SOLID DRY CAST-RESIN TRANSFORMERS

Singapore Prestige Brand Award
BULOX's Quality & Reliability
ESQR Excellent in Quality Award

SOLID TECHNOLOGY | SOLID INNOVATION | SOLID FUTURE

GREEN INITIATIVE

A new generation of **Eco-Friendly Transformers** that help keep our planet green

BULOX
BULOX POWER PTE LTD
a Bulox Corporation company

SOLID CAST-RESIN & DRY TYPE TRANSFORMERS

Bulox Power Pte Ltd – a subsidiary of **Bulox Corporation** is one of the leading and most established electrical solution providers in the region. The company collaborates with many leading-edge OEM partners to design, manufacture and distribute a wide range of quality products for the Electrical Power Generation, Transmission and Distribution industry. Bulox Power earned a strong reputation in the electrical industry for its design innovation, quality products and excellent services as the company always keep to its commitment.

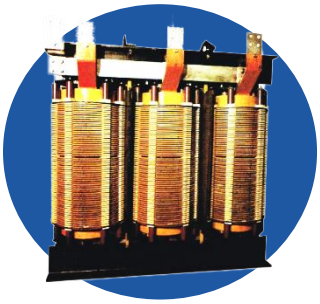
Nowadays, with climate change and global warming coupled with many natural disasters and uncertainties associated with it, society has to be responsible to minimize waste and help keep our planet green. Bulox Power and its subsidiary companies under Bulox Corporation have committed to ensure all its products are produced from sustainable sources and are recyclable. The company has the strong conviction to help keep our environment safe and green - as well as our desire to keep all our products simple and reliable. Bulox Power is pleased to introduce its range of quality **Solid Cast Resin / Dry Type Transformers** for the electrical power industry to help mitigate this matter.

All **Bulox Solid Cast-Resin / Dry Type Transformers** are designed and manufactured in accordance to IEC 60076 Standards and compliances – with strict Quality Control under modern production process. Each Transformer is fully tested in the factory before they are allowed to leave for shipment. The advantages and benefits of manufacturing our range of transformers under our OEM qualified factories are as follows:

- Standard design and documentation
- Better efficiency & faster respond
- More flexibilities to meet production volume and targeted delivery schedule
- More cost-effective and no licensing constraints, etc
- Standard warranty & better aftersales service

TYPE OF TRANSFORMERS

The following are the two most common type of non-liquid filled type of Transformers:



DRY TYPE TRANSFORMER

The **Dry Type Transformers** are designed and manufactured for LV application which made up of high quality Class H insulation materials with full impregnation through the VPI process. The Capacity ranges from **10kVA to 2000 kVA** at maximum voltage level **7.2kV.**

SOLID CAST RESIN TRANSFORMER

The **Solid Cast-Resin Transformers** (SCT) are designed for mostly MV applications. It fully complies to E2, C2, F1 Environmental requirements. The capacity ranges from **100kVA to 25,000 kVA** with maximum voltage at **36 kV**

PRODUCTS COMPARISON

The following are the main features / comparison among different type of Transformers:

No	Attributes	Cast-Resin	FR3-Oil	Silicon Oil	Mineral Oil
1	Type-Tested according to IEC 60076 standard	Yes	Yes	Yes	Yes
2	Transformer Efficiency / Losses	Better	Standard	Standard	Standard
3	Higher Thermal Loading Capability	Yes	Normal	Normal	Normal
4	Transformer Overall Dimension	Smaller	Normal	Larger	Normal
5	Relative Weight Comparison	Lighter	Normal	Heavier	Normal
6	Potential for Oil Leakages	No	Yes	Yes	Yes
7	Fire Risks / Hazards	No	Limited	Limited	Yes
8	Fire-Walls / Oil-Containment Requirement	No	Yes	Yes	Yes
9	Environmental Friendly	Yes	Yes	No	Yes
10	Potential for Green Mark	Yes	Yes	No	Limited
11	Underground / Higher Floor Installations	Suitable	Limited	Limited	No
12	Maintenance Free	Yes	No	No	No

TYPICAL USES

The **BULOX range of Solid Cast-Resin / Dry Type Transformers** are designed and manufactured by **Bulox Power Pte Ltd** – in collaboration with its OEM partners are very simple, modular, safe, reliable and low maintenance. It can be used for the following industries:

