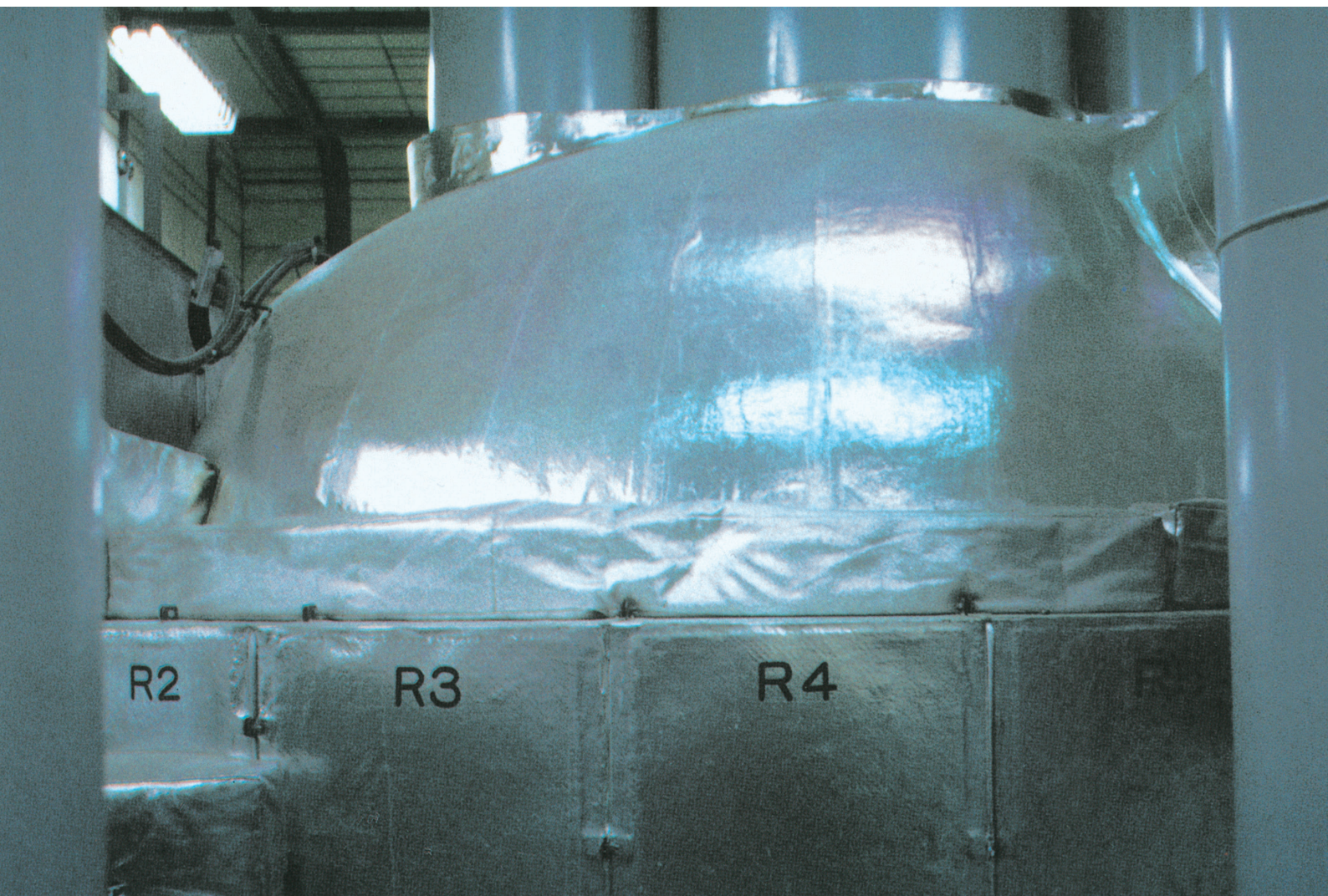


FI Type Method
of
Spraying Insulating
for
Thermal Insulation and Soundproof



FUJI I-TEC CO., LTD.

