JST POWER EQUIPMENT

Cast Resin Dry Type Transformers

JST Power Equipment is more than a manufacturer – we are a solutions innovator at the cutting edge of transformer technology. We continually work to create products with higher efficiencies and lower costs. Each year we make substantial investments in the research and development of new products and manufacturing techniques. We regularly innovate on behalf of our customers, collaborating with them to find solutions to their specific challenges. Explore JST's Cast Resin Transformers.

JST POWER EQUIPMENT

Cast Resin Transformers. The Best Choice for Your Application Needs

While the term “dry type” transformer is often used only to refer to transformers processed with varnish and cured in ovens, such as VPI transformers, Cast Resin Transformers are also dry type transformers. Cast Resin Transformers are highest on the evolutionary scale of transformer design and offer the best combination of electrical and mechanical performance factors. Cast Resin Transformers offer higher performance than other dry type transformers and do not present the environmental risks, safety and hazards found in liquid filled transformers.

Available up to 45 MVA, 40.5 kV, Cast Resin Transformers provide the best lifetime values and meet both GB1094, IEC 60076, UL 1562, and IEEE C57.12.01 requirements.

Advantages

- **Low Maintenance:** As companies continue to look for ways to reduce their O&M expenses, Cast Resin Transformers provide instant savings considering there is no oil to sample or Doble testing of bushings. The only required routine maintenance of Cast Resin transformers is occasional visual inspections.
- **Eco-Friendly:** Lack of oil in the design makes them ideal for environmentally sensitive areas or places where oil would be a risk (buildings, marine, etc.).
- **Safety:** The design of Cast Resin Transformers is inherently safe as the unit is flame-retardant, self-extinguishing, and produces no toxic by-products.
- **Very High Short-Term Overload Capacity:** Cast Resin Transformers are able to handle short-term overloads due to the inherent strength of the resin and fiberglass encapsulation and a long thermal time constant. This allows them to handle the axial and radial forces associated with overload conditions.
- **Space Savings:** Cast Resin Transformers are a compact design and, when coupled with the elimination of oil containment structures, fire suppression systems and coolers provide meaningful on-site space savings.
- **Low Noise Levels:** By the nature of the design, Cast Resin Transformers are more compact and have lower noise.
- **Designed for Use in Harsh Environments:** Cast Resin Transformers provide the maximum protection from moisture, particulates and pollution and can survive in some of the harshest environments in the marketplace.

JST POWER EQUIPMENT

Capabilities

JST Power Equipment is one of the largest manufacturers of Cast Resin Transformers in the world, able to design, test and build transformers to meet some of the most challenging applications in the market today. Our teams of engineers have been leading the industry for over 25 years in terms of technology advancements, quality and customer support.

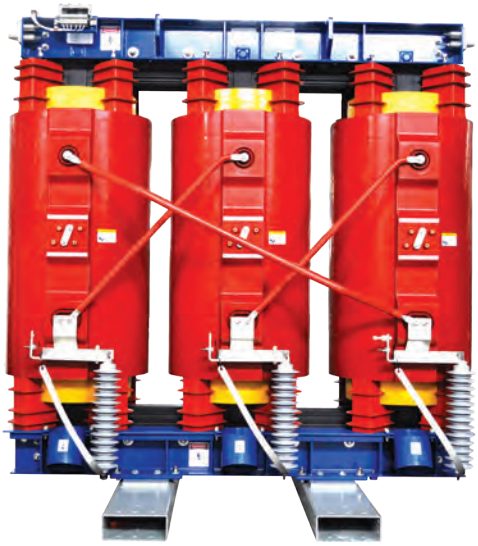
We build Cast Resin Transformers for a wide array of applications, sizes and configurations. Currently we are able to build units up to 45MVA, 40.5kVA and 200 kV BIL.

We have installed them in a wide array of applications including:

- Marine and offshore applications
- Traction power systems for rail and transit systems
- Power distribution
- Power plant applications
- Indoor and outdoor units for primary and secondary substations
- Mobile applications for substations and for OEM equipment
- Drive system applications and reactor applications
- High peak demand loads, harmonics loads and intermittent load applications
- Chemical, petrochemical, mining, pulp and paper plants, and many more!
- Amorphous metal transformers
- Wind power generation
- Excitation rectifier transformers

When in harsh environments – such as outdoor installations, corrosive environments, off-shore applications, petrochemical facilities and the like – it is best to choose a Cast Resin Transformer for your needs. This type of construction is designed specifically to protect the coils from the devastating effects that salt, water, particulates, caustic substances and sun can have on a transformer. For longest life and improved system reliability, Cast Resin Transformers are designed to survive.

Cast Resin Transformers are also designed to stand up better than oil filled transformers for harsh duty applications where rapid cycling or short, high current overloads are expected, such as in many industrial processes. This robustness leads to improved system reliability and lower maintenance costs thoughout the life cycle of the transformer.



