

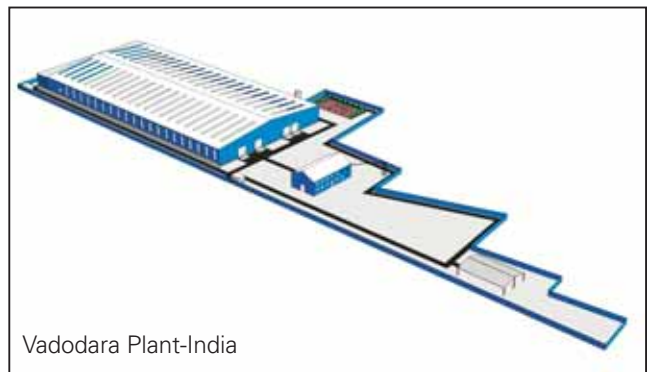


SHUNT REACTOR CORES

Up to 765 kV - 300 MVAR



CORPORATE PROFILE



ENPAY: A GLOBAL BRAND, A ROOTED COMPANY

Established in 1978, ENPAY is a world-known producer of

- Transformerboard
- Transformer Components
- Magnetic Cores
- Flux Collectors
- Transformer Tanks
- High Voltage Insulation Components
- Transformer Windings

ENPAY is a reliable partner to its customers in solving complex technical problems with an excellent reputation and market track record. High qualified staff, a strong know-how, an enviable R&D base, and a comprehensive range of products are the most valuable assets of the Company.

The investments with up-to-date technological equipment, its determined steps toward institutionalization and its quality-oriented corporate culture and customer approach are among the most important competitive advantages of ENPAY.

ENPAY's plants are located in Turkey and Slovakia. In 1989, the Company launched production of transformer components in its Izmit Plant. First manufactured products were exported to Germany. Since mid-2005, ENPAY launched a manufacturing plant in Slovakia. ENPAY TRANSFORMER COMPONENTS S.R.O. operates in the same field equivalent to the production in Turkey plant.

We are going to launch a manufacturing plant in India on June 2010.

The total closed production area of the plants has reached 72,000 m². ENPAY is ranked 142nd in the first 250 exporters in Turkey.

We thank you for your interest you have shown to ENPAY and its products.

ENPAY'S VISION

In order to reach the goal of becoming a company of worldwide reputation ENPAY ensures,

- customer satisfaction and preference
- profitable growth
- perpetuity
- shareholder's satisfaction and pride fulfillment of social obligations.

Through continuous improvement of processes ENPAY focused on,

- total quality
- high productivity
- cost effectiveness

and by creating an environment which encourages team effort and where,

- each individual's contribution is recognized and esteemed
- each individual enjoys his work and has urge to excel
- each individual gives his best to achieve the common vision.

QUALITY AND ENVIRONMENT

ENPAY APPROACH TO QUALITY

Thanks to a wide activity range in ENPAY Group, overall quality levels can be achieved in the field of transformer insulation, complete active part -core and coil assembly and consulting for transformer production.

This is the main reason ENPAY became a traditional supplier for the transformer industry.

ENPAY has been awarded with the ISO 9001 Quality Management System Certificate from TÜV Süd.

All incoming materials are checked and further controls are carried out; manufacturing processes are frequently monitored. Final checks are made on fully assembled cores, and test reports are sent together with them to the customer. The type of packaging and labeling is chosen according to the transport means, the final destination and the customer specific requirements.

ENPAY Quality Control System

ENPAY is based on the criteria of satisfying the needs of the customers in quality and quantity for transformer components.

ENPAY investment planning is designed in such a way that will ensure service in the future. Effective production techniques creates also resources for R&D. The Company's facilities have state of the art technology with modern production processes. ENPAY production of transformer components are fully compatible with the International Electrotechnical Standards and complies with customer demands.

We are aware that in the global market priority number one is quality, therefore we established the ENPAY Quality Control System in order to ensure that the quality of our products is kept steadily at a high level. In case the information in this catalogue is not sufficient, we would be glad to work with you in solving your individual problems. Our R&D activities are responding to the needs of the future. Being informed of your problems and comments will be of great help to us.

ENVIRONMENTAL PROTECTION: OUR UNIVERSAL RESPONSIBILITY

We are responsible for the society and environment at our industrial location. Active participation in environmental measures to protect the human being and nature is a major aspect of our company policy. It begins in development, runs through the entire production process and covers waste disposal problems.