FT Type Method of Spraying Thermal Insulation Material

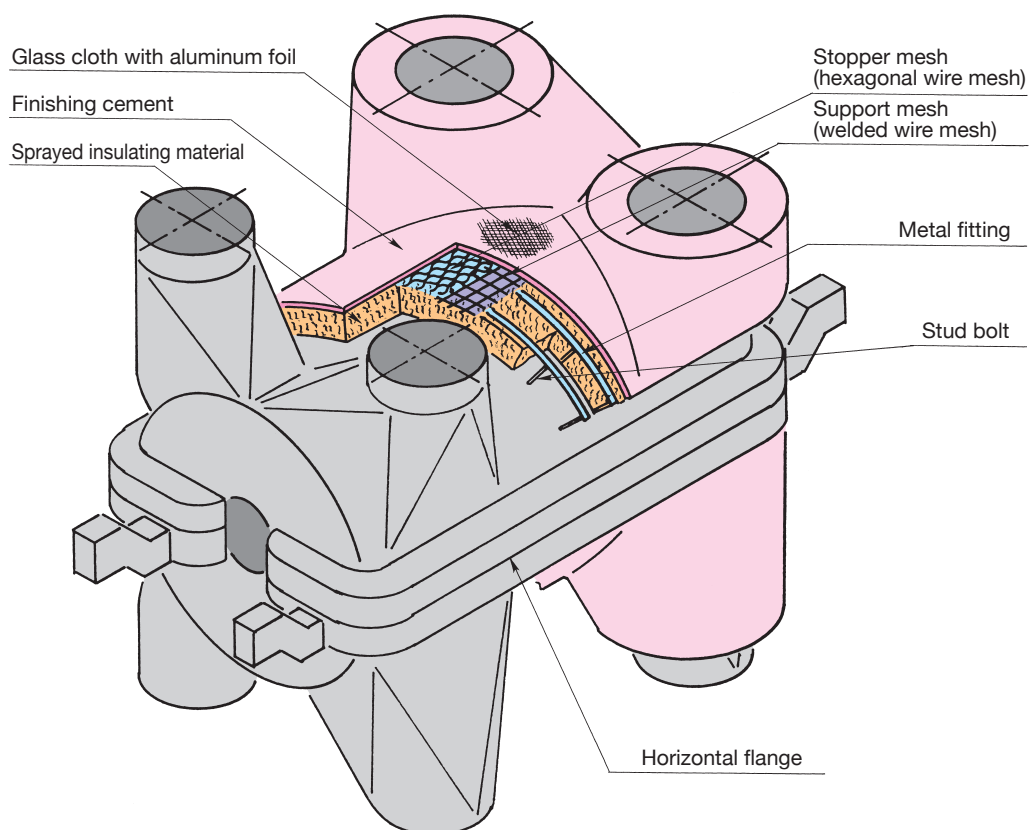
This is our newly developed method of spraying, with a spray machine, an insulating material composed of a mixture of mineral wool as its main ingredient and a heat-resisting binder, onto the surfaces to be insulated for thermal insulaion / soundproof, and this method can