Multi-Tap, Split-Core design, years of experience, and customized designs allow us to meet demanding application designs.

Standard Features

- Primary and Secondary Cast Resin Transformer Construction
- Aluminum or Copper Windings
- Standard ANSI 61 Gray Powder Paint Enclosures
- Easy Access Terminal Taps
- Multiple and Customer Bus Configurations Available
- Highest Quality Grain Oriented Steel
- 80° and 115°C Temperature Rise Options
- 180C Class H UL Listed Insulation System
- UL and cUL Listings
- 50 or 60 Hz

Optional Features

- Special Paint and Customer Paint Colors Available
- Forced Air Cooling
- Water Cooling
- Pad Mounted Design
- Jacking Pads
- Anti-Vibration Mounting Systems
- Electrostatic Shielding
- Temperature Monitoring Systems
- Metering
- IR Viewing Ports
- Custom Control Panels
- Surge Arresters
- Neutral Grounding Resistors
- Ground Fault Relay Protection
- Drive Isolation Ratings
- Low Inrush Current Design
- Special Enclosure Ratings (marine, fungus resistance, UV)
- RC Snubber with monitoring circuit

JST POWER EQUIPMENT

Enclosure Options

JST provides a wide array of options when it comes to enclosures to help you meet your system needs. JST enclosures are designed to meet all requirements of CSA and UL 50.

NEMA 1:

Primarily for indoor use. This general-purpose enclosure protects against falling dust and debris and offers a degree of protection from equipment contact. Its primary purpose is to minimize the risk to personnel of contact with live or hazardous parts.

NEMA 12:

Primarily for indoor use. This general purpose enclosure is similar to NEMA 1 but also provides some protection against dust, falling dirt, and dripping noncorrosive liquids. Meets drip, dust and rust resistance tests.

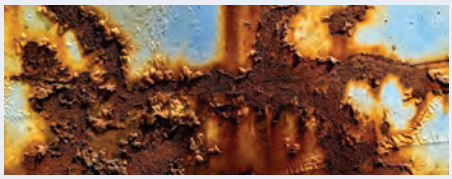
NEMA 3R:

Designed for both indoor and outdoor applications, the 3R enclosure provides protection against falling dirt and windblown dust, and weather hazards such as rain, sleet and snow, and is undamaged by the formation of ice.

NEMA 4/4X:

Designed for indoor and outdoor applications. This watertight design meets the NEMA requirements for excluding at least 65 GPM of water from a one-inch nozzle delivered from a distance of not less than 10 feet for five minutes. Used outdoors on ship docks, in dairies, and in wastewater treatment plants and breweries. X (as in 4X) indicates additional corrosion resistance. Note: NEMA 4/4X does not mean submersible.

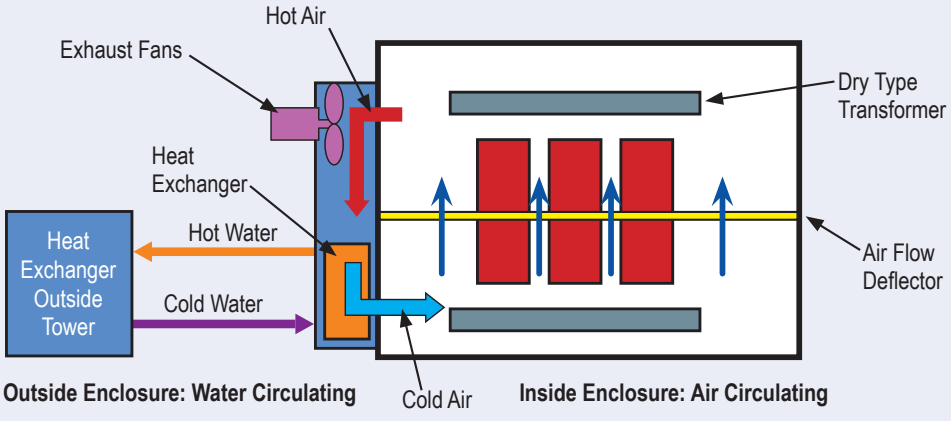
MARINE RATED TRANSFORMERS (AFWF)



Off-shore and Marine applications are some of the most challenging applications for electrical equipment. The need for power on ships and expansion of off-shore wind and coastal applications all provide a wide array of challenges to equipment.

- High salt and humidity lead to high corrosion
- Wind and sea conditions lead to high mechanical stress and vibrations/shocks
- Remote locations lead to high maintenance costs

- Sealed IP54 enclosure with Cast Resin Transformer
- Core spray with Hempel paint, and certified by SGS to reach C4H class
- Use of hot-galvanized steel and all hardware Dacromet treated or stainless steel
- Reinforced core construction and clamps
- Locking bolt system



Outside Enclosure: Water Circulating **Inside Enclosure: Air Circulating**

The JST Transformer is sealed by an IP54 enclosure to reduce the ocean effects of corrosion. It also helps by eliminating the increased creepage distance associated with harsh environments.

