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CORROSION PROTECTION

Flue Gas Desulphurization Plants

REMA TIP TOP

Lining Systems for Flue Gas Desulphurization Plants

As a result of increasing environmental protection regulations, Flue Gas Desulphurization Plants have been installed in power plants worldwide since the early 1980's. The predominant technology utilized is based on wet scrubbing which produces widely varying corrosive environments within the absorbers, tanks and flue gas ducts. Such a Flue Gas Desulphurization Plant requires the use of different corrosion protection systems.



REMA TIP TOP provides the most reliable, advanced and long-term proven corrosion protection systems for Flue Gas Desulphurization Plants combined with competent consultation services to plant owners, operators and engineers. In order to provide the best corrosion protection system available, our products have been developed based on extensive performance testing and further by simulating actual service conditions with a wide range of chemicals under different temperature gradients. Our extensive experience installing over 1,000,000 m² CHEMOLINE linings and 500,000 m² COROFLAKE linings in Flue Gas Desulphurization Plants (FGD) sets REMA TIP TOP apart as a leader in the installation of corrosion protection linings for Flue Gas Desulphurization Plants. We have a wealth of experience with all fuels used for power generation like hard coal, lignite, heavy oil and orimulsion, as well as with all common flue gas cleaning processes, like e.g. lime milk suspension and sea water.

Furthermore we apply rubber lining in filter tanks, thickeners and centrifuges in the gypsum slurry or water purification.

In specific areas like the floor of an absorber REMA TIP TOP brick linings are applied. With a high exposure to acids and high temperatures in raw gas ducts and heat exchangers we apply highly resistant fluoropolymer linings based on PTFE-M. REMA TIP TOP successfully executed corrosion protection in more than 100 flue gas desulphurization plants worldwide. Our profound experiences and knowledge of the system characteristics and their response to the service conditions form the basis for the development of the most reliable and cost effective solutions existing on the market. For the long-term trouble-free operation of the plants we provide state of the

art materials and services. REMA TIP TOP linings are highly resistant against permeation, chemicals, abrasion and protect plants permanently.

Our quality assurance program forms an integral part of our application process; in view to the critical nature of the lining work required in Flue Gas Desulphurization installations. Working independently from our application teams, our quality control inspectors strictly follow the QC parameters parallel to the lining installation. The excessive and precise lining inspection is a vital necessity to achieve the best possible end product. Every inspection is recorded according to current specifications. Our linings and coatings are subject to strict regulations. All preparations of steel or concrete surfaces are performed according to the specifications of EN 14879-1. Linings and coatings are applied according to EN 14879-2 to EN 14879-5 depending on the substrate.



RUBBER LININGS

Lining Systems for Flue Gas Desulphurization Plants



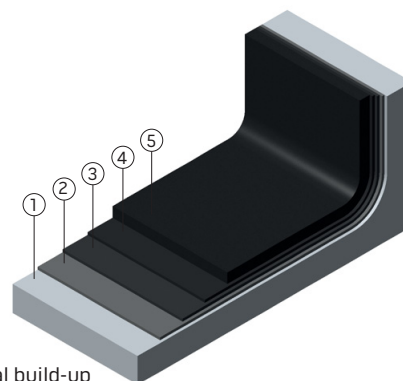
Rubber lined supports in an absorber

RUBBER LINING

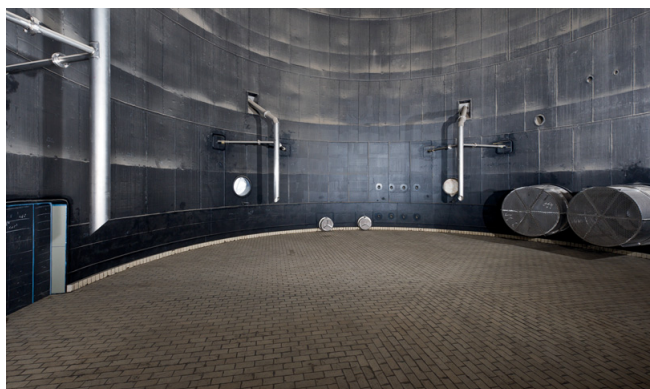
In Flue Gas Desulphurization Plants, **REMA TIP TOP** rubber lining materials are installed in areas where temperatures do not exceed 100 °C. The combination of their excellent chemical resistance and equally good resistance against abrasion, allow them to be used for corrosion protection in absorbers, tanks, clean gas ducts and circulation and distribution pipes as well as in stacks that can be erected directly on the absorber. In addition to chemical and mechanical resistance, the **CHEMOLINE** rubber linings have very low permeation coefficients and water absorption values.

