

1	17.09.2009	E. Morelli	E. Morelli	R.Pisano	Revised cladding structural calculation – Attachment A05	RFC
0	11.07.2008	E. Morelli	E. Morelli	F. Volpe		FUS
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Project (Проект)

## Maritza East I Power Station

Company (Възложителя):



**ALSTOM Power Italia S.p.A.**

SIGNED BY: DATE: 17/09/09

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**ALSTOM**  
Power Italia SpA

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## 1. GENERAL

### 1.1. Scope

This document defines the conditions of design, materials characteristics, and guarantees concerning thermal insulation of the absorbers.

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## 2. PLANT DATA

### 2.1. Plant description

In a WFGD system flue gas is scrubbed in the absorbers and cleaned from acid gases (SO<sub>2</sub>) by means of an intimate contact with limestone slurry and recirculated reaction products.

### 2.2. Site Conditions

Location	<i>Plant site</i>			
Installation:	<input checked="" type="checkbox"/>	Outdoor	<input type="checkbox"/>	Indoor
Environment:	<input type="checkbox"/>	Clean	<input checked="" type="checkbox"/>	Industrial
	<input type="checkbox"/>	Marine	<input type="checkbox"/>	Corrosive
	<input type="checkbox"/>	.....	<input type="checkbox"/>	.....
Elevation (m a.s.l.)	106,5			
Atmospheric pressure (bar)	1,0035			
Ambient temperature (°C)				
- Min	-23			
- Max	+40			
- Design	+35			
Ambient humidity (%)				
- Max	100			
- Design	73			
Wind load (km/h)	89,6			
Seismic zone	MSK 9			

Different terminology or definitions may be used in some specification attachments.

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### 3. DESIGN REQUIREMENTS

#### 3.1. Design Codes & Standards

- DIN 4140 Insulation work on industrial installations and building equipment - Execution of thermal and cold insulation
- DIN 4102 Fire behavior of building materials and building components
- AGI specification Q 135 Thermal insulation - Water soluble chlorides in mineral wool insulants- Determination, limit values, marking
- ISO 1182 Reaction to fire tests for building products - Non-combustibility test
- VDI 2055 Thermal Insulation for Heated and Refrigerated Industrial and Domestic Installations
- EN 13162 Thermal insulation products for buildings. Factory made mineral wool (MW) products. Specification
- EN 12667 Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance
- EN 12939
- EN 1602
- EN 1609
- EN 823 Thermal Insulating Products for Building Applications - Determination of Thickness
- EN 13820 Isolanti termici per edilizia - Determinazione del contenuto di sostanza organica