JST POWER EQUIPMENT

Cost Considerations

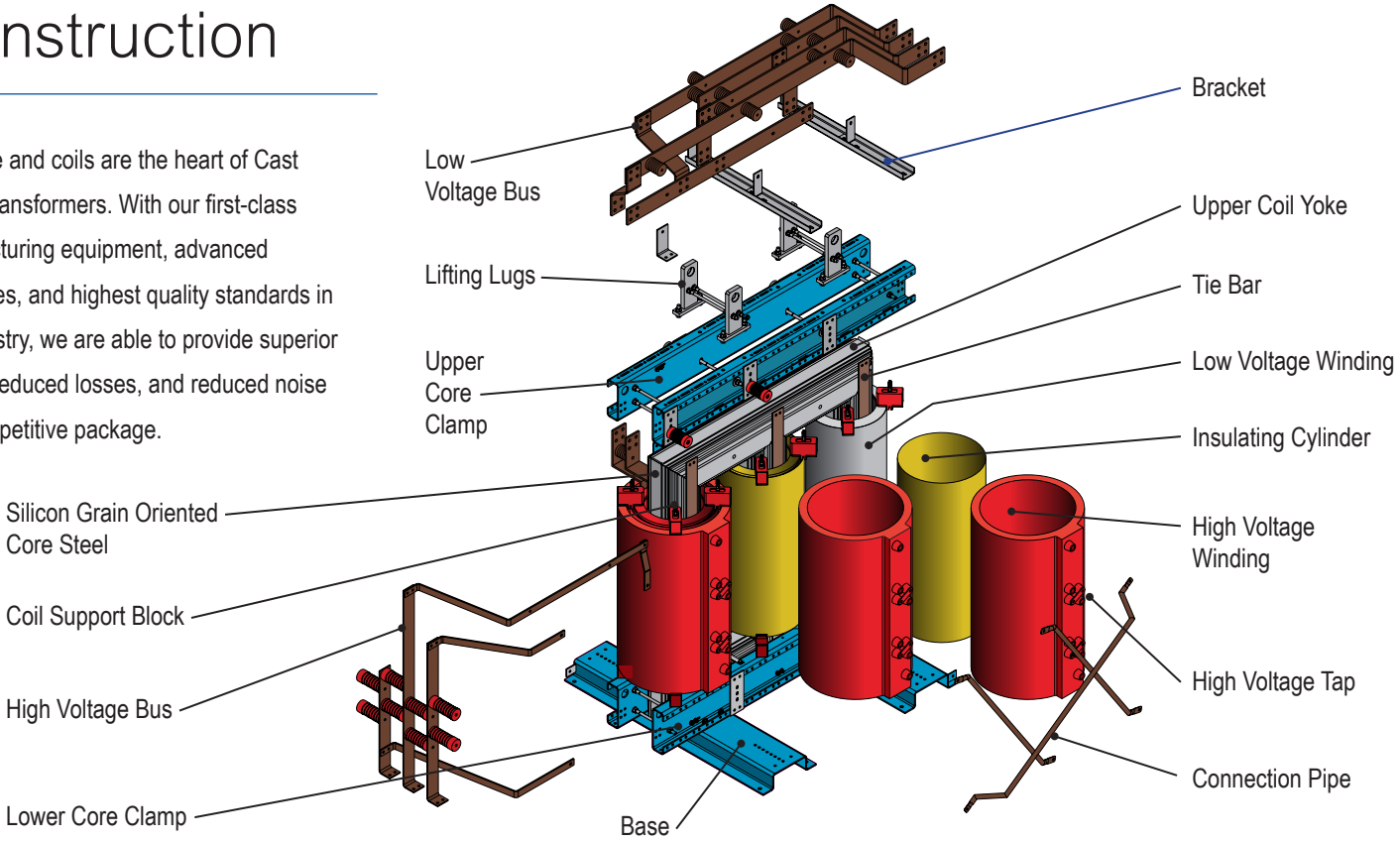
When choosing the correct transformer for your application needs, it is important to consider the many different costs and risks over the life span of a transformer. Below you will find a list of those considerations and a chart to help you make the best decision.

