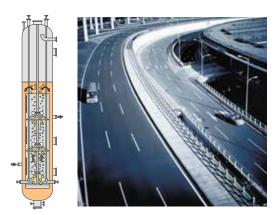




## WWW.BITUROX.COM

## MODERN BITUMEN IS A SPECIAL PRODUCT.



## BITUROX<sup>®</sup> BITUMEN MEANS:

TO THE DRIVER: THE MOST COMFORTABLE ROAD

TO THE ROAD DEPARTMENT: ECONOMY OF TOTAL OWNERSHIP

TO THE REFINERY: PRODUCTION FLEXIBILITY AND SPECIAL QUALITY

# THE WORLD OF TODAY AND TOMORROW NEEDS MORE AND BETTER ROADS...

Roads have to be inexpensive both in construction and maintenance. Equally they must provide utmost durability. And finally, used road paving material should be easily and completely reprocessable and reusable.

Bituminous binders of highest quality, as a component of road pavement formulations, meet all criteria listed above. They perform excellently under extreme climatic conditions and can stand heaviest traffic. Furthermore, drivers prefer the comfort of jointless bitumen roads. With this in mind, bitumen production presents itself as an increasingly attractive and profitable sector of downstream business.

## **REFINERIES NEED MORE THAN ONLY CRUDE DISTILLATION**

Today's petroleum product marketers are confronted with the need to supply top bitumen binder qualities to the construction industry at reasonable prices. Another business line, however, of interest is the speciality



Biturox<sup>®</sup> Paramo Pardubice, Czech Republic

chemicals sector. Frequently, an advanced bitumen processing technique is the key to new valuable business relations in the field of premium lubricants and special process products.

The main aim of any large-scale refinery in the world is to produce million of tons of fast moving products (e.g. gasoline, diesel fuel, kerosene, feedstocks for the petrochemistry etc.) at least possible costs. A usual way to reach this aim is a proper crude mix and a sophisticated refinery technology. This approach, however, has the consequence that a straight production of high quality bitumen is more and more impracticable.

THE NAME OF THE TOOL TO OPTIMALLY RECONCILE THE DEMAND FOR TOP-GRADE BITUMEN WITH THE UPSTREAM COST CONTROL IS BITUROX®

# **PÖRNER: BITUMEN UPGRADING SPECIALISTS**

With a workforce of about 500 people the Pörner Group has made a name for itself with chemical and refinery engineering and as an expert in bitumen technology. It has built the largest number of bitumen processing plants of every size in different parts of the world. This achievement enabled Pörner Group to accumulate the most comprehensive expert knowledge in engineering, design, construction, start-up and operation of bitumen plants.

## **KNOW HOW – THREE COLUMNS OF COMPETENCE**

The Biturox<sup>®</sup> Process is the modern and time-tested answer to the need for first class bitumen made from a great variety of raw materials. Pörner's expertise includes technological, commercial and market aspects. Biturox<sup>®</sup> plants produce bitumen according to various national quality standards (conventional, viscosity or performance based).

### TECHNOLOGY

The core piece of the Biturox<sup>®</sup> Process is the unequalled loop reactor. In this perfect air-lift reactor with agitator the thermo-chemical conversion of selected raw material blends by atmospheric oxygen takes place continuously and under repeatable conditions. It is thus possible to control all important process parameters (pressure, temperature, flow rates, residence time etc.) with high accuracy. Biturox<sup>®</sup> technology proves that the oxidation process can run both effectively and very softly: The valuable resins are formed and preserved in the reaction mixture and, at the same time, the degradation of organic compounds to coke and the build-up of deposits are minimised.

Features such as safe and automated operation, lowest possible turnaround and minimum maintenance as well as environmental compatibility make the Biturox<sup>®</sup> process the most attractive choice for a modern bitumen producer.

## DESIGN, RESEARCH AND PILOT TESTING

A satisfying bitumen quality depends on the harmonised balance of its chemical components: saturates, aromatics, resins and asphaltenes. In more than 35 years and supported by several hundred research lab and pilot tests using almost any type of crude, Pörner, together with its partner OMV, developed methods how to formulate and process bitumen: All findings have been stored in a know-how database. It enables Pörner to recommend for almost every feedstock/product combination the most efficient and economical way of making top quality bitumen.



