J+C REFRACTORIES

Tube Wall Protection System

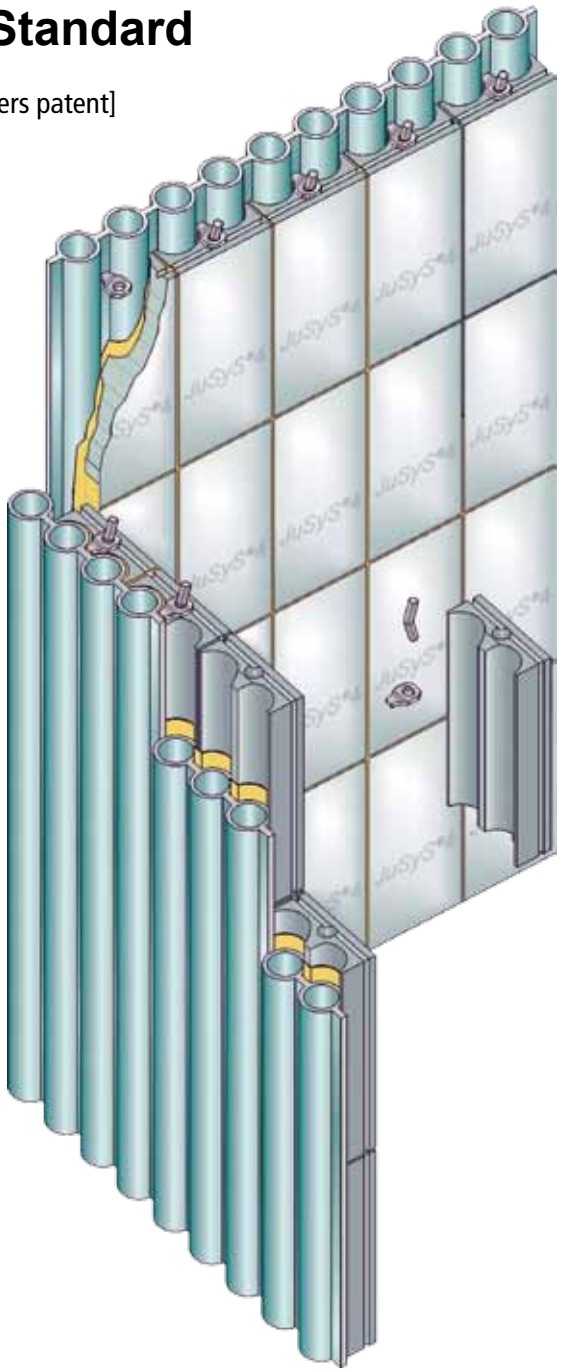
JuSyS® Standard

Refractory Linings for Waste Combined Heat & Power Plants and Bio Mass Boilers

with adhesive Tile system

***JuSyS*® Standard**

[protected by letters patent]



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Tube Wall Protection System

JuSyS® Standard

Technology & Function

The adhesive ***JuSyS*® Standard** Tube Wall Protection System has been continuously successful in over 75 boilers for more than 20 years.

***JuSyS*® Standard** consists of tiles made of nitride-bonded SiC which are fixed to the tube wall by heat resistand metallic anchors. The tube wall tiles are so constructed that each tile is on one retaining bracket. There is SiC mortar between tube wall and ***JuSyS*® Standard** tile.

***JuSyS*® Standard** provides decisive advantages:

>> The system, consisting of
- uninterrupted volume, simple tile geometry, no groove or recess
- stressless fastening on the top of the tile

>> Solid tile fixing:
- each tile is fixed by two retainers
- each tile is on one bracket
- movement/forces of one tile are not transferred to other tiles

>> Forces due to the tube wall movement are transferred via the soft mortar in a „damped" way onto the tile system

>> High oxydation resistance through the use of high-purity SiC base material

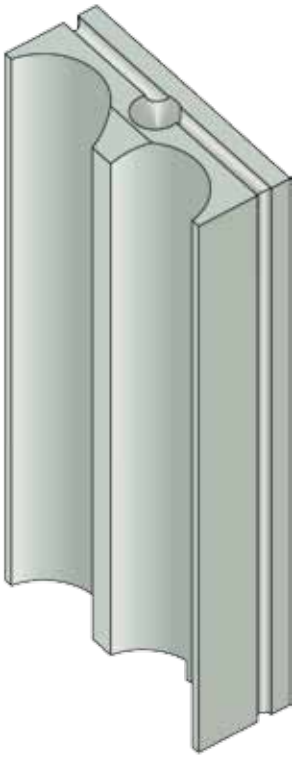
>> The SiC tile is a pre-manufactured mechanically pressed shaped part having a considerably more homogeneous structure than the hand-applied SiC mix and therefore very good heat flow coefficients.

