

# ATOMEX Europe 2011

**SIGMA GROUP a.s.**  
**Presentation of a supplier 2. part**



**SIGMA<sup>®</sup>**

Prague 25. - 26. October 2011

## 1. Introduction

- SIGMA GROUP a.s. follows up the pump manufacturing tradition in Lutin by Ludvik SIGMUND (1868)
- Since 1930' s deliveries of industrial pumps
- Since 1970' s deliveries of pumps for nuclear power plants

### **SIGMA GROUP a.s. – deliveries for nuclear energetics:**

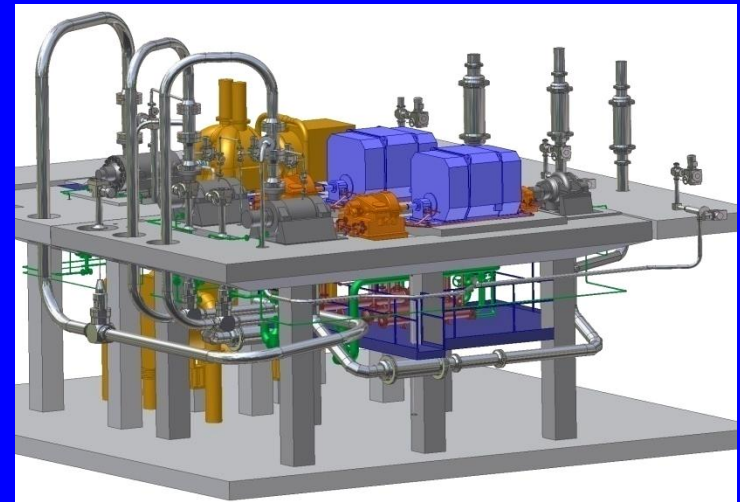
- **R&D:** SIGMA Research and Development Institute, s r.o.
- **Production:** SIGMA GROUP a.s., Industrial Pumps Division
- **Engineering:** SIGMA DIZ, s r.o.
- **Installation/maintenance:** SIGMA-ENERGO, s r.o.

**SIGMA GROUP WEBSITE: [www.sigma.cz](http://www.sigma.cz)**

## 2. Scope of activities-nuclear sector

Since 1970 's "turn-key" deliveries of pumping station and single pump deliveries for nuclear power plants in Slovakia, Czech, Russia, Ukraine and India

- Scope of deliveries:
- **Turn-key projects – pumping stations:**
  - engineering
  - pump manufacturing and delivery
  - pump installation
  - pump commissioning
  - pump maintenance



### **B. Single pump deliveries**

- pump manufacturing and delivery
- pump installation
- testing, pump commissioning
- pump maintenance, service



## 3. References – Nuclear Power Plants

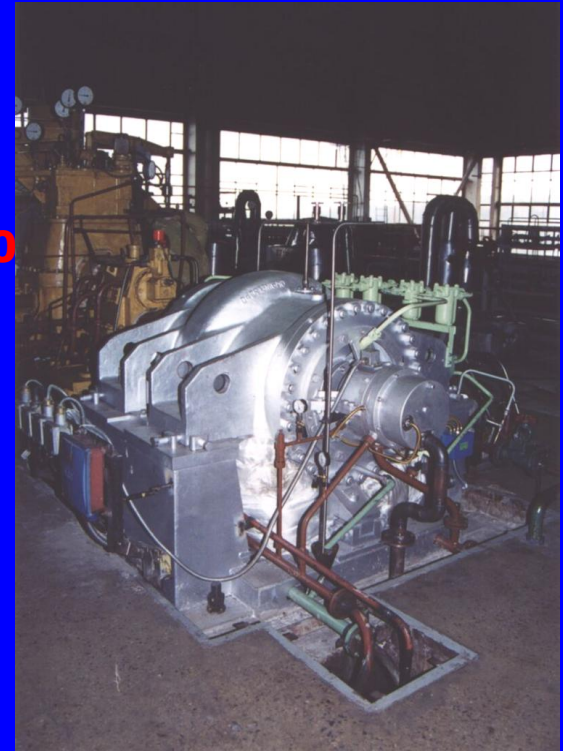
### Nuclear Power Plants - Czech and Slovakia

- **1979-1985 NPP Jaslovske Bohunice 4x440 MW (Slovakia)**
- **1984-1987 NPP Dukovany 4x440 MW (Czech Republic)**
- **2002 NPP Mochovce 2x 440 MW (Slovakia)**
- **2011-2 NPP Mochovce 2x 440 MW (Slovakia)**
- **2002-2003 NPP Temelin 2x1000 MW (Czech Republic)**



• Nuclear Power Plants - Russia 

- Novovoronezskaya 1000 MW (1977,2000, 2001)
- Novovoronezskaya 440 MW (2001)
- **Novovoronezskaya VVER (MIR) 1200 MW (2010)**
- Kalininskaya 1000 MW (1997, 2000, 2009)
- Balakovskaya 1000 MW (2002, 2009)
- Rostovskaya 1000 MW (2003, 2008)
- Beloyarskaya 800 MW (2011)
- **Leningradskaya VVER (MIR) 1200 MW (2011)**