### EXPERIENCE

Pörner knows much about bitumen: A visco-elastic, complex mixture of chemical compounds, difficult to handle. Based on Pörner's engineering expertise perfect bitumen plants have been realised. All principles of efficiency are applied when it comes to blending, heating, cooling of bitumen, optimizing instrumentation and automation, minimizing by-produdcts and emissions, saving and recovering energy, keeping maintenance and downtimes at a minimum. By selecting the ideally suited equipment Pörner minimises delivery times and makes construction fast and easy. Additionally Pörner takes care of personnel training, commissioning and start-up.

Pörner designs and realises Bitumen Plants including all infrastructures out of one hand: production units of high availability, easy to operate and designed to last long.

## THE MODERN WORLD OF BITUMEN

Roads connect people. Bitumen is the most versatile and qualified material for fast construction of long-life and inexpensive roads. The building material industry is another consumer of extra bitumen qualities for isolating and roofing felts, construction coatings, bitumen emulsions etc.

Biturox<sup>®</sup> bitumen products add to creating a world-wide network of perfect roads and to protecting people and property from rain and humidity.

### **CHANGES – CHALLENGES – CHANCES**

Almost every day crude prices, qualities and availability undergo radical changes. The number of bitumen producers falls off as some refineries decide to crack or coke their short residues. Thus, bitumen becomes more and more a specialty business.

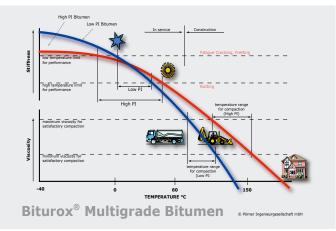
Meeting the demands of highway departments and road constructors in public-private partnerships, the bitumen producers have to fulfil new performance-oriented bitumen standards (e.g. SHRP). Flexibility and rapid response to new requirements are a must in the petroleum industry's day-to-day struggle for market shares. Modern refineries generally need to improve the bitumen processing technology, which should fit into their completely automated manufacturing pattern and contribute to the plant's economic efficiency by higher production flexibility combined with greater independence from the crude type available.

The Biturox<sup>®</sup> Process has turned out to be the right solution for the production of both big quantities of standard road paving bitumen binders as well as special "multigrade" and industrial bitumens in a continuous, fully automatic operation and allowing the utilisation of crude baskets beyond the limits of traditional bitumen feedstock selection.

### HIGHLIGHT

The Biturox<sup>®</sup> Process guarantees the user the highest independence from crude types and best bitumen qualities that are eco-firendly and reasonable in cost.

This is what the Biturox<sup>®</sup> paradox stands for: Better quality from cheaper feedstock components.



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**BITUROX®: HIGH QUALITY - ENDURING - IN LARGE QUANTITIES** 





BITUMEN BY BITUROX<sup>®</sup>

## **BITUROX® – MULTIGRADE BITUMEN**

Multigrade bitumen is a special product for which the Biturox<sup>®</sup>-based refinery technique is applied. Such bitumen shows a reduced thermal susceptibility - meaning that it behaves like a stiff grade at high and like a soft grade at low temperatures. Preferably, multigrades are used as binder for High Stiffness Modulus Asphalt (HSMA) mixes. Applied in the bearing course of the road, these show high consistency against rutting as well as good resistance to fatigue, combined with excellent aging stability. The HSMA concept provides for a longer service life of roads and minimizes cost because of reduced layer thickness.

## THE FEEDSTOCK

Besides short residue obtained from vacuum distillation, a variety of high molecular weight refinery components of all chemical configuration types present in most crude oils are suited as feedstock for the Biturox<sup>®</sup> Process. The following refining products are on the list of bitumen raw material:

- Vacuum residue (short residue) VR
- Pitch from bright stock de-asphalting PDA-P
- Aromatic extracts from lubricating oil processing EXT
- Atmospheric residue (long residue)
- Heavy vacuum gas oil HVGO
- Heavy cycle oils from cracking, visbreaking, coking

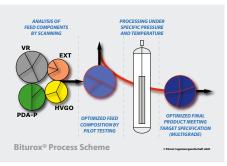
## THE METHOD

High quality bitumen must show a harmonic distribution of saturates, aromatics, resins and asphaltenes. Biturox<sup>®</sup> multigrade bitumen is made by the method of composition control.

