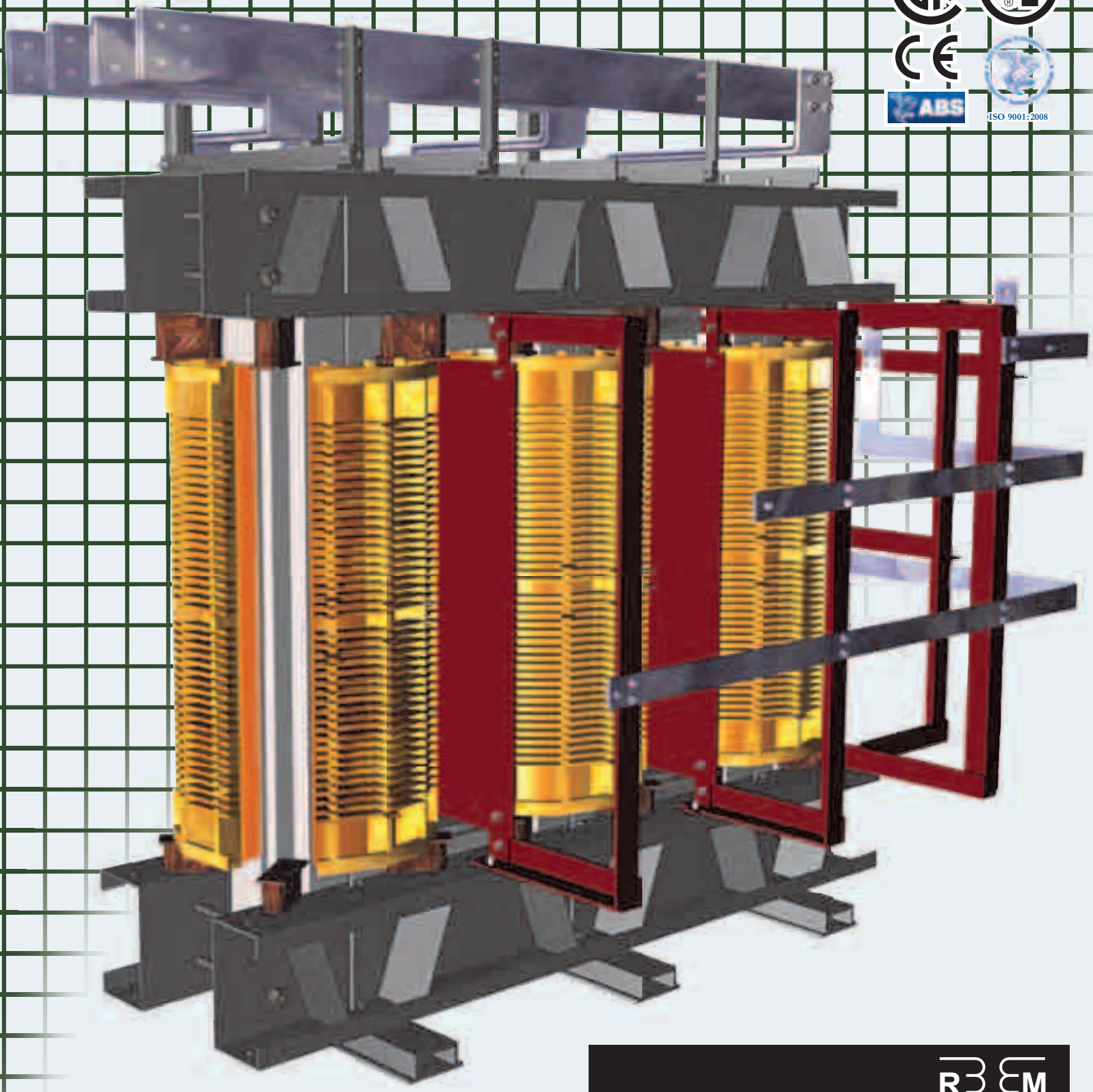
DRY TYPE POWER TRANSFORMERS

VACUUM PRESSURE EPOXY IMPREGNATION • CAST COIL



REX POWER MAGNETICS

A Division of Transfactor Industries Inc.
Concord, Ontario, Canada

REX POWER MAGNETICS POWER TRANSFORMERS

REX POWER MAGNETICS

Rex Power Magnetics, established in 1972 is an ISO 9001 registered **leading manufacturer** of CSA certified and UL listed **custom dry type Transformers.** Rex is **driven by technology, innovation, and customer service,** and has a track record of sustained profitable growth. With a central and integrated engineering, manufacturing, and customer service facility located just north of Toronto, Ontario, Canada, and warehouses throughout Canada and the United States, the company offers a **broad range of dry type power magnetic products** to markets throughout North America and internationally.

The Rex product line includes custom designed specialty transformers, Power Transformers up to 15 MVA and 35,000 Volts, distribution transformers, reactors, autotransformers, control and machine tool transformers, custom enclosures, custom cut electrical steel cores, and other power magnetic products and services. Supported by considerable and **sustained investment in research and development,** new and automated equipment, and efficient processes Rex Power Magnetics continually expands and enhances its product and service offering.

We pride ourselves: firstly in our **superior delivery responsiveness** supported by our passion for customer service and our vertically integrated in-house design, manufacture, and testing capabilities; and secondly in our **Technology leadership** supported by our industry leading R&D effort, engineering expertise, technical competence, and manufacturing know-how.