SHUNT REACTOR CORES

RADIAL STACKED LIMBS FOR SHUNT REACTORS

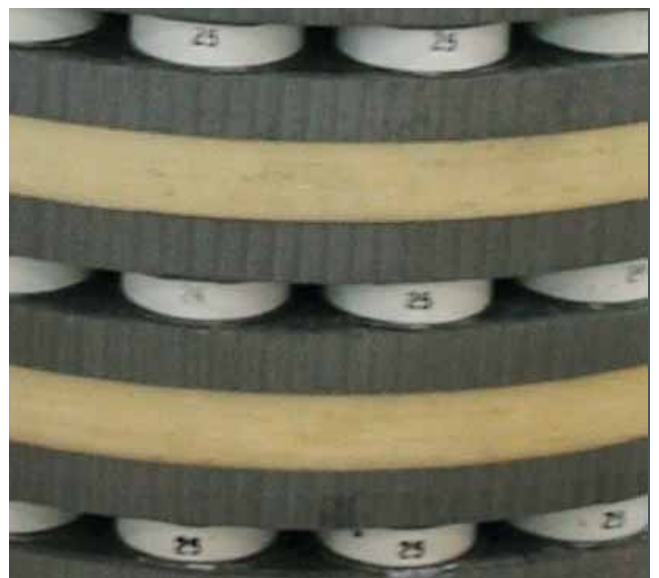
ENPAY produce special stacked cores for Medium and High voltage reactors from grain oriented magnetic steel according to customer design. These cores are produced with legs and yokes complete with its cooling channels and insulation accessories. Wound yokes are also in the production scope of ENPAY.

Ceramic spacers as per customer specifications are used to obtain radial distance between core elements. These ceramic spacers are tightly glued on both sides to the core elements with special adhesive under pressure. The total weight of the core may reach 100 tons.



The Order data for radial stacked limbs are shown on Page 4. There are various types of construction for complete reactor cores. ENPAY manufactures reactor cores according to customer specifications in a high flexibility. ENPAY, thus, is able to meet all of the requirements of its customers.

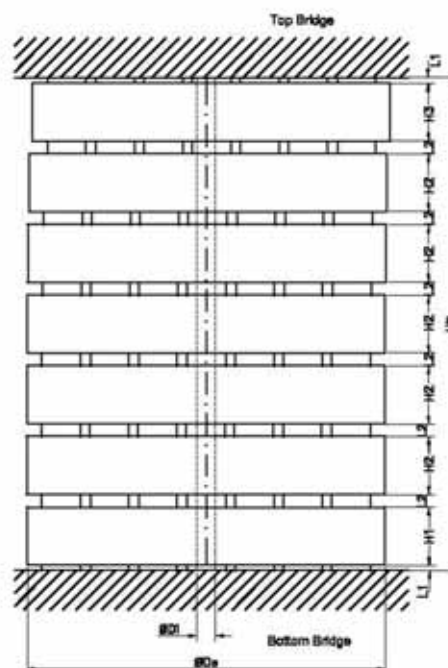
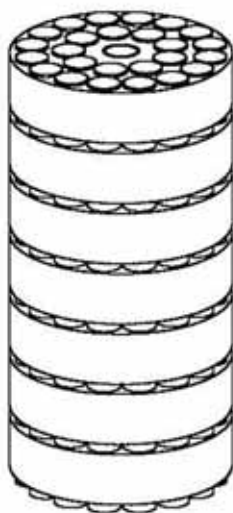
On Page 5, a schematic drawing is shown for the vertical clamping of the yokes and the side limbs. First, the limbs are completed and they are controlled before assembling on the yoke.