Lifetime Costs to Consider	Oil Filled Transformer	Cast Resin Transformer
Initial Cost of Transformer	Typically lower initial unit cost.	Higher initial purchase cost.
Size and Construction of Pad	Baseline design with no containment is smallest of the options. Bigger pads are required when units have radiators.	May require larger pad to accommodate larger size of transformer. Pad size can have minimal impact when comparing the two technologies.
Oil Containment	Size required is based on total oil volume. Typically runs between $500-5,000 depending on size. This includes engineering and construction costs.	Not required for Cast Resin Transformers.
Fire Suppression System	Required for many applications if near or in building. Starts at $5,000 and goes up. Can exceed $50,000 if infrastructure does not already exist. Also has disadvantage of additional maintenance, leaks, and cost if removing for future maintenance on transformers.	Not required for Cast Resin Transformers.
Transportation Cost of Transformer	For smaller transformers, unit may ship with oil in unit. Typically for 20 MVA and below. They can be shipped filled with oil on a single truck.	Full unit ships assembled on a standard single truck. Open flatbed is typically the trailer used.
Transportation Cost of Oil	Separate tanker sent to site with oil. Oil is then processed and loaded into the transformer. Typically, this occurs on units above 20 MVA.	No oil required.
Offloading of Unit	Typically requires crane to offload.	Typically requires crane – may be slightly heavier lift than similar size oil due to increased weight. Customers also have the option to offload via forktruck if rated for the size of transformer.
Assembly/Commissioning of Unit on Site (Dress out)	On larger units, may require mounting radiators, installing bushings and processing oil. Typically runs 7% of transformer price.	Not required for Cast Resin Transformers. Unit ready for energization after visual inspection at site. Lower total installation costs.
O&M Costs	Largest expenses can be replacement of the bushings of the unit. Typically, this runs 5-8% of the cost of transformer. Also, they have maintenance for leaks, fan failures, N2 system recharges (if applicable). Additional costs can be incurred if items like a fire suppression system need to be disassembled prior to work. These costs are not inclusive of outage costs, tag-out costs, etc., that may be incurred by the owner.	Limited requirements. If forced air is used, may need to do maintenance on the fans. Cast Resin Transformers are a much better offering if planned outages are routine. Due to the design of no oil samples, oil slushing in cold conditions is applicable. Costs remain very low throughout life of transformer.
Routine Maintenance (oil samples, etc.)	Typically, very low at beginning of life. Does require Doble testing of bushings every five years. In SPT sizes, will require an outage and tag out.Crew to do testing and then recommissioning. Also, DGA samples will be required periodically depending on customer specifications. These can cost $500 per sample.	In most cases, visual inspection is the only requirement to ensure no corrosion or buildup of debris or critters. The philosophy of the Cast Resin Transformer design is low to no maintenance. As noted, visual inspection is the most important.
Decommission Costs	Requires either reprocessing of oil or disposal of oil. Transformer steel and copper can be reprocessed.	Easier decommissioning of the transformer due to lack of oil to be dealt with. Customer can scrap the dry type transformer and receive small incentives for the commodity items within design.
Oil Monitoring Systems	Often added later in transformer life to monitor oil. Typically costs between $10,000 to $50,000 installed based on features selected.	No oil monitoring system required.
Risk Factors	**Oil Filled Transformer**	**Cast Resin Transformer**
Transformer Fire	Transformer fires are very rare but can be exceedingly expensive for the owner. Costs can include the fire department, surrounding equipment, bad publicity, and potential injuries and death.	Cast Resin Transformers are made of materials that do not burn, thus they eliminate the risk of fire due to oil and other combustibles. Self extinguishing.
Oil Leak (contained or not contained, environment, publicity, Cleanup costs, additional maintenance, etc.)	Worst case scenarios of oil leaks involve oil spilling onto the ground, requiring large cleaning activities, including removing and cleaning the soil. Of even more concern would be spills in or near water where the oil could contaminate the environment. In all cases, the costs and negative publicity can cause lasting negative impacts.	No oil leaks due to no oil.
Porcelain Bushing Failure	Often, when porcelain bushings fail, they can shatter the glass and drop that into the tank. This mode of failure makes it extremely difficult to clean the glass out of the tank, and the bits of glass will cut the paper insulation in the coils, thus leading to a quick failure of the transformer.	Most connections for dry type transformers are internal to the cabinet. Therefore, bushings are not required in most cases considering a cable connection design. The enclosed connection is safe for the public, personnel, and the transformer itself.

JST POWER EQUIPMENT

Construction

The core and coils are the heart of Cast Resin Transformers. With our first-class manufacturing equipment, advanced processes, and highest quality standards in the industry, we are able to provide superior quality, reduced losses, and reduced noise in a competitive package.