>> The higher surface density in connection with the lowe porosity values reduces the slag deposits to a great extent.

Tube Wall Protection System

JuSyS® Standard

Detail Tube Wall Tile



Tube Wall tile
e.g. KRW 75/57-01

Detail retainer

Retaining stud
e.g. SHRW-02

Welding part
e.g. SHRW-01

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Installation examples

KVA Bern, Switzerland

Installation of ***JuSyS*® Standard** tube wall tiles and holding by means of retaining studs.

Sealing of expansion joints with ceramic fiber strips when the tiles are installed.

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JuSyS® Standard

Application examples

ZMS Schwandorf, Germany

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Application examples

ASN Nürnberg, Germany

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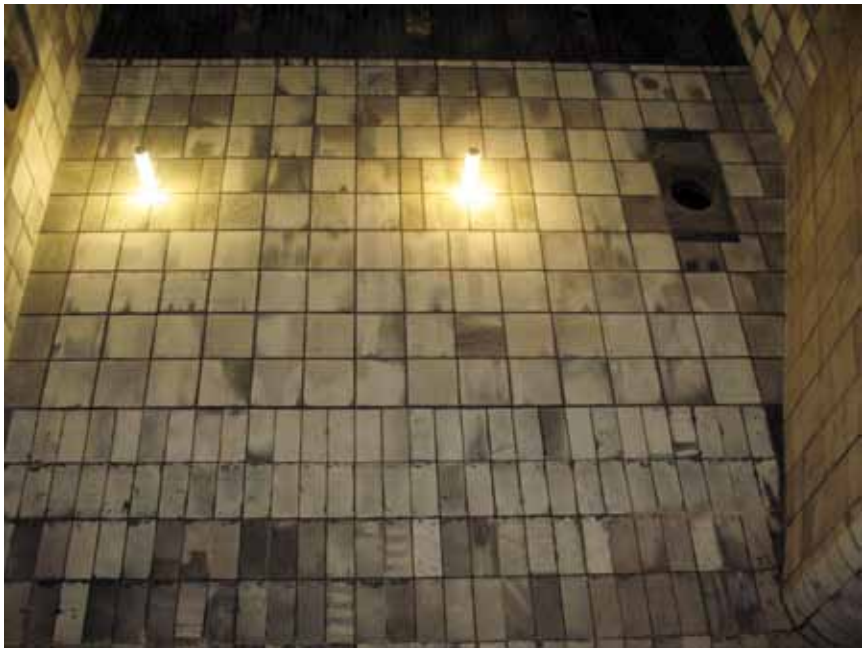
Application examples

ZMS Schwandorf, Deutschland



Tube Wall Protection System ***JuSyS®*** **Standard**

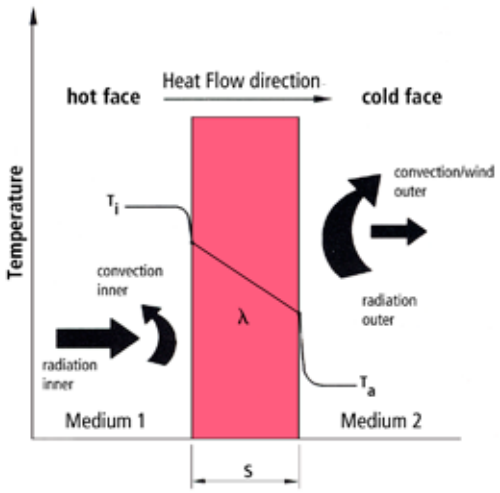
Heat Transfer Calculation

Heat transfer

The following Heat Transfer Calculations for the adhesive Tube Wall Protection System JuSyS Standard apply to the new condition of the refractory lining without contamination of the surface as well as to the operating condition of the refractory lining with a surface contamination.

The calculations are based on the following parameters:

Combustion Chamber Temperature [T_i]:	1.000 °C
Tube Medium Temperature [T_a]:	257 °C (depending on the boiler pressure stage)
Heat Transfer Coeffizient [α_i]:	100 W/m²K
Heat Transfer Coeffizient [α_a]:	10.000 W/m²K
Surface Contamination:	5 mm Coating/Slag