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Rex Power Magnetics is proud to have been recognized as one of

Canada's 50 Best Managed Companies

REX POWER MAGNETICS

CANADA'S 50 BEST MANAGED COMPANIES

APPLICATIONS FOR MEDIUM VOLTAGE DRY TYPE POWER TRANSFORMERS

Rex dry type power transformers are primarily designed for stepping down high voltages from transmission and distribution systems to utilize voltages in commercial and industrial, institutional or utility applications. They are ideally suited for both indoor and outdoor applications.

Dry type power transformers require minimal maintenance to provide many years of reliable trouble free service. Unlike liquid filled transformers, which are cooled with oil or a fire resistant liquid dielectric, dry type units utilize only environmentally safe, CSA and UL recognized high temperature insulation systems. Every dry type design provides a safe and reliable power source that does not require fire proof vaults, catch basins or the venting of toxic gasses. These important safety factors allow the installation of dry type transformers inside buildings close to the load, which improves overall system regulation and reduces costly secondary line losses.

Rex Power Magnetics provides quality dry type power transformers up to 10 MVA at 44 kV and 200 kV BIL. Some of their applications are:

- **Power Distribution**
- **Indoor or Outdoor Primary and Secondary Unit Substations**
- **Grounding Transformers**
- **Mining, Pulp, and Paper Application Transformers**
- **Corrosion Resistant Transformers for Marine Power Distribution**
- **Low Electromagnetic Field Emission Transformers For Hospital and Institutional Use**
- **Traction Power Rectifier Transformers for Transit Systems**
- **Motor Starting & Drive System Applications**
- **High-Harmonic and Intermittent-Load Applications**

REX POWER MAGNETICS' TECHNICAL CAPABILITY

Rex Power Magnetics has the engineering capability to design, manufacture, and test all standard and specialty dry type transformers, related magnetic products, and power transformers rated up to 10 MVA and 200 kV BIL. All Rex products are CSA certified and most are UL listed, including power transformers. CE marking and ABS marking are also available.

Rex Power Magnetics maintains a complete sheet metal fabrication and paint facility to produce its own transformer enclosures, core clamps, brackets, and accessories, as well as manufactured custom enclosures.

The Rex engineering and design team consists of highly competent and qualified individuals with many years of transformer design experience.

STANDARD REX POWER TRANSFORMER DESIGNS

Cast Coil Transformers: The ultimate dry type transformer for use in harsh environments.

Drive Isolation Transformers: Specifically designed to meet the requirements of AC and DC variable speed drives or rectifier units. Available in 6-pulse, 12-pulse, 18-pulse, and 24-pulse.

Electrostatically Shielded Transformers: Designed to protect systems from high-frequency transients that occur due to switching and loading on distribution lines.

Energy Efficient Transformers (Green Star): Designed to perform with lower than standard conductor and total losses which result in greater life expectancy, lower operating costs, and significant overload capabilities. Rex Power Magnetics Transformers are built to meet and exceed CSA C802 and NEMA TP-1 (DOE) standards.

Non-Linear Load (K-factor Rated): Power transformers for use where harmonic currents are present. Available in all ratings, for example K4, K9, K13, K20, K30, etc.

Low E.M.F. Emission Transformers: Designed to allow very low electromagnetic field emission outside of the enclosure.

Low Sound-Level Transformers: Designed to emit lower than normal audible hum.

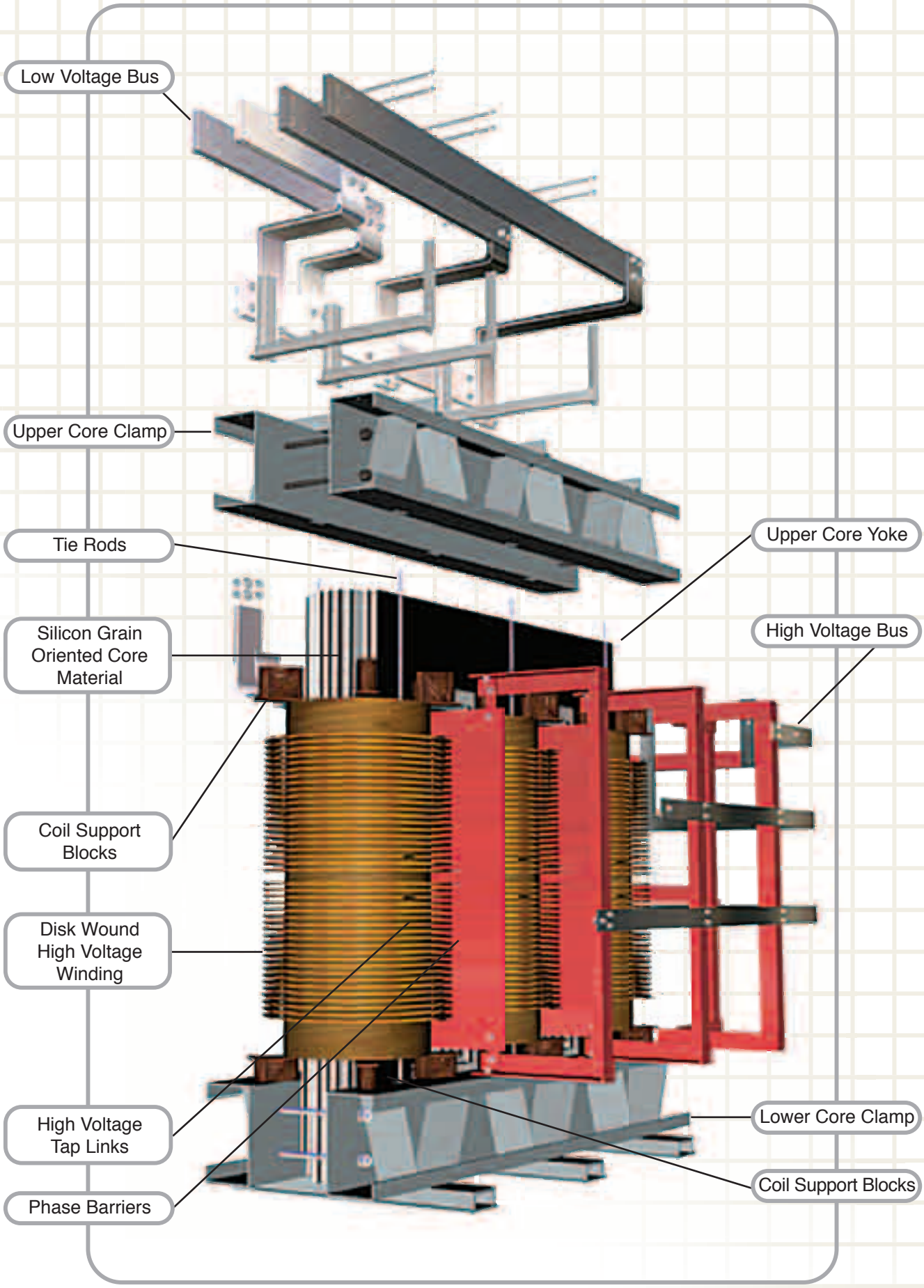
Special Frequency Designs: Can operate at frequencies other than 60Hz.