- **Underground / Compact Substation**
- **Telecommunication/ Data Centre**
- **Metro / Rail & Track**
- **E-Bus / Fleet Charging Centre**
- **Solar / Renewable Energy**
- **Office & Commercial Building**
- **Industrial Plants**
- **Marine & Offshore**

STANDARD COMPLIANCES

The **Solid Cast Resin Transformers** are designed and manufactured in our selected OEM partners factories with high quality materials and with modern manufacturing processes. The equipment generally complies with the main **IEC Standards**: **IEC 60076 – 11** and meet the requirement of the highest classes, as proven in comprehensive testing:

In addition, the **Solid Cast Resin Transformers** are designed to meet the following classes and conditions:

Environmental Class E2
- Frequent moisture and / or severe pollution

Climate Class C2
- Able to operate, storage and transport at ambient temperature down to -25°C, suitable for outdoor installation

Fire resistance class F1
- No danger in case of surrounding fire in the area of installation, flame retardant, self-extinguishing, no toxic gases
- Self-extinction of fire < 1 hour. No emission of toxic substances.

Eco-Design
- Our range of Solid Cast Resin Transformers also complies to the latest Eco-Design Tier 1 & 2 requirements.

TYPE TEST CERTIFICATE

All **Bulox Solid Cast Resin / Dry Type Transformers** manufactured by our OEM partners have also been type tested by independent institution and / or internationally recognized testing laboratory such as **ASTA / CESI** etc. Individual and / or customized transformers can also be type tested by 3rd party, testing institution if needed.

CLASS APPROVAL

The **Solid Cast-Resin / Dry Type Transformers** can also be tested and complied to meet the international standards & classes. If needed, we can also comply or meet the other classes or society requirement –**DNV, ABS**, **BV, Lloyd or GL**

QUALITY ASSURANCES

Bulox Power strives to provide the **highest guarantee on Quality & Safety** by adopting and implementing all the relevant international Quality Standard, Compliances, Approvals and best practices in the industry.

ADVANTAGES OF SOLID CAST RESIN TRANSFORMERS

The following are some of the main advantages of using Solid Cast Resin Transformer compared to liquid filled type Transformer:

SIMPLE, SAFE & RELIABLE

Compared to Oil-Immersed Transformers, Solid Cast Resin Transformers are very simple and do not need many accessories. It is also not subjected to issue pertaining to oil leakages & oil-monitoring, etc.

NO NEED FIRE WALL & OIL CONTAINMENT

Solid Cast Resin Transformers do not require any Fire-Walls or Oil-Containment; hence reduce civil works costs drastically. It is also more suitable for Underground Substation & High Rise Buildings – nearer to Load Centre.

ABILITY TO WITHSTAND SHORT CIRCUIT

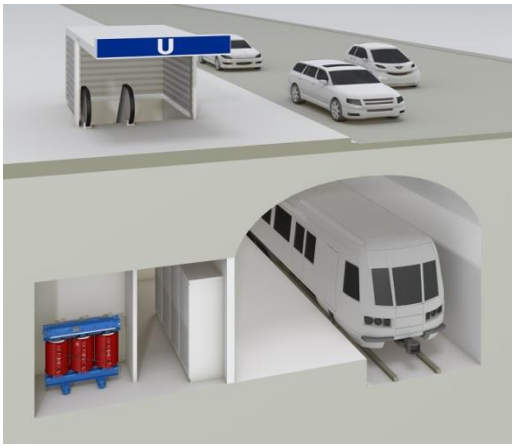
With simple construction using foil windings - fully vacuum casted, it is able to withstand a better electro-mechanical force during short-circuit.

LOW LOSSES & HIGHER EFFICIENCY

With the use of quality foil windings materials & high grade lamination cores, the transformer has relatively lower losses, hence, higher efficiency.

SMALLER DIMENSION & CONVENIENCE

With simple construction & fewer parts, Solid Cast Resin Transformers has smaller footprint and are more convenient for Site Installation.



MAINTENANCE FREE

Generally, all Solid Cast Resin Transformers are almost maintenance-free.

NO FIRE HAZARD

Solid Cast Resin Transformers generally does not have propagated fires and the cast-resin materials are self-extinguishing, hence, they are more fire-resistant.