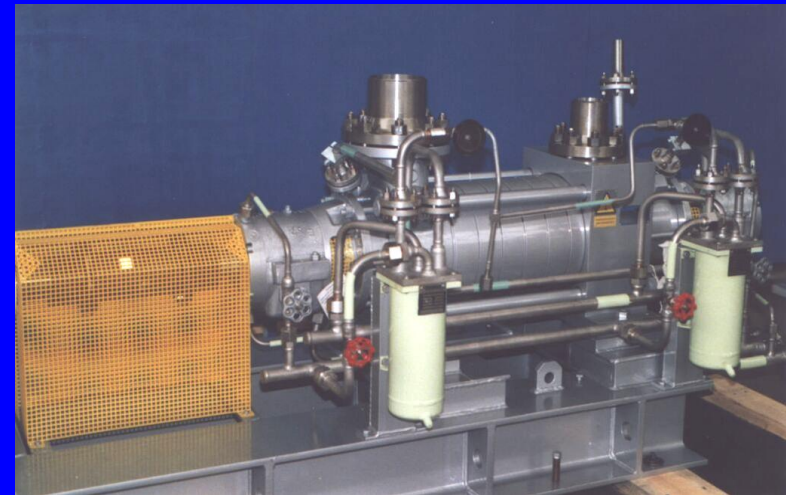


• Nuclear Power Plants – Ukraine 

- Juznoukrajinskaya 1000 MW(1996, 1998)
- Chmelnickaya 1000 MW (1997, 2001)

• Nuclear Power Plants - India 

- NPP Kudan Kulam 1000 MW (2007)



# List of deliveries for NPP Temelin Unit 1+ 2

## Raw water pumping station Hněvkovice

PS 0.10 – 6x pump SIGMA 600-HVBW-1045-86-2-OU-00

6x pump SIGMA V-VN-/III-D-01-LN-9

2x pump SIGMA 100-GFHU-270-60-LU-00

4x pump SIGMA 125-KDFU-170-17-AO-02

Including electric motors, electric parts, control systém, crane

## Backwater pumping station

PS 0.163 – 2x pump SIGMA 65-NHD-250-18-LC

2x pump SIGMA 32-GFHU-95-11-LA-01

Including electric motors, electric parts, control system

## Emergency feed water pumping station

PS 1.09 - 3x pump SIGMA 150-CIX-335-15,5-7-UC-000

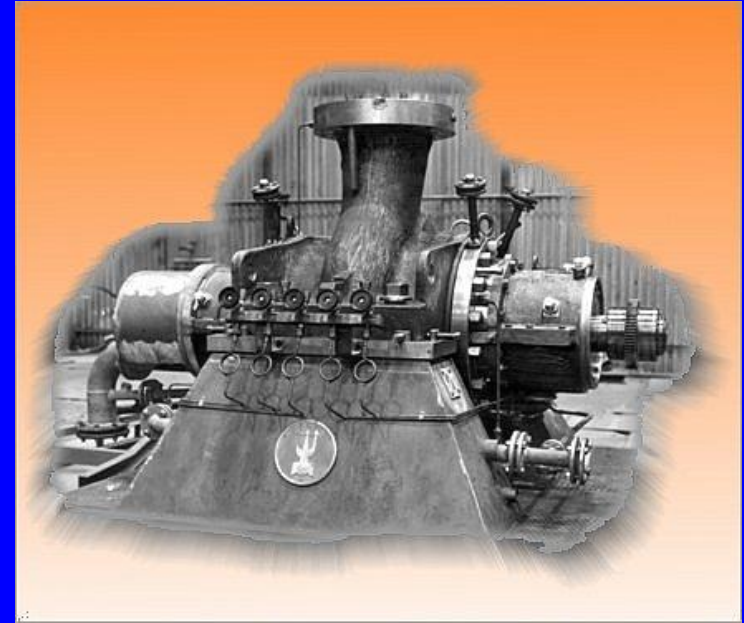
PS 2.09 - 4x pump SIGMA 150-CIX-335-15,5-7-UC-000

- Both including electric motors, tanks and system of pipe



### Feed water pumping station

- PS 1.32 - 3x pump SIGMA 300 QHX-463-82-ZC-010  
3x pump SIGMA 400 QHD-725-102-ZC-000  
2x pump SIGMA 125 CHX-310-12-8-UC-000
- PS 2.32 - 4x pump SIGMA 300 QHX-463-82-ZC-010  
4x pump SIGMA 400 QHD-725-102-ZC-000  
3x pump SIGMA 125 CHX-310-12-8-UC-000
- Including turbine, electric motors and electric equipment