widely be applied to turbine casing, piping, control valves, combined valves, reheat strainers, ventilation fans, pumps, heat exchangers, etc. at power plants, iron works and chemical plants.

An insulation material consist of asbestos free mineral fiber completely.

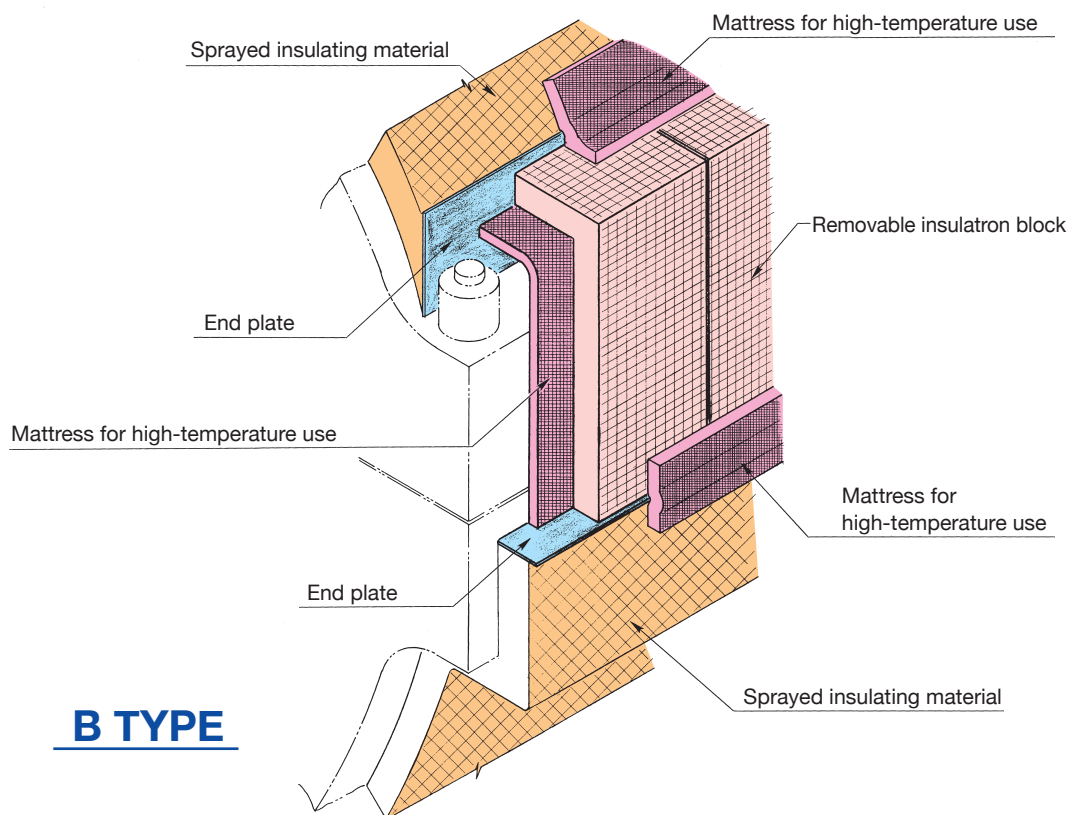
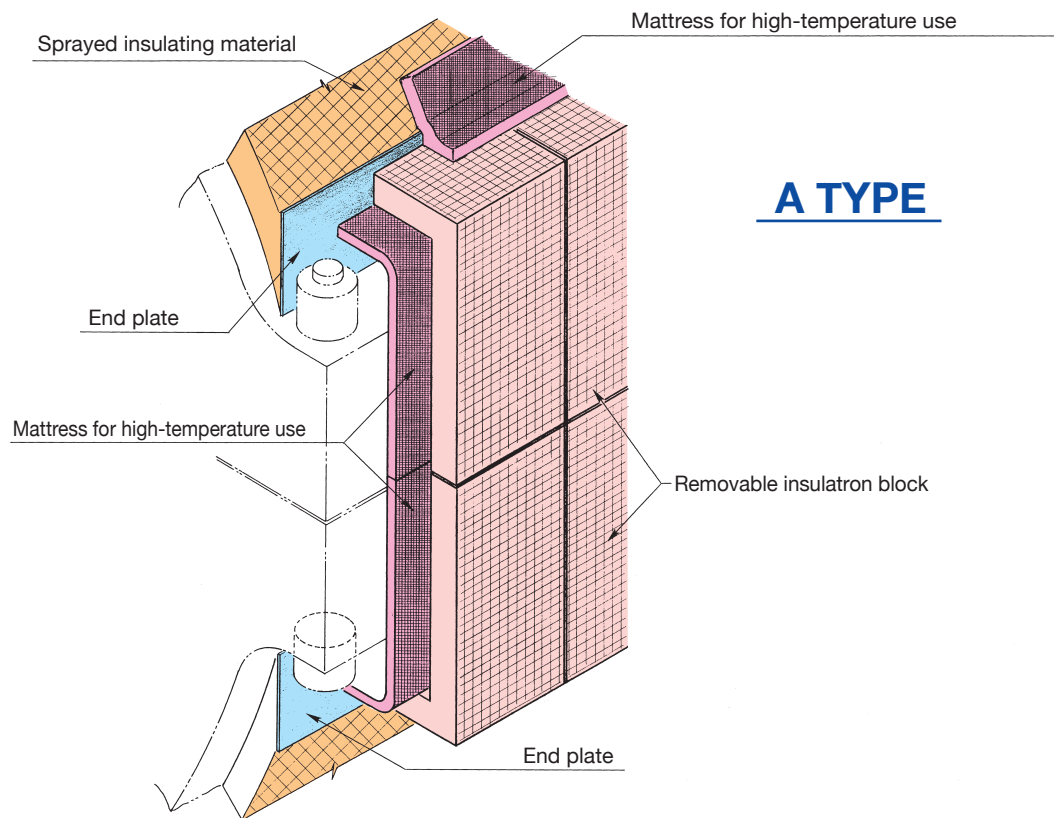
Merits of This Method