VPI and Epoxy Dipped Windings: All Rex Power Magnetics transformers windings are vacuum pressure impregnated and polyester resin. For applications with harsh operating conditions or where airborne contaminants are present an epoxy resin coating can be added to the polyester impregnated coils.

OPTIONAL ACCESSORIES:

- Provisions for future fans or fan packages completely installed with or without control power
- Bus coordination with primary and secondary switchgear
- Dial type or digital thermometers to monitor winding temperatures
- Neutral grounding resistors and monitors
- Strip heaters to avoid condensation when the transformer is not energized
- Ground fault relays
- Anti-vibration mountings to reduce transmission of vibration to the surrounding structure
- Provision for seismic mounting or seismic snubbers and restraints
- Lighting arrestors: distribution, intermediate, or station class
- Provisions for rolling, skidding, and lifting
- Provisions for bus duct entry
- Mimic bus
- Key interlock systems
- Fully insulated bus
- Special enclosures, NEMA 1, NEMA 3R (with or without filters), NEMA 4, NEMA 12; special paint or material

TYPICAL CONSTRUCTION OF A MEDIUM VOLTAGE POWER TRANSFORMER



COIL CONSTRUCTION

Rex power transformers utilize either barrel or disk wound coil construction. Winding type selection is determined by the design, which will provide the optimum combination of short circuit strength, impulse distribution, and dielectric withstand characteristics. All windings are insulated to withstand surge voltages and basic impulse level. Primary windings are manufactured of high quality Nomex wrapped copper or aluminum conductor.

Low voltage windings may be strip (foil) wound and are constructed to be electrically balanced to reduce axial short circuit forces.

BARREL WINDINGS:

This construction consists of progressively wound turns of magnet wire from one end of the coil to the other. Layers are electrically insulated by solid sheet insulation and cooling ducts.

DISK WINDINGS:

This construction is achieved by winding the conductor into slotted spacers (combs) that are arranged around the circumference of the coil. The continuous series-connected disk winding provides a high capacitance which improves the distribution of the impulse wave throughout the winding. Cooling efficiency is also maximized by exposing a large surface area of the conductor to the air.

VACUUM PRESSURE IMPREGNATION (VPI)

Subjecting coil windings to VPE treatment ensures that Rex Power transformers have outstanding electrical, thermal, and mechanical properties.

At the conclusion of the winding process, the completed transformer coil is prepared for impregnation by preheating to reduce moisture. The drying process is completed when the coil is subjected to full vacuum in a vacuum chamber removing all the moisture absorbed by the insulation from the atmosphere.

A clear, low-viscosity high temperature epoxy resin (Class 220°C) is introduced into the tank under vacuum, eliminating any air bubbles in the resin. When the winding is completely submerged, pressure is applied forcing the resin into all winding spaces and voids in the turn-to-turn and layer-to-layer insulation.

The vacuum/pressurization cycle is repeated four times to achieve full resin penetration. The coil is then removed from the chamber and placed in a baking oven to cure the resin. The entire vacuum impregnation process is repeated twice to ensure a uniform protective, hard and impermeable coating is formed on all exposed surfaces of the winding.

As an option and for greater protection, the coils can be coated with an additional layer of high-viscosity heat-cured epoxy resin.

INSULATION

The life span of the insulation is the main determinant in the longevity of the transformer. The working temperature of the transformer affects the life of the insulation. This working temperature is a combination of the *temperature rise* of the unit, the ambient temperature, and the *hot-spot temperature rise.*

Rex power transformers are manufactured with Class 220°C insulation materials. Only high temperature resistant materials of the best quality are used, including Nomex Aramid papers, silicone or polyester coated fiber-glass, Nomex sleeving, glass tapes and polyester/glass duct sticks.