### Essential water pumping station

- PS 1.16 - 6x pump SIGMA ATYP 600-HVBW-1045-86/1-OU-80  
6x pump SIGMA 80-KDFU-150-9,5-AO-03
- PS 2.16 - 7x pump SIGMA ATYP 600-HVBW-1045-86/1-OU-80  
6x pump SIGMA 80-KDFU-150-9,5-AO-03
- Both including electric motors, filters Passavant, valves



## Cooling and technical water pumping station

PS 1.15 - 2x pump SIGMA 1800 BQUV-3090-72-OW-000

2x pump SIGMA A-600 CVFV-700-90/1-LN-00

2x pump SIGMA 250 CVEV-400-30/5-LN

2x pump SIGMA 125 CVEV-265-15/3-LN

2x pump SIGMA 350 CVEV-460-53/3-LN-000-3

3x pump SIGMA 100 GFHU-250-60

1x pump SIGMA 100 KDFU-150-13,5

PS 2.15 - 2x pump SIGMA 1800 BQUV-3090-72-OW-000

3x pump SIGMA A-600 CVFV-700-90/1-LN-00

2x pump SIGMA 250 CVEV-400-30/5-LN

2x pump SIGMA 125 CVEV-265-15/3-LN

3x pump SIGMA 350 CVEV-460-53/3-LN-000-3

3x pump SIGMA 100 GFHU-250-60

5x pump SIGMA 100 KDFU-150-13,5

- Both including electric motors, electric parts, crane





### Main circulation pumps including oil economy

PS 1.20F - 4x HCČ GCN-195M – Supplier CKBM

PS 2.20F - 4x HCČ GCN-195M – Supplier CKBM

- Both including oil economy, system of pipe and fittings

### Single pump deliveries including electric-motors:

5x pump SIGMA 300-CHO-385-49-4

10x pump SIGMA 300-CJRV-550-46-1÷3

9x pump SIGMA 80-CES

2x pump SIGMA 250-CHO-335-43-3

2x pump SIGMA 300-CHO-385-49-2

2x pump SIGMA 400-QHT-670-84

8x pump SIGMA 200-CJMV

4x pump SIGMA 125-CVN

7x pump SIGMA 500-BQLV-640-19-LN-080

5x pump SIGMA 300-BQLV-460-19-LN-080



**IN TOTAL pumps 167 pcs. + Lots of other smaller pumps**

## Current nuclear activities

- Single pump deliveries (domestic, abroad)
- Delivery of spare parts (domestic, abroad)
- Maintenance (NPP Dukovany, NPP Temelín)
- **Completion of NPP Mochovce Unit 3+4 (Slovakia)**

--- Primary area (NI)

--- Secondary area (CI)

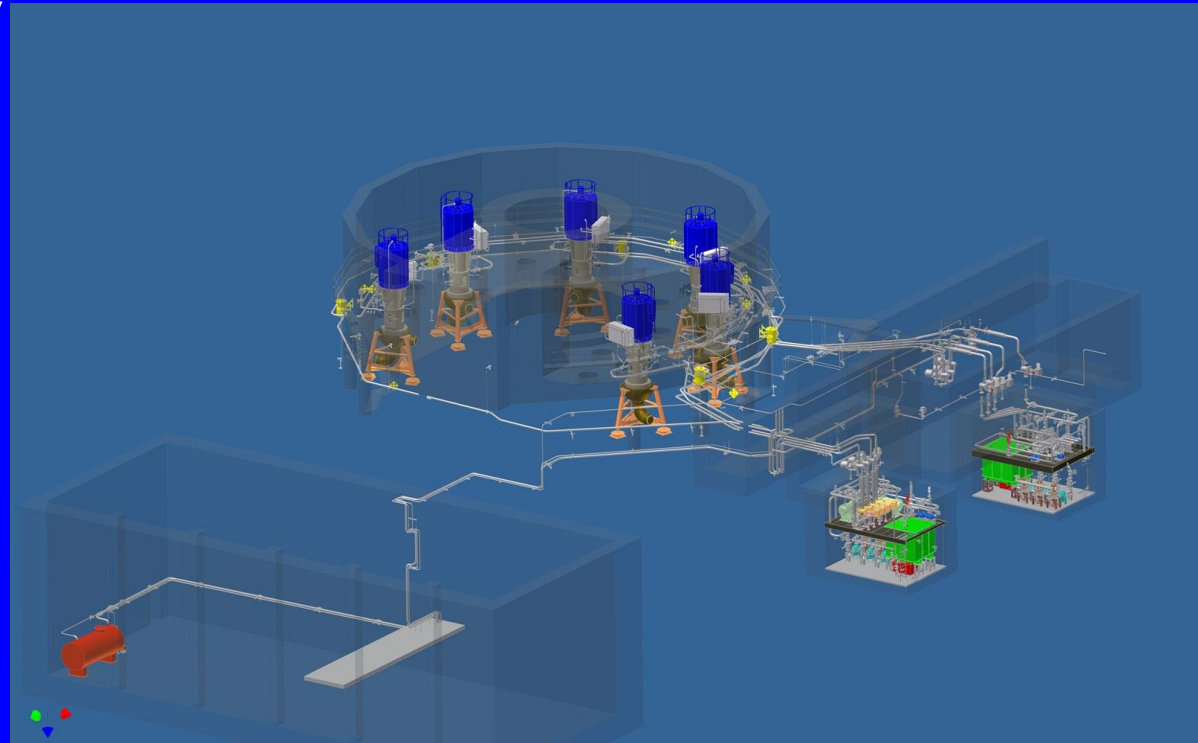
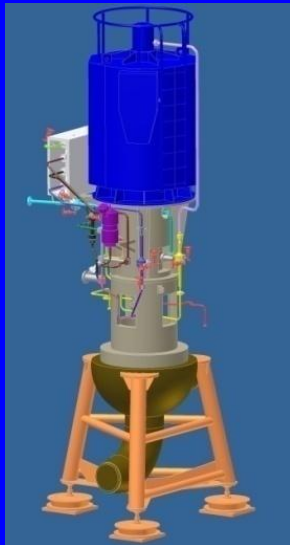


