The company Teplotechna DIS, s. r. o. was founded in 1998 by former employees of the state company Teplotechna PKZ (doing projects for all its subsidiaries) and Teplotechna DIZ Olomouc (realized deliveries at home and abroad).

By creating a team of employees with many years of experience in designing of linings (with specific realization and management of people) and manually skilled and technically savvy fireclay builders we founded a company that was able to successfully assert itself in the business of refractory linings for thermal units.

Our employees have many years of experience in the design and implementation of refractory linings of thermal units.

The experienced team consists of:
→ Sales Department,
→ Realization Department,
→ Lining Design Department,
→ Employees qualified for refractory works, welding works on auxiliary structures etc.

For larger projects and constructions, we are able to provide other experienced fireclay builders, carpenters and locksmiths as needed.

We specialize in the supply of refractory linings for the following areas:
→ production of building materials (cement and lime kilns)
→ energy production (boilers)
→ chemicals and petrochemicals (recuperators, heat exchangers, combustion chambers, etc.)
→ other industrial furnaces (melting, annealing, heating furnaces, etc.).

Services we provide to our customers:
→ technical documentation and engineering,
→ supply of materials including auxiliary anchoring structures,
→ installation of linings including welding of fasteners,
→ dismantling of linings,
→ drying of linings.

At present, our company operates mainly in the Czech and European market, where it has established a steady good position. Our advantage is the high flexibility and fast adaptation to customer requirements.

Teplotechna DIS, s. r. o. is certified to ISO 9001.
CEMENT KILNS

We are one of the most experienced suppliers of refractory linings for the cement manufacturing lines.

Thanks to many years of experience gained in the construction of new cement kilns and their annual repairs, we can say that there has been a relatively large increase in the demand for quality and durability of the refractory linings. The main reason is the increasing use of alternative fuels, which are associated with formation of chemical compounds on the basis of Cl, F and SO2, which adversely affect the service life of the conventional refractory lining and the steel fasteners. At present the cement plants in which we operate, burn about 30 - 70% alternative fuels (TAP or bone meal), which has a negative impact on the life of the refractory linings.

In cooperation with the manufacturers of firebricks and refractory concrete we responsibly recommend the most suitable type of material for the process conditions of a given cement manufacturing line. We do not prefer refractory concrete or fireclay material, so we can really choose the best quality and mutually combine materials from different manufacturers so that the result truly meets the purpose and use of the various parts of the cement line.

In the Cement Journal we published two articles on the topic:

The use of alternative fuels promotes corrosion of the lining, abrasion, build-ups formation and dynamic loads (air blasters, rotary kiln). This is a very articulated section, so there we choose mainly a lining of suitable refractory concrete with a higher proportion of SiC (10-25%).

In straighter sections, instead of refractory linings we can use pre-dried shaped bricks made of suitable refractory concrete.

### 3. INLET CHAMBER

- There are applied linings resistant to alkaline corrosion, abrasion, build-ups formation and dynamic loads (air blasters, rotary kiln).
- This is a very articulated section, so there we choose mainly a lining of suitable refractory concrete with a higher proportion of SiC (10-25%).
- In straighter sections, instead of refractory linings we can use pre-dried shaped bricks made of suitable refractory concrete.

### 4. CALCINING CHANNEL - KKN

KKN consists of:
- Ascending part of KKN,
- Descending part of KKN,
- Vortex head.
- From structural viewpoint calcination channel has a circular or rectangular cross section.
- The temperature ranges 900 - 1000°C.
- Mostly (from 80%) there is suitable lining from fireclay material, even in the round and rectangular cross section.
- In places like transition pieces, etc., we choose a lining from LCC refractory concrete, which is installed by casting into formwork.
- For the lower part of the ascending channel we choose quality materials, due to higher temperatures, alkaline corrosion, abrasion and formation of build-ups.
- At the bottom of KKN there is evident the pronounced influence of the use of alternative fuels.
- In the vortex head the material is chosen according to its particular shape.
- The ceiling in the vortex head can be solved by means of suspended shaped pieces made of fireclay material or LCC refractory concrete with silicon carbide content.
- In places where we decide to use refractory concrete lining, we can replace the selected installation method also with gunned concrete.