1. To shorten the period of time required for insulation work
2. To prevent dust generation
3. To improve thermal insulating/soundproofing effect since the insulating material is sprayed and bonded onto the entire surfaces to be insulated, without seams or joints
4. The insulating material is secured, with supporting hardware, to the surfaces to be insulated, which prevents the insulating material from falling off and not deformed even under stepped
5. To be able to easy apply the insulating material to the surfaces of any complex configuration and finish it to a smooth and uniform surface
6. To surpass in safety the conventional method applied heretofore, and
7. To curtail costs for thermal insulation work as compared with the conventional method

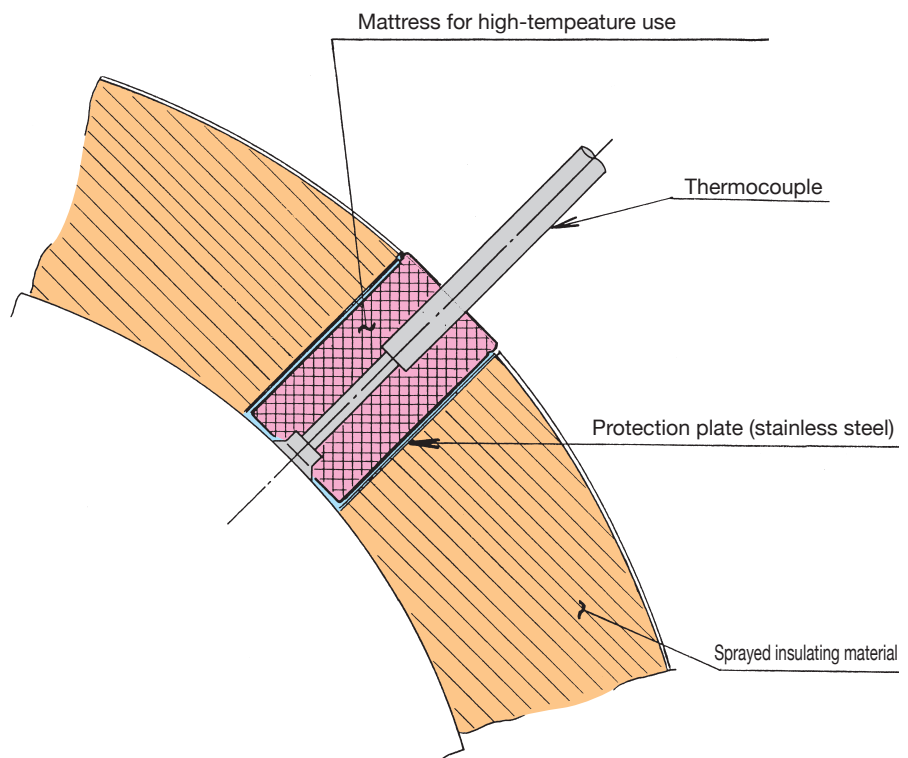
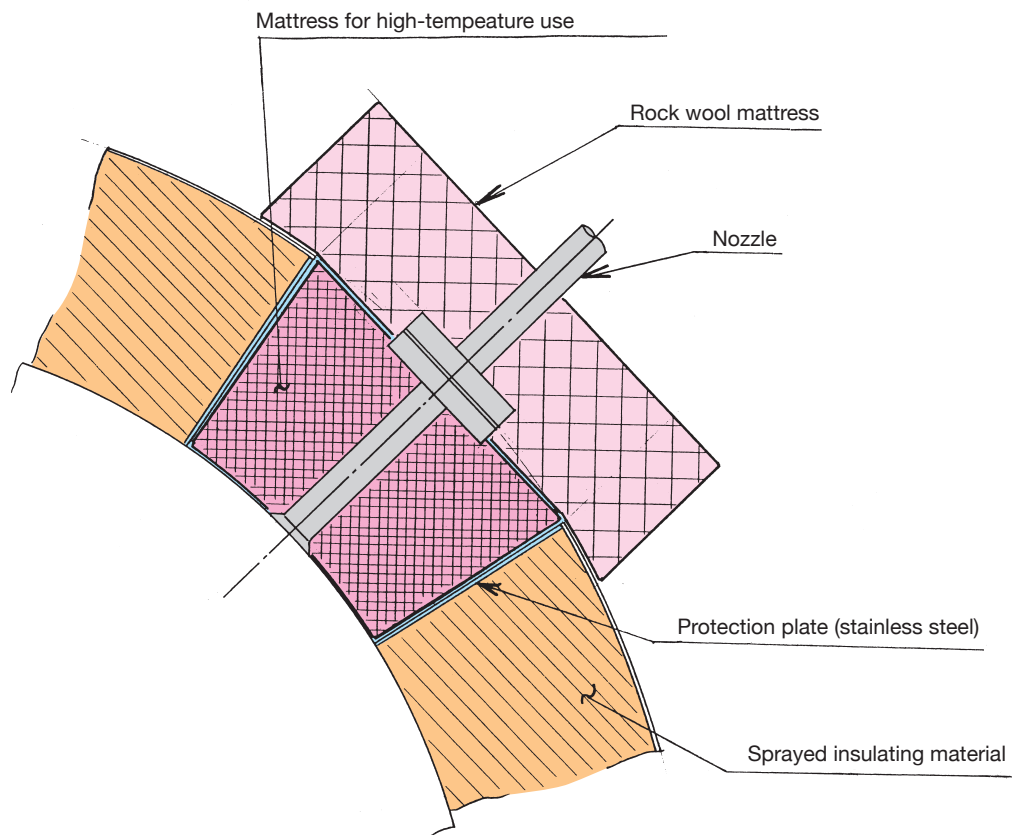
Turbine Casing