- **Deliveries for Unit VVER/MIR 1200 MW - Rusia**

# Completion of NPP Mochovce Unit 3+4 (Slovakia)

- **Nuclear Island (NI) – Delivery of main circulation pumps including oil economy (made in Russia)**

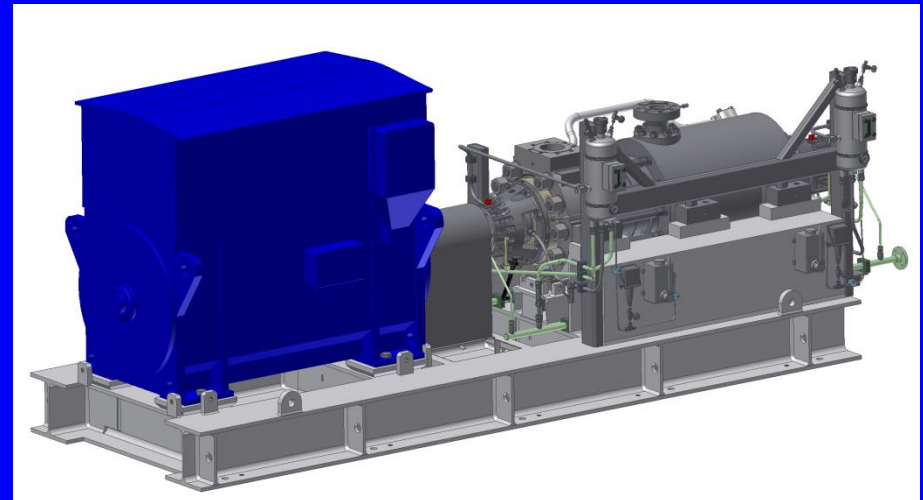
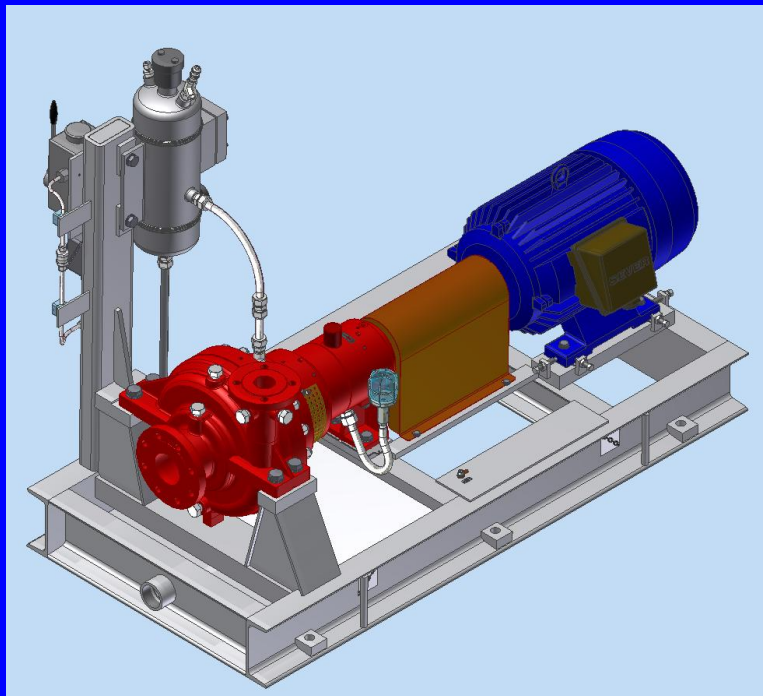
- preparation of technical documentation
- refurbishment of existing technology
- deliveries of new technology
- installation
- commissioning



