19 INSIDER TIPS!

HOW TO SAVE MONEY ON CUSTOM TRANSFORMERS

PREM MAGNETICS, INC.

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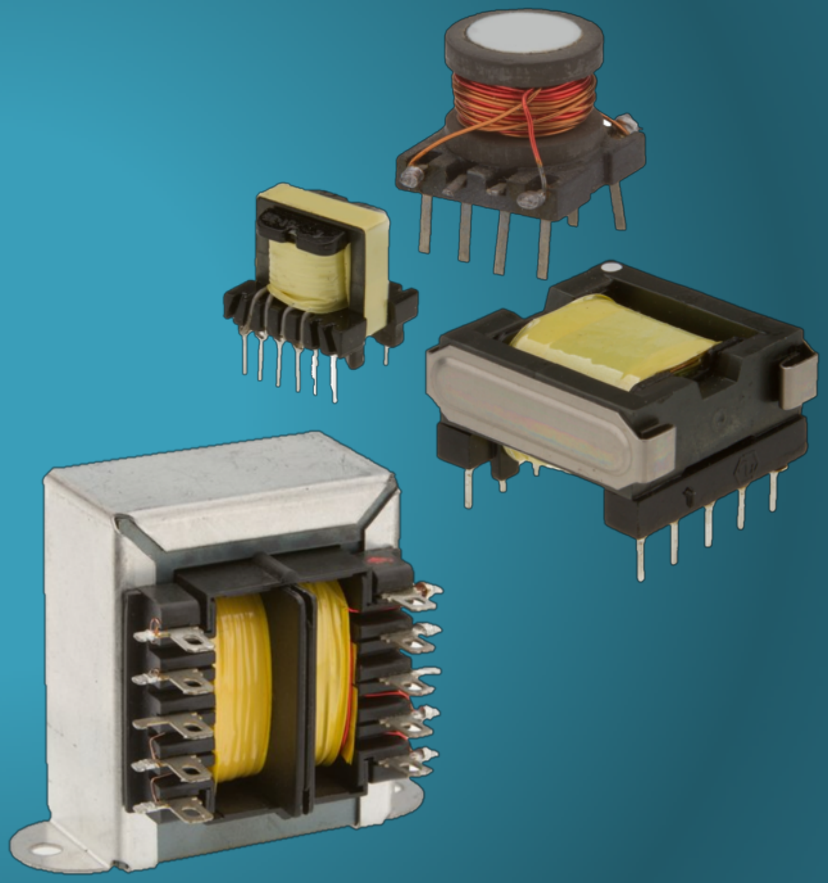


PREM
MAGNETICS, INC.

DO YOU REALLY NEED A CUSTOM TRANSFORMER?

SOME HISTORY: A transformer is an electrical device which, by electromagnetic induction transforms energy from one or more circuits to one or more circuits of the same frequency but usually at a different voltage and current.

The fundamental principles of construction and operation of power transformers has not changed since the time that the first commercial transformers were manufactured. They have been some performance changes. For example, core materials used today have lower losses and better permeability. There have also been some changes in the configuration of the laminated core which allows the design to reduce the profile or height of the transformer to meet various packaging demands.

The transformer coil itself has also seen changes as the industry has moved away from the paper section (stick wound units), to a molded coil form or bobbin which allow transformers to be smaller and lighter in weight.

Standard Products

Today there are numerous standard, off-the-shelf transformers in various sizes and configurations. Standard transformers generally offer the best price and delivery. Following are links to our standard products:

- Audio, Coupling & Telephony
- CRT Display Magnetics
- Inductors
- Instrument Current Transformers
- Line Matching Transformers
- Single Phase, Linear Power Transformers
- Switchmode Transformers

However, if a standard part is not exactly what you need, it's quite possible that a custom part can reduce your cost. So proceed to develop your specification. On this site, we have included a great deal of transformer design information to help your obtain the best custom component for your purposes..

HOW TO SPECIFY A CUSTOM TRANSFORMER

As soon as you know the electrical parameters the custom transformer must meet, contact the technical sales manager at Prem Magnetics, or one of our design engineers.

While the folks that work the order desk may be very sociable, they're best at providing price and delivery information.

We've sometimes had an engineer call up at the last stage of the design process and say that there is a certain open spot of the circuit board that, even with a shoe horn, we could not fit in a transformer meeting the requested power requirements.

Take a few minutes early on to determine the data needed to design your power transformer and pass it along to our technical or design staff. It will eliminate retooling printed circuit boards and late in the design process changes.

Money Saving Tip

Saving money starts with design. Communicate directly with design engineers with your requirements.