JST Competitive Advantages

JST clamping technology allows for a more uniform pressure while providing for thermal expansion

Cast Resin Transformer construction of both HV and LV coils offers higher reliability and longer life

JST uses a static mixing process allowing better control over viscosity and uniformity when curing, resulting in void-free coils and stronger structural integrity

Cast Resin Transformer built in clean room environment to minimize risk of any contamination

JST POWER EQUIPMENT

Data

Standard Cast Resin Transformer Data

State-of-the-art manufacturing systems are used throughout JST's entire operations. First is a detailed computer-aided design defining the entire transformer and all of its components in exact detail with CAD optimized designs. The design process, computerized automatic precision cutting, stacking and handling, the highest quality, high permeability, and grain oriented silicon steel all contribute to achieve a consistently high core quality with the lowest possible losses and sound levels, all at an economical cost.

Typical Cast Resin Transformer Impedance Ranges

Voltage	<2000 kVA	>2000 kVA
4.16kV	4.0-6.0%	6.0-7.0%
8.8kV	4.5-6.5%	6.0-8.0%
15kV	5.5-7.0%	6.5-8.0%
27kV	6.5-7.5%	7.0-8.5%
38kV	6.5-7.5%	7.0-8.5%

Cast Resin Transformer Basic Impulse Level (BIL)

Voltage	Standard	Available Options
4.16kV	30kV	45kV / 60kV
8.8kV	45kV	60kV / 95kV
15kV	60kV	95kV / 110kV
27kV	110kV	125kV / 150kV
38kV	150kV	200kV

Dimensions and Weights Three-Phase Cast Resin Transformers

The information below is meant as a guideline for the typical sizes of JST Transformers. Sizes may vary based on individual specifications and requirements. All units are in inches and pounds.

Cast Resin Transformer Core and Coil Assembly

4160V, 30kV BIL, Open Unit

kVA	Width	Depth	Height	Weight
250	47	39	55	2750
500	59	47	61	4750
750	65	47	63	6500
1000	73	55	65	8400
1500	77	55	77	10950
2000	79	55	79	13150
2500	85	55	81	15900
3000	89	55	83	17850

Cast Resin Transformer NEMA 3R Enclosure

4160V, 30kV BIL, NEMA 3R Enclosure

kVA	Width	Depth	Height	Weight
250	78	60	94	5400
500	102	78	94	8500
750	102	78	94	10250
1000	102	78	94	12150
1500	120	78	94	15100
2000	120	78	94	1730
2500	132	78	94	20300
3000	132	78	94	22300

JST POWER EQUIPMENT

Transformer Components

CORE

The core is the heart of the transformer. Using first-class equipment, advanced processes and high-quality material, our core is high grade quality, and greatly reduces no load losses and the noise of the transformer.

We fully-automatic silicon steel sheet cutter. Operating under computer program controls, it has a high cutting precision with no burrs, and has the function of multi-end feeding, automatic stacking collection and step lap. It can reduce the amount of vibration during cutting, so that the crystal grain structure is maintained with less variation of finished silicon steel sheet.

Our core has an approximate circular section. Silicon steel sheets are cut fully-oblique at 45°. The joint between core column and top yoke is a step lap structure. These measures improve the magnetic field distribution of the core and reduce the consumption of materials and energy.

We also utilize a core inverting/lap/assembling table. It assembles the core column and yoke iron into an epsilon – shaped core, and significantly improves the processing quality and production efficiency of the core.

WINDINGS

The computer-controlled HV automatic winding machines apply and maintain constant tension during the automatic winding process. The HV windings are made of copper and aluminum electromagnetic wire and insulated with fiberglass mats through segmented cylindrical structures. The winding method maintains a low voltage between layers and strong over-voltage resistance. The windings of larger capacity coils will incorporate air ducts built into the structure, allowing good heat dissipation.

JST also produces LV copper foil wiring. The advantage of foil winding is that the current density can distribute itself freely along the width of the conductor and has strong short-circuit resistance. The LV coil is wound using highly-purified round-edge foil strip and insulating material pre-saturated in epoxy resin. Controlled by a computer module, the machine can maintain constant tension, wipe off any debur and rectify any deviation automatically.