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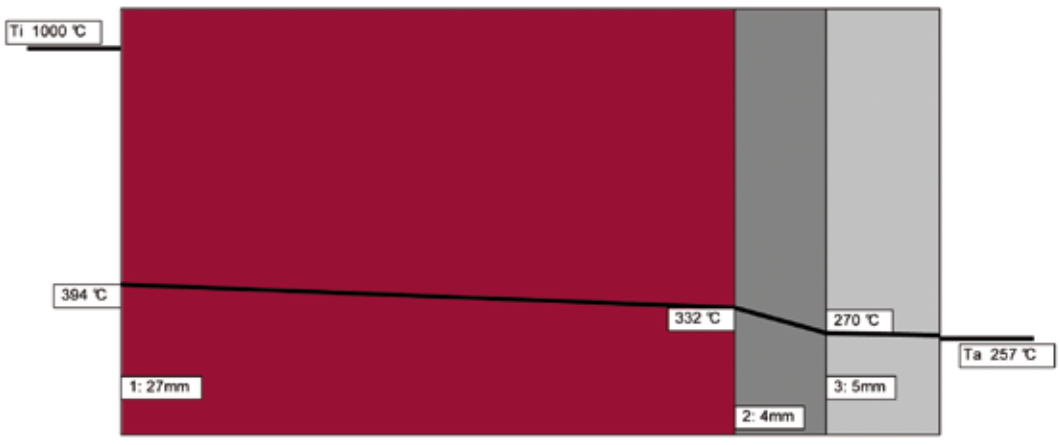
Tube Wall Protection System *JuSyS*® Standard
Heat Transfer Calculation

Client	**: Tube Wall Tile JuSyS Standard**
Project	**: adhesive with SiC mortar**
Component / Part	**: Tile system without surface contamination**
Calculation Model	**: Plane vertical Wall**

Ambient Conditions	**Inner**	**Outer**	**Unit**
Ambient Temperature	1000	257	℃ (Input)
Wall Temperature	394	263	℃ (Calculated)
Heat Transfer Coefficient	100	10000	W/(m²K)
Calculation Model	manual	manual	--
Air Speed			m/s
Radiation Coefficient			--
Sun Radiation			W/m²
Diameter			mm
Heat Flow Density through Wall	60603	60603	W/m²

Wall Construction		**Cond. Factor**	**Thickn.**	**Cond.**	**Temperature of Layers**	
Material			**mm**	**W/(mK)**	**Face ℃**	**Mean ℃**
1: +SI107C	SiC brick		27	26,300	394,0	362,9
2: +MK100P	refractory mastic		4	3,951	331,8	301,1
3: +ST0425	steel		5	41,332	270,4	266,7
			36		263,1	

Temperature Diagram



Inserted thermal conductivity data represent average values without tolerances of dimensions and fabrication technique. Calculated data can, therefore, not be used as guarantee data. Heat bridges such as metallic anchors, joints or similar devices or deposits at the brickwork (fouling factor) and/or influence through surrounding walls resp. areas have not been taken into consideration in this calculation.

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Tube Wall Protection System *JuSyS*® Standard
Heat Transfer Calculation

Client	**: Tube Wall Tile JuSyS Standard**
Project	**: adhesive with SiC mortar**
Component / Part	**: Tile system with surface contamination**
Calculation Model	**: Plane vertical Wall**

Ambient Conditions	**Inner**	**Outer**	**Unit**
Ambient Temperature	1000	257	℃ (Input)
Wall Temperature	798	259	℃ (Calculated)
Heat Transfer Coefficient	100	10000	W/(m²K)
Calculation Model	manual	manual	--
Air Speed			m/s
Radiation Coefficient			--
Sun Radiation			W/m²
Diameter			mm
Heat Flow Density through Wall	20248	20248	W/m²

Wall Construction		**Cond. Factor**	**Thickn.**	**Cond.**	**Temperature of Layers**	
Material			**mm**	**W/(mK)**	**Face ℃**	**Mean ℃**
1: +MK597A	contamination		5	0,204	797,5	555,6
2: +SI107C	SiC brick		27	26,300	302,8	292,4
3: +MK100P	refractory mastic		4	3,936	282,0	271,8
4: +ST0425	steel		5	41,494	261,5	260,2
			41		259,0	

Temperature Diagram

Inserted thermal conductivity data represent average values without tolerances of dimensions and fabrication technique. Calculated data can, therefore, not be used as guarantee data. Heat bridges such as metallic anchors, joints or similar devices or deposits at the brickwork (fouling factor) and/or influence through surrounding walls resp. areas have not been taken into consideration in this calculation.