Do not attempt to design your customer transformer yourself. Review the information in this site and provide our designers with all available date. (HINT: Use our handy Specification Guide.) This should include the primary voltage and frequency, secondary loads and type of circuit used, regulation, allowable temperature rise, shielding and physical configuration desired. In addition, you need to specify the type of winding termination.

STANDARD CONFIGURATIONS OF CUSTOM TRANSFORMERS

First decide if you need an isolation transformer or if you can get by with using an autotransformer.

ISOLATION TYPE: These consist of a minimum of two windings where the secondary(s) is isolated from the primary(s) winding(s) ensuring limited voltage potential between the primary/input circuit and the secondary/output circuits.

AUTOTRANSFORMER TYPE: The least expensive type consist of one winding tapped or two windings interconnected to provide a step-up or step-down voltage. The secondary winding(s) is common with the primary winding. Normally most isolation type transformers can be redesigned as autotransformers providing a significant cost savings if isolation is not required.

Money Saving Tip

Ask a technical service person or design engineer which configuration best meets your needs.

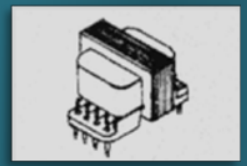

Vertical L Bracket


Horiz. l L Bracket

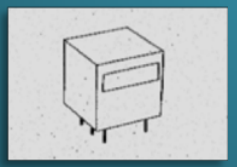

Vert. Channel Frame


Horiz. Channel Frame


Double Shell


Printed Circuit Board


Low Profile


Capped


Gull Wing Lead Style Bell


End Bell


Open Coil & Core


3-Flange Bobbin

PRIMARY RATING OF CUSTOM TRANSFORMERS

It is important to determine the frequency that the transformer will see.

Of course, if you need the 50 Hz and the transformer is designed for only 60 Hz the unit will run hotter, possibly reducing the transformer's life. For high and low line input conditions, primary voltage taps such as 100V, 115V and 130V may be added in the same size unit, through each tap will impact the unit's cost. A dual voltage primary, 115/230 for series or parallel can usually be accommodated except on very small units. In those cases it may be necessary to increase the size of the unit.

Money Saving Tip

Often an engineer will automatically call for 50/60 cycles. However, if the transformer is for domestic use only, this unnecessarily increases the size (as a rule about 20%) and adds cost to the unit.

LOAD VOLTAGE OF CUSTOM TRANSFORMERS

To assure proper design, load information on all secondaries must be determined. It is assumed that all secondary windings are loaded simultaneously and have a continuous duty cycle.

For RMS loads, voltage designed at maximum current should be specified. If a maximum value no load (open circuit) voltage is required, this should also be specified. For DC loads, the type of rectifier circuit, such as half-wave, full-wave center tapped or bridge, with capacitor or reactor input, should be specified. Voltage and current may be specified as either AC or DC values.

Money Saving Tip

The size and price of the unit can be reduced if the duty cycle is less than 100%.

REGULATION OF CUSTOM TRANSFORMERS

Regulation is based upon RMS values of voltage from no load to full load. DC regulation is usually higher than the AC regulation and varies with the type of circuit used.

Transformer Rating
<20 watts: 20% to 30% regulation is normal.
20 to 100 watts: 10% to 20% regulation is normal.
100 to 500 watts: 5% to 10% regulation is normal.

In general, the smaller the size and rating of the transformer, the higher the percentage regulation. Small transformers can have as high as 40% regulation without exceeding a 55ºC temperature rise. Regulation can be improved by reducing IR drops in the windings.

Money Saving Tip

The size and cost of the custom transformer will increase if better regulation is required.

TEMPERATURE RISE OF CUSTOM TRANSFORMERS

Hey, we're not talking about global warming here, but you should be concerned about the temperature rise of your transformer. Rise calculations assume that core and copper losses can be lumped together and this energy is dissipated through the effective area of the core and coil. Higher input voltage and lower frequency will produce greater temperature rise. Duty cycle, if any, should be considered when making rise measurements.

For Class A (105ºC) transformers, a temperature of 55ºC is considered normal in a ambient temperature of 40ºC. Most commercial units are designed at this rating. **Class B (130ºC) transformers** require special insulating materials and should be specified only when a high ambient temperature is encountered or when size restriction causes a higher heat rise.

Heat rise measurements to determine the internal temperatures are usually done by the change of resistance method. Due to greater thermal conductivity, the core or laminations will feel hotter than the coil. A core temperature rise of 30ºC above room ambient (25ºC) will be hot to the touch.