Horizontal Flange of Steam Turbine



Details of Parts Penetrated by Nozzles and Thermocouples



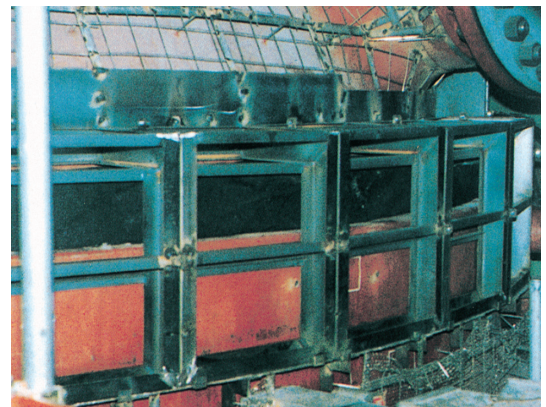
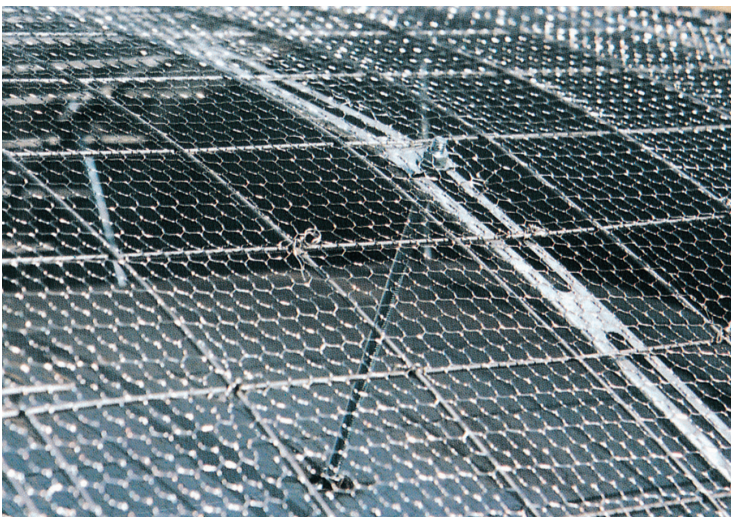
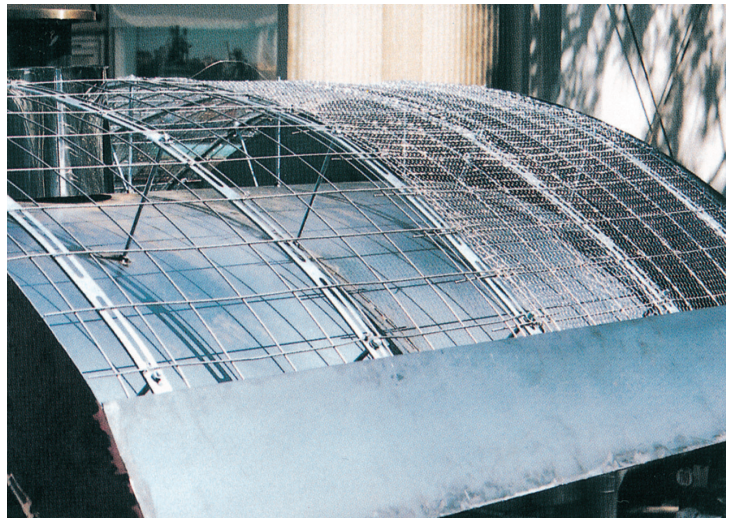
WE ARE MOST CONFIDENT OF BEING ABLE TO COMPLY WITH OUR CUSTOMERS' NEEDS BY APPLYING OUR NEW FIT TYPE THERMAL INSULATING METHOD

Typical Example of Fixing Supports onto Turbine Casing



- To fix the metal fitting with bolts and nuts(M8~M12)
- To make basket-shaped air space to the specified height on the turbing casing
- To fix the stopper mesh(hexagonal wire mesh) to prevent the sprayed insulating material from falling off

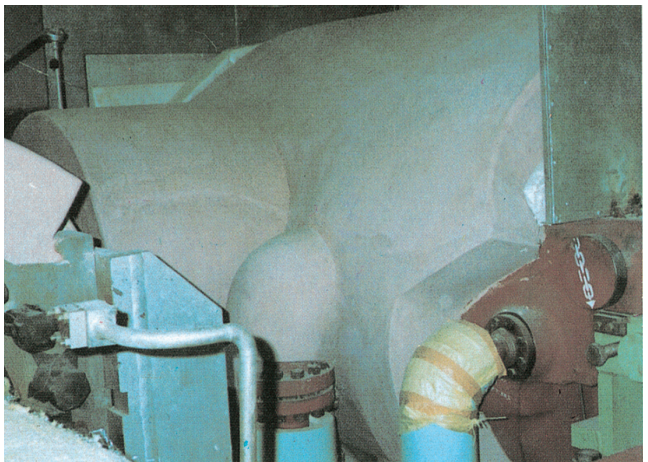
- No field welding work is required at work site
- All the metal fitting the stopper mesh as placed are easily removable in the event of regular maintenance and repair work of the turbine casing