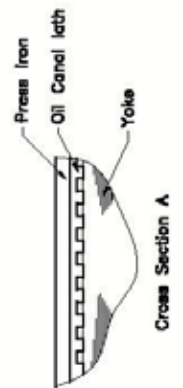
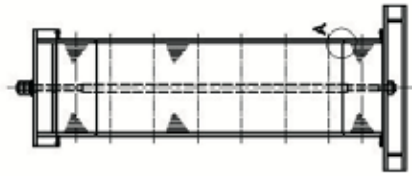
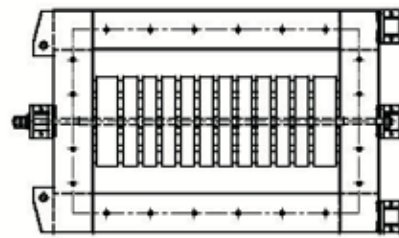
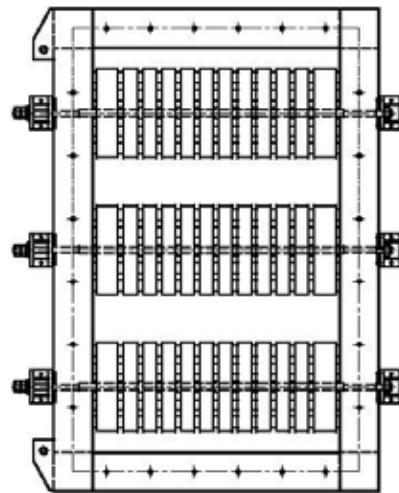
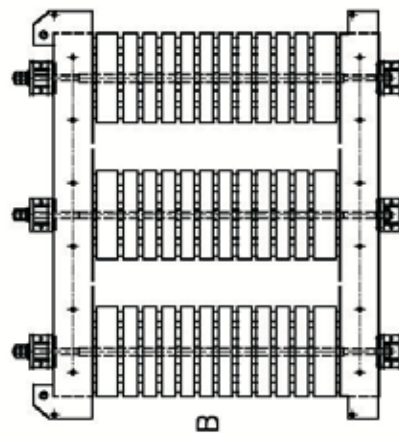
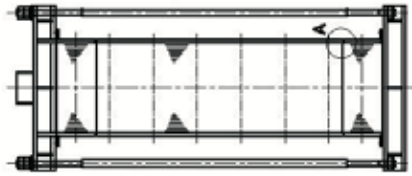
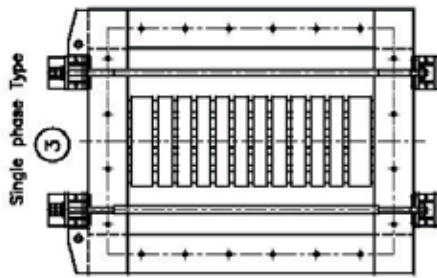
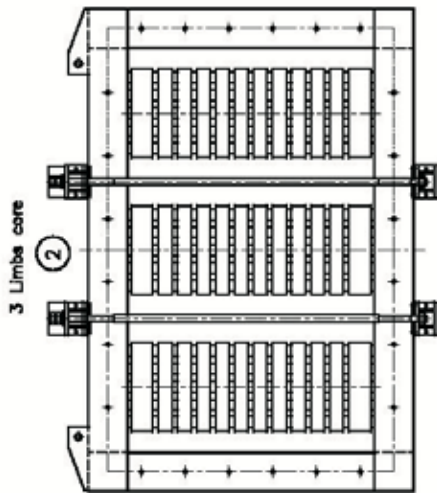
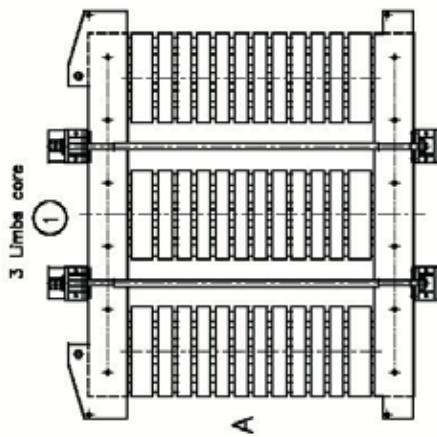


SHUNT REACTOR CORES

Order specification sheet to be filled for each reactor order

	Number for each leg	Axial height
Package		H1=
		H2=
		H3=
Air gap		L1=
		L2=
		L3=
		L4=
Window height		Hf=
Outer diameter		Da=
Inner diameter		Di=
Section		Cm2=
Steel weight on the limb		Kg=
Gross weight of the limb (ceramics+glue)		Kg=
Steel		
Filling Factor		0.63
Number of ceramics on each package		





A schematic drawing about reactor cores

SHUNT REACTOR CORES

PRODUCTION OF COMPLETE RADIAL STACKED REACTOR CORE

First the limbs are completed and they are controlled before assembling on the yoke.

An assembly picture for a 5 Limb assembled reactor core. Lower yoke and external limbs are assembled altogether. The yoke clamping parts and the tightening bolts are made of special anti-magnetic steel. In case of requirement, the cooling-channels are placed between yoke and clamps.



