



## Design of super large caliber fabric expansion joint for power plant

**Abstract:** This paper introduces the working environment, structure, characteristics, installation instructions and advantages of super large fabric expansion joint.

**Key words:** fabric expansion joint; fabric expansion cincture; thermal insulation layer; fission design

Fabric expansion joints has been widely used in various industries and fields in recent years. Fabric expansion joint' s structure is simple, easy to install, and with good corrosion resistance. Shorter length can compensate for the larger axial displacement and lateral displacement and angular displacement; itself does not have the displacement caused by the stiffness of the reaction of the output, the requirement of distance between the fixed bracket and load capacity is not high, the safety of the equipment and system has quite improved. Meanwhile with good sound insulation, vibration isolation, thermal insulation function, easy to install and easy to replace. The disadvantage of fabric expansion joint is withstanding lower pressures. The device between the boiler slag well of the dry-type deslagging equipment of the 2 × 660MW generating unit of a thermal power plant and the comb-shaped plate of the boiler lower header box is designed to absorb the expansion deformation of the boiler in all directions and to withstand the maximum working of the furnace pressure. When the vertical expansion of the boiler deformation in the range of  $\pm 10\%$ , should be ensured that its normal use.

### Design condition

The device is used for the outside position of the comb-plate of the boiler' s water-wall lower-section header and can withstand the working pressure of  $\pm 9.8\text{kPa}$  in the furnace. There is dusty hot air with a maximum temperature of  $950\text{ }^{\circ}\text{C}$ . Boiler water wall Lower side comb box Outer side position Interface size is 21598 (boiler furnace width direction) × 4460mm (Boiler furnace depth direction). Thermal displacement value of boilers: Direction X (Boiler furnace width direction of the two-way) 59 mm, 35mm; Direction Y (Boiler Furnace Depth Direction Horizontal Unidirectional) 59mm, 35mm; Direction Z (Down) 465mm. The outer surface temperature of the device is not higher than  $100^{\circ}\text{C}$ , the upper end is the movable end and the bottom is fixed with the H-shaped steel frame.

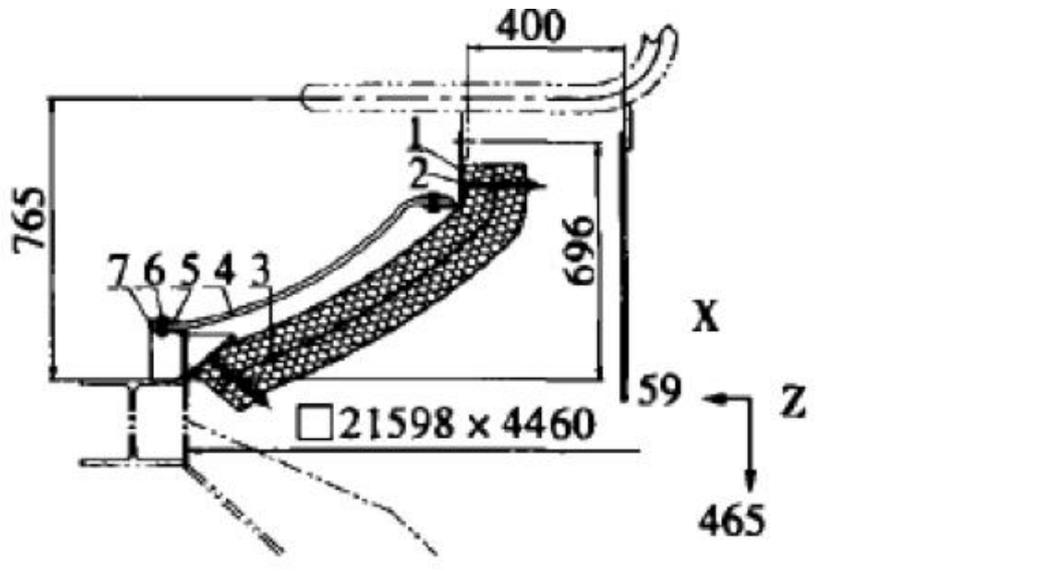
### Design

Since the diameter of the device to be designed is large, but the installation space is small, the fabric expansion joint can meet the above-described displacement amount. The working temperature of fabric expansion joint in the current market is





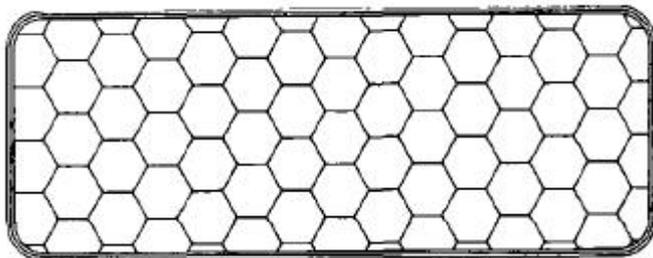
-40~90℃, the working pressure is  $\pm 30\text{kPa}$ , it can be used for high dust concentration of cement production lines, metallurgy, power industry, smoke exhaust pipe. This device can be designed as fabric expansion joint. The structure as Pic 1.