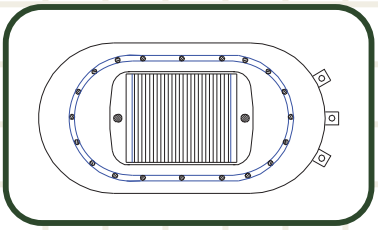
CORE CONSTRUCTION

Every Rex power transformer core is constructed from electrical grade, cold-rolled grain-oriented silicon steel of M5 grade or better. Grain-oriented steel is utilized for its superior magnetic permeability, low hysteresis, and eddy current losses. Steel is cut into individual laminations on automated cutting machines to ensure precise and consistent dimensions.

Core laminations are meticulously stacked on specially designed jig tables. The individual laminations of the core are then clamped together by structural grade steel core clamps. Once the core is complete, an epoxy coating is applied to guard against corrosion. Cores are of either a rectangular or cruciform configuration. The core configuration is a design consideration chosen to optimize efficiency and dimensional factors. With either configurations, either the butt lap stacking method or the full mitre stacking method can be utilized.

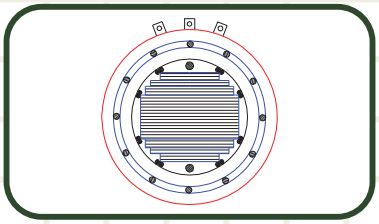
RECTANGULAR CORE

This configuration is used mainly for smaller units constructed with layer wound coils.



CRUCIFORM CORE

This configuration is utilized mainly for large round windings. The core shape is stepped to give as close as possible coupling with the round coils, which inherently have higher short circuit capability.



POWER TRANSFORMER LOSSES:

Losses of transformer mainly consist of:

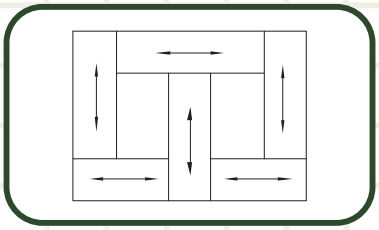
1. Conductor losses which are proportional to the load and vary with loading.
2. Core losses which are constant and are present as long as the transformer is energized.

Since most transformers are energized at all times, regardless of the loading, it is therefore evident that reducing the core losses will result in significant energy and cost savings.

CORE STACKING METHODS:

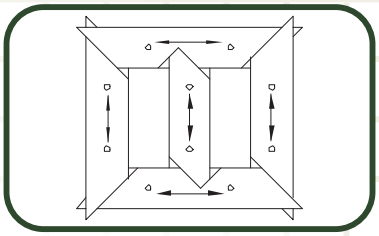
BUTT LAP CUT *(Good Efficiency)*

Consists of rectangular pieces of core steel arranged in such a way so that the grain orientation of the steel is along the flux path except in the corners where the flux path changes direction from the legs to the yolk members.



FULL AND STEP LAP MITRE *(Best Efficiency)*

This type of core cutting and stacking ensures that the overlapping of the joints in the corners are mitred and staggered so that the best possible grain orientation and flux transition is achieved. By avoiding crowding of the flux lines, low core losses are achieved and therefore the best efficiency.



CAST COIL DRY TYPE TRANSFORMERS

The unique design and manufacturing process of cast coil type transformers offers several key advantages over liquid filled or conventional dry type transformers. Specifically, cast coil type transformers are environmentally safe units, providing long uninterrupted service in the most demanding applications and under the most severe conditions.

The most important distinguishing feature of the cast coil transformer design is that the primary and (optionally) secondary coils are solidly vacuum-cast in epoxy resin. The casting process effectively locks the windings in a very strong, high-dielectric resin which protects the transformer from extremely severe environments and electrical demands. During the casting process, the coil windings — layered with absorbent fiberglass — are fully and completely impregnated with the epoxy resin. The result is a coil construction which provides the following key features:

SUITABILITY FOR HARSH ENVIRONMENTS

Cast coil type transformers offer the greatest degree of protection against the presence of moisture and atmospheric pollutants affecting the performance and life expectancy of dry type transformers.

HIGH SHORT CIRCUIT STRENGTH

The fiberglass reinforced solid cast construction provides superior mechanical strength with the highest short circuit withstand capability of all transformer types including that of liquid filled units.

HIGH OVERLOAD CAPABILITY

Due to the longer thermal time-constant of cast coils in comparison with conventional ventilated dry type transformers, higher short-time overload capabilities are possible.

ENVIRONMENTALLY FRIENDLY

Cast coil transformers contain only chemically non hazardous materials.

SAFETY

Cast coil transformers are self extinguishing, virtually eliminating the possibility of fire or explosion. Installations do not require special fire protection systems.