Money Saving Tip

For a given power rating, the size and cost of the custom transformer will increase as the maximum acceptable rise decreases.

DIELECTRIC TEST OF CUSTOM TRANSFORMERS

Generally, twice the maximum rated voltage plus 1000 volts for one minute without breaking down between the windings and between the windings and the core is considered standard practice and is adequate is most cases. a 500V test is normally used between primary windings of a dual primary transformer.

Recently, as we've watched the wonderful world of international approvals develop, we've seen this requirement change to where 3,000 volts primary to secondary is not uncommon. We've also found that creepage and clearance distances have become factors. If you are looking toward the international market, be sure to tell us what approvals are required. In addition to the dielectric test, other testing may include induced voltage, core loss, exciting current, polarity, turns ratios, and full load voltage which actually simulates the actual application.

Money Saving Tip

Further special tests can be performed if required. But additional tests mean additional cost. Ask the custom transformer manufacturer what standard tests they already perform and whether they 100% test (we do!) or use statistical sampling (we don't).

PHYSICAL CONFIGURATIONS OF CUSTOM TRANSFORMERS

Specify the maximum length, width and height available.

Specify the type of mounting, such as printed circuit, channel frame, or L-brackets. Avoid special fabricated parts that substantially add to the cost. Standard transformer hardware is usually adequate.

The method of impregnation is critical in almost all applications. If the part is to be inserted into a printed circuit board and wave soldered you want the impregnation to withstand most aqueous and solvent cleaning systems. (Ahem...Prem's does.) This eliminates the need to post insert the transformer in the board after washing.

Most 100% solids epoxy materials will meet this requirement and provide a superior mechanical bonding of the windings and lamination to minimize 60 Hz buzz. For chassis mounted units, this bonding is also the reason we recommend using an epoxy impregnation process instead of a varnish method.

Specifying the type of winding termination is important. If a printed circuit board application is involved, the design engineer needs to determine if a suitable coil form is available. If the unit requires PVC insulated lead wire you need to specify the lead lengths and the colors. A lead length tolerance of plus or minus 1/4 inch is recommended.

Marking is another consideration. You want to identify the source, the date of manufacture, and perhaps your part number.

Money Saving Tip

- **For a given power rating**, a smaller than average size may force the design engineer to use a premium grade steel and the unit may also run hot. Do you really need it that small?
- **Solder lugs** and quick connect terminals generally cost more than flying leads.
- **Be generous** with mechanical tolerances. This is one of the main reasons for higher costs and delays in finalizing custom transformer designs.

COST SAVING CHECKLIST FOR CUSTOMER TRANSFORMERS

Is 50/60 Hz necessary or could 60 Hz alone be sufficient?

How many taps are necessary, if any at all?

What are the actual leadwire length requirements?

What specific breakdown tests are required? Insulation costs are considerable and over-designing should be minimized where possible.

What mechanical limitations are involved?

What is the duty cycle?

Will the manufacturer permit you to place large quantity orders with significant price breaks and then schedule the shipments are needed? (We do.)

Are standard components available having domestic and/or international safety agency approvals which would allow you to avoid the cost and time needed to get approvals?

Will the manufacturer modify standard components to fit your needs? (We will.)

Are the components already 100% final tested so you can avoid testing costs? (Ours are.)

Will your transformer withstand aqueous and solvent printed circuit board cleaning systems to simplify your cleaning procedures?

Are there middleman markups or can you buy factory direct?

Money Saving Tip

Review these cost saving opportunities with your design engineer early in the process.

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CUSTOM POWER TRANSFORMERS

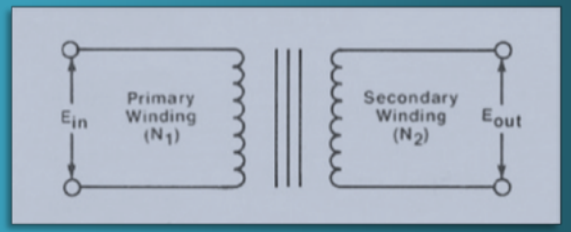
Power transformers change voltage and current from one level to another (as when changing line voltage to the specific voltage required by the circuit). Power transformers normally operate a a single frequency, or within a narrow band of frequencies such as 50 to 60 Hz.

An isolation type power transformer consists of a minimum of two windings where the secondary(s) is isolated from the primary(s) winding(s) ensuring limited voltage potential between the primary/input circuit and the secondary/output circuits.

The autotransformer design is the least expensive type available. It consists of one winding tapped or two windings interconnected to provide step-up or step0down voltages. The secondary winding(s) is common with the primary winding. Normally most isolation type power transformers can be built as autotransformers if isolation is not required.