Our Solid Cast Resin Transformers meet the requirements of the highest defined protection classes:

- Environmental category E2
- Climatic category C2
- Fire category F1

SUSTAINABILITY

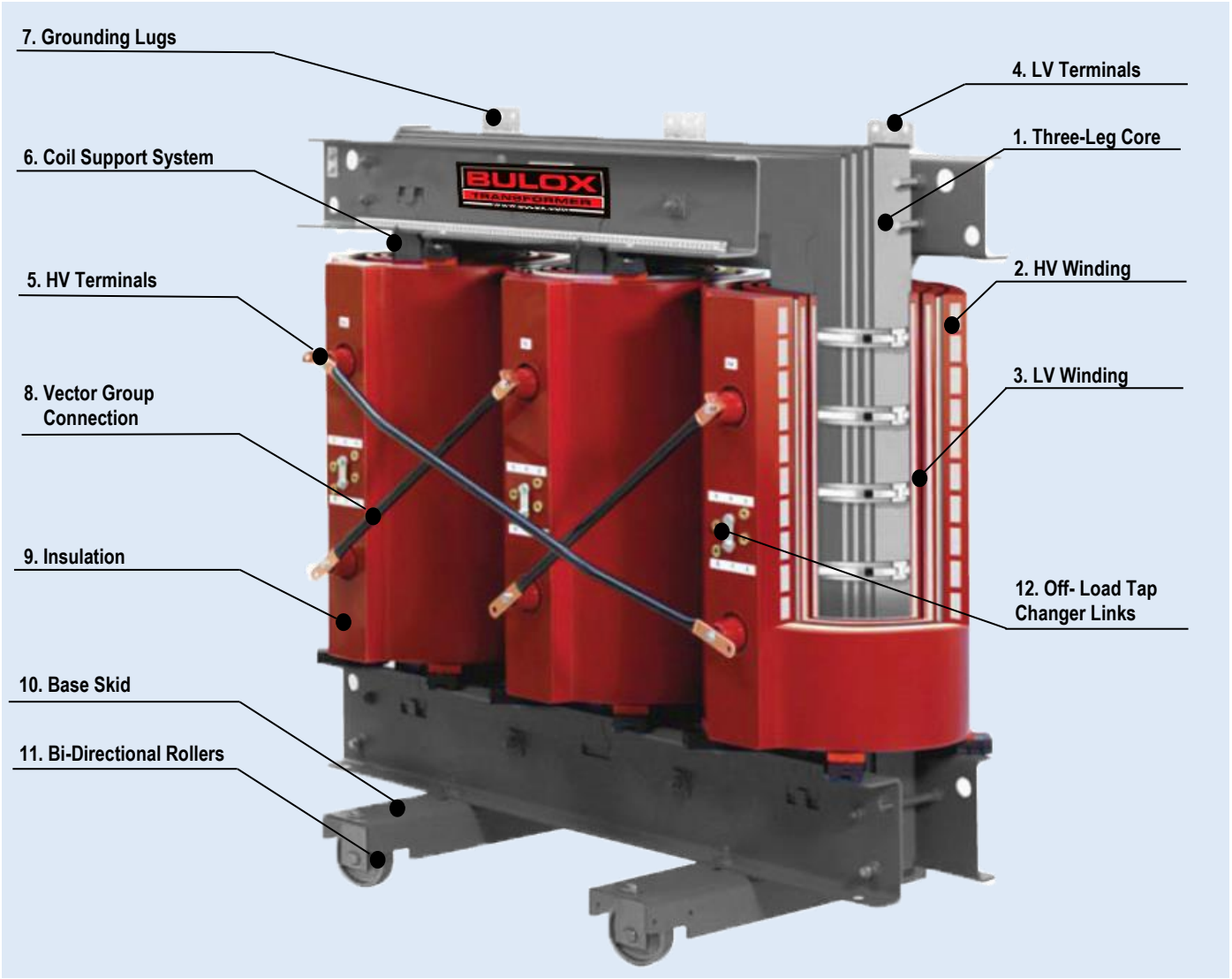
Materials used for manufacturing Solid Cast Resin Transformers are procured from sustainable sources and all main materials are fully recyclable.

