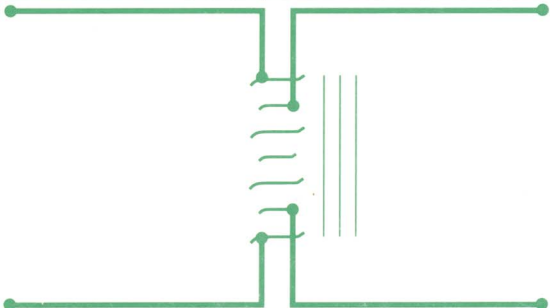
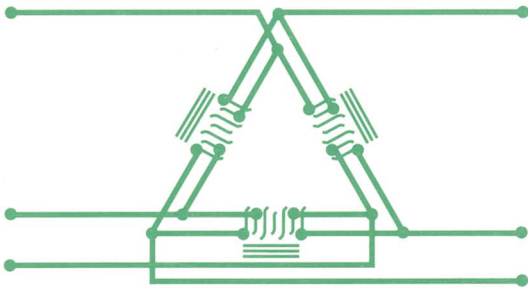


MINI-LOG VI

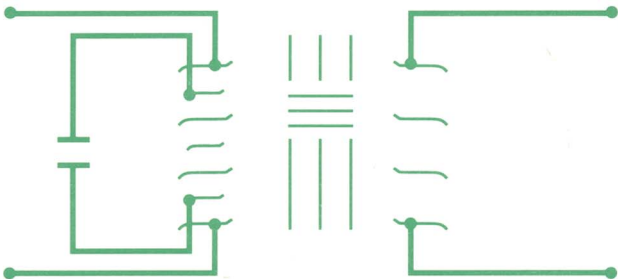
ELECTRICAL LAMINATION CATALOG



SCRAPLESS AND WIDE WINDOW SINGLE PHASE



THREE PHASE



FERRO-RESONANT AND CRUCIFORM



Thomas & Skinner, Inc.

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· FAX 3179235919



MASTER MAGNETICIANS SINCE 1901.

Thomas & Skinner is one of the oldest manufacturers of Permanent Magnets in the United States. Its origins trace back to the Magnet Department of the Esterline Company before the partnership of J. R. Thomas and O. H. Skinner acquired it in 1923.

From the beginning Thomas & Skinner has been a consistent leader in developing new magnetic materials: Transformer Laminations of all types, Alnico 5Cb, Alnico 8C, Alnico 9 and 9Nb.

From initial transformer lamination production in 1927 to serve the infant radio industry, Thomas & Skinner's EI Transformer Lamination operation led the way pioneering large three-phase, wide-window, and "thin-gauge" laminations. From thin (4 to 6 mil) laminations to Orthosil squared hysteresis loop silicon iron alloys, the current product line has grown into seven distinct families, comprising the largest size range available from any manufacturer.

Most recently, the Thomas & Skinner tradition of superior quality and performance has been further enhanced with the acquisition of Ceramic Magnetics, Inc., the premiere supplier of high quality soft ferrites, also joined the T&S family.

Today Thomas & Skinner operates from 3 warehouses, and 5 manufacturing facilities, serving industry in the United States and worldwide.

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Mr. Magnetician



Thomas & Skinner, Inc.

DISTRIBUTION

Thomas and Skinner's Indianapolis plant is centrally located for quick nationwide distribution. Additional warehouse facilities on the east coast (New Jersey) and the west coast (California), backed up by a nationwide sales organization, permit overnight shipment practically anywhere in the United States.

CERTIFICATION OF MAGNETIC QUALITY

Thomas and Skinner is the first manufacturer to provide certification of magnetic quality with each lamination shipment. All T & S laminations are tested and certified under ASTM A-346 specification. The T & S material certifications provide volt amperes per pound, core loss and material lot number. The material lot number identifies and serves as a control on each lot. The material certification is included with the packing slip covering the shipment. Our quality control system conforms to MIL-T9858.