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Tube Wall Protection System *JuSyS*® Standard
Material Data Sheet

Technisches Datenblatt / Data sheet — Rev. Hp / 30.03.2009

JUBRICK SI 107 C — SiC-Stein / SiC brick

Allgemeine Eigenschaften / General properties

ROHSTOFFBASIS **Raw material base**			Siliciumcarbid silicon carbide
BINDUNGSART: **Type of setting**			keramisch-nitridisch ceramic-nitride
ROHDICHTE **Bulk densitiy** DIN EN 993-1			2,70 g/cm³ +/-0,07 g/cm³
CHEMISCHE ANALYSE: **Chemical analysis** RFA	SiC		71,00 - 79,00 %
	$Si_3N_4+Si_2ON_2$		18,00 - 26,00 %
	Fe_2O_3		0,50 %
	Si metall.	≤	0,10 %
MAX. ANWENDUNGSTEMP.: **Max. service temperature**			1150 °C
POROSITÄT (OFFEN): **Porosity (apparent)** DIN EN 993-1		≤	14,0 %

Physikalische Eigenschaften / Physical properties

	IRREV. LÄNGENÄNDERG. Irrev. change of length	REV. THERM. DEHNUNG Rev. therm. expansion	KALTDRUCKFESTIGKEIT Cold crushing strength	WÄRMELEITFÄHIGKEIT Thermal conductivity
		DIN 51045	DIN EN 993-5	EN 993-15
			190,0 - 250,0 MPa	
400 °C		0,18 %		26,300 W/mK
600 °C		0,27 %		
800 °C		0,37 %		19,000 W/mK
1000 °C		0,46 %		17,400 W/mK
1200 °C				16,900 W/mK

Weitere Eigenschaften / Further properties

TEMPERATURWECHSELBEST.: Wasser / Water: > 30 x
Thermal shock resistance
DIN EN 993-11

Die Daten sind Durchschnittswerte aus Laboruntersuchungen. Sie unterliegen den in der Grobkeramik produktionsbedingten Toleranzen und stellen keine Zusicherung von Eigenschaften dar. Maximale Anwendungstemperatur: Angabe gilt bei einseitiger Erwärmung in neutraler Atmosphäre ohne korrosive Einflüsse./ These data are mean values from lab-examinations. They are subject to the tolerances dependent on the production in ordinary ceramics and do not represent a warranty for the material characteristics. Maximum service temperature: Applies for one-sided heating in neutral atmosphere without corrosive agents.

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Tube Wall Protection System *JuSyS*® Standard
Material Data Sheet

Technisches Datenblatt / Data sheet — Rev. Hp / 21.12.2010

JUBOND MK 100 P — Feuerkitt / refractory mastic

Allgemeine Eigenschaften / General properties

ROHSTOFFBASIS **Raw material base**		Siliciumcarbid silicon carbide	**VERARBEITUNG** **Application**		Vermörteln mit Kelle mortar by means of a trowel
BINDUNGSART: **Type of setting**		chemisch-keramisch chemical ceramic	**KÖRNUNG:** **Grain size**		0 - 0,5 mm
ROHDICHTE **Bulk densitiy**	110 °C	2,00 g/cm³	**MATERIALBEDARF:** **Required material**		2,00 t/m³
CHEMISCHE ANALYSE: **Chemical analysis**	SiC	87,00 - 90,00 %	**ANMACHFLÜSSIGKEIT:** **Mixing liquid**		siehe Bemerkungen see remarks
	Al_2O_3	3,00 - 6,00 %			
	SiO_2	5,00 - 8,00 %	**ANLIEFERUNGSZUSTAND:** **Condition at delivery**		2 Komponenten two-components
	Fe_2O_3	≤ 0,50 %			
MAX. ANWENDUNGSTEMP.: **Max. service temperature**		1500 °C	**HALTBARKEIT:** **Shelf life**		24 Monate / months

Physikalische Eigenschaften / Physical properties

	IRREV. LÄNGENÄNDERG. Irrev. change of length	REV. THERM. DEHNUNG Rev. therm. expansion	KALTDRUCKFESTIGKEIT Cold crushing strength	WÄRMELEITFÄHIGKEIT Thermal conductivity
200 °C				3,900 W/mK
400 °C				4,000 W/mK
600 °C				4,000 W/mK

Weitere Eigenschaften / Further properties

BEMERKUNGEN:
Remarks

Anmachflüssigkeit: 1 Kanister MK 490 B (MK 408 A) / 1 Sack Trockenmehl + max. 3,6 l Wasser
Mixing liquid: 1 jug of MK 490 B (MK 408 A) / 1 bag of dry flour + max. 3,6 l water

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References

The adhesive Tube Wall Protection System ***JuSyS*® Standard** has already been successfully installed in a large number of plants since the year 1986. In numerous furnaces throughout Germany and in other European countries we accomplished a surface of more than 30.000 m² of installed tube wall tiles. To best customer satisfaction.

We will gladly give you more details & information upon request.

Just talk to us or write us.

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