### 5. TERTIARY PIPELINE - TAD

- Usually (about 90%) the most suitable lining is from fireclay material.
- In bending points we use lining from suitable refractory concrete, or use a pre-dried shaped bricks made of suitable refractory concrete.
- In TAD the environment is heavily exposed to abrasion dust.
- Here we choose abrasion-resistant material resistant to alkalis.
- The tertiary conduit includes also a damper, which helps against the abrasion of the flowing clinker dust and against temperature variations. Lining of the damper is designed as self-flowing SFC refractory concrete or other suitable refractory concrete.

### 6. CYCLONES - THE BOTTOM PART

- The bottom usually includes the lowestmost cyclones, CIV and CV.
- Contemplated temperatures in these cyclones reach 800 to 900°C, in some cases the temperature can reach 1000°C.
- In these cyclones we can already see a clear impact of alternative fuels on the lining.
- There is chemical corrosion of linings, corrosion of hot dip steel and formation of build-ups.
- We mostly chose linings made of fireclay material in combination with a suitable LCC refractory concrete, which is installed by casting into formwork under vibration. It is a circular and conical part of the cyclones.

- Ceilings of cyclones are formed from suspended fireclay shaped bricks.
- For lining of ceilings, circular part and conical part there may also be used suitable LCC refractory concrete that resists alkalis with the content of silicon carbide.
- All steel constructions (brackets, anchors, hinges) are made from heat-resistant stainless steel.

- In some cyclones there may also be used suitable LCC refractory concrete that resists alkalis with the content of silicon carbide.
7. CYLCONES - THE UPPER PART

- The upper part usually includes cyclones CI, CII, and CIII.
- Contemplated temperatures in these cyclones range 300-600°C, in the cyclone CIII it can reach even 800°C.
- With proper operation of the line, the effects of alternative fuels shall not have impact any more.
- In these areas there is in particular mechanical stress on the linings – due to abrasion.
- Here, we choose linings from fireclay materials or sprayed dense and insulating refractory concretes (especially in cyclones CI and CII).
- Recently there have been used insulating refractory concretes with higher thermal conductivity for single-layer lining.

8. MEAL PIPES

- Lining is from LCC concrete, which is installed by casting into formwork under vibration.
- The insulating layer is made of calcium silicate boards.
- For lining of meal pipes connecting cyclone IV and V, LCC refractory concrete is used which resists alkalis due to presence of silicon carbide.
- For lining of meal pipes connecting cyclone I, II and III, standard LCC refractory concrete is used.

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Petersburgement (Eurocement group)</th>
<th>TAD Lining, kiln head, inlet chamber grate cooler, cement plant in Slantsy in Russia</th>
<th>2015</th>
<th>A + B + C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aliacem, s. r. o.</td>
<td>installation of a new heat exchanger linings, cement plant in Hranice Czech Republic</td>
<td>2014</td>
<td>C</td>
</tr>
<tr>
<td>PSP Engineering, a. s.</td>
<td>bypass linings, cement plant Saint Pierre la Cœurt, France</td>
<td>2015</td>
<td>A + B</td>
</tr>
<tr>
<td>PSP Engineering, a. s.</td>
<td>lining of a new heat exchanger, cement plant Lafarge Cement, Čížkovice, Czech Republic</td>
<td>2014</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Aliacem, s. r. o.</td>
<td>lining of a grate cooler, cement plant Cemmac in Horné Srnie, Slovakia</td>
<td>2013</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Aliacem, s. r. o.</td>
<td>lining of a grate cooler, Libya</td>
<td>2013</td>
<td>A + B</td>
</tr>
<tr>
<td>PSP Engineering, a. s.</td>
<td>linings of new cement lines, cement plant in Turňa nad Bodvou in Slovakia</td>
<td>2004</td>
<td>A + B + C</td>
</tr>
<tr>
<td>PSP Engineering, a. s.</td>
<td>linings of new cement lines, cement plant Lafarge Cement, Čížkovice, Slovakia</td>
<td>2000</td>
<td>A + B + C</td>
</tr>
</tbody>
</table>

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In addition to these contracts, we are involved in repairing the lining in these cement plants:

- Českomoravský cement a.s., plant in Mokrá
- Cement Hranice, a.s.
- CEMMAC, a.s. in Horné Srnie
- Lafarge Cement a.s. in Čížkovice
LIME KILNS

1. LIME KILNS IN SUGAR REFINERIES

We have extensive experience with lining of lime kilns in sugar refineries, which were plenty in the region of Haná. The most widely used are the simple shaft lime kilns with circular cross section and internal heating, where limestone is burned with the aid of coke. The lime kilns are continuous type furnaces, so the risk of thermal shock is minimal.