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## 4. DESIGN CALCULATION

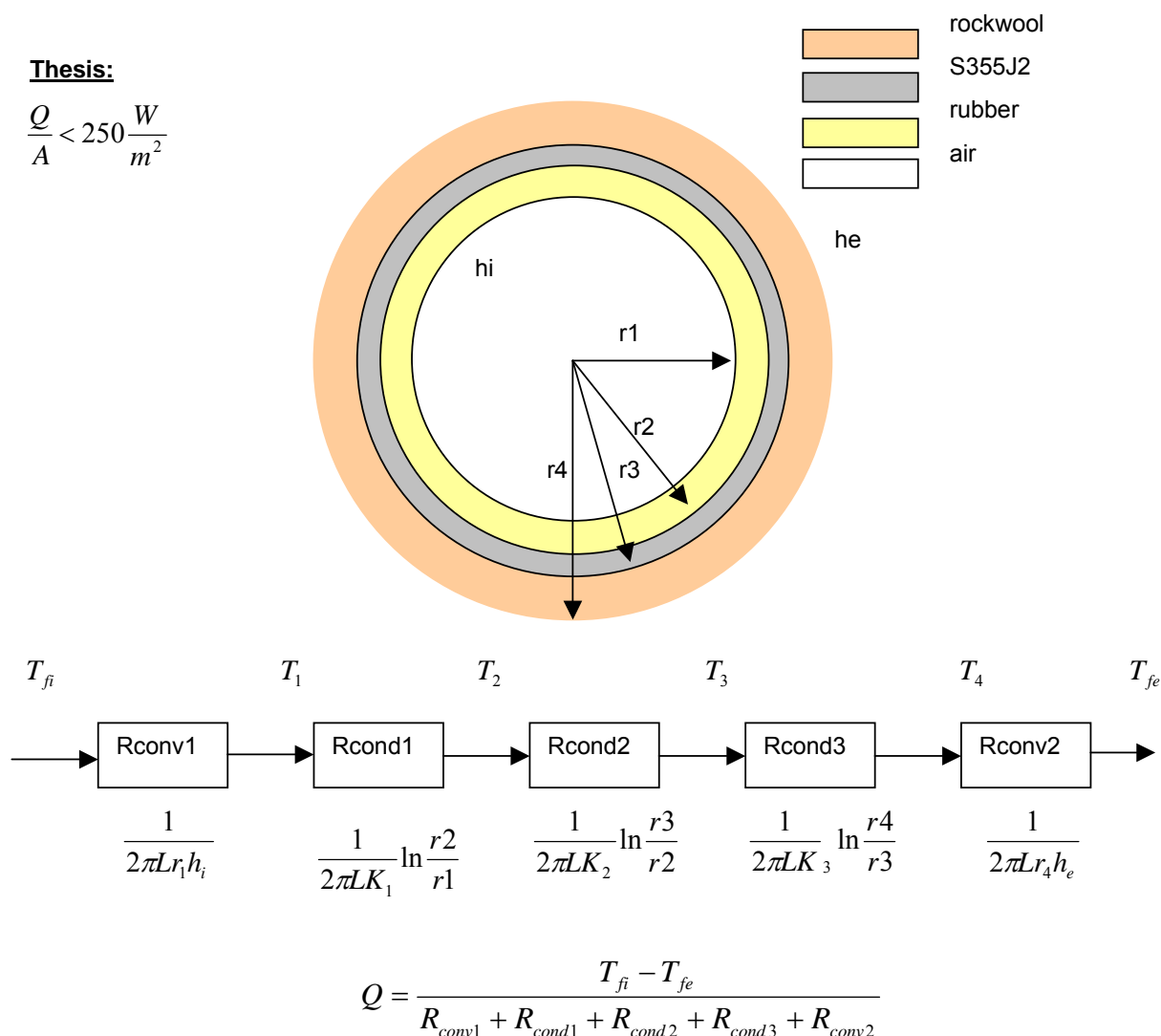
### 4.1. Thermal proof

The absorbers insulation calculation takes in account convection heat transfer. Convection is a combination of conduction and the transfer of thermal energy by fluid circulation or movement of the hot particles in bulk to cooler areas in a material medium. The influence of heat radiation of reflecting components as well as construction related thermal bridges are excluded.

The thermal insulating layer thickness is determined in such a way that the unit heat losses of surfaces which are not singular points remain generally below  $250 \text{ W/m}^2$ , refer to attached document A01 (see chapter 8 Attachments).

#### Thesis:

$$\frac{Q}{A} < 250 \frac{\text{W}}{\text{m}^2}$$



The global coefficient transmission is expressed:

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$$U = \left( \frac{1}{2\pi r_1 h_i} + \frac{1}{2\pi} \sum_{i=1}^n \frac{1}{k_i} \ln \frac{r_{i+1}}{r_i} + \frac{1}{2\pi r_{n+1} h_e} \right)^{-1}$$

Thermal flow:

$$Q = UL(T_{fi} - T_{fe})$$

Data	
r <sub>1</sub>	Internal radius absorber – rubber thickness
r <sub>2</sub>	Internal radius absorber
r <sub>3</sub>	Internal radius absorber + S355J2 thickness
r <sub>4</sub>	r <sub>3</sub> + rock wool thickness
h <sub>i</sub>	Internal convection coefficient
h <sub>e</sub>	External convection coefficient
L	Length
K <sub>1</sub>	Rubber conductivity coefficient
K <sub>2</sub>	S355 J2 conductivity coefficient
K <sub>3</sub>	Rock wool conductivity coefficient
Q	Transfer heat flow
T <sub>fi</sub>	Internal temperature
T <sub>fe</sub>	External temperature

For the calculation see attached document A08 (see chapter 8 Attachments).

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## 5. BUILDING AND INSULATING MATERIAL

### 5.1. Insulation materials

Mineral wool KNAUF INSULATION KR PVS-80, density 80kg/m<sup>3</sup>, see attached specification A03 (see chapter 8 Attachments)

- non-combustible A1 acc. to DIN 4102
- thermal conductivity according to AGI Q 132
- upper limiting temperature: 700 °C (750 °C)
- resistant to wood pests, rodents and insects
- AS-quality according to AGI Q 135 (chloride ion concentration < 6 mg/kg insulating material)
- hydrophobic according to AGI Q 136
- test certificate according to VDI 2055 item 4.3 *Quality assurance*

### 5.2. Spacer ring constructions and supporting structures

For spacing and supporting aluminium cladding structures shall be used S235J2 material.

Minimum dimensions for all components: 30x3 mm.

Copies of cladding support structural calculation is attached in document A05 (see chapter 8 Attachments).