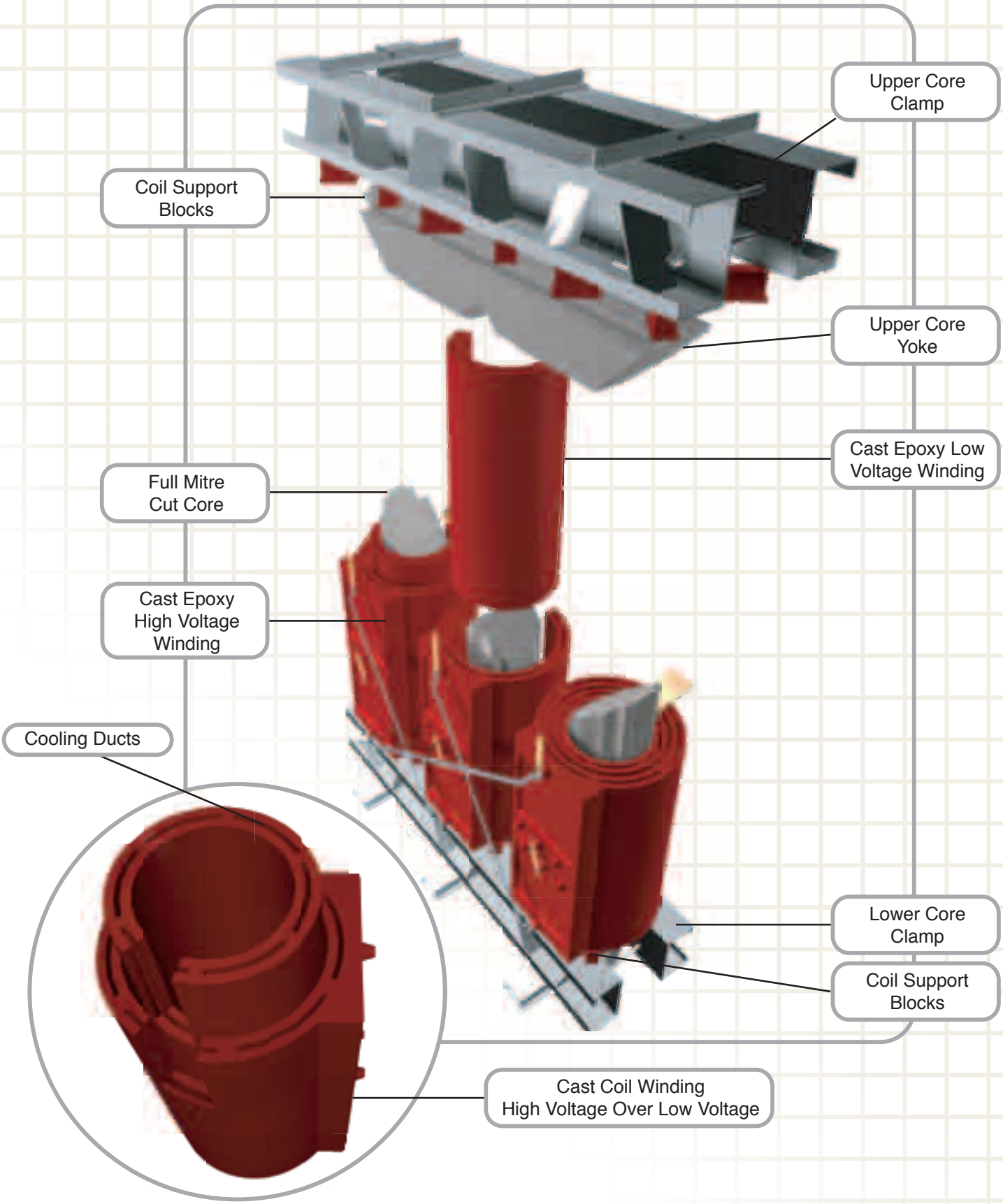
HIGH IMPULSE VOLTAGE STRENGTH

The impulse voltage withstand capability of cast coil transformers is higher than conventional dry types and is comparable to liquid filled units.

LOW MAINTENANCE

Cast coil type transformers are virtually maintenance free due to the smooth crevice-free construction of the coils. With proper precautions cast coil units can be installed at ambient temperatures as low as -50°C and can be energized from a cold start at full rating.

TYPICAL CONSTRUCTION OF A CAST COIL TRANSFORMER:



DESIGN AND CONSTRUCTION FEATURES OF CAST COIL TRANSFORMERS

- The primary and secondary windings are magnetically and electrically balanced to minimize mechanical stresses due to short circuits and momentary overloads, especially those due to axial forces.
- Unique coil construction techniques are used to reduce the dielectric stresses due to uneven distribution during impulse. The dielectric stresses are such that partial discharges are virtually non-existent at 120% overvoltage. The basic construction of the cast resin has high permittivity material in the series capacitance paths. The result is a more linear distribution of transient voltages.
- The epoxy used in casting the coils is a two-part very low viscosity resin with excellent penetration capabilities and superior thermal shock performance. Extensive use of fiberglass reinforcement during coil construction enhances the strength and crack-resistance of the finished coils.
- Conductor and inter-layer insulation used during coil construction are Aramid paper (Nomex) and the casting epoxy resin is approved for use in 180°C systems.
- Each coil is preheated in its casting mold which must be specifically designed to withstand vacuum. The preheated mixed epoxy is then introduced under high vacuum into the mold. The procedure of pulling vacuum directly into the mold ensures the great penetration and most void-free casting possible. The filled mold is then subjected to a programmed pre-bake, bake, and post-bake cycles that can last from 16 to 30 hours to relieve the casting of all residual stresses before removing the finished coil from the mold.
- The primary and secondary coils are cast separately and assembled on the core. Special axial clamping techniques are used to give uniform pressure while allowing for thermal expansion and ensuring maximum creepage distance between the coils. This type of assembly also provides better isolation between the coils by reducing the number of creepage paths and increasing the lengths of these paths where they exist.