CHEMOLINE 4 A, **CHEMOLINE 4 B** and **CHEMOLINE 4 CN**, all based on Bromo Butyl Rubber, are the primary rubber products offered for lining in Flue Gas Desulphurization Plants but can also be used in various other application fields. **CHEMOLINE 4 B** (self curing) and **CHEMOLINE 4 CN** (cured) have been developed for the on site application processes, whereas **CHEMOLINE 4 A** is the product for conventional lining of vessels and pipes, where the vulcanization process requires high pressures of either hot air or steam. The use of durable and suitable rubber linings at the high process requirements in absorbers, tanks and stacks demand a high level of experience and knowledge of materials. In this field **REMA TIP TOP** and its experts are worldwide leading.

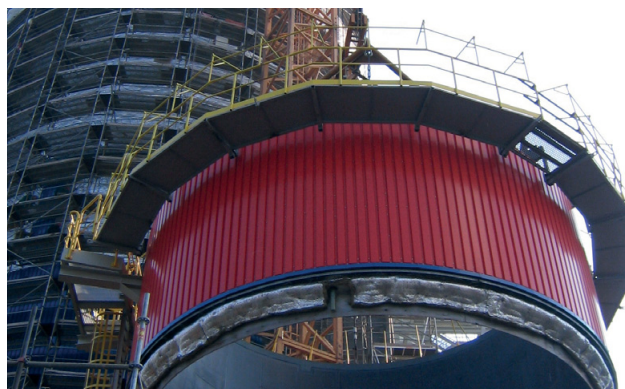
1. Steel, sandblasted
2. PRIMER PR 500-1
3. PRIMER S 500-2
4. ADHESIVE TC 5000
5. **CHEMOLINE 4 B**



CHEMOLINE 4 B – Typical build-up



Floor of an absorber rubber lined with **CHEMOLINE 4 B** and additional brick lining with **CHEMOKITT FU 1310**



Stack Section rubber lined with **CHEMOLINE 4 B**

RUBBER LININGS

Lining Systems for Flue Gas Desulphurization Plants

RUBBER LININGS



Rubber lined pipe parts after vulcanization in the autoclave



Rubber lined small parts of a pipe

COATINGS

REMA TIP TOP has performed more than 500,000 m² of coatings in Flue Gas Desulphurization Plants and is therefore one of the world's leading companies in this field. **COROFLAKE** coatings are mainly applied in raw gas ducts, heat exchangers and stacks with an operating temperature up to 230°C. Furthermore **COROFLAKE** lining systems can be used for absorbers, tanks and clean gas ducts as well as in concrete pits.

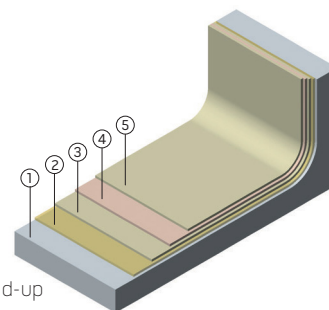


Absorber lined with COROFLAKE 24 and LINING 65 W



Clean Gas Duct lined with COROFLAKE 24

1. Steel, sandblasted
2. COROFLAKE S PRIMER
3. COROFLAKE 23 - 1. layer
4. COROFLAKE 23 - 2. layer
5. COROFLAKE 23 - 3. layer



COROFLAKE 23 – Typical build-up

All **COROFLAKE** lining systems that are applied in Flue Gas Desulphurization Plants are based on high-quality vinyl ester resins. Our coating systems are characterized by their high chemical resistance and an excellent diffusion density. This important diffusion density is reached through the application of various flake fillers. The ideal coordination of the flakes within the resin matrix base was achieved by practical experience and laboratory tests. Depending on the service conditions and the operation site, the most suitable coating system will be used. Due to our extensive experience and the employment of qualified technicians and supervisors we can provide the best corrosion protection possible.