# Completion of NPP Mochovce Unit 3+4 (Slovakia)

## Deliveries performed for KRÁLOVOPOLSKÁ RIA, a.s. (Safety system pumps)

- Emergency high pressure filling IO
- Controlled leakage pumps
- Coolant removal pumps
- Pump of deflation tank
- Spent fuel pool filling pumps



- **Completion of NPP Mochovce Unit 3+4 (Slovakia)**
  - **Conventional Island (CI)**

- refurbishment /renovation of already delivered SIGMA pumps (30 pcs.)
- delivery of new SIGMA pumps (129 pcs.)
- installation of pumping units
- commissioning

**The pumps delivery is divided into „JOBS“**

- **JOB M11** 2nd stage condensate pumps
- **JOB M12** cooling pumps
- **JOB M13** auxiliary make-up pumps
- **JOB M14** 1st stage condensate pumps  
service water pumps  
important technical water pumps  
fire-fighting pumps
- **JOB M15** emergency feed water pumps  
superemergency feed water pumps



## • **Completion of NPP Mochovce Unit 3+4 (Slovakia) Conventional Island (CI)**

### Deliveries performed by SIGMA Slovakia spol s r.o.

- **JOB M16** – Non essential service water (noESW) booster pumps for nuclear island (NI)
  - Drainage tank pumps
  - Non essential service water (NESW) drainage recovery
  - ESW sump pumps
  - MSR moisture collecting tank
  - Condensate pumps to steam generators (SG) blowdown cooler
  - Hot collecting condensate pumps
  - LP heaters drains forwarding pumps
  - Emergency demi water heating and distribution pumps
  - Condensate pumps for electrical generator cooling
  - Cooling water booster pumps
  - Non essential fixed fire fighting pumps
  - Non essential fixed fire fighting jockey pumps
  - Fire fighting diesel pump
  
- **JOB M16A** – Residual Heat Removal (RHR) pumps
  - Severe Accident Minimalization System (SAMS) main pump

## Deliveries performed for ČKD PRAHA DIZ, a.s. (CI)

- chilled water pumps
- circulating cooling water pumps
- booster pumps

**IN TOTAL pumps 171 pcs.**

## • Deliveries for Unit VVER/MIR 1200 MW Russia

### • Novovoronezhskaya VVER/MIR 1200 MW (2010-1)

#### Scope of deliveries:

- Raw water pumps
- Cooling water pumps
- Essential water pumps
- Pumps of flushing circuit
- Pumps for emergency cooling of the steam generator
- Pumps for cooling of a storage/detention basin
- Pumps for flushing water of steam generators
- Pumps of tank for water outlet from steam generators
- Pumps for filling of a storage/detention basin

### • Leningradskaya VVER/MIR 1200 MW (2011)

#### Scope of deliveries:

- Cooling water pumps
- Heat water circulating pumps

• **IN TOTAL pumps 61 pcs.**



## 5. Reference – fossil fuel power plants

**SIGMA delivered range of pumps for units to 660 MW supercritical;  
cooling water pumps till 860 MW**



## Feed water pump stations for power units over 200 MW

1. Thermal Power Plant <b>DĚTMAROVICE</b>	4 x 200 MW	Czech Republic, 1977-1979
2. Thermal Power Plant <b>DOICESTI II</b>	1 x 200 MW	Romania, 1980
3. Thermal Power Plant <b>CHVALETICE</b>	4 x 200 MW	Czech Republic, 1977-1980
4. Thermal Power Plant <b>MĚLNÍK III</b>	1 x 500 MW	Czech Republic, 1981
5. Thermal Power Plant <b>KAKANJ V</b>	1 x 230 MW	Jugoslavia, 1986
6. Thermal Power Plant <b>DRMNO</b>	2 x 350 MW	Jugoslavia, 1987-1988
7. Thermal Power Plant <b>JORGE LACERDA</b>	1 x 350 MW	Brazil, 1990
8. Thermal Power Plant <b>FELTON</b>	2 x 250 MW	Cuba, 1990
9. Thermal Power Plant <b>TALKHA II</b>	2 x 200 MW	Egypt, 1990-1992
10. Thermal Power Plant <b>SHEN TOU 1, 2</b>	2 x 500 MW	China, 1992-1993
11. Thermal Power Plant <b>TUŠIMICE II</b>	4 x 200 MW	Czech Republic, 1997-1998
12. Thermal Power Plant <b>SHEN TOU 3, 4</b>	2 x 500 MW	China, 2004-2005
13. Thermal Power Plant <b>Ledvice</b>	1 x 660 MW supercrit.	Czech Republic, 2012

## References – Regulation cooling water pumps

# BQDV

Power Station	Country	Type	Number – year
Novovoronezskaya	Russian Federation	1400-BQDV	4 – 1978
Mělník III	Czech Republic	1600-BQDV	2
Jaslovske Bohunice	Slovakia	1600-BQDV	4
Dukovany	Czech Republic	1600-BQDV	8
Slovjansk	Russian Federation	1400-BQDV	4
Želivka	Czech Republic	1000-BQDV	5
Mochovce	Slovakia	1600-BQDV	8
Soma	Turkey	1000-BQDV	6
Talkha	Egypt	1000-BQDV	14
Temelín	Czech Republic	1800-BQUW	4
Vřesová	Czech Republic	1000-BQDV	2
Jaworzno III	Poland	1600-BQDV	6
Laziska	Poland	1000-BQDV	1