COMPARISON WITH OTHER TRANSOFRMER TYPES

- Cast coil transformers are ideal for use in installations where environmental restrictions discourage the use of liquid filled units.
- Cast coil units require very little maintenance in comparison to liquid filled transformers, which require regular maintenance to check gauge levels as well as periodic sampling and testing of cooling fluids. Low maintenance type transformers are preferable for inallation in harsh environments where regular maintenance routines are difficult or inconvenient to perform.
- The initial cost of cast coil type transformers is comparable to silicon filled units and is higher than the cost of conventional ventilated dry types. Although the equipment cost is marginally higher, the installation cost of cast coil transformers are similar to that of conventional dry type units and significantly lower than liquid filled transformers.
- Cast coil transformers are as adaptable as conventional ventilated dry type transformers allowing for easier coordination with other equipment compared to liquid filled units.
- Cast coil transformers are designed with a long thermal time-constant. This results in a transformer with superior short-term overload capabilities.
- The solid epoxy, fiberglass-reinforced cast construction produces coils that have outstanding mechanical strength which results in unparalleled short circuit withstand capabilities. This high short circuit withstand and the short-term overload capabilities of cast coil transformers make them ideal for heavy industrial installations such as automotive manufacturing and rapid transit/traction power applications.
- When specifying transformers there are many different types and many different options to consider, all of which can provide many years of satisfactory service when installed and maintained properly. However, cast coil type transformers offer a long life with practically maintenance-free operation in nearly any environment.

ENERGY EFFICIENT POWER TRANSFORMERS

All Rex power transformers are **Green Star *Premium* Energy Efficient Transformers.** These units are built to the current Canadian and U.S. required level of efficiency, which is often referred to as the C802 or D.O.E. level.

With ongoing improvements in transformer materials and design, as well as the rising cost of energy, higher and higher levels of transformer efficiency are becoming achievable and economically feasible. Transformers, despite being inherently efficient devices, always have losses that appear in the form of heat. When there is little or no load connected to the transformer, the power needed to keep the transformer energized consumes electricity (core losses). When the loading is increased, the resistance of the conductors in the windings begin to contribute and becomes the primary source of loss (load losses). Rex transformers use higher-grade materials and superior construction methods to reduce both types of losses, achieving ultra-high efficiency levels.

Ultra-high efficiency units are designed with lower core flux density and lower operating temperature-rise (i.e. 80°C or 115°C). This approach has a further benefit, as it gives the transformer additional overload handling capability and better short-circuit withstand strength.

Rex has performed a study and costing-analysis to investigate the value of electrical cost savings gained by installing ultra-high efficiency transformers. Our analysis included transformers with B.I.L. ratings of 45 kV, 95 kV, and 125 kV. Findings included the following:

- The U.S. Department of Energy has defined the "CSL-3" efficiency level, which is a higher level than what is currently legislated. Even with conservative estimates for loading percentage and cost-of-electricity, the incremental cost for upgrading to such a unit **will be recovered in less than 5 years.**
- In applications where the average loading is greater than 50% of rated capacity, **dramatically rapid payback may be realized.**
- With today's costs for electricity, transformers with efficiency levels that are approximately 5% higher-than-legislated offer attractive savings that will **pay back for themselves in 2 — 3 years.**

The Rex Power Magnetics website offers a free transformer efficiency and cost analysis tool. The *Rex Transformer Efficiency Comparator* allows you to enter parameters such as your loading percentage and cost of electricity. Using transformer loss data and purchase price, the tool can present analyses such as payback periods and a profile of the transformer's efficiency across the range of loading factors.

The tool graphically illustrates the efficiency of the transformer throughout the range of loading. The software requires that the user enter their projected cost for electricity and loading percentage. Using this information, it can show when the additional cost for a more efficient transformer is recovered in saving of electricity.

www.RexPowerMagnetics.com

LOW E.M.F. SHIELDED TRANSFORMERS

APPLICATION: Power frequency electromagnetic fields from electrical distribution systems are virtually omnipresent. The closer to a source the higher the field intensity, be it a transformer, feeder run, or switch gear.

To prevent interference with sensitive electronic equipment and to satisfy possible health concerns, major magnetic field "polluters" can be located in remote areas of a building. However, this is not always possible or practical and may add additional costs or limit useful space.

Solution: The installation of electrical equipment designed with low electromagnetic field emissions.

Rex Power Magnetics has developed a complete line of Low Emission power and distribution transformers that have the external stray flux attenuated by 95% or better than the standard transformer field emission.

Unshielded transformers 300 – 3000 kVA produce electromagnetic fields in the order of 100 – 500 milligauss in the immediate vicinity of the unit. Rex's specially designed shielded transformers can lower these emissions by a factor of 10 or better depending on the specification.