Pic 1 Simplified diagram of super large fabric expansion joint

1. Upper end plate pipe; 2. Insulating layer fixing device; 3. Insulation layer; 4. fabric expansion cincture; 5. Platen; 6. Firmware; 7. Connected tube of the bottom plate

The internal temperature of the fabric expansion joint is higher, and the surface temperature is lower than 100 °C. So the insulating layer is filled inside. The material of the insulating layer is: stainless steel wire mesh, aluminum silicate fiber blanket and wired ceramic cloth. The heat-resistant temperature of aluminum silicate fiber cloth and ceramic fiber cloth can reach above 1000°C. 2 insulation layer is fixed with device to ensure that work does not fall off.



Pic 2

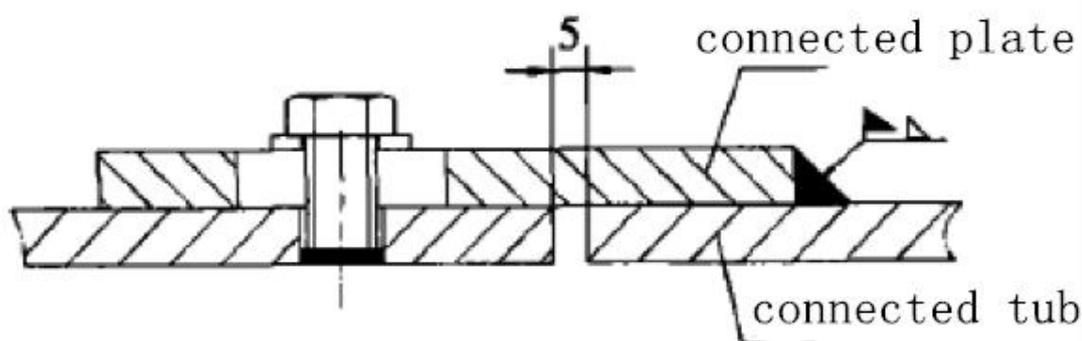




The ceramic fiber mat is wrapped with a ceramic fiber cloth and stainless steel wire mesh and sewn together with stainless steel wire to make it integral. The out layer is stainless steel wire mesh, the middle layer is ceramic fiber cloth folder, the inner layer is ceramic fiber mat.

The internal temperature of fabric expansion joint is high, and the high-quality heat-resisting steel is selected for the expansion joint steel structure. The fixing device of the fixed insulation layer is made of high-quality heat-resisting steel and connecting heat-resistant steel.

The diameter of fabric expansion joint is large, and steel with thermal expansion and contraction characteristics, the movable end of the connected tube is fixed with the grooved hole bolt, design the platen connection to absorb the thermal expansion of the non-metallic connected tube, and to avoid the connected tube structural parts to expand with heat and contract with cold, but also to eliminate the installation error, and convenient transportation and easy installation, and convenient to transport, easy to install.



Pic 3, The design of active end of connected tube

Silicone rubber has high thermal stability, operating temperature range of 100 to 300°C. Has excellent aging resistance and good process; glass cloth with high strength, dimensional stability and good temperature characteristics; PTFE film has good sealing effect, wired fiberglass cloth has high mechanical properties.

The fabric expansion cincture of the expansion joint: PTFE film, wired ceramic fiber fabric, aluminum silicate fiber blanket, fluorine rubber glass fiber cloth, stainless steel wire mesh, E-glass fiber cloth, aluminum fiberglass cloth, and with glass fiber cloth to cover the edge.