Teplotechna DIS, s.r.o. performs either complete or partial replacement of magnesite and refractory lining and also lining repairs by gunning (gunned concrete) a layer of a suitable refractory concrete.

Condition of the lining greatly affects the way of operation of the lime plant and dispensing the mixture of coke and limestone. Due to improper stratification of coke in the mixture there occurs local overburning of lining.

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moravskoslezské cukrovary, a. s.</td>
<td>new lining of a lime kiln no. 1</td>
</tr>
<tr>
<td>sugar refinery in Hrušovany nad Jevišovkou</td>
<td></td>
</tr>
<tr>
<td>Slavonski cukrovary, a. s.</td>
<td>partial repair of the magnesite housing and spraying of the refractory coating</td>
</tr>
<tr>
<td>sugar refinery in Sereď</td>
<td></td>
</tr>
<tr>
<td>Litovelská cukrovarna, a. s.</td>
<td>partial repair of fireclay casing and spraying of a refractory concrete coating</td>
</tr>
<tr>
<td>Cukrovar Vrbátky, a. s.</td>
<td>partial repair of fireclay casing and spraying of a refractory concrete layer</td>
</tr>
<tr>
<td>Hanácká potravinářská společnost, s. r. o.</td>
<td>partial repair of fireclay casing and spraying of a refractory concrete layer</td>
</tr>
<tr>
<td>sugar refinery in Prosenice</td>
<td></td>
</tr>
<tr>
<td>VUC, a. s.</td>
<td>lining of the upper part of the lime kiln and a new cap for the sugar refinery Agrana</td>
</tr>
</tbody>
</table>

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Depending from the success in annual tenders we carry out repairs in these sugar mills:

- Sugar refinery in Litovel
- Sugar refinery in Vrbátky
- Sugar refinery in Vrbátky
- Sugar refinery in Prosenice
- Sugar refinery in Hrušovany nad Jevišovkou

2. LIME KILNS FOR THE MANUFACTURING OF LIME

Maertz type lime kilns

Our employees have participated in the construction of refractory lining for Maertz type lime shaft kiln in lime kilns Varín (Dolvap, s.r.o.) and Čertovy schody (Lhoist Group) and the installation of a lime shaft kiln in Kotouč Štramberk, s.r.o.

Line for the production of lime with a rotary kiln (PSP Engineering design)

The line consists of a pre-calciner, rotary kiln, hot head and a shaft cooler; the system of lining is similar to the one of cement kilns. We are able to offer documentation for the lining, material supply and installation of lining in the lime lines.

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carmeuse Czech Republic, s. r. o.</td>
<td>new lining of the kiln head</td>
</tr>
<tr>
<td>plant in Mokrá</td>
<td></td>
</tr>
<tr>
<td>PSP Engineering, a. s.</td>
<td>new lining for a lime kiln in Lithuania</td>
</tr>
</tbody>
</table>

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When designing linings of boilers we build upon the experience of our engineers, who have been designing them during the period of massive construction of power and heating boilers since 1960s.

Repairs of linings are greatly facilitated by the original documents to the boilers, of which a substantial part has been preserved.

We have experience with these types of boilers:

1. WATER PIPE BOILERS
   - upright-tubular boilers (single-drum, double drum and three drum types)
   - chamber boilers
   - radiant heat boilers with natural circulation (ČKD Praga-Tatra, ČKD Oil and gas type)
   - radiant heat boilers with forced circulation up to 100 atm (ČKD powder, oil and gas type, Löffler, La Mont, ZSMK Timače)
   - Special high-pressure systems with pressure over 100 atm

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Company</th>
<th>Plant Details</th>
<th>Year</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litevská cukrovarna, a.s.</td>
<td>boiler Stádek</td>
<td>2003</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Veolia Energie ČR, a.s.</td>
<td>boiler 75 t/h</td>
<td>2003</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Dalkia ČR, a.s.</td>
<td>boiler K12</td>
<td>2002</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Elektrárna Třebovice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cukrovár Vrbátky, a.s.</td>
<td>boiler Oschatz</td>
<td>2001</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Dalkia ČR, a.s.</td>
<td>heating plant in Přerov</td>
<td>2009</td>
<td>A + B + C</td>
</tr>
</tbody>
</table>