TEST PROCEDURES FOR STANDARD EI LAMINATIONS

Thomas and Skinner EI Laminations are tested under standards set up by ASTM A-346. A reprint of the standard method of test entitled "Alternating-Current Magnetic Performance Of Laminated Core Specimens Using The Modified Hay Bridge Method" is available from ASTM. For reprints and prices, write to:

American Society for Testing Materials
1916 Race Street
Philadelphia, PA 19103
USA

MIL-T-27 LAMINATIONS

Recognizing the need for uniform laminations, the U.S. Signal Corps has specified tooling for the production of laminations to MIL-T-27 specifications. The laminations have the mounting holes offset in the corners, to permit an uninterrupted magnetic path. The lamination sizes available under this program are listed below. The series is designed for .014" Orthosil® M-6. Some sizes are available in 0.004" and 0.006". Also SuPer Orthosil® .007, .009, .011.

MIL-T-27

W/Center Slots	Holes Only	Thickness Available		See Page
EI- 7/8MHS	EI- 7/8MH	.014"		51
EI-1 MHS	EI-1 MH	.004"	.006" .014"	55
EI-1 1/8MHS	EI-1 1/8MH	.014"		59
EI-1 1/4MHS	EI-1 1/4MH	.006"	.014"	62
EI-1 3/8MHS	EI-1 3/8MH	.006"	.014"	65
EI-1 1/2MHS	EI-1 1/2MH	.014"		70

ORTHOSIL

.004"—.006"—.014" LAMINATIONS

SuPer Orthosil® .007, .009, .011

Thomas and Skinner—first to offer oriented electrical transformer irons (Orthosil®) in .004", .006" and .014" thicknesses for your lamination requirements—has led the field in employing this material for lamination manufacture. Orthosil®—a squared hysteresis loop iron-silicon alloy—was expressly developed to provide lower core loss with higher permeability in the rolling direction. The elementary patterns of crystals in the material are "oriented", or so arranged that the axis of easiest magnetization is nearly parallel and aligned in the direction of rolling. The alignment is accomplished by special cold-rolling and annealing processes.

Design and economic advantages in using Thomas and Skinner Orthosil® .004", .006" and .014" laminations in punched and stacked cores are:

1. Lower core losses as a consequence of design.
2. Higher initial permeability.
3. Higher permeability at higher inductions.
4. Controlled gauge uniformity.
5. More compact design—easier installation and mounting of transformers.
6. More economical than cut, tape-wound "C" cores.
7. VA/Temperature relationship is much more stable over a wide range of ambient temperatures as compared to cut, tape-wound "C" cores.
8. Withstands more severe vibration and shock than cut, tape-wound "C" cores.

THREE PHASE LAMINATIONS

The three phase concept for transformers is relatively old. Nevertheless, it was not until 1950 that the lamination problem had become acute. Thomas and Skinner, working with several transformer manufacturers in the aerospace industry, established a thin lamination concept to meet the objectives of these transformer manufacturers.

1. High performance at 400-cycle and higher frequencies.
2. Balanced three phase windings.
3. Transformer cores which could withstand temperature, shock and other severe environmental conditions.
4. Stacked cores which would lend themselves to transformer manufacturing with repeatable performance levels, guaranteeing reliability.

As a result of this program, new designs were developed and the manufacturing problems of thin silicon iron laminations were solved. This original concept at Thomas and Skinner has been extended until today a complete range of sizes, gauges and grades of material are offered. This is the culmination of 30 years of development.

Available sizes run from the small EI— $\frac{1}{4}$ three phase rated at approximately 10.0 watts power handling capacity for a square stack at power line frequencies, to the EI—3.60 three phase lamination rated at 25.0 kilowatts power handling capacity for a square stack at power line frequencies. In between is a complete range of sizes that allows the transformer designer wide latitude in selection of design parameters.