JST POWER EQUIPMENT

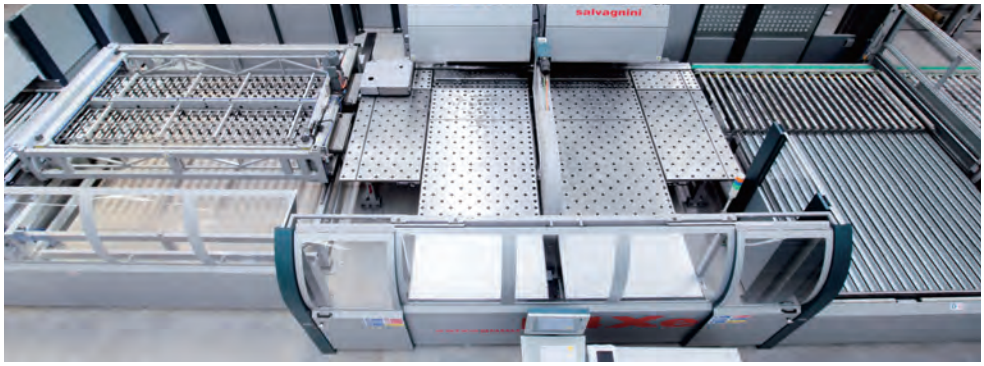
Transformer Assembly

CASTING

The winding is then moved safely to the pre-heating casting chamber to dry after preheating, removing any moisture/gas in the insulation. Meanwhile, the imported chemical materials (e.g. epoxy resin and hardener) are continuously prepared in separate vessels. After the preparation is finished, all the materials are pumped into a static mixer at the ratio preset by the precise computer measuring system, and then cast into the molds. The casting chamber utilizes an oil diffusion pump to create the vacuum levels sufficient to ensure a perfectly void free casting. After the completion of casting, the coils are cured in an oven to form strong solid coils under high temperatures.

We adopt state-of-the-art casting equipment, which applies patented technologies (e.g. thin-film deaeration and static mixing). The static mixing technology is significantly superior to dynamic mixing, yielding consistent physical/chemical properties of material mixture (e.g. viscosity and chemical reaction degree).

SHEET METAL



S4Xe and P4Xe are some of the advanced CNC machines utilized by JST, which makes small batch production pattern possible. Lean production can be realized and automatic feeding, punching, quadrilateral bending and unloading can be done. S4 punching compound system is a composite punch and integrated right angle shear device to conduct automatic cutting and processing for the whole panel. A stacking robot and a duel row of large 3D warehouse is available for the production line. Fully automated distribution can be realized for sheet metal production, ranging from raw material stacking to the finishing products of sheet metal parts. The overall efficiency is four to five times higher than ordinary stand-alone machines.

An advanced power and chain-free flexible transmission system is utilized to allow “intelligent movement.” of the work piece, namely, the “continuous movement + step movement.” JST has also created an ingenious design of a vortex paint mist filter and photocatalyst to remove at least 98% of paint mist, thereby resulting in pollution-free air and environment.

ASSEMBLY LINE

The whole procedure can then be finished with processes ranging from production assembly, spraying, inspection, testing and packaging. In addition, specialized equipment such as full closed loop servo control systems, laser positioning, industrial grade wireless communications, laser scanning and multiple mechanical safety protections are used throughout.

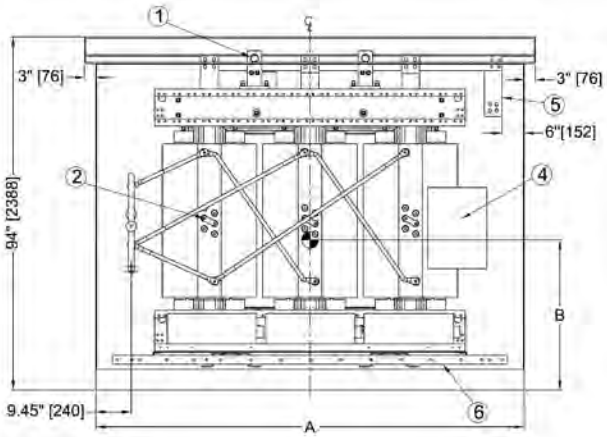
The “Flexible production line” concept is applied to arrange customized production lines matched to produce products with different specifications. Such a concept has enabled us to arrange techniques, manufacturing procedures, staff and dedicated equipment in a very flexible way, thus labor intensity can be lowered but production and management efficiency can be enhanced.

JST POWER EQUIPMENT

Typical Drawings

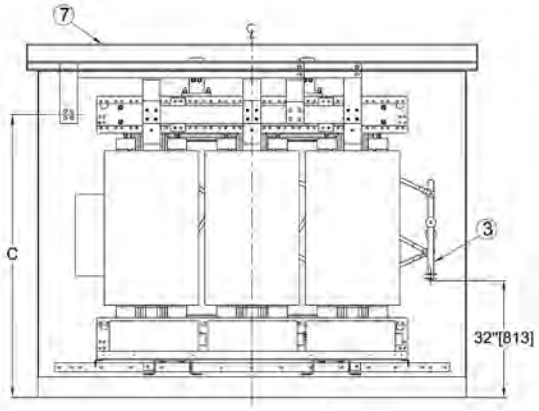
13.8kV to 480/240V, 500/1000/2000/3000 kVA, NEMA 3R, Close coupled

The drawings below are typical drawings provided with the transformer showing physical characteristics. This drawing is for reference only. JST reserves the right to adjust parameters as required.