2. CABINET AND SECTIONAL BOILERS
   - 2D Bohumín, cast iron (VSB, E, ECA, EMKA, LIGNO, ETERNA)
   - Steel (SNINA, SLATINA, ROUČKA)

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Company</th>
<th>Plant Details</th>
<th>Year</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cukrovar Vrbatky, a.s.</td>
<td>boiler Slatina 100 m²</td>
<td>2003</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Litovelska cukrovarna, a.s.</td>
<td>boiler Slatina 80 m²</td>
<td>2003</td>
<td>A + B + C</td>
</tr>
</tbody>
</table>

3. FLUIDIZED BED BOILERS

Fluidized bed boiler is a device for fluidized combustion of mostly pulverized coal or biomass. The ground coal is fed to the boiler combustion chamber along with air and granular material (sand), and above the bed it acquires fluid properties. Thus, the fuel in this layer burns in the entire volume of the fluidized bed. Fluidized bed boiler achieves better overall efficiency (up to 80%) than conventional boilers burning coal and thanks milled limestone, which is added to the boiler, it emits less sulfur dioxide.

For the lining of fluidized bed boilers we use a self-flowing LCC refractory concretes and ramming materials with high resistance to abrasion, corrosion, sulfur dioxide and CO and thermal shocks. In some types of fluidized bed boilers we can use calcined clay, concrete blocks and special insulation boards.

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Company</th>
<th>Plant Details</th>
<th>Year</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dalkia ČR, a.s.</td>
<td>installation of new linings of boiler K5</td>
<td>1999</td>
<td>C</td>
</tr>
<tr>
<td>Dalkia ČR, a.s.</td>
<td>new lining for combustion chamber of boiler K5</td>
<td>2012</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Polycomp a.s.</td>
<td>project documentation of linings</td>
<td>2013</td>
<td>A</td>
</tr>
<tr>
<td>ČEZ, a.s., Power plant in Tisová</td>
<td>FK 350t/h</td>
<td>1994</td>
<td>A</td>
</tr>
<tr>
<td>Alpiq Generation, s. r. o.,</td>
<td>FK 150t/h</td>
<td>1996</td>
<td>A</td>
</tr>
</tbody>
</table>

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4. BIOMASS-FIRED GRATE BOILERS

With the growing popularity of alternative fuels there is increasing demand for biomass-fired boilers.

Over the last 10 years we have developed projects and delivered linings for 40 pieces of these boilers with an output of 1 to 20 MW.

Lining is selected according to the type of boiler and can be made of fireclay shaped bricks or refractory concrete. Material of the working layer must be resistant to alkalis, abrasion and thermal shock. The insulating layer is made of lightweight insulating bricks and calcium silicate boards. The temperature on the housing exceeds about 50°C above the ambient temperature. If technically possible, in most cases we prefer fireclay material to refractory concrete. Refractory concrete is proposed for places around the burners, air jets and transient and complex shaped parts of the boiler. Lining on ceilings and sloping walls shall be from suspended fireclay shaped pieces. We also have experience with realization of lining for straw-fired boilers. In these boilers, because of the frequent formation of the build-ups on the lining we recommend to use lining as little as possible.

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Company / Location</th>
<th>Description</th>
<th>Year</th>
<th>Description Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Büttner Energie- und Trocknungstechnik GmbH, Německe</td>
<td>Lining of a biomass-fired 20 MW boiler</td>
<td>2014</td>
<td>A + B + C</td>
</tr>
<tr>
<td>TSG enero, s. r. o.</td>
<td>Lining for more than 30 pieces of biomass-fired and straw-fired boilers with a capacity of 2 MW to 10 MW</td>
<td>2000</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Vyncke, s. r. o.</td>
<td>Lining for biomass-fired boilers (Hofatex, Slovakia)</td>
<td>2000</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Step Trutnov, a.s.</td>
<td>Lining for biomass-fired boilers with an output of 1.5 to 3 MW</td>
<td></td>
<td>A + B + C</td>
</tr>
</tbody>
</table>

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In the petrochemical and the chemical industry it is very difficult to select proper refractory material for heat-resistant lining, especially due to various possible chemical effects.

In order to choose suitable type of material it is necessary to know the exact environmental conditions in which the linings are to be installed.

Lining consists largely of acid-proof materials, chemically bonded refractory concrete or refractory shaped bricks.

PETROCHEMICAL INDUSTRY

- various distillation furnaces
- furnaces for fission of gases
- tube furnaces
- converters and more

These devices are part of larger technological units where a minor failure could cause a shutdown of the entire production line. Its re-launch is in most cases very expensive.