COATINGS AND FLOORINGS

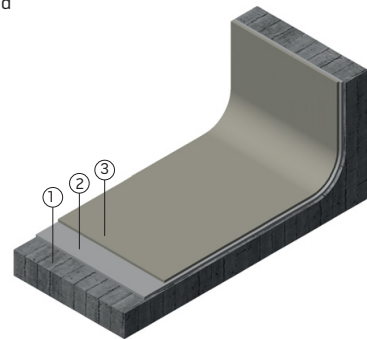
Lining Systems for Flue Gas Desulphurization Plants

REMA TIP TOP provides coatings systems and combined linings for floors, pits, sumps and trenches in Flue Gas Plants.



ESKANOL EF floor coating with skid-proof top coating

1. Concrete, sandblasted
2. ESKANOL EF PRIMER
3. ESKANOL EF



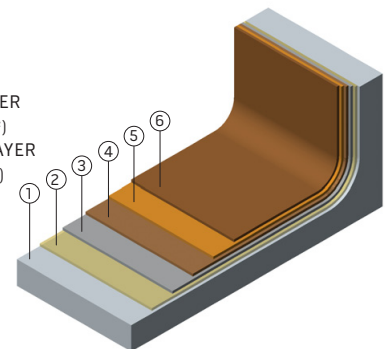
Coating for floors in FGD buildings
ESKANOL EF – Typical build-up

For sumps and trenches under constant strain it is essential to apply coating systems that are permanently resistant to chemical and thermic stresses as well as crack bridging. As concrete structures rarely remain free of cracks, it is important that the corrosion protection can bridge such cracks so that the chemicals do not penetrate the ground. REMA TIP TOP uses laminated coatings like LINING 65 for these areas, since these provide very high crack bridging characteristics. The same applies for secondary containment in areas where large amounts of chemicals are stored, which are not allowed to enter the ground in case of a tank break down.



Coated secondary containment

1. Steel, sandblasted
2. COROFLAKE N PRIMER
3. LINING 65 - BASECOAT
4. LINING 65 - 1. LAMINATE LAYER
(1 x ECR- Fiberglass mat 450 g/m²)
5. LINING 65 - 2. LAMINATED LAYER
(1 x ECR-Fiberglass mat 450 g/m²)
(1 x C-Glass surface veil)
6. LINING 65 - SEALING



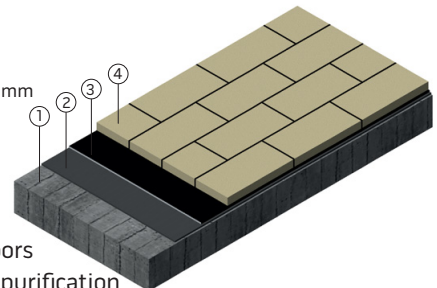
Coatings for sumps and trenches
LINING 65 – Typical build-up

Within the water purification or in pump stations, where chemicals or fluids often occur, and where mechanical stresses appear when replacing the pumps and the pipes, usually ceramic linings (combined linings) are performed. For these areas the combined linings consisting of CHEMOLINE 4 CN as membrane and ceramic tiles bedded in CHEMOKITT FU 1310 are ideal and they are nearly maintenance free for several years.



Combined lining consisting of membrane and ceramic tiles

1. Concrete, sandblasted
2. CHEMOLINE 4 CN
3. CHEMOKITT FU 1310
4. Acid proof ceramic tiles 25 mm



Combined Lining for Floors
in the water or gypsum purification
Typical structure of CHEMOLINE 4 CN
+ ceramic tiles in CHEMOKITT FU 1310

FLUOROPOLYMER LININGS AND PLASTIC CONSTRUCTION

Lining Systems for Flue Gas Desulphurization Plants

FLUOROPOLYMER LININGS

In application areas that are especially critical like heat exchangers or raw gas ducts, where sulphuric acid constantly accrues in high concentrations combined with simultaneously high temperature, **REMA TIP TOP** applies PTFE-M (Polytetrafluorethylen) linings, which are characterized wby high resistance to high temperature and acids. The PTFE-M lining gets fixed mechanically to the surface with an exactly calculated number of mounting bolts. **REMAFLON** with PTFE (Polytetrafluorethylen) material with rubber substrate and CN bonding layer is ideal for areas where nonstick characteristics are required, for example to avoid gypsum caking.