Assembly operation (process) of a radial stacked reactor limb. The picture below shows the limb, which is being glued on the lower yoke. It is very important to pay special attention to the assembly of the reactor cores.

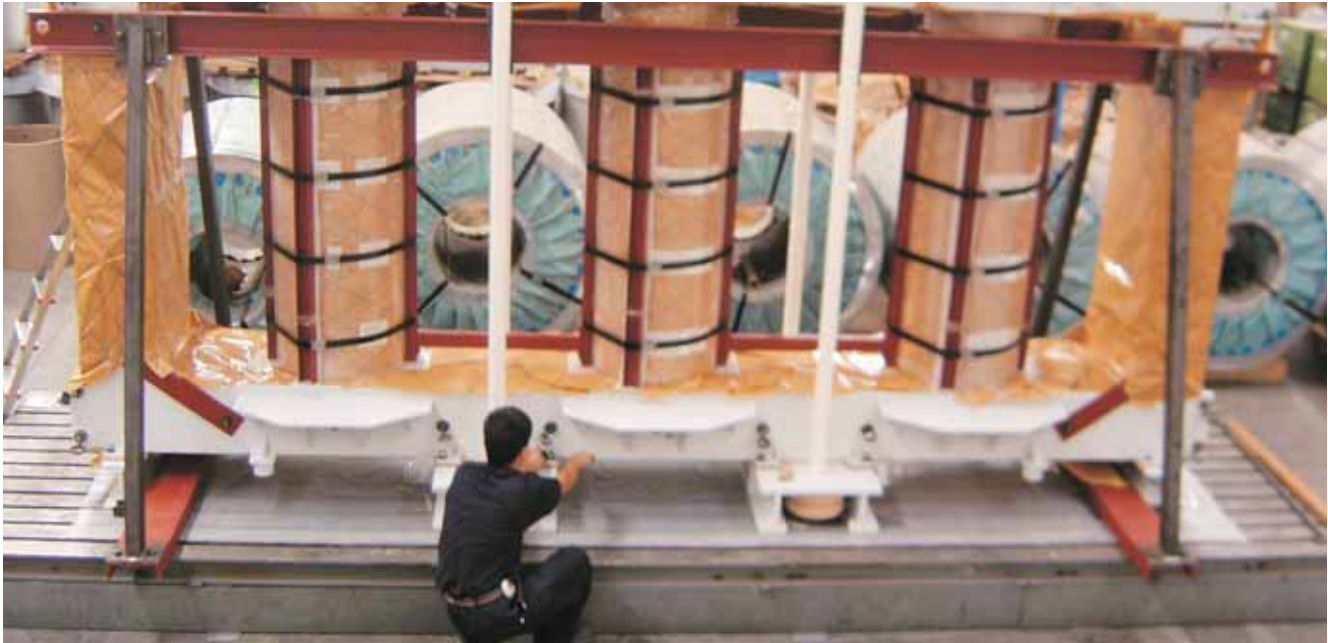
ENPAY have staff who have experience for long year in this field. Conformity of the tolerances is a criteria for the quality of the finished product.



An assembled radial stacked limbs on the lower yoke. The tolerances either in page 4 or in customer specifications are applicable.



An assembled 5-limb reactor core, upper yoke and fixed threaded bolts.



SHUNT REACTOR CORES

CORE DESIGN FOR SHUNT REACTOR

- Enpay is able to make core designs of Shunt Reactors for its customers.
- Each reactor is computed to fulfill requirements of the technical specifications which are set out by customer.
- Among many constraints of the technical specification, the main data for the computation of shunt reactor are listed below;

1. Rated Power as kVAR or MVAR
2. Frequency f as Hz
3. Winding Connection Group
4. Cooling system (ONAN, ONAF...)
5. Environment temperature
6. Altitude of operating location
7. Rated operating voltage
8. Maximum voltage (kV) (Winding input terminals and neutral p.)
9. Lightning impulse voltage (kV) (Winding input terminals and neutral p.)
10. AC induced voltage (kV)
11. Switching impulse voltage (kV)
12. AC applied voltage kV (Winding input and neutral p.)
13. Tolerances in Inductance
14. Total losses (copper + iron + additional losses)
15. Number of phases, number of legs
16. Maximum oil t., winding t. and hot point t.
17. The name of standards (IEC, IEEE-ANSI etc...)