Several raw material components of different chemical nature are selected and combined to an adequate feed composition. This composition is forwarded to the Biturox<sup>®</sup> Process where it is integrated by mild air oxidation under clearly defined and absolutely controlled processing conditions.

## **BITUROX®-CONTROLLED OPERATION**

The Biturox<sup>®</sup> reactor is the perfect tool for such operation: efficient, controllable and safe. The feed composition is processed very gently under elevated pressure and the amount of asphaltenes is increased minimising the risks of local overheating and coke build-up. Internal reactor cooling enables exact temperature control. The process runs continuously resulting in a consistent and homogenous finished product quality.



## CONCLUSION

Bitumen as the residue of crude distillation is chemically very complex. Taking advantage of its research database and many hundreds of pilot tests carried out on crudes from all over the world, Pörner has gained the experience to optimise feedstock compositions and design the process most adequately to make a quality product – even from unconventional cheaper feed components.

The Biturox<sup>®</sup> Process preserves valuable aromatics and increases the asphaltene amount in bitumen. Improving the visco-elastic properties as well as the adhesion on the aggregate. The result is a product with tailored chemical structure and optimum quality characteristics: Biturox<sup>®</sup> Multigrade Bitumen.

## THE BITUROX<sup>®</sup> PLANT

### REACTOR

- Inner loop type reactor design stands for optimised but also very gentle treatment of the medium
- Operation is very safe due to total utilisation of oxygen

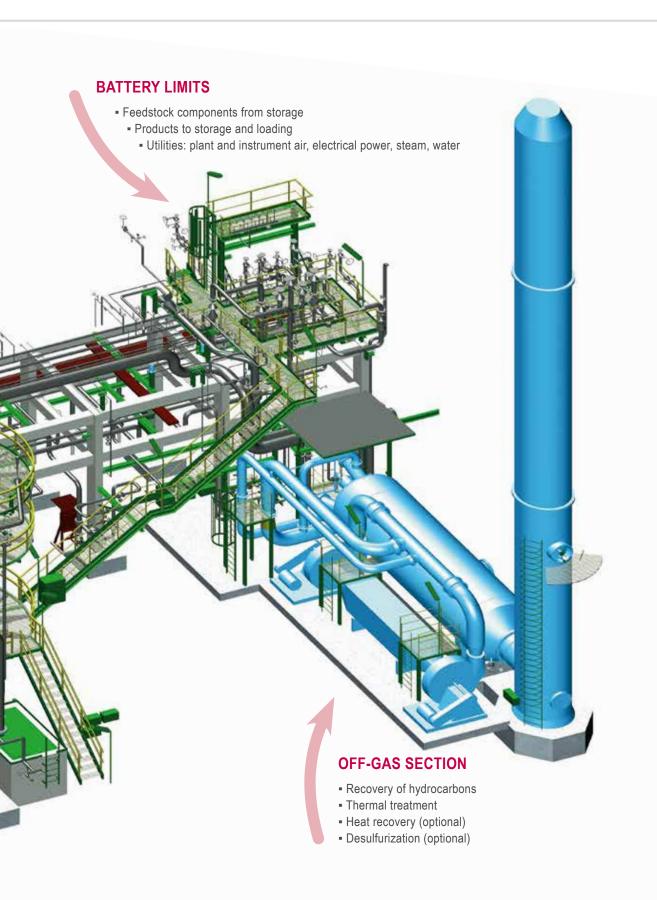
## **PRE-HEATING**

Pre-heating of feedstock blend to processing temperature

## 06 BITUMEN BY BITUROX®

### **PRODUCT SECTION**

Cooling of product to storage temperature
 Heat recovery for pre-heating
 Product blending for tailor-made products (optional)



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## **RESEARCH AND PILOTING**

### **BITUROX® RESEARCH FACILITIES**



After more than 35 years of service to the industry, the Biturox<sup>®</sup> Bitumen Research Centre is the acknowledged service provider for the development of high quality bitumens made from various crude and refinery feedstock bases. Up to date laboratory and semi-technical research and development facilities, latest analytical methods and the backup of the nearby OMV refinery enabled and promoted Pörner's efforts to stock up the most comprehensive expertise on bitumen making world-wide.