## References – Regulation cooling water pumps

# BQDV

Lagisza 460 MW nadkritický, ALSTOM	Poland	1800 - BQDV	2 ks. - 2007
Moskva, TEC 26, ALSTOM	Russian Federation	1000 - BQDV	2 ks. - 2008
Belchatow 860 MW nadkritický, ALSTOM	Poland	2000 - BQDV	2 ks. - 2008
Ivanovská TEC	Russian Federation	1000 - BQDV	2 ks. - 2008
Kaširská TEC	Russian Federation	1400 - BQDV	2 ks. - 2008
Šaturská TEC	Russian Federation	1400 - BQDV	2 ks. - 2009
Ledvice 660 MW nadkritický	Czech Republic	1400 - BQDV	2 ks. - 2010
Južnouralská	Russian Federation	1000 - BQDV	2 ks. - 2011
Urenhojská	Russian Federation	1000 - BQDV	2 ks. – 2011

# Fossil Fuel Power Plants

## References Russia



### Controlled Cooling Water Pumps:

Južnaja TEC 22  
Šaturská Gres  
Ivanovská Gres  
Kaširská Gres  
Mosenergo TEC 26  
Slavjansk  
Novovoronežská AES



### Feed Water Pumps:

Nojabrskaja TEC  
Kazchrom, Kazachstan



### Hot Water Circulators:

Těreškovo GTEC  
Kožuchovo GTEC

## 6. Mobile Pumping Stations with Diesel Engine



## Mobile Pumping Stations with Diesel Engine – references

Number of pieces	Type	Country
1	MČS 14-480	Slovakia
3	MČS 20-1500	Czech republic
5	MČS 20-1500	France
1	MČS 20-1500	Belorussia
1	MČS 24-590	Russia
1	MČS 62-240	Slovakia
1	MČS 70-110	Russia
5	MČS 400	Czech republic

## 7. Petrochemical Industry

### References Russia



--- deliveries of one stage volute casing and multistage ring sectional pumps:

NPZ Kiriši  
NPZ Nižněkamsk  
NPZ Syzraň  
NPZ Marijskij  
NPZ Jaroslavl  
NPZ Ufa





## 8. Water Injection („turn-key deliveries“)

### References

- Pumping stations with high pressure centrifugal pumps 65 bar - Kazakhstan
- Pumping stations with high pressure centrifugal pumps 200 bar – Azerbajdzan
- Pumping stations with high pressure piston pumps - Kazakhstan



## 9. Admission of scales

### References Russia



--- Deliveries of high pressure centrifugal pumps:

Alčevsk Ukraine

Magnitogorsk Russia

--- Today's realization of changing the whole system (turn-key delivery) in Uralskaja Stal, Novotroick, Rusko



# 10. Technology & Manufacturing equipment

- **Machining:**
  - centre or vertical lathes,CNC lathes
  - milling machines
  - classic horizontal machine-tools
  - grinding and drilling machines
- **Thermal processing**
- **Welding shop**
  - certified welders for assignments on nuclear power plants
- **Dynamic parts balancing**
- **Nondestructive material testing**
  - Penetration tests
  - Magnetic powder tests
  - Ultrasonic tests
  - Radiographic tests
- **Defectoscopy shop**
- **Hydraulic test shop**
- **Painting shop**