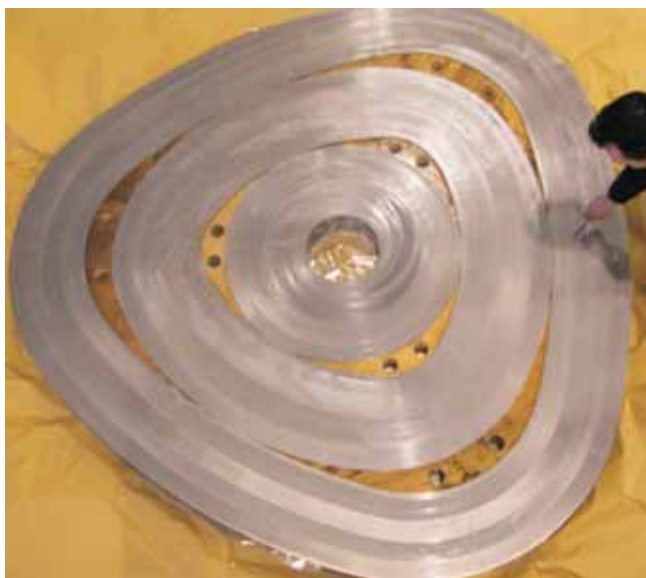
SINGLE-PHASE REACTOR CORE



The picture on the left side shows a single-phase reactor core. Such single-phase reactors are utilized in various fields of application.

SHUNT REACTOR YOKES

Triangular yokes are also available. A sample of separately wound, glued triangular yoke is presented below. The limbs are glued to the triangular yokes. The radial-stacked reactor cores which are manufactured by the concerned method have cylindrical tanks.



SHUNT REACTOR CORES

TRANSPORTATION OF REACTOR CORES

Due to the transportation constraints, the Limbs and Yokes can be packed and delivered separately.



According to the total weight of the cores, the different modes of transport are applicable. If the complete delivery of the reactor core is not possible, the parts are delivered separately and our technical experts can assemble the parts in customer's workshop. ENPAY ensure the dimensions in all cases. The essential precautions against corrosion during transportation are performed.



SATURABLE REACTOR CORES FOR RECTIFIER TRANSFORMERS



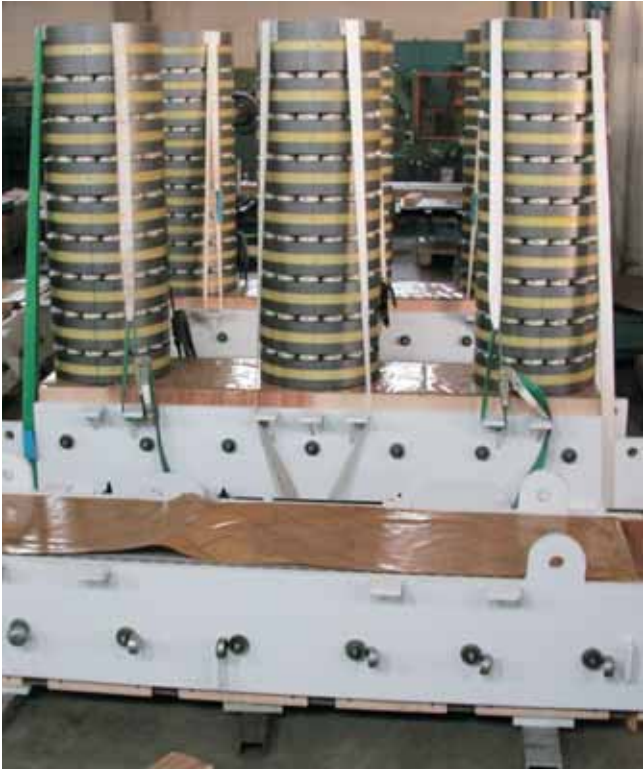
Transducer Cores are being manufactured upon the customer specification and by wound technology. Complete manufacturing with copper bars is also applicable. You can also see on the left side the assembly between transformer and rectifier.

OTHER TYPES OF REACTORS



ENPAY is also manufacturing reactor cores in various characteristics which are widely used in diverse area of industry; e.g. Current Limiting Reactors, Reactors for HVDC Applications, Series Reactor for Electric Arc Furnaces, Filter Reactor, Bus-tie Reactor, Neutral Grounding Reactors, Petersen Coils (Arc-Suppression Reactors), Capacitors-Inrush Reactors etc. On the photos such reactors are shown.

SHUNT REACTOR CORES



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