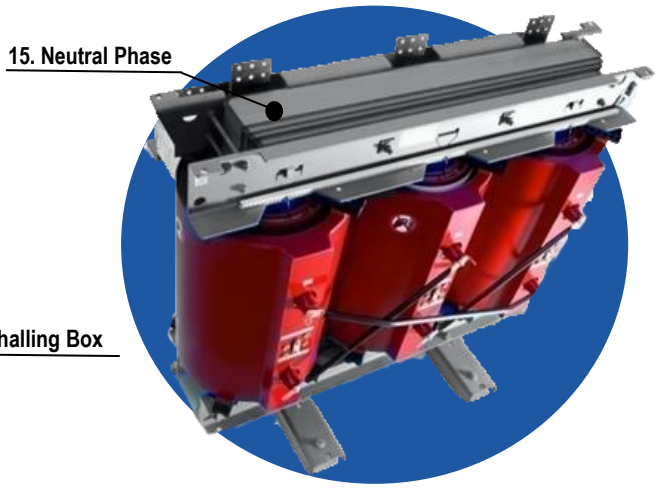
ENVIRONMENTAL FREE

Solid Cast Resin Transformers do not use or produce any toxic by-products which are harmful to the environment.

MAIN COMPONENTS & FEATURES

The following illustrates the key features / components:





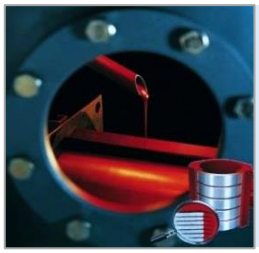
Note: Pictures above are for illustration only

HIGH VOLTAGE WINDINGS

The HV Windings are typically wound with high grade aluminium sectional foils materials or copper flat wires. For Cast-Resin Transformers, aluminium foil winding is preferred than copper as the temperature co-efficient of expansion are closer to the cast resin materials to reduce thermal stresses. Foil windings are also providing uniform potential and less susceptible to inter-turns failures. The coils are wound concentrically for each phase with appropriate type of inter-layer insulations, tested fully before oven vacuumed and casting to form an impregnable solid block.

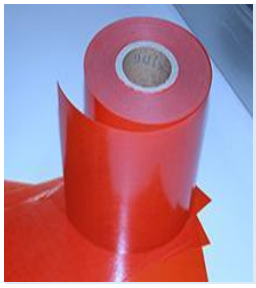
LOW VOLTAGE WINDINGS

The LV windings are also wound with high grade aluminium or copper foils materials. Unlike HV windings, LV Coils are normally not fully casted as they need to dissipate the heat generated out fast. The LV coils are also wound concentrically and vacuum pressure impregnated (VPI) with Class H varnish and polymerized in stoving oven to form a very compact unit that can withstand high dynamic stresses and humidity. They are typically located and secured between the HV coils and the magnetic core limbs.



EPOXY CAST RESIN MATERIALS

The epoxy cast resin materials used for the casting of the coils are made of a mixture epoxy resin and quartz powder mixture. It is not only providing a very good level of electrical insulation but helps to keep the coils solidly intact, moisture resistant and maintenance free. The cast-resin materials are also flame retardant and have self-extinguishing properties –with no toxic gasses. All windings are casted under special in-house vacuum process with strict quality control - that ensures they meet all the basic quality requirements and achieve extremely low Partial Discharge measurements.



INSULATION MATERIALS

The insulation materials used for producing the HV and LV coils are typically made of high grade materials such as nomex or equivalent with Class F / H temperature rise respectively. The insulation materials are also procured from sustainable sources and provide a very high level of electrical safety.

TRANSFORMER CORES

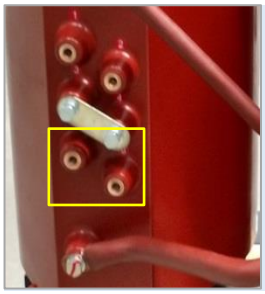
All Bulox transformers 3-cores limbs are made from high grade cold rolled, grain-oriented, low loss, laser-cut magnetic steel sheets which are electro-laminated and insulated on both sides. All the corner joints are typically cut at 45-degree step-lap to increase the magnetic circuit coupling and reduce noises. All the cores laminations are solidly clamped and insulated to form a very strong and rigid block.

HV TERMINALS

The transformer HV terminations are typically located around the mid-section of the HV coils areas and normally suitable for both vertically ascending and/ or descending HV cable terminations.