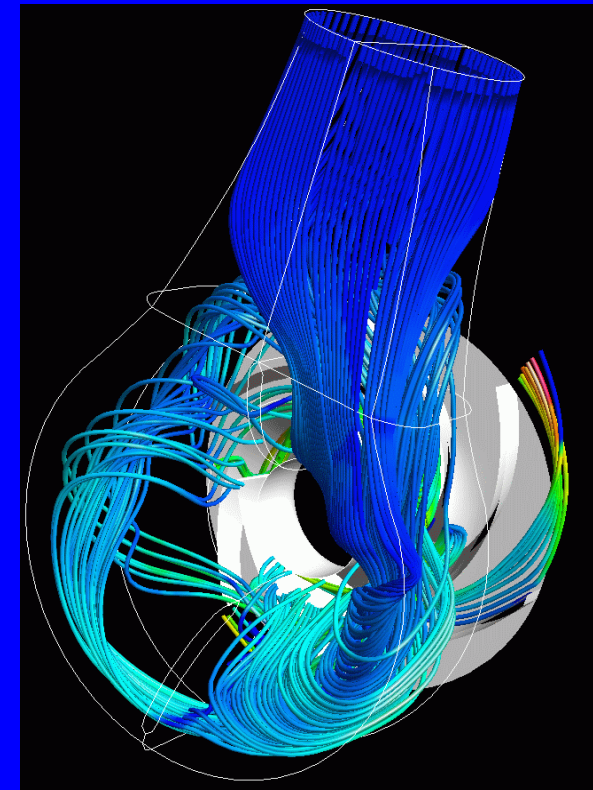
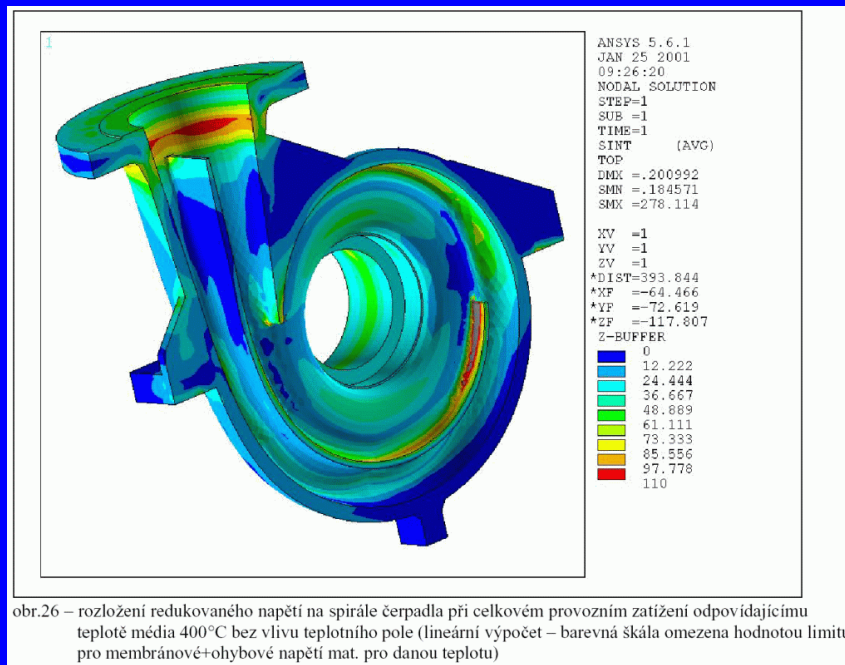
# Hydraulic testing

Water tank capacity .....	4500 m <sup>3</sup>
Max. depth of the tank .....	8,2 m
Max. measurable flow rate .....	7 m <sup>3</sup> /s
Max. power input of electric motor .....	12 MW / 6000 V
Continuous speed regulation by Ward-Leonard .....	25 – 60Hz, 500 – 6000V, 700kW
Heights of cranes above the floor .....	6,3 m
Lifting capacity .....	20 t



# 11. Software equipment

- **Mechanical:** AutCAD Mechanical 2012, Inventor Suite 2012, Inventor Professional 2012, Solid Works 2011
- **CAM software (machinery) :** SurfCAM Velocity
- **Fluid flow simulation:** FloWorks, ANSYS CSX
- **Rigidity calculation:** ANSYS Mechanical 12, ANSYS Professional 12, ANSYS Design Space
- **Design&Engineering:** AVEVA Plant PDMS





## 12. Quality Assurance System

- **Since 1994** SIGMA GROUP a.s. has been a holder of quality certificate according to ČSN EN ISO 9001
- Currently, the **ČSN EN ISO 9001:2008** certificate issued by TÜV NORD Czech on 4th January 2010 is valid. The validity expires on 3rd January 2013.
- **November 2008** – SIGMA GROUP successfully passed customer audit by ATOMSTROJEXPORT
- **May 2011** – SIGMA GROUP successfully passed customer **audit by ENEL – Completion NPP Mochovce34**
  
- **Quality System (QS) is applied to:**
  - R&D,
  - production and maintenance of pumps,
  - engineering and deliveries of turn-key investments
  - SIGMA GROUP a.s. has employees in certificated areas
  
- **QS training in cooperation with TÜV NORD Czech:**
  - SIGMA GROUP a.s. has been ensuring continuous training of employees from technical, design and commercial dpts.
  - The training is focused on requirements according to the public notice SÚJB no. 309/2005 Sb. and no. 132/2008 Sb.
  
- **SIGMA meets quality requirements for nuclear sector deliveries (Slovakia, Russia)**

# CERTIFICATE

Management system as per  
EN ISO 9001 : 2008

In accordance with TÜV NORD CERT procedures, it is hereby certified that

**SIGMA GROUP a.s.**  
Jana Sigmunda 79  
783 50 Lutín  
Czech Republic



including Ltd: **SIGMA DIZ,**  
**SIGMA ENERGOINŽENÝRING, SIGMA Výzkumný a vývojový ústav**

applies a management system in line with the above standard for the following scope

**Development, production and service of pumps,  
design and deliveries of pumping technologies and  
production of protective filters.**

Certificate Registration No. 04 100 950278  
Audit Report No. 624 403/300

Valid until 2013-01-03  
Initial certification 1995-06-01

Certification Body  
at TÜV NORD CERT GmbH

Praha, 2010-01-04

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is subject to regular surveillance audits.