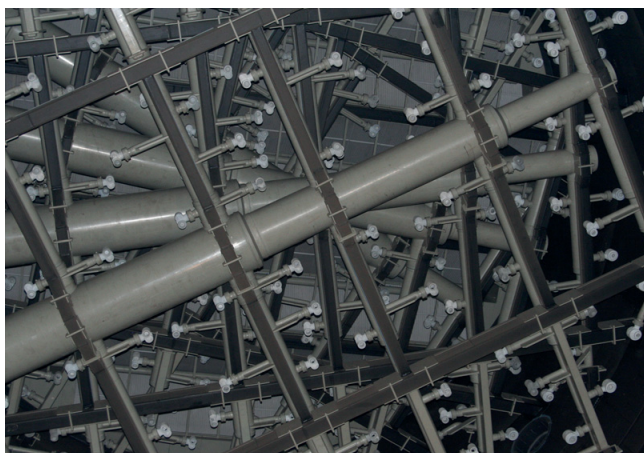
PTFE-M lining in a raw gas duct



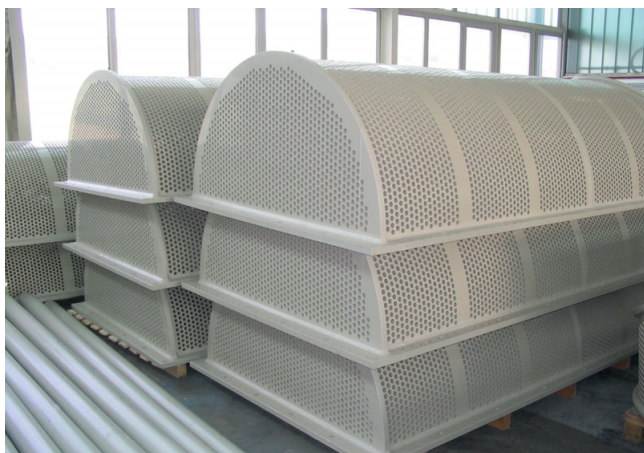
REMAFLON (PTFE) as nonstick lining in a flue gas fan

PLASTIC CONSTRUCTION

REMA TIP TOP also provides the production and installation of spray levels, pipes and pump strainers for Flue Gas Desulphurization Plants (FGD). In this area mainly Polypropylen (PP) is applied.



Spray level made of Polypropylen (PP)



Pump strainers for absorber made of Polypropylen (PP)

RECOMMENDED MATERIALS

Lining Systems for Flue Gas Desulphurization Plants

To be used for reference only, REMA TIP TOP recommends that a professional review specific applications and make a formal product recommendation based upon the environmental conditions present.

Absorber	Recommended Material	Alternative Material	Remarks
ABSORBER FOR LIMESTONE GYPSUM PROCESS			
Raw gas inlet	COROFLAKE 23/PTFE-M LINING	COROFLAKE 28/COROFLAKE 29	The choice of the optimum material depends on the service conditions
Absorber wall	CHEMOLINE 4 B	COROFLAKE 24/COROFLAKE 23	
Absorber wall spray level section	CHEMOLINE 4 B*	COROFLAKE 24 AR	*A lining thickness of ≥ 6 mm is recommended
Absorber floor	CHEMOLINE 4 B (two layers)	LINING 65 W	An additional protective layer of ceramic bricks is recommended
Mist eliminator	CHEMOLINE 4 B	COROFLAKE 24/COROFLAKE 23	
Circulation pipe	CHEMOLINE 4 A		The lining thickness should be ≥ 6 mm
ABSORBER FOR SEAWATER PROCESS			
Raw gas inlet	COROFLAKE 23/PTFE-M LINING	COROFLAKE 28/COROFLAKE 29	The choice of the optimum material depends on the service conditions
Absorber wall	COROFLAKE 24/COROFLAKE 24 M	COROFLAKE 23 T/CHEMOLINE 4 CN	The choice of the lining material depends on the substrate (steel or concrete)
Absorber wall spray level section	COROFLAKE 24/COROFLAKE 24 M	COROFLAKE 23 T/CHEMOLINE 4 CN	The choice of the lining material depends on the substrate (steel or concrete)
Absorber floor	LINING 65	LINING 65 W/CHEMOLINE 4 CN	
Mist eliminator	COROFLAKE 24/COROFLAKE 24 M	COROFLAKE 23/COROFLAKE 23 T	
Circulation pipe	CHEMOLINE 4 A		
TANKS			
EMERGENCY SLURRY TANK			
Floor	CHEMOLINE 4 B/LINING 65 W	CHEMOLINE 4 CN/LINING 65	
Wall and ceiling	CHEMOLINE 4 B/COROFLAKE 24	CHEMOLINE 4 CN/COROFLAKE 23 T	
GYPSUM SLURRY TANK			
Floor	CHEMOLINE 4B (two layers)	LINING 65 W	
Wall and ceiling	CHEMOLINE 4 B	COROFLAKE 24/COROFLAKE 23	
FILTRATE TANK			
Floor	CHEMOLINE 4 B/LINING 65	CHEMOLINE 4 CN/LINING 65 W	
Wall and ceiling	CHEMOLINE 4 B/COROFLAKE 24	COROFLAKE 23	
Process water tank	CHEMOLINE 4 CN/COROFLAKE 23 T	COROFLAKE 24	
Filter vessel	CHEMONIT 33	CHEMONIT 35	
Thickener	CHEMOLINE 4 CN	LINING 65	
FLUE GAS DUCTS			
Raw gas ducts	COROFLAKE 23/COROFLAKE 29/PTFE-M LINING	COROFLAKE 28	Chosen corrosion protection system depends on detailed process data
Bypass ducts	COROFLAKE 23/COROFLAKE 29	COROFLAKE 28	Chosen corrosion protection system depends on detailed process data
Clean gas ducts after absorber	CHEMOLINE 4 B/COROFLAKE 24	COROFLAKE 23	
Clean gas ducts after heat exchanger	COROFLAKE 23/COROFLAKE 23 T	COROFLAKE 24/COROFLAKE 28	
Clean gas ducts after heat exchanger (including bypass mode)	COROFLAKE 23	COROFLAKE 27/COROFLAKE 28	
STACKS			
Stack – Clean gas after absorber, wet	CHEMOLINE 4 B/COROFLAKE 24	COROFLAKE 23	
Stack – Clean gas after reheating	COROFLAKE 24	COROFLAKE 23/COROFLAKE 23 T	
Stack, bypass mode	COROFLAKE 23/COROFLAKE 29	COROFLAKE 27/COROFLAKE 28	Chosen corrosion protection system depends on detailed process data
SUMPS AND TRENCHES			
Sumps and Launderers made of concrete	LINING 65	LINING 65 W	

