture of steam and saturated liquid and dehumidifier (Special steam separator & Chevron dryers) inside the steam drum, the quality of the saturated output steam is purified by more than 90% And to superheat the saturated steam to the desired temperature, it's transferred to the primary/secondary superheater package of the boiler.
- 03** The thermal efficiency of the Industrial water-tube packaged boiler of this company is more than 90% on 100% MCR, so that it's possible to obtain A or B grade in energy consumption from the client. In this regard, with the possibility of pressurizing the combustion conditions of the boiler furnace up to 45 mbarg pressure, it has acted for more absorption by thermal surfaces and the thermal coating of the body, especially the thermal surfaces of the lower part of the boiler, is done by rock wool with the density of 80 Kg/m³ in the first layer and rock wool with the density of 100 Kg/m³ in the second layer, along with the precise sealing of the rock wool layers.
- 04** The use of the furnace pressure control damper in the connection of the flue gas outlet of the boiler to the economizer, allows the possibility of setting the pressure of 45 mbarg of the furnace in different operating capacities.
- 05** Material used in Furnace water wall section is SA-210 Gr. A1 and superheater tubes are SA-213 T22 as "lowmaintenance" tubes of reputable global brands and provide their original certificates. In addition, only the production of tubes by cold drawn method will be approved. This is a point that the metallurgical laboratory can hardly detect.
- 06** Creating at least two access doors to the furnace and bank tube for periodic visits and repairs, and also creating at least two explosion doors to prevent the possible explosion of compressed gases. Note: The Explosion door for the initial discharge of the gases accumulated in the furnace during the startup of the boiler by the fan and to prevent sudden ignition and consequently the rapid discharge of combustion gases due to the opening.
- 07** Proper inspection is considered during construction and assembly, and it's emphasized that in addition to preparing WPS & PQR for welding water drum and steam drum shells, it is also important to prepare block test or coupon test including: Drilling, Switching, Bending, Expanding, Seal welding of water wall tube are carried out and any destructive and non-destructive tests are performed according to each mentioned processes in the presence of the employer's inspector.
- 08** Expanding boiler tubes to water drum and steam drum are done in two Light & Hard stages. In this regard, after the fit-up of the boiler tubes to the water drum/steam drum, soft expand or initial expand is performed. Then, all of the welding operations on the boiler body, as well as the connection of riser tubes, feeders, and the saturated steam collector of the steam drum and also the final expansion are performed. Actions are taken according to the defined sequence.
- 09** In case of regional dust, a cellulose dust collector system is provided in the air supply channel of the fan boiler.
- 10** In case of regional high humidity, a moisture filter is provided in the air supply channel of the fan boiler.
- 11** Due to the possibility of power outages during the operation of the boiler and due to the accumulation of very hot gases in the furnace, which causes overheating of the tubes, at least one opening in the roof of the furnace is used to discharge the hot gases of the furnace during shutdown.
- 12** To control the lateral expansion of the boiler, at least two rows of buck stay and bumper are used to stabilize the side walls of the boiler.
- 13** The flow chart for sequence of construction, assembly and installation of the main components in the boiler is prepared and implemented with the inclusion of inspection points and the time of the work corresponding to the WBS to inform about the work process and the presence of the employer in special cases.
- 14** SA-516 Gr. 70N (Normalized) is used for the construction of steam and water drum. Registration of Normalized operations in the original certificate is required by the manufacturer.
- 15** In order to prevent any corrosion caused by air humidity and long-term durability of the boiler in operation or lack of water, electricity and fuel and after drying the boiler with precision instrument air, nitrogen blanketing process of all tubes at a constant pressure of at least 5 mbarg and also Silica gel is used in the furnace and chamber of bank tube and economizer.
- 16** The superheater package is designed in such a way that it can be easily installed and periodic inspections and possible repairs can be done.
- 17** Installation of nozzles related to the installation of electric heating elements on the water drum in order to keep the boiler warm and ease the start-up package.
- 18** In addition to the 24-month guarantee period, the Industrial water-tube packaged boiler package of this company has a warranty period of 200,000 hours (25 years).
- 19** Considering the sensitivity of water level and boiler pressure control, VOTING 2 O 3 is used in their control system.
- 20** The FAIL SAFE and REDUNDANCY control system is used in POWEWR SUPPLY, CPU, CRITICAL I/O & SERIAL LINK. The system is used to increase the safety of the boiler operation.



Prepared by research and
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