Two Biturox<sup>®</sup> pilot plants are available for practical testing of feedstock or compositions of several components in batch or continuous mode. The results of pilot tests are used as design basis for Biturox<sup>®</sup>

plants (i.e. reactor rating). Reference samples of bitumen can be produced from defined feed compositions ready for further applied testing by the client.

All results of basic and applied research, the experience gathered during design, construction, start-up and routine operation of the numerous Biturox<sup>®</sup> plants, the feedback from the Biturox<sup>®</sup> licensees, the latest findings of the Biturox<sup>®</sup> Enhancement Technique (chemical upgrading of bitumen) and, obviously, the performance reports on the application of Biturox<sup>®</sup> bitumen have been collected in a most comprehensive database.

### **OBJECTIVE**

Many bitumen research institutes over-emphasise the significance of crude oil provenance and compositional classification, simultaneously neglecting to notice and review the chances, which lie in the thermochemical modification of an almost unlimited range of crude oil derived feedstock.

The main objective of the Biturox<sup>®</sup> Research Facilities is therefore to optimize the product quality by using the right feed blend, controlling the operation conditions and improving the chemical composition of the bitumen.

The ultimate goal of all this is to satisfy the needs of the market for bitumen that has outstanding and superior qualities and is available at reasonable prices.

DESIRED CHARACTERISTICS	PROBLEMS TO SOLVE
Stiffness against Rutting (high Temp. Deformation)	<ul> <li>Chemical composition – asphaltene content</li> </ul>
<ul> <li>Fatigue resistance (low Temp. Cracking)</li> </ul>	Chemical composition – ratio asphaltene / resin
<ul> <li>Stability against Fretting</li> </ul>	Chemical balance
Adhesive Properties	Chemical composition – ratio asphaltene / resin
<ul> <li>Resistance to Ageing</li> </ul>	Chemical balance, stabilization by oxidation
<ul> <li>Compatibility with Polymers</li> </ul>	Chemical balance
Ability to Emulsify	Chemical composition – ratio asphaltene / resin

### RESULT

The Biturox<sup>®</sup> technology is a representative example how applied and scientific research can be conducted effectively, to the benefit of many people, driving on good roads, living in comfortable housing and saving cost at the same time.

BITUMEN BY BITUROX®

## **PROJECT REALIZATION**

The Pörner Group is the most experienced designer and constructor of bitumen processing plants worldwide. The huge collection of data in electronic form is the basis for an expedient and cost-saving project realisation in every single step. The table below gives a general overview of the scope and steps of the realisation of a "turn-key grass-root" project:

- Preliminary studies, information & data collection
- Feasibility study
- Evaluation of raw material, laboratory & pilot-plant testing
- Evaluation of the technical, commercial, legal and environmental conditions
- Project management
- Process design & basic engineering
- Detail engineering (civil, mechanical, electric & instrumentation)
- Procurement & logistics of equipment and material
- Engagement and supervision of contractors
- General on-site supervision of the construction work
- Commissioning of the complete plant
- Staff training
- Acceptance test
- Final documentation

#### PÖRNER HAS LEARNED A LOT ABOUT BITUMEN IN MORE THAN 35 YEARS.

Benefit from Pörner's four decades of experience in bitumen plant construction!



Biturox<sup>®</sup> ESHA, Amsterdam, Netherlands



From Lab Tests to Turn Key Realization



With Pörner the world of Biturox<sup>®</sup> bitumen is yours.