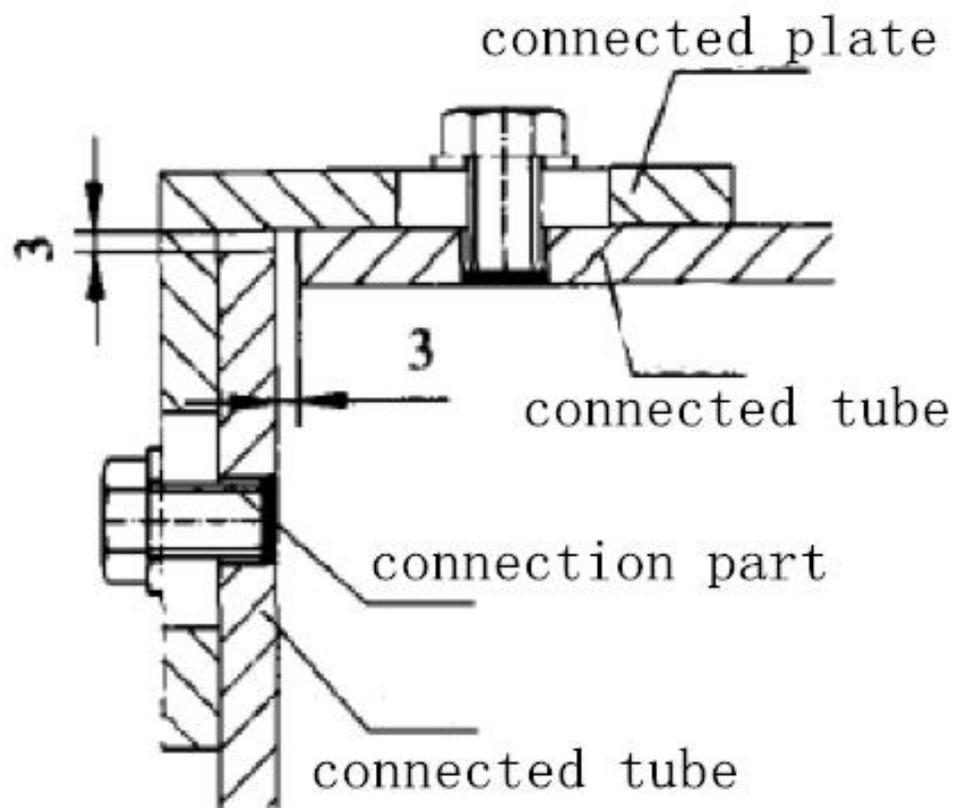
Fabric expansion joint is equipped with a floating inner liner, the liner can





effectively block the dust so that the insulation layer is not worn. The inner liner is designed in the form of a segment to absorb the horizontal expansion, and a stainless steel plate is used to connect the plates to each other and fix them with bolts.

The right angel of fabric expansion joint: The bending plate and the two sides of the straight bar is fixed with bolt connection.



Pic 4, The design of right angel of connected tube

#### Installation of fabric expansion joint

According to the drawing, connect the movable end of the fabric expansion joint to the comb box of the lower box one by one. Do not tighten the bolts. After the connection, adjust the gap between the joints to ensure the gap is 5mm. Adjustment is completed, confirming that is correct to weld the pipe and and pipe, pipe and





comb plate. Adjacent tubes are connected by connecting plates, the connection plate is connected with the bolt at one end (connected before delivery), the another end is connected with connecting tube. Shown as Pic 3, welding with continuous fillet weld, the implementation of JB / T4709 - 2000 Steel Pressure Vessel Welding Rules. Note that the connection between the angle connecting plate and the connected tube is not welded;

Taking the lap joint form for the 3 layers insulation layer during installation, amount of lap is 300~400mm. After lapping, sew the lap joint with stainless steel wire, and pay attention to the installation of insulation layer, do not pull too tight to destroy it. Special attention to install the expansion joint itself up and down caliber inconsistent that the thickness insulation cotton lap joint is too thick, if the overlap is too thick, and it's inconvenience to operate, so it's ok to cut the lap, and sew again. it's ensured that the thickness of the lap shall not be less than the thickness of a single layer of insulation.

The side with stainless steel wire mesh is mounted towards the furnace during the installation of fabric expansion joint. Do not pull the expansion joint cincture too tightly, and pay attention to protect the cover during the installation, in case of Welding spatter and protect the skin from scratches, cuts, and other mechanical damage.

For the large caliber fabric expansion joint, after installation, must pay attention to check the fabric expansion cincture whether there is damage, leakage, and uncompressed; for steel structure whether there is leakage welding; or whether fastening bolts are not tightened.

For the large caliber fabric expansion joint, manufacture individual parts, transport individual parts, and install each part to large caliber fabric expansion joint. Now it's one of the essential equipment in the power plant.