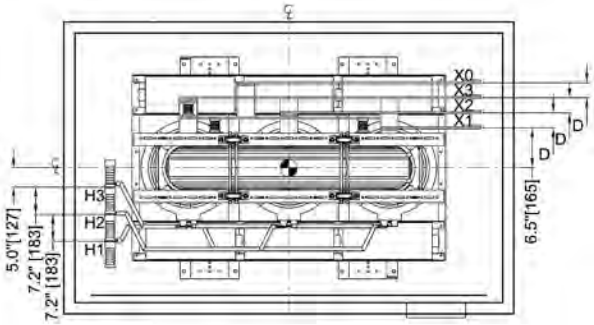


FRONT VIEW (HV TAPS)

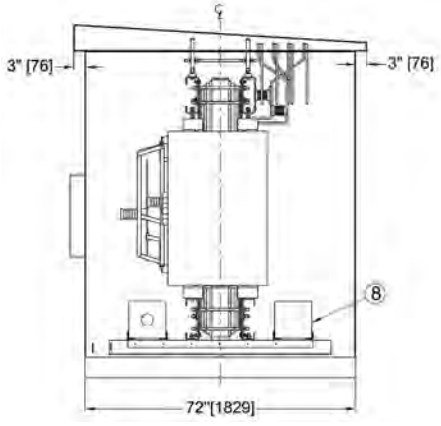
Rated (kVA)	Dimension(in/mm)								LBS/KG	
	A	B	C	D	E	δ	F	G	W1	W2
500/665	96"[2438]	33"[838]	65"[1651]	3.78"[96]	3.15"[80]	0.24"[6]	Ø1.97"[Ø50]	38"[965]	4550/2065	8180/3715
1000/1330	96"[2438]	35"[889]	65"[1651]	3.94"[100]	3.15"[80]	0.39"[10]	Ø1.97"[Ø50]	38"[965]	8065/3660	11695/5310
2000/2660	114"[2896]	40"[1016]	75"[1905]	4.02"[102]	5.91"[150]	0.47"[12]	Ø1.97"[Ø50]	47"[1194]	14200/6440	18270/8290
3000/3990	126"[3200]	42"[1067]	75"[1905]	4.13"[105]	5.91"[150]	0.59"[15]	Ø2.76"[Ø70]	53"[1346]	17800/8075	22160/10055



REAR VIEW



TOP PLAN VIEW



RIGHT SIDE VIEW

STANDARD: IEEE Std C57.12.01,IEC 60076-11				
KVA: Rated			COOLING CLASS:	AA / FA
HV. 13800 V D			B.I.L. 95 kV 34 kV AC	
LV. 480 V Y			B.I.L. 30 kV 4 kV AC	
PHASE: 3			FREQUENCY: 60 Hz	
INSULATION SYSTEM: 185°C(365°F)			TEMPERATURE RISE: 80°C(176°F)	
HV TAPS: ±5%, 2.5% EACH STEP				
CONNECTION: Dyn1				
IMPEDANCE: 5.75% based on Rated kVA (Tolerance: +/-7.5%)				
APPROX. WEIGHT	TRANSFORMER: W1			
	TRANSFORMER WITH ENCLOSURE: W2			
JST POWER EQUIPMENT, INC LAKE MARY,FL				
CAST COIL DRY-TYPE TRANSFORMER				
13.8 KV PRIMARY AND 0.48 KV SECONDARY				
OUTLINE DRAWING				
DWG NO: 13.8-0.48-NEMA 3R-BUSBAR				
SIGNATURES		DATE	SCALE: NONE	
DRAWN: M.Song		Sep 15, 2017		
CHECKED: R.Mao		Sep 15, 2017	REV: A	
APPROVED: P.Wan		Sep 15, 2017	SHEET: 2 of 3	

SIZE D | DWG NO 13.8-0.48-NEMA 3R-BUSBAR | SH 2 | REV A | DISTR TO

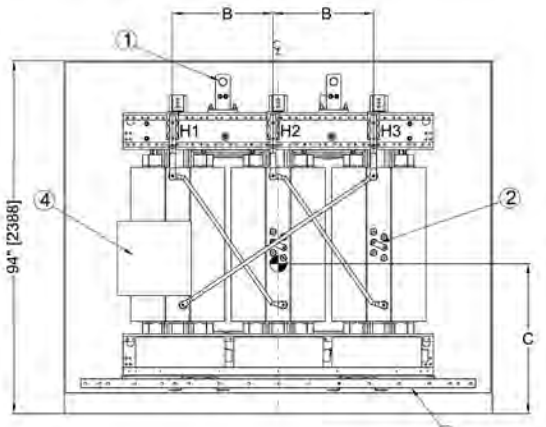
JST POWER EQUIPMENT

Typical Drawings

13.8kV to 208/120V, 500/1000/1500 kVA, NEMA 1, Cable in, Cable out

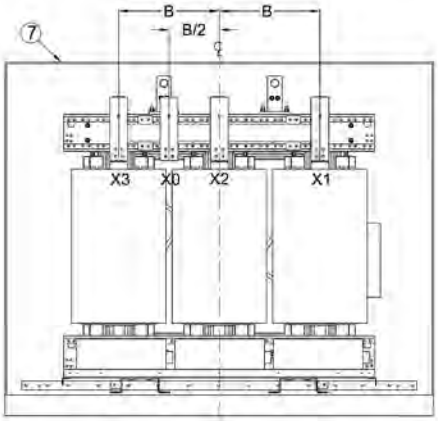
The drawings below are typical drawings provided with the transformer showing physical characteristics. This drawing is for reference only. JST reserves the right to adjust parameters as required.