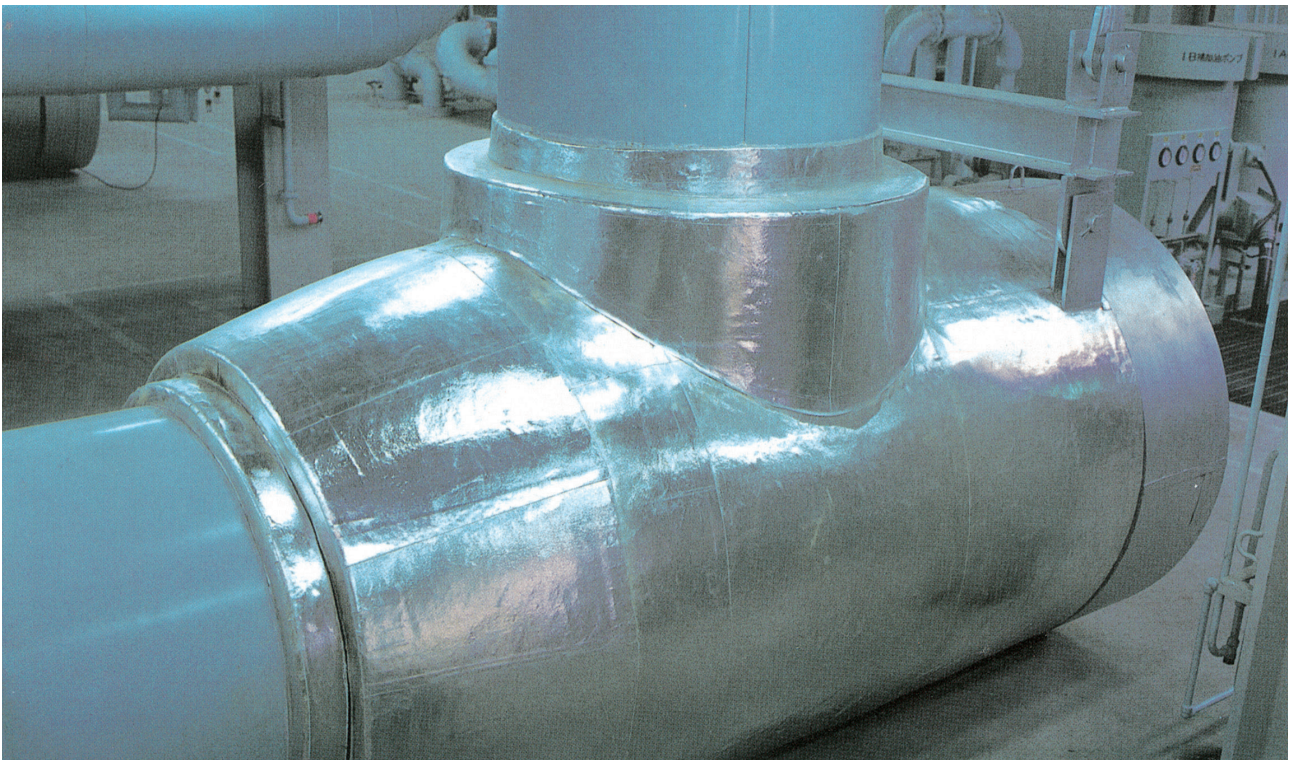
TO SPRAY INSULATING MATERIAL



To spray the insulating material



To apply the finishing cement and finish its surface with a trowel



To apply the glass cloth with aluminum foil

INSULATING MATERIAL



PROPERTIES

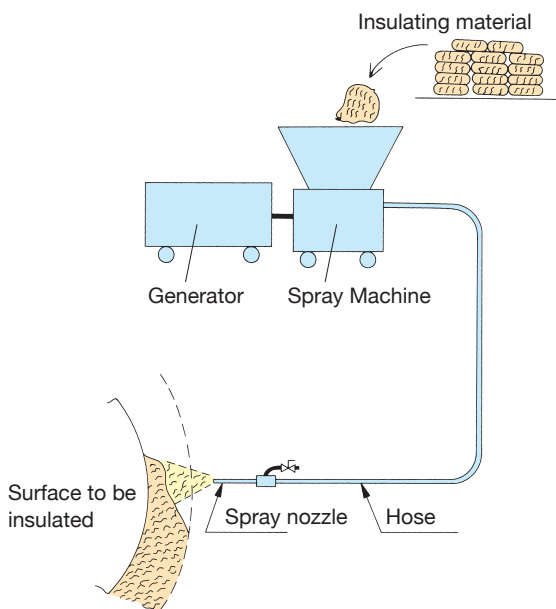
The insulating materials is composed of mineral wool as its main ingredient and mixed with a heat-resisting binder

- Heat resistance: 650°C
- Density as sprayed: about 250 kg/m³
- Thermal conductivity: 200°C 0.072 W/m·K
(Mean temperature) 300°C 0.091 W/m·K
400°C 0.114 W/m·K
500°C 0.142 W/m·K

FEATURES

The insulating material:

- Has a lower rate of shrinkage by heat because using inorganic binder
- as a sprayed in high density (250kg/m³), has excellent adhesion
- high quality and has an excellent thermal insulation and soundproof effect
- inorganic and nonflammable
- consist of asbestos free mineral fiber
- sprayed in uniform layers with no seam or joint,
- as sprayed, has high elasticity and an excelent resistance against vibration and sound



Spray Machine

RESULTS OF THERMAL CONDUCTIVITY MEASURING TEST ON SPRAYED INSULATING MATERIAL

1. TEST METHOD

- (1) Test method : In compliance with JIS A 1412 “Test Method for Thermal Conductivity” (Direct method)
- (2) Testing Device (GHP method) : manufactured by Eikoh Seiki Co.,Ltd.