### 5.3. Pins

The absorbers are provided with insulation pins (welded on the absorbers) 4mm Ø, 90 mm length.

After installation of the insulation material a self-contained clip will be pushed over the pins.

### 5.4. Insulation jacketing

Outdoor lagging shall be installed to secure a weatherproof installation. Lagging shall be carefully fabricated and fitted to ensure a neat appearance. Open ends of all fluted sections shall be provided with tight-fitting closure pieces.

All areas of contact between dissimilar metals shall be protected against galvanic corrosion by a suitable insulating coating or adhesive tapes.

Removable insulated covers shall be provided over all equipment manhole, nameplates, and code stampings. Access doors through lagging shall be provided as required.

See attached specifications A06 and A04 (see chapter 8 Attachments)

### 5.5. Joints and fastenings

All lagging shall be secured in place using pin-head self-tapping screws, fitted with neoprene washer.

Screw shall be 1.4301/1.4541, stainless steel. Spacing of screws for joints in ribbed aluminium lagging shall be not more than 300 mm.

All joints shall be weatherproof.

See attached document A07 (see chapter 8 Attachments)

### 5.6. Thermal separation

For thermal separation 5 mm thick asbestos-free insulation material intermediate layer or equivalent will be used. This will be fixed between spacer ring and L or C-section respectively (product data sheets attached).

In addition an elastic PE sealing tape 50 x 3 mm will be applied between substructure and sheet metal.

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See attached document A07 (see chapter 8 Attachments)

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## 6. CONSTRUCTIVE STRUCTURE OF INSULATION

### 6.1. Absorbers

The thermal insulation works shall be started after absorbers have passed the final conformity inspection and the hydraulic tests. Before the insulating material is put in place, the surfaces shall be dried, cleaned and primerized. The surfaces have to be brushed down to surface preparation degree St3 as per SIS 055 900-1967 standard, and the primed surfaces have to be cleaned.

### 6.2. General

The insulating materials should be always perfectly butted. The insulating material is fixed on pins.

The protruding parts of clips and band shall be folded not to damage the sheet.

On bends and shaped peaces the mats should be cut to profile in order to ensure a tight sealing of the joints. In case of horizontal position of the object the longitudinal joints should be arranged in the bottom area.

Stiffeners/reinforcement profiles should be covered by the full nominal thickness of insulation.

Refer also to the documents A02 (see chapter 8 Attachments)

### 6.3. Installation

The mattresses shall be impaled on pins welded on absorbers.

After installation of insulation material the pins shall be pushed with clips and cut or bended in such a way that their ends be 10 mm at least away from the sheet so as to prevent thermal bridges.

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## 7. INSTALLATION OF SHEATHING

### 7.1. Types of sheathing

The thermal insulation sheathing consist of Aluminium see attached document A04 (see chapter 8 Attachments)

### 7.2. General

1

Trapezoidal sheet metal 0.80 or 1,00 mm thick, arrangement in positive position (wide swage to the outside), substructure of the cylindrical area from band iron ring 30 x 3 mm with spacers 30 x 3 mm, intermediate layer 3 mm insulation material, substructure rigid, insulation thickness 50 mm single-layer, on angular faces and in roof areas.

The spacers of the substructure will be welded to the absorbers wall.

Insulation thickness 50 mm, single-layer.

Flat sheet 1,00 mm thick, arrangement by standing seam. Standing seam fixed by screws.

The sheet should be cut to the overall dimensions of the insulation increased by the overlaps.

The overlaps should be so arranged as to prevent water penetration, and opposite to the direction of the prevailing winds.

The sheets should be rolled to the outside diameter of the insulation, and then moulded at each edge.

The sheet should be fixed by screws as per document A07 (see chapter 8 Attachments).

Outdoor tightness should be ensured by butyl or mastic type joint at the sheet overlaps.

Refer also to the documents A02 (see chapter 8 Attachments)

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## 8. ATTACHMENTS

Following attachments are to be considered as integral part of this Specification.

N°	FILE NAME	REV	TITLE/DESCRIPTION
A01	MTZ_00_M_PR-----_GS_110	01	General Specification for thermal Insulation (**)
A02	MTZ_00_M-----_EG_O18	00	Erection Standard for thermal Insulation
A03			Rock-wool Specification
A04			Aluminium Specification
A05			Insulation Absorber 1&2 Cladding Support
A06			Aluminium Cladding detail
A07			Insulation details (n. 8 sheets)
A08			Absorber calculation insulation
A09			
A10			

1

\*\* This document has been issued officially and therefore is not attached to this document. Please refer to last official document.

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