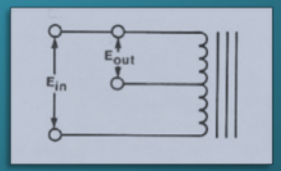
Design Considerations

Input voltage and frequency
Output voltage and current
Type of rectifier circuit and filter
Maximum temperature rise
Regulation: no load to full load
Duty cycle



BASIC TRANSFORMER FUNCTION

ISOLATION TYPE



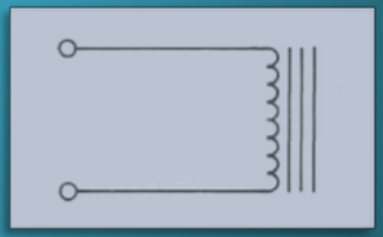
AUTO TYPE

CUSTOM INDUCTORS, REACTORS AND FILTER CHOKES

The Reactor (Inductor, Filter Choke) is a device used to store energy in a magnetic field as a method of providing high impedance to alternating currents (while allowing the flow of direct current). In rectifier circuits, the reactor is used to help smooth the DC rectifier wave shape.

Design Considerations

Inductance at a specific voltage
Current
Frequency
Maximum temperature rise



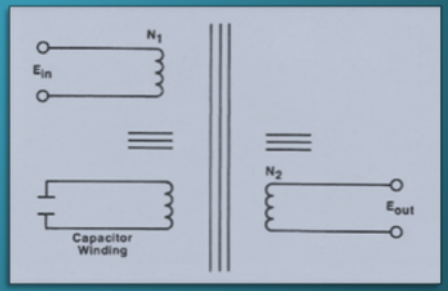
REACTOR TYPE

CUSTOM CONSTANT VOLTAGE TRANSFORMER

Constant voltage transformers are designed to provide constant output voltage with input line fluctuations. Formerly categorized as a power transformer, the unique characteristics of the constant voltage transformer has resulted in it being recognized separately.

Design Considerations

Input voltage
Range and Frequency
Output voltage and current
Output regulation requirement
Harmonic distortion
Maximum temperature rise



CONSTANT VOLTAGE TRANSFORMER

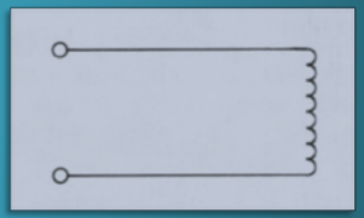
CUSTOM COILS

Coils are an integral part of a custom transformer and are made available through transformer manufacturers. Typical applications are in solenoids and electro-magnetic devices.

Because of its excellent conductivity and ready availability, copper is used in the manufacturer of custom transformer coils. Selection of magnetic wire size and insulation is dictated by the design requirements of the transformer application.

Design Considerations

Number of wire turns
Wire size



COIL

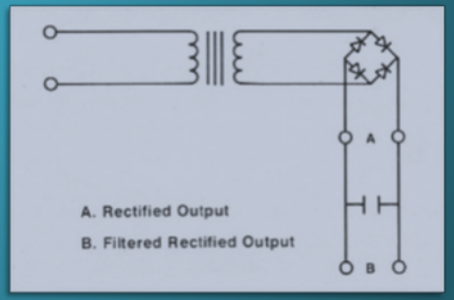
CUSTOM DC POWER SUPPLY TRANSFORMERS

Transformer manufacturers have been successful at saving customers time and money by including a rectifier and if required, a capacitor as a part of the transformer.

This provides DC power from a single component instead of the user adding these additional parts to the circuit board.

Design Considerations

Input voltage and frequency
Output voltage and current
Type of rectifier circuit and filter
Maximum temperature rise
Regulation: no load to full load
Duty cycle



DC POWER SUPPLY TRANSFORMER

ABOUT US

Prem Magnetics was organized in 1972 as the Magnetics Division of Prem Enterprises (a machine shop) to be a manufacturer of coils and transformers. The founders decided to emphasize quality long before quality got the attention it does today. In 1979, Prem Magnetics became a separate Illinois corporation.

After more expansion and growth, Prem Magnetics remains a leader in the transformer industry. We are located roughly 40 miles northwest of Chicago, allowing access to anywhere in the world via numerous shipping hubs.

We are proud of the products we manufacture and look forward to demonstrating how Prem Magnetics can work for you.

Our Products are 100% Tested. Our mission is to provide products of only the highest quality. That is why we 100% Test every product we sell. We work hard to supply products that we are proud to offer to our customers.

Thank you again for visiting our website, and we look forward to doing business with you.

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