ITEM	QTY.	DESCRIPTION
8	6	COOLING FAN
7	1	ENCLOSURE
6	1	GROUND BUS
5	4	LV TERMINAL
4	1	JUNCTION BOX (JB)
3	3	HV TERMINAL
2	3	HV TAPS
1	4	LIFTING LUG

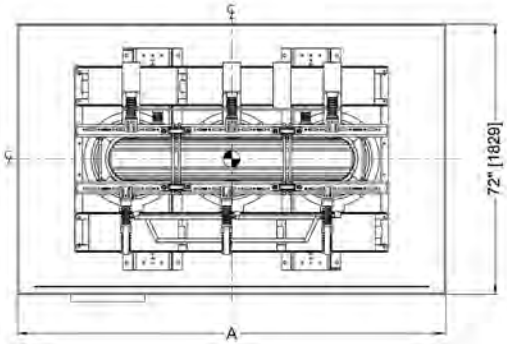


FRONT VIEW (HV TAPS)

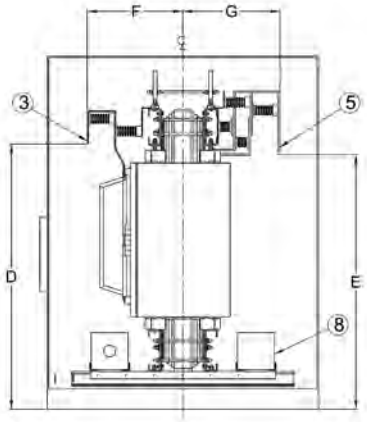
Rated (kVA)	Dimension(in/mm)											LBS/KG	
	A	B	C	D	E	F	G	H	δ	I	J	W1	W2
500/665	96"[2438]	20.3"[515]	33"[838]	55"[1397]	50"[1270]	23.4"[595]	23.7"[602]	3.94"[100]	0.39"[10]	Ø1.97"[Ø50]	38"[965]	5155/2340	7095/3220
1000/1330	96"[2438]	24.6"[625]	40"[1016]	71"[1803]	68"[1727]	24.4"[620]	24.7"[627]	5.91"[150]	0.47"[12]	Ø1.97"[Ø50]	38"[965]	10810/4905	12750/5785
1500/1995	114"[2896]	26"[660]	42"[1087]	71"[1803]	68"[1727]	25.4"[645]	25.7"[654]	7.1"[180]	0.59"[15]	Ø1.97"[Ø50]	47"[1194]	13120/5950	15315/6945



REAR VIEW



TOP PLAN VIEW



RIGHT SIDE VIEW

STANDARD: IEEE Std C57.12.01,IEC 60076-11			
KVA: Rated		COOLING CLASS:	AA / FA
HV. 13800 V D		B.I.L. 95 kV	34 kV AC
LV. 208 V Y		B.I.L. 30 kV	4 kV AC
PHASE: 3		FREQUENCY:	60 Hz
INSULATION SYSTEM: 185°C(365°F)		TEMPERATURE RISE: 80°C(176°F)	
HV TAPS:	±5%, 2.5% EACH STEP		
CONNECTION:	Dyn1		
IMPEDANCE:	5.75% based on Rated kVA (Tolerance: +/-7.5%)		
APPROX. WEIGHT	TRANSFORMER:	W1	
	TRANSFORMER WITH ENCLOSURE:	W2	

JST POWER EQUIPMENT, INC LAKE MARY,FL

CAST COIL DRY-TYPE TRANSFORMER

13.8 KV PRIMARY AND 0.208 KV SECONDARY

OUTLINE DRAWING

DWG NO: 13.8-0.208-NEMA 1-CABLE

	SIGNATURES	DATE	
DRAWN:	R.Fu	Sep 27, 2017	SCALE: NONE
CHECKED:	R.Mao	Sep 27, 2017	REV: A
APPROVED:	P.Wan	Sep 27, 2017	SHEET: 2 of 3

SIZE D | DWG NO: 13.8-0.208-NEMA 1-CABLE | REV: A | SHEET 2 OF 3

JST POWER EQUIPMENT

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