Three phase laminations are available in thin-gauge Orthosil® .004" and .006" thickness from EI— $\frac{1}{4}$ three phase to EI—1.80 three

phase. Most sizes are available in .014" Orthosil® and high permeability M-15 and SuPer Orthosil® .007", .009" and .011".

Special advantages that will ensue from using Thomas and Skinner three phase laminations are:

1. Wider variety of sizes, gauges and grades.
2. Consistent high magnetic quality.
3. Certification of magnetic quality for every lot.
4. Widest experience in manufacturing and design of three phase laminations insures most modern product line available.

T & S WIDE WINDOW® LAMINATIONS

Thomas and Skinner recognized the need for laminations that would permit the designer of high frequency transformers to improve the copper/iron loss ratios . . . to utilize fully the improved core loss characteristics of existing core materials . . . and to allow the use of more insulation in high voltage applications, using copper or aluminum conductors. The result is a complete series of laminations with expanded windows which give this increased winding area.

CRUCIFORM LAMINATIONS

These laminations have been found to be especially suitable for constant voltage, reactor and ferro-resonant transformers . . . such as those used for supplying rectified loads with capacitor filters. T & S makes them of grain-oriented silicon steels which are selected for their high permeability at high flux densities. This is a prime requirement in the operation of these transformer types.

Full die-cut Cruciform Laminations permit controlled assembly line technology, affording dramatic savings in labor assembly costs. Standard design Cruciform Laminations are available from stock dies. In addition, T & S welcomes the opportunity to assist in the design and manufacture of custom laminations to your specifications.

SHUNTS & I-STRIPS

These laminations provide you with design versatility. You can use individual Shunt Laminations with Single Phase Standard and Wide Window® Laminations for cruciform-type construction transformer cores. "I" Laminations can be used for custom-stacked cores. Precision die-cut Shunt & I Laminations provide for mechanical uniformity in assembly of transformer stacks, and have the design flexibility necessary for short or long-run production quantities.

Material Certifications can be provided on request with each shipment of these laminations. You are guaranteed the uniformity of consistency so important in the manufacture of these special transformers. We welcome the opportunity to quote on custom Shunt & I Laminations, or assist you by recommending the proper lamination for your specific design.

LARGE LAMINATIONS

Thomas and Skinner, realizing the need for Large Laminations, adopted a program of constructing stock tooling using the standard EI lamination design concept. The size range has been extended upward in graduated steps in both single phase and three phase designs, starting with EI—1⁵/₈" through EI—5" single phase, and EI—1.00" through EI—3.60" three phase. T&S precision die-cut EI

Large Laminations provide the transformer design engineer with scrapless and expanded window designs utilizing the most economic and efficient aspect of today's improved core materials.

CENTRA-GAP® LAMINATIONS

Specifically engineered and precision die-cut air gap makes possible the unique reactor construction that greatly reduces the problematic hum and vibrations normally associated with filter chokes.

Using Centra-Gap® Laminations reduces the stray fields of the reactor to practically zero. No chance of stray ferrous particles collecting around the air gap, causing possible electrical shorting and a change in the operating inductance. Stable operating inductance over the expectant life of the unit is further assured by the inherent shielding effect of the Centra-Gap® feature. Magnetic coupling to associated components or cabinet structure is reduced to a level of minimum concern.

Where stability and low mechanical hum levels are required, as in filtered DC power supplies, the Centra-Gap® Laminations are the answer. These same laminations are designed primarily as a companion to T & S Large Laminations.

Centra-Gap® Laminations are manufactured to your specific gap and design requirement, using most listed Thomas and Skinner EI type laminations. Available in stock grade silicon steel, oriented "Orthosil"® or non-oriented grades and gauges .004", .006", .014", .0185". Also SuPer Orthosil® .007", .009" & .011".

VARI-GAP® SYSTEM

The Vari-Gap® System (Pat Nos. 4,081,777 & 4,080,725) is a new shunt assembly method introduced by Thomas & Skinner to allow the transformer designer and manufacturer complete flexibility in adjusting or “tuning” a ferro-resonant transformer.