REMA TIP TOP Product & Solutions

CONVEYING SOLUTIONS

Pulley Lagging

- PERFORMANCE GRIP 70
- REMAGRIP
- REMAGRIP Ceramic Lagging
- UNIGRIP
- UNILAG
- T-REX

Belt Cleaners

- REMACLEAN - T-Bar Scrapers
- REMACLEAN - Green Combi
- REMACLEAN - Grey Combi
- REMACLEAN - Cleaning Brush

Skirting

- REMASKIRT
- Combi-Skirt
- T-REX
- UNISKIRT

Repair Products

- Repair Patches
- Repair Strips
- REMA GOO
- RG 7000
- T-2 Repair System

Other

- Conveyor Belting
- REMACLEAT
- Edge Wall
- Impact Slider Bed Bars
- REMAMILL
- REMASCREEN

Rollers & Pulleys

- REMASLEEVE
- REMAROLL
- REMATRACK

WEAR & CORROSION PROTECTION

Wear Protection Lining

- REMA Performance Line
- REMALINE
- REMASTAR
- UNILINE
- REMATHAN
- T-REX

Rubber Linings

- CHEMOLINE
- CHEMONIT

Heavy Wear Protection

- REMALOX
- REMALOX HD
- KG Bars
- ZP Profile Bars
- REMA WEAR Repair

Anticaking

- REMAFLOX
- REMALEN
- REMASLIDE

Corrosion Coatings & Linings

- COROFLAKE
- COROGARD
- COROFLOOR
- TOPLINE
- RCC LININGS
- COROFLEX

Material Handling Hose

- Fixed Flange
- Split or Swivel Flange
- Cut End Hose

ADHESIVES & SOLUTIONS

Cements & Adhesives

- SC 2000 Black / White
- SC 4000 Black / White
- BC 3004 Blue Cement
- PC-4 Plastic Cement

Solutions

- PR 200 Metal Primer
- #13 Cleaning Solvent
- R50 Cleaning Solvent
- TIP TOP Hand Cleaner
- A&B Vulc Compound

Splice Kits

- Hot Splice Kits
- MSHA Splice Kits
- WK Press and Splice Material
- Filler Rubber
- CN Bonding Rubber

TOOLS & REPAIR

Tools

- Rubber Cut Saw
- Extruder Gun
- Vulcanizing Presses
- Combi Stripper
- Grooving Tool

Other

- REMAWRAP Pipe Repair
- OTR Tire Patches



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