The annex (1 page) is the integral part of the certificate.  
TÜV NORD CERT GmbH Langemarckstrasse 20

45141 Essen

www.tuev-nord-cert.com



TGA-ZM-07-06-00

# ANNEX

to Certificate Registration No. 04 100 950278  
of Management system as per EN ISO 9001 : 2008

Company

**SIGMA GROUP a.s.**  
Jana Sigmunda 79  
783 50 Lutín  
Czech Republic



including Ltd: **SIGMA DIZ,**  
**SIGMA ENERGOINŽENÝRING, SIGMA Výzkumný a vývojový ústav**

Locations included to the certified area

Certified branch I - Development, production and service of pumps, design and deliveries of pumping technologies and production of protective filters.

**SIGMA GROUP a.s., Jana Sigmunda 79, CZ - 783 50 Lutín**

Certified branch II - Design and deliveries of pumping technologies.

**SIGMA ENERGOINŽENÝRING spol. s r.o., Jana Sigmunda 79, CZ - 783 50 Lutín**  
**SIGMA DIZ spol. s r.o., Jana Sigmunda 79, CZ - 783 50 Lutín**

Certified branch III - Development of pumps. Production of protective filters.

**SIGMA Výzkumný a vývojový ústav spol. s r.o., Jana Sigmunda 79, CZ - 783 50 Lutín**

--- End of the list ---

Certification Body at  
TÜV NORD CERT GmbH

Praha, 2010-01-04

This certification was conducted in accordance with the TÜV NORD CERT auditing and certification procedures and is subject to regular surveillance audits.

TÜV NORD CERT GmbH

Langemarckstrasse 20

45141 Essen

www.tuev-nord-cert.com



TGA-ZM-07-06-00



СЕРТИФИКАТ

СИСТЕМА СЕРТИФИКАЦИИ ОБОРУДОВАНИЯ, ИЗДЕЛИЙ И ТЕХНОЛОГИЙ ДЛЯ  
ЯДЕРНЫХ УСТАНОВОК, РАДИАЦИОННЫХ ИСТОЧНИКОВ И ПУНКТОВ ХРАНЕНИЯ

№ ФАС 1588

## СЕРТИФИКАТ СООТВЕТСТВИЯ



№ РОСС RU.0001.01AЭ00.00.10.1640

Дата выдачи 25.08.2011

ОРГАН ПО СЕРТИФИКАЦИИ Автономная некоммерческая организация "Центр по оценке соответствия и  
подтверждению качества оборудования, изделий и технологий" (Орган по сертификации "АтомТехноТест")  
Адрес: Российская Федерация, 107078, г. Москва, Рязанский пер., д. 2

РОСС RU.0001.01AЭ00.77.30.0007

УДОСТОВЕРЯЕТ, ЧТО ДОЛЖНЫМ ОБРАЗОМ ИДЕНТИФИЦИРОВАННЫЕ ЗАЯВИТЕЛЕМ  
«Насосные агрегаты типа А 500-QVD-750-100-ZC-000-FE» по техническим

условиям N 530 964, партия 4 штуки (зав. №№ 10100045, 10100046, 10100047,  
10100048), для Нововоронежской АЭС-2

8413 70 6500

Код К-ОКП

код ТНВЭД

ИЗГОТОВИТЕЛЬ (ПРОДАВЕЦ, ИСПОЛНИТЕЛЬ) фирма «SIGMA GROUP» a.s.  
Jana Sigmunda 79, 783 50 Lutín, Чешская Республика

СООТВЕТСТВУЮТ ТРЕБОВАНИЯМ НОРМАТИВНЫХ ДОКУМЕНТОВ см. Приложение 1

СЕРТИФИКАТ ВЫДАН НА ОСНОВАНИИ см. Приложение 2

ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ Условия действия сертификата - см. Приложение 3

РУКОВОДИТЕЛЬ ОРГАНА ПО СЕРТИФИКАЦИИ

  
Подпись

Ageev A. B.

МП

Сертификат имеет юридическую силу на всей территории Российской Федерации

## Summary – why to use SIGMA pumps?

- More than 140 years experience with development and manufacturing of pumps
- More than 30 years continuous deliveries to Nuclear Power Plants in 5 countries
- Referencies of almost complete range of pumps for NPP units VVER 440 and VVER 1000
- Refernces of engineering, installation and servis of Russian Reactor Coolant Pumps. We are qualified to extend it to cooperative manufacturing.
- Pump deliveries to new generation units VVER 1200 MW in Russia.
- Intensive pump development, expressively oriented to pumps for NPP
- Professional qualification and capacity for both manufacturing of pumps and „turn-key“ deliveries of pumping stations for nuclear program.



Thank you for attention