**REFERENCES** 



## REFERENCES



#### BITUROX<sup>®</sup> PLANT SAMIR

Turn-key realization of a Biturox<sup>®</sup> plant for special road paving bitumen including storage tanks and HGV filling station

#### Scope of services:

General planning incl. licensing, financial support, project management, basic engineering, detail engineering, supply of entire plant, plant construction, commissioning support & start-up, personnel training and documentation

Client: Societé Anonyme Marocaine l'Industrie du Raffinage (SAMIR)

Capacity: 800 TPD

Location: Mohammedia / Morocco Year: 2011



 BITUROX® PLANT PARCO

 Biturox® bitumen processing plant for production of industrial and road grade bitumen

 Scope of services:
 licensing, pilot testing, basic engineering, detail engineering, supply of core components, site supervision, commissioning, training and documentation

 Client:
 Pak-Arab Refinery Ltd. (PARCO)

 Capacity:
 500 TPD

 Location:
 Qasba Gujrat, Pakistan

 Year:
 2012

#### FURTHER REFERENCES

Plant	Client	City / Country	Year
Biturox <sup>®</sup> Plant SCOP	SCOP	Nassiriya / Iraq	2015 *)
Biturox <sup>®</sup> Plant SRC	South Refineries Company	Maissan / Iraq	2015 *)
Biturox <sup>®</sup> Plant SCOP	SCOP	Kerbala / Iraq	2015 *)
Biturox <sup>®</sup> Plant NZNP	NZNP	Rostov / Russia	2012
Biturox <sup>®</sup> Plant COCHIN	BPCL Kochi Refinery	Cochin / India	2007
Biturox <sup>®</sup> Plant MATHURA IOCL	Mathura Refinery	Mathura / India	2007
Biturox <sup>®</sup> Plant TAIF	ZAO < <taif-nk>&gt;</taif-nk>	Nizhnekamsk / Russia	2007

\*) planned start-up

#### BITUROX® PLANT CEPSA

Biturox<sup>®</sup> plant for special road paving bitumen in Spain

#### Scope of services:

licensing, basic engineering, detail engineering, supply of core components, commissioning support & start-up, personnel training and documentation

Client:

Compania Espanóla de Petróleos, S.A.U. (CEPSA)

Capacity: 1.080 TPD

Location: La Rabida / Spain

Year: 2011

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#### **BITUROX® PLANT OMV**

Biturox® bitumen processing plant for production of special road paving bitumen		
Scope of services:	licensing, basic engineering, detail engineering, procurement and supply of process unit, site supervision, start-up assistance, training and documentation	
Client:	OMV Austria GmbH	
Capacity:	240 TPD	
Location:	Schwechat / Austria	
Year:	2006	

#### FURTHER REFERENCES

Plant	Client	City / Country	Year
Biturox <sup>®</sup> Plant PARAMO	Paramo	Pardubice / Check Republic	2006
Biturox <sup>⊛</sup> Plant MBW	MBW	Webau / Germany	2005
Biturox <sup>®</sup> Plant IOCL	IOCL Gujarat Refinery	Vadodara Gujarat / India	2002
Biturox <sup>®</sup> Plant SIMOSA	SOC Simosa Oil Company	Mailiao / Taiwan	2002
Biturox <sup>®</sup> Plant Myanma	MPE Myanma Petroche- mical Enterprise Ltd.	Yangon / Myanmar	1999
Biturox <sup>®</sup> Plant RAYONG	TPI Thai Petrochemical Industry	Rayong / Thailand	1996
Biturox <sup>®</sup> Plant PLOCK	Petrochemia Plock	Plock / Poland	1997





Extension of an existing bitumen production by Biturox<sup>®</sup> process

#### Scope of services: basic engineering for the process unit, detail engineering, procurement and supply of key equipment, site supervision, start- up assistance, training and documentation

Client: LOTOS Gdansk

Capacity: 1.680 TPD

Location: Gdansk / Poland

Year: 2005



BITUROX <sup>®</sup> PLANT LAVERA Revamp of an existing bitumen oxidation plant based on the Biturox <sup>®</sup> process		
Scope of services:	basic engineering for the process unit, supply of key equipment, start up assistance, training and documentation	
Client:	BP Lavera	
Capacity:	750 TPD (1x 480 TPD and 1x 270 TPD)	
Location:	Lavera / France	
Year:	2004	

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