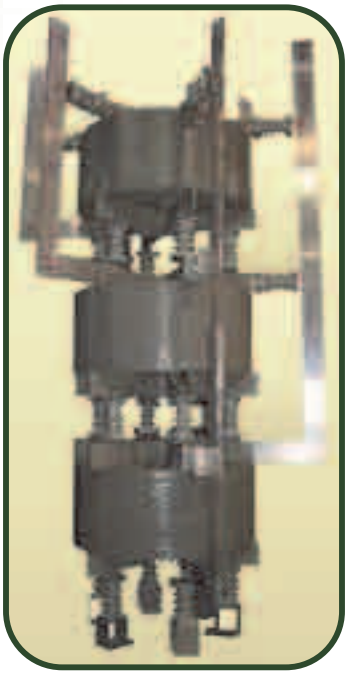
This allows for the transformers to be located at practically any location in a building without any restrictions due to intrusive magnetic fields.

UNIQUE APPLICATIONS AND CUSTOM DESIGNS

Besides our custom transformer offerings, Rex Power Magnetics is also structured and prepared to work with our customers on very unique and specialized projects. Our engineering department's focus on continual research and product development means we have the resources to offer unique and practical solutions to a wide variety of needs, in industries ranging from aerospace to medical test equipment.

The following is a list of magnetic devices built for specialized customer requirements in recent years:

- Variable-output high-current test set for testing circuit breakers
- High Capacity Neutral-Grounding Zig-Zag transformer
- Heavy clamped and reinforced cores for Inductive heating
- Transformer mated to an automatic drive-controlled vacuum-tap changer
- Magnetics built for integration with UPS and voltage regulation system
- Ultra low-profile mining transformers
- Multiple reactance iron-core reactor
- Current limiting air core reactors



TESTING

Every power transformer supplied by Rex Power Magnetics receives the following standard production tests:

- **Resistance Measurement:** Measures the DC resistance of the windings to ensure integrity.
- **Ratio Test:** Determines that the ratio of the turns in the primary winding to the turns in the secondary windings is correct.
- **Polarity and Phase Relation Test:** Compares the instantaneous direction of the current and voltage in the primary relative to the secondary to determine the angular displacement and phase sequence. Determining the polarity is particularly important when paralleling or banking two or more transformers.
- **No-Load Loss and Excitation Current Test:** Measures the losses in a transformer operating at rated voltage and frequency under no load conditions. These losses include core loss, dielectric losses, and I2R losses from no-load current flow in the primary winding.
- **Load Loss Test:** Measures losses in the windings resulting from full load current flow and stray losses due to magnetic leakage to the core clamps and other structural members.
- **Impedance Test:** Measures the voltage required to circulate rated current through the windings.
- **Applied Potential Test:** Determines the dielectric strength of the insulation between windings and between the windings and ground.
- **Induced Potential Test:** Checks the dielectric strength and integrity of the turn-to-turn and layer-to-layer insulation.
- **Basic Impulse Insulation Level (BIL):** A dielectric test consisting of a high frequency instantaneous impulse voltage applied to the windings to determine the ability of the unit to withstand overvoltage surges.
- **Temperature Rise Test:** The transformers are tested under loading conditions that give losses as near as possible to the nameplate rating to ensure its ability to operate within its designed temperature limit.
- **Partial Discharge Test (Corona):** An induced voltage is applied to the transformer to determine corona. Corona is a type of localized discharge resulting from transient gaseous ionization in the insulation system under voltage stress.
- **Sound Level Test:** Measures the level of sound (transformer hum) emitted by the transformer.

AVERAGE AUDIBLE SOUND LEVEL

VENTILATED SELF COOLED

KVA RATING	LINE TO LINE VOLTAGE CLASS UP TO 15 KV 95 KV BIL	ABOVE 15 KV VOLTAGE CLASS UP TO 125 KV BIL
300-500	60db	62db
501-750	62db	64db
751-1000	64db	66db
1001-1500	65db	67db
1501-2000	66db	68db
2001-3000	68db	70db
3001-4000	70db	72db
4001-5000	72db	74db

STANDARD IMPEDANCE RANGE

VOLTAGE CLASS	UP TO 2000 KVA	OVER 2000 KVA
5.0 KV	4.0-6.0 %	6.0-7.0 %
8.7 KV	4.5-6.5 %	6.0-8.0 %
15.0 KV	5.5-7.0 %	6.5-8.0 %
25.0 KV	6.5-7.5 %	7.0-8.5 %
35.0 KV		

BASIC IMPULSE LEVELS (BIL)

BIL FULL AND CHOPPED WAVE KV CREST

VOLTAGE CLASS (KV)	CSA STANDARD	REX MFG STD.
2.5 KV	20	30
5 KV	30	30
8.7 KV	45	60
15 KV	60	95
18 KV	95	110 or 125
25 KV	125	125
35 KV	150	150

REX STANDARD ENCLOSURES

Rex power transformer enclosures are designed and manufactured to protect against accidental contact with the enclosed transformer, while protecting the transformer core and coil from a variety of different operating conditions. Rex enclosures are fabricated and painted in-house to ensure stringent controls over quality and a broad variety of custom features to match your coordination requirements.

NEMA 1

A general-purpose indoor ventilated enclosure designed to provide a limited degree of protection against falling dirt particles. It is commonly utilized indoors for commercial and industrial applications.

NEMA 2

A general-purpose indoor ventilated enclosure designed to provide a degree of protection against dripping and light splashing of non-corrosive liquids and falling dirt particles.

NEMA 3R

A general-purpose ventilated enclosure for either indoor or outdoor use, designed to provide a degree of protection against rain, sprinklered water, and snow. Ideal for sprinklered commercial applications, severe industrial environments, and outdoor applications.
Note: For outdoor applications, Rex recommends the installation of optional ventilation filters.