LV TERMINALS

The LV Terminations from the secondary coils are suitable for both LV cables or dusducts terminations. It is normally designed for vertically ascending cables or busducts but in special cases, it can also be designed for vertically descending cables terminations.



OFF-LOAD TAP CHANGER LINKS

The Off-Load Tap-Changer links for Solid Cast Resin Transformers are normally designed with tap-changing links located around the mid-section part of the HV Windings.

MARSHALLING PANEL

Marshalling panel is typically installed in a safe and accessible position of the transformer active component. It is used to house all the control and monitoring devices terminations of the transformer for easy interfaces.

Note: Pictures above are for illustration only

TRANSFORMER ENCLOSURE

The Transformers are typically installed indoor with a standard metal enclosure protection Class of IP20~23. However outdoor installation with enclosure protection class of IP23W or higher such as IP54 and etc can also be considered – though normally at special design consideration.

BI-DIRECTIONAL ROLLER

Bi-Directional Rollers are temporary installed on the transformer based skid to help it move around easily during installation period.

TEMPERATURE SENSING & CONTROL

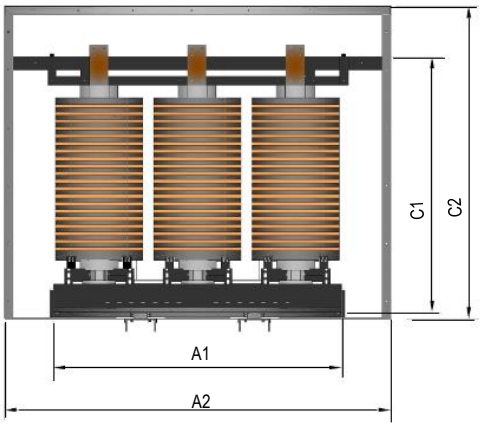
Temperature monitoring of the Transformers are normally needed to ensure the transformers perform well under any circumstances. Normally 3-sets of PT100 with special calibrated high temperature control cable are inserted between HV and LV coils and wired to a microprocessor based digital temperature controller. The controller can be set to different temperature level to provide warning, fans activation & tripping function.

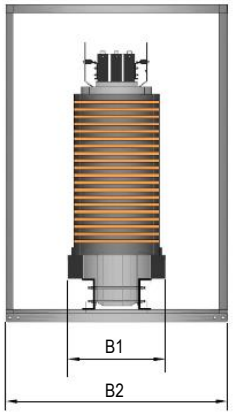
COOLING FANS & CONTROL SYSTEM

Cooling Fans and its associated controller can be provided under option for the Transformers. The fans can provide temporary overload condition for the transformer up to 40% of the transformer maximum rated capacity. These fans are typically used as a standby for seasonal load or any abnormal temporary overload condition

Note: Pictures above are for illustration only

TECHNICAL SPECIFICATION – DRY TYPE TRANSFORMERS

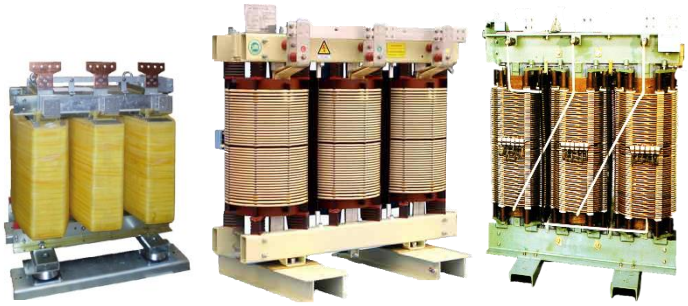




Standard	: IEC 60076 - 11
Rated Power	: 50 - 2500 kVA
Rated Frequency	: 50Hz / 60Hz
HV Rating	: up to 1000V
LV Rating	: up to 1000V
Tapping on HV Side	: ± 2 x 2.5 %
Connection (Typical)	: Pri - Delta; Sec - Star
Impedance Voltage	: 4-6 %
Insulation Class	: Class F / H
Temperature rise	: Class F
K-factor Design	: K1 / K4 / K13 / K20
Enclosure Protection	: IP00 / IP20 / IP23

