GRAIN-ORIENTED ELECTRICAL STEEL

APPLICATION ENGINEERING GUIDE

This guide provides engineering recommendations for the selection and application of OSAN grain-oriented electrical steel in transformer and reactor systems for maximum efficiency and reliability.

1. SERIES POSITIONING

Series	Performance Level	Core Loss (W17/50)	B_8 @ 800 A/m (T)	Key Characteristics
PHD	Premium High Efficiency	0.60 – 0.80	1.90 – 1.92	Ultra low core loss, very high permeability, maximum efficiency
PH	High Efficiency	0.80 – 0.95	1.88 – 1.91	High permeability, low core loss, balanced performance
PG	Standard Performance	1.20 – 1.55	1.80	Cost-effective solution, standard performance, reliable operation

2. TRANSFORMER APPLICATION MATRIX

Application	Transformer Type	Recommended Series	Performance Focus
Power Transmission (Extra High Voltage)	Large Power Transformer	PHD	Maximum efficiency, minimum no-load loss
Power Distribution (High Efficiency)	Power Transformer	PH / PHD	High efficiency, low core loss
Distribution (General Purpose)	Distribution Transformer	PH / PG	Optimized cost, reliable performance
Renewable Energy (Wind / Solar)	Generator Step-up Transformer	PH / PHD	Dynamic load stability, efficiency
Industrial Systems (Reactor / Choke)	Shunt Reactor Series Reactor	PG / PH	Magnetic stability, low loss

3. CORE LOSS vs FLUX DENSITY (REFERENCE)

- Lower core loss at the same flux density improves efficiency.
- PHD series provides the lowest core loss performance.

4. CORE DESIGN CONSIDERATIONS

Core Structure	Step-lap or multi-step core design is recommended to minimize air gaps and reduce loss.
Lamination Factor	High lamination factor (94.5 – 98.0%) improves magnetic performance and reduces no-load loss.
Stacking	Precision cutting and high quality stacking ensure low vibration, low noise and high efficiency.
Joint Design	Mitred or step-lap joints reduce magnetic flux leakage and improve core performance.

5. TYPICAL OPERATING CONDITIONS

Parameter	Specification
Operating Frequency	50 Hz
Magnetic Flux Condition	B_8 @ 800 A/m
Temperature Range	Standard transformer operating range (typcically -25 °C to +40 °C)
Cooling System	Oil-immersed / ONAN / ONAF / OFAF
Environment	Indoor / Controlled humidity
Humidity Resistance	Inorganic coating provides excellent insulation stability in high humidity

6. MATERIAL SELECTION GUIDE

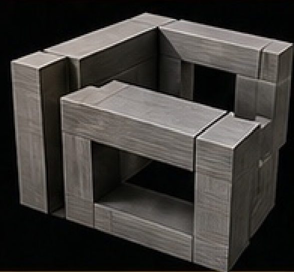
Design Requirement	Recommended Series	Reason
Maximum efficiency minimum no-load loss	PHD	Lowest core loss and highest permeability
High efficiency, balanced design	PH	Good balance between performance and cost
Standard performance cost sensitive	PG	Reliable performance at optimized cost
High flux density design	PHD / PH	Higher B_8 for compact core
Renewable energy systems	PH / PHD	Dynamic load capability and low loss
Distribution networks	PG / PH	Optimal for cost and performance

7. PERFORMANCE SUMMARY

Parameter	PHD Series	PH Series	PG Series
Core Loss (W17/50)	0.60 – 0.80	0.80 – 0.95	1.20 – 1.55
B_8 @ 800 A/m (T)	1.90 – 1.92	1.88 – 1.91	1.80
Permeability	Very High	High	Standard
Efficiency	Highest	High	Standard
Thermal Stability	Excellent	Very Good	Good
Application Level	Critical Systems	High Performance	Standard Systems

8. ENGINEERING NOTES

- Transformer efficiency depends on material properties, core design, manufacturing quality and operating conditions.
- Proper material selection and core design can significantly reduce losses and improve system efficiency.
- OSAN grain-oriented electrical steels are manufactured to IEC 60404-2 standards ensuring consistent performance and reliability.



TEST CONDITIONS (REFERENCE)

Frequency	50 Hz
Core Loss Measurement	W17/50
Flux Density Measurement	B_8 @ 800 A/m

COATING / INSULATION REFERENCE

Coating Type	Inorganic insulation coating
Base Layer	Forsterite (Mg_2SiO_4)
Application	Both surfaces

DIMENSIONAL REFERENCE

Thickness Range	0.23 / 0.27 / 0.30 / 0.35 mm
Width	900 – 1250 mm
Length	Coil