Teplotechna DIS, s. r. o. has extensive experience with lining of apparatuses for production of hydrogen.

We gradually forged and improved the system of design, calculation and installation of linings so that now we have the optimal situation where over the last decade we have successfully put into operation five pairs of these apparatuses. One pair is in a chemical plant in Ostrava and four pairs were exported to the Russian Federation. We are an approved supplier of linings for these devices under the Haldor Topsøe license.
CHEMICAL INDUSTRY

- various chemical furnaces
- WHB
- reformers
- furnaces for the production of titanium dioxide, red paint, pigments
- deck ovens
- equipment for the production of sulfuric acid

Teplotechna DIS, s. r. o. has long experience with these units.

SELECTED REFERENCES

- Precheza, a. s. lining for the red pigment production lines 2014 A + B + C
- Precheza, a. s. lining for titanium dioxide production lines od roku 2000 A + B + C
- Precheza, a. s. waste heat fired boiler - sulfuric acid production line 2007 A + B + C
- ZVU Engineering, a. s. lining for soot production - CS Cabot 2015 A + B + C
- ZVU Engineering, a. s. lining for 5 pieces of apparatus to produce hydrogen under Haldor Topsoe license 2006 2012 A + B + C
- Ateko, a. s. lining of a contact reactor for the company Spolana 2012 A + B + C
- Excon Steel, a. s. lining of a collector 2004 A + B + C

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ANNEALING FURNACES AND TROLLEY KILNS

Lining of annealing furnaces is nowadays usually realized as a fibrous lining (see below - section fibrous lining).

Kiln trolley and the lock around the trolley are made from refractory concrete and fireclay shaped bricks. In some ovens, instead of fibrous lining, there are used lining made of lightweight insulating bricks for temperatures up to 1250°C or 1430°C.

SELECTED REFERENCES

- ČKD Kutná Hora, a. s. lining of the kiln trolley for an annealing furnace 2012 A + B + C
- Pavus, a. s. heating furnace lining 2015 A + B + C

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MALT ROASTER

Malt roaster is a sophisticated device that forms the basis of a technological roasting line. It starts with the preparation and feeding of green malt into the roaster and ends with cooling and output of roasted malt. At the bottom of the roaster, in an insulated shaft, there are positioned special natural gas burners with a “soft flame”.

In total, we have designed and supplied refractory lining to about 15 malt roasters, which are located in the Czech Republic, Poland, Lithuania, France, New Zealand, Russia and Belarus.
FIBROUS LINING

Fibrous lining is mostly used in afterburner devices and annealing and heating furnaces. It is characterized by superior resistance to thermal shock, low heat and high insulation capacity. The lining is made of mats from ceramic fiber resistant to temperatures up to 1250°C, 1400°C or 1600°C.

The design and installation uses either pre-prepared blocks [modules], or we glue and anchor the lamellas with stainless steel anchors. In some devices can be used the wallpaper installation method, where the lining may be covered with stainless steel sheets.

SELECTED REFERENCES

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Year</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asper Envi, s. r. o.</td>
<td>Lining of about 10 pieces of reactor for a BASF chemical plant</td>
<td>2007-2013</td>
<td>C</td>
</tr>
<tr>
<td>Pavus, a. s.</td>
<td>Heating furnace lining</td>
<td>od roku 2000</td>
<td>A + B + C</td>
</tr>
<tr>
<td>Thermal Project, s.r.o.</td>
<td>Combustion chamber lining</td>
<td>2013</td>
<td>C</td>
</tr>
</tbody>
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Drying usually takes place by means of hot flue gas from an external burner along a drying curve to temperatures of 350°C to 500°C.

Our company is ready to become your reliable partner whenever you need to solve thermal-technical problems of any industrial furnace in engineering, metallurgy, ceramics, glass and chemical industries as well as in the field of energy generation, particularly concerning boilers and incinerators.

We provide:

- Drying of refractory linings of all thermal units,
- Diagnostic check measurement of thermal operation of furnaces (temperature, pressure, volume, emissions).

TUNNEL KILNS

We have realized tunnel kiln installation in the company Tondach [Hranice na Moravě and Nitrianské Pravno].

GLASS FURNACES

We are in charge of the installation of glass furnace lining in Klatovy and Lednické Rovné.

We assemble the glass furnaces in cooperation with a partner company.