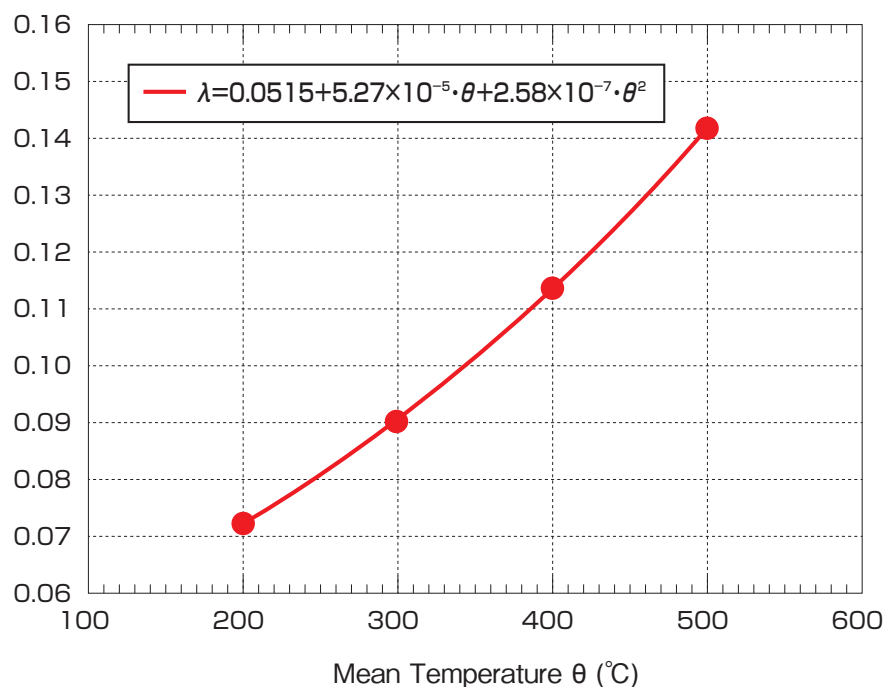
2. TEST SPECIMEN

- (1) Test sample : Sparayed dry-type insulating material
- (2) Size of sample : 50mm(thickness)×300mm(diameter)
- (3) Density of sample : 250kg/m³
- (4) Mean temperature for testing : 200℃、300℃、400℃ and 500℃

3. MEASUREMENTS OF THERMAL CONDUCTIVITY(λ)

Mean Temperature(℃)	Thermal Conductivity W/m·K	(Kcal/m·h·℃)
200	0.072	(0.0623)
300	0.091	(0.0778)
400	0.114	(0.0980)
500	0.142	(0.1225)

Thermal Conductivity
 λ [W/m·K]



Sprayed Insulating Material (dry-type) θ - λ Diagram

Reference Data

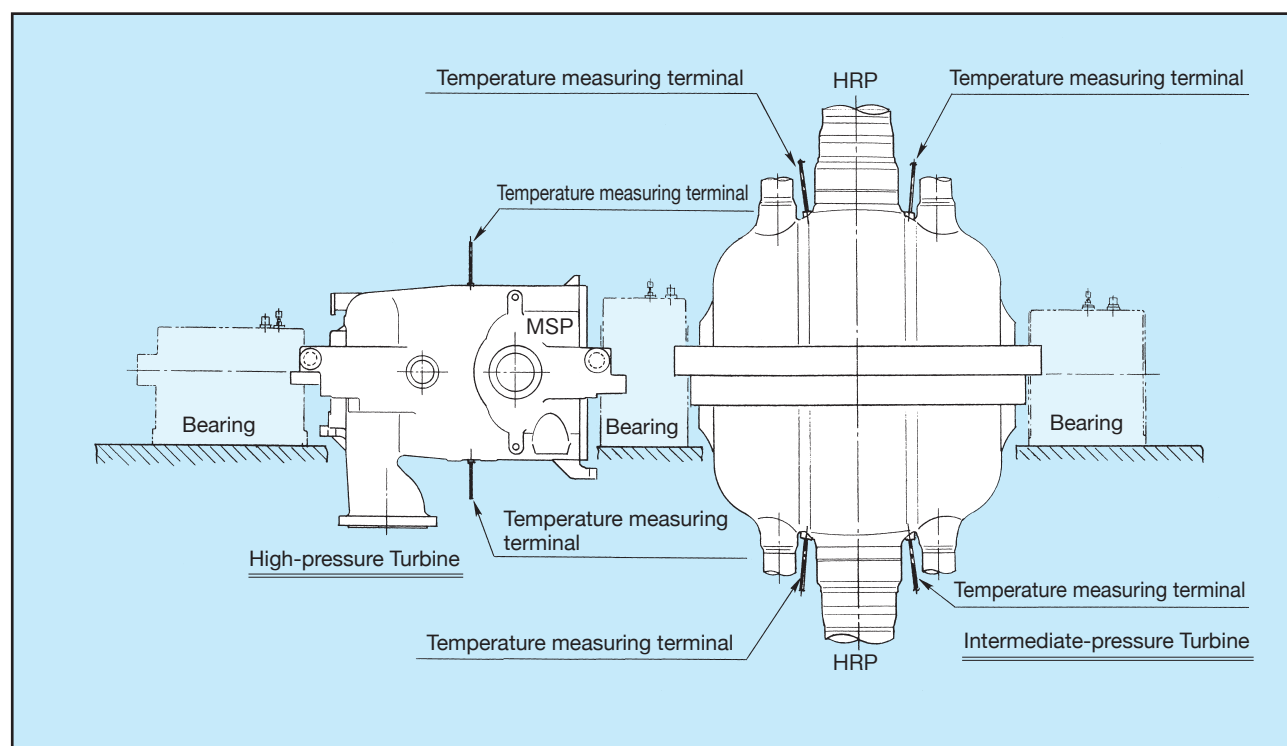
PERFORMANCE OF THERMAL INSULATING MATERIAL (DRY TYPE) SPRAYED ON TURBINE CASING AT 600MW THERMAL POWER PLANT

Records of Surface Temperature Differences between Upper and Lower Halves of High/intermediate-pressure Turbine Casing