NEMA 4

A non-ventilated enclosure for either indoor or outdoor use, constructed to provide a degree of protection against windblown rain, snow, dust, and splashing water. Hose-directed water, and to be undamaged by the formation of ice externally. Ideal for industrial and commercial applications in harsh environments or where severe weather conditions are likely.

NEMA 4X

A non-ventilated enclosure identical to NEMA 4, but with added corrosion resistance. Ideal for industrial applications such as food processing, refineries, and mining.

NEMA 12

An indoor enclosure constructed to provide a degree of protection against circulating dust, lint, fibers, and flings. It also provides protection against dripping and light splashing of non-corrosive liquids. Ideal for industrial applications such as mills, refineries, or mines.

NEMA 1

NEMA 3R

NEMA 3R with filters

DIMENSIONS AND WEIGHTS THREE PHASE POWER TRANSFORMERS

	DIMENSIONS FOR CORE AND COIL ASSY CLASS 220°C INSULATION (150°C RISE)					ENCLOSURE DIMENSIONS STUBS-UP PADS ARRANGEMENT				
KVA	WIDTH	DEPTH	HEIGHT	WEIGHT		WIDTH	DEPTH	HEIGHT	WEIGHT	TOT. WT.
	DIMENSIONS IN INCHES			LBS		DIMENSIONS IN INCHES			LBS	LBS
5 kV (30 kV B.I.L.)										
300	41.00	30.00	39.00	1900	PDF	46.00	40.00	60.00	500	2400
500	51.00	30.00	46.00	2800	PDF	60.00	45.00	70.00	700	3500
750	60.00	35.00	60.00	3200	PDF	72.00	45.00	80.00	850	4050
1000	62.00	35.00	62.00	4000	PDF	72.00	45.00	80.00	850	4850
1500	66.00	45.00	66.00	7000	PDF	80.00	48.00	91.50	1050	8050
2000	70.00	45.00	70.00	8400	PDF	90.00	60.00	91.50	1250	9650
8.5 kV (45 kV B.I.L.)										
500	60.00	36.00	54.00	3300	PDF	72.00	45.00	80.00	850	4150
750	62.00	42.00	62.00	4500	PDF	72.00	45.00	80.00	850	5350
1000	66.00	42.00	64.00	5000	PDF	80.00	48.00	91.50	1050	6050
1500	70.00	44.00	66.00	6000	PDF	80.00	48.00	91.50	1050	7050
2000	72.00	44.00	68.00	8900	PDF	90.00	60.00	91.50	1250	10150
2500	76.00	50.00	74.00	9700	PDF	90.00	60.00	91.50	1250	10950
3000	80.00	50.00	78.00	11000	PDF	90.00	60.00	100.00	1300	12300
15 kV (60 kV B.I.L.)										
750	66.00	42.00	62.00	5000	PDF	80.00	48.00	91.50	1050	6050
1000	68.00	42.00	64.00	6200	PDF	80.00	48.00	91.50	1050	7250
1500	72.00	44.00	68.00	8000	PDF	90.00	60.00	91.50	1250	9250
2000	75.00	44.00	72.00	9500	PDF	90.00	60.00	91.50	1250	10750
2500	78.00	50.00	77.00	10500	PDF	100.00	60.00	110.00	1450	11950
3000	84.00	50.00	80.00	12100	PDF	100.00	60.00	110.00	1450	13550
3750	90.00	55.00	84.00	17000	PDF	110.00	72.00	110.00	1600	18600
5000	100.00	55.00	96.00	19500	PDF	120.00	72.00	120.00	1900	21400
18 kV (95 kV B.I.L.)										
750	72.00	45.00	64.00	6200	PDF	90.00	60.00	91.50	1250	7450
1000	78.00	45.00	70.00	6800	PDF	100.00	60.00	91.50	1300	8100
1500	80.00	45.00	76.00	8200	PDF	100.00	60.00	110.00	1450	9650
2000	80.00	45.00	80.00	9600	PDF	100.00	60.00	110.00	1450	11050
2500	87.00	50.00	82.00	10800	PDF	110.00	60.00	110.00	1550	12350
3000	95.00	50.00	86.00	13000	PDF	110.00	60.00	110.00	1550	14550
3750	98.00	60.00	88.00	17700	PDF	120.00	72.00	120.00	1900	19600
5000	100.00	60.00	92.00	20500	PDF	120.00	72.00	120.00	1900	22400
25 kV (125 kV B.I.L.)										
1000	80.00	48.00	80.00	7200	PDF	100.00	60.00	110.00	1450	8650
1500	84.00	48.00	82.00	8500	PDF	110.00	60.00	110.00	1550	10050
2000	90.00	50.00	85.00	9800	PDF	110.00	60.00	110.00	1550	11350
2500	92.00	50.00	90.00	11000	PDF	110.00	60.00	120.00	1600	12600
3000	95.00	50.00	95.00	14000	PDF	120.00	60.00	120.00	1900	15900
3750	98.00	55.00	108.00	18500	PDF	120.00	72.00	132.00	2100	20600
5000	100.00	60.00	118.00	21000	PDF	130.00	72.00	130.00	2500	23500

NOTE: Dimensions are estimates and may change. For firm dimensions, consult the office. Dimensions can be changed to accomodate switchgear coordination or other requirements.

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CAT DATE: 08/12