Great economic advantage to the transformer builder is provided by the following features:

1. The shunts are supplied with each E and I lamination set at no extra cost to the transformer manufacturer.
2. The shunt system supplied allows the manufacturer to adjust the air gap from the maximum provided to a value approximately 20% of this maximum.
3. The Vari-Gap® System provides an “isthmus” shunt configuration whose permeance is sensitive to induction. This feature gives a higher degree of stability at low-line voltage and low-load conditions than otherwise possible.

Bulletin L558 describes in detail the design theory and assembly methods recommended for proper application of the Vari-Gap® shunt system to your ferro-resonant transformer production needs.

UI DESIGNS

Recent Thomas & Skinner innovations make the use of UI laminations more economical and allows versatility in transformer design. The traditional UI lamination designs have been used for many years, but these older designs do not make efficient use of the material. Thomas & Skinner's new MH designs are scrapless and consequently less costly than the old traditional designs. Also, the new MHW configurations have non-uniform leg width and a wider window which provides the engineer many new options for the design of ferro-resonant and special transformers.

STACKING FACTORS

The following stacking factors are suggested for design purposes.

Thickness	Stacking Factor, K_s
Butt Joint	
.004, .006, .007, .009	.90
.011 & .014	.95
.0185	.95
Interleaved	
.004, .006, .007, .009	.80
.011 & .014	.90
.0185	.90

HOW TO ORDER

- H = Holes Only
- HS = Holes & Slots
- HX = Modified Hole Location
- MH = Mil-T-Holes
- MHS = Mil-T-Holes & Slots
- 2MH = Mil-T-(Type) Hole Location (2 Holes)
- 3MH = Mil-T-(Type) Hole Location (3 Holes)
- L = Long Legs
- HW = Wide Window (Holes Only)
- HSW = Wide Window, Holes & Slots
- LW = Wide Window, Long Legs (Holes Only)
- LSW = Wide Window, Long Legs, Holes & Slots
- 3 ϕ = Three Phase
- TO = Cruciform Type

ORDERING EXAMPLES

SINGLE PHASE LAMINATIONS

<u>EI</u>	<u>4</u>	<u>3(2)MH</u>	<u>M-6</u>	<u>29 Ga.</u>
Set	Dimension (center leg)	Holes	Material Grade	Thickness

<u>EI</u>	<u>1½</u>	<u>HS</u>	<u>M-19</u>	<u>26 Ga.</u>
Set	Dimension (center leg)	Holes & Slots	Material Grade	Thickness

WIDE WINDOW® LAMINATIONS

<u>EI</u>	<u>7/8</u>	<u>HW</u>	<u>SuPer Orthosil.®</u>	<u>9-mil</u>
Set	Dimension (center leg)	Holes Only	Material Grade	Thickness

<u>EI</u>	<u>1¾</u>	<u>HSW</u>	<u>M-6</u>	<u>29 Ga.</u>
Set	Dimension (center leg)	Holes & Slots	Material Grade	Thickness

THREE PHASE LAMINATIONS

<u>EI</u>	<u>¼</u>	<u>3ϕ</u>	<u>Orthosil.®</u>	<u>4-mil</u>
Set	Dimension (center leg)	Type	Material Grade	Thickness

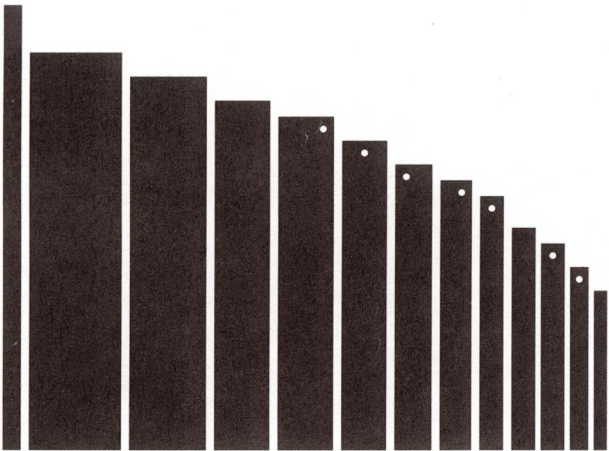
<u>EI</u>	<u>1.20</u>	<u>3ϕ</u>	<u>M-6</u>	<u>29 Ga.</u>
Set	Dimension (center leg)	Type	Material Grade	Thickness