Measuring Parts/Thickness of Insulating Material			Output	0 MW	210MW	450MW	540MW	600MW
High-Pressure Turbine Casing	Surface Temperature on Upper Half °C	Thickness of Insulating Material: 225mm		242	498	505	505	505
	Surface Temperature on Lower Half °C	Thickness of Insulating Material: 275mm	※	263	486	492	494	493
	Temperature Difference °C			−21	12	13	11	12
Intermediate-pressure Turbine Casing	Surface Temperature on Upper Half °C	Thickness of Insulating Material: 100mm		129	281	285	284	283
	Surface Temperature on Lower Half °C	Thickness of Insulating Material: 125mm		129	279	282	283	283
	Temperature Difference °C			0	1	3	1	0

*When the high-pressure turbine is started up, the casing drain flows into the exhaust pipe, and the surface temperature on the lower half of the turbine casing is higher than that on the upper half.

Temperature Measuring Points



Comparison in Features between Coventional Method and FIT Type Method

Conventional Method	FIT-Type Method
<p>1. Physical Properties (calcium silicate as per JIS-A9510 No.2-17)</p> <ol style="list-style-type: none"> 1) Porous/nonflammable inorganic thermal insulation material 2) Thermal resistance : max.650°C 3) Thermal conductivity : $\lambda(\text{W/m/K})=0.0570-9.36 \times 10^{-6}\theta+3.74 \times 10^{-7} \cdot \theta^2$ 4) Density: about 170kg/m³ 5) Asbestos free material <p>2. Thermal Insulating Effect</p> <ol style="list-style-type: none"> 1) The board-like shape of the insulating material increases heat loss at seams of joints 2) Air spaces as likely made between the insulating material layers is prone to cause a heat convection phenomenon 3) The board-like insulating material placed is prone to fall off 4) It is not easy to maintain seams/joints in the insulating material and its thickness as specified which is prone to increase heat loss 5) The insulating material is placed manually, and the workmanship or the quality of work varies widely 6) The insulating material has no elasticity <p>3. Workability (at work site)</p> <ol style="list-style-type: none"> 1) Skilled workers are required 2) A number of materials are used which increases the manpower requirements for quality control 3) A lot of dust is generated, which extremely worsens work environment 4) The manually performed work physically fatigues the workers involved 5) Dismantling work is almost manually, so during working it should have management strategy of safety/hygienic, and also need to dispose of debris surplus materials <p>4. Period of Time Required for Insulation work 100%</p> <p>5. Costs</p> <ol style="list-style-type: none"> 1) Material cost : 100% 2) Manpower cost : 100% 	<p>1. Physical Properties</p> <ol style="list-style-type: none"> 1) As man made mineral fibers insulating material, nonflammable and has lower rate of shrinkage by heat. 2) Thermal resistance : max.650°C 3) Thermal conductivity : $\lambda(\text{W/m/K})=0.0515+5.27 \times 10^{-5} \cdot \theta+2.58 \times 10^{-7} \cdot \theta^2$ (almost the same as that of the conventional insulating material) 4) Density: about 250kg/m³ 5) Asbestos free material <p>2. Thermal Insulating Effect</p> <ol style="list-style-type: none"> 1) The Insulating material covers the entire surfaces to be insulated with no seam or joint, which reduces heat loss 2) The insulating material is densely filled up on and tightly bonded to the surfaces to be insulated which prevents the heat convection 3) The hardware to support the insulating material is basket configuration around the surfaces to be insulated, which also prevents the insulating material from falling off 4) The insulating material can easily be placed uniformly on the surfaces of complex and narrow cofiguration to be insulated 5) The workmanship or the quality of work is maintained uniform 6) The sprayed insulating material has high elasticity and an excellent resistance against vibration and sound. <p>3. Workability (at work site)</p> <ol style="list-style-type: none"> 1) Few skilled workers are required 2) Only a few materials are used, which makes it easy to maintain appropriate quality control on materials to be used 3) The dust prevention system in use materials clean work environment 4) All the work is mechanically performed, which alleviates the workers' fatigue 5) Which dismantling the spray system, the vacuum system in use disposes of most of dust, which makes it easy to dispose of debris surplus materials <p>4. Period of Time Required for Insulation work *65% to 70%</p> <p>5. Costs</p> <ol style="list-style-type: none"> 1) Material cost : *80% to 90% 2) Manpower cost : *70% to 80% *The number shall be reference, and changed by the application volume of insulation

FUJI I-TEC COMPANY.,LTD.

Construction Enterprise Permit by the Construction Minister:

Permit No.:8809 for General Construction

Line of Business:

Engineering, design and execution of thermal insulation/soundproofing work

Planning, engineering, design and execution of various painting work

Engineering, design and execution of piping work, sheet metal work, rigging work, earthwork, and installation of machinery

Sale of various thermal insulating and painting materials

Manufacture, fabrication and sale of corrugated steel sheets, and

Engineering, design and execution of thermal insulation work by the FIT Type Spray Method

Domestic Office Network

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Business Office		in Chiba, Yokohama, Nagoya, Kobe, Fukuyama and Kashima.



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