MATERIAL APPLICATIONS

Grade	General Applications	Description
Orthosil® M-6 29 Gauge - .014" (0.355 mm)	Audio amplifiers; current, output, power transformers; chokes and saturable reactors; ferro-resonant regulators.	Has directional electrical characteristics. Extreme high permeability and low core loss.
Orthosil® 4-mil - (0.101 mm) 6-mil - (0.152 mm)	High performance @ 400 Hz or higher frequencies	Has directional electrical characteristics. Extreme high permeability and low core loss.
T&S M-15 26 Gauge - .0185" (0.469 mm) 29 Gauge - .014" (0.355 mm)	Audio and filter transformers (general). High efficiency rotating machines.	High permeability at low inductions; low core loss.
T&S M-19 26 Gauge - .0185" (0.469 mm)	Television, radio and electronic power transformers, chokes and special transformers, continuous duty vibrators, solid state inverters.	A transformer grade with both good magnetic and physical properties.

I-STRIPS

FOR YOUR CUSTOM DESIGN OR REBUILDING OF TRANSFORMERS



- Fast delivery on custom-made I Laminations, trimmed to precise tolerances and relatively burr-free.
- Available in the following thicknesses: .004, .006, .007, .009, .011, .014, .018, .024.
- Available in lengths from 1" to 40", widths from 1" to 9".
- Can be supplied with any size holes, positioned as required, and/or mitered corners.

THOMAS & SKINNER PRODUCTS

ALNICO PERMANENT MAGNETS

Thomas & Skinner is one of the largest manufacturers of high energy Alnico Permanent Magnets in the country. Permanent Magnets are available in Alnico grades 2, 5, 6, 8C, 8HC, 8HE, 9 and 9Nb for applications that include simple holding and lifting devices, sophisticated current generating and electron beam focusing devices, motors and other rotating devices. Industries which are utilizing T & S Permanent Magnets include microwave, geophysical and aerospace, ample proof of the quality and performance of Thomas & Skinner's superior Permanent Magnet products.

LAMINATIONS

Thomas & Skinner has been adding to and perfecting its line of Laminations since 1925. Today the Company is recognized in the industry for providing the largest range in Lamination sizes including Thin (4 & 6 mil) Laminations, Ferroresonant and Wide Window, 3 ϕ , Centra-Gap, Vari-Gap[®], I Strips, U-I designs, Orthosil[®] and SuPer Orthosil[®] Laminations. Most of these laminations are available in a wide range of sizes and can usually be shipped from stock in the warehouse nearest you.

CUSTOMER SERVICE

Thomas & Skinner engineering assistance is available to you in the design and development of magnetic materials to suit your specific applications.



Thomas & Skinner, Inc.

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Transformer Lamination Servicenters

Eastern Region

16 Law Drive
Fairfield, NJ 07004
Phone: 973/227-4222
Fax: 973/227-6735

Western Region

1550 S. Sunkist St., Suite G
Anaheim, CA 92806
Phone: 714/634-3880
Fax: 714/634-3885

Other Manufacturing Locations

Sintered Alnico

Osgood Grinding

Western Avenue
Osgood, IN 47037
Phone: 812/689-4811

Electro-Magnetic Ferrite Subsidiary

Ceramic Magnetics, Inc.
16 Law Drive
Fairfield, NJ 07004
Phone: 973/227-4222
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