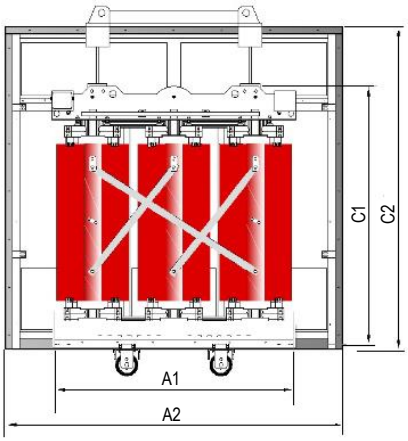
Power kVA	Reference IP-00	Impec Ucc (%)	Losses No Load (W)	Losses Load (115°C) (W)	IP-00			IP-20/23			Est Weight (kg) without Enclosure	Est Weight (kg) with Enclosure
					A1	B1	C1	A2	B2	C2		
10	BX3-10-1	4	150	400	360	240	410	560	510	760	70	110
13	BX3-13-1	4	175	475	360	260	410	560	510	760	80	120
16	BX3-16-1	4	200	560	430	270	460	560	510	760	93	133
20	BX3-20-1	4	230	670	430	290	460	560	510	760	108	148
25	BX3-25-1	4	270	780	430	300	460	560	510	760	130	165
32	BX3-32-1	4	300	980	460	330	460	760	710	1010	140	200
40	BX3-40-1	4	350	1120	460	360	480	760	710	1010	170	233
50	BX3-50-1	4	400	1250	560	390	440	760	710	1010	190	255
63	BX3-63-1	4	450	1450	560	460	440	760	710	1010	230	290
80	BX3-80-1	4	520	1750	590	460	490	760	710	1010	260	330
100	BX3-100-1	4	600	2250	590	480	550	760	710	1010	310	370
125	BX3-125-1	4	700	2700	590	500	610	760	710	1510	370	470
160	BX3-160-1	4	840	3100	660	530	630	1010	1010	1510	460	560
200	BX3-200-1	4	1050	3500	750	520	690	1010	1010	1510	560	660
250	BX3-250-1	4	1250	3900	780	530	790	1010	1010	1510	660	765
315	BX3-315-1	4	1500	4400	780	580	790	1010	1010	1510	790	895
400	BX3-400-1	4	1750	5000	870	610	870	1010	1010	1510	1000	1100
500	BX3-500-1	4	2100	5900	870	700	940	1010	1010	1510	1210	1310
630	BX3-630-1	4	2650	6800	960	740	1010	1210	1210	1760	1580	1730
800	BX3-800-1	4	3200	8200	960	840	1070	1210	1210	1760	1930	2080
1000	BX3-1000-1	4	3750	10000	960	860	1170	1210	1210	1760	2160	2310

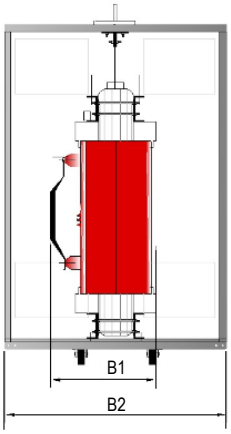
The Dry Type Low Voltage Transformers with three phase or single phase are designed and manufactured as isolation transformers which used to adjust the voltage level in the low voltage distribution grid. This Dry Type Transformers are widely used in industrial applications as well as commercial or public building.



Note: The technical specifications provided above are based on Bulox's standard Varnish Impregnated Dry Type Transformers and are used for guidance only. Manufacturer reserved the rights to change technical specifications without giving prior notice. All other customized or non-standard design technical specifications can be provided separately upon request before manufacture.

TECHNICAL SPECIFICATION – SOLID CAST RESIN TRANSFORMERS





Standard	: IEC 60076 - 11
Rated Power	: 100 - 25000 kVA
Rated Frequency	: 50Hz / 60Hz
HV Rating	: up to 36kV
LV Rating	: up to 780V (Special designs for up to 12kV)
Tapping on HV Side	: ± 2.5 % or ± 2 x 2.5 %
Connection (Typical)	: HV - Delta; LV - Star
Impedance Voltage	: 4-8 %
Insulation Class	: HV / LV - Class F / Class F
Temperature rise	: HV / LV - 100K / 100K
K-factor Design	: K1 / K4 / K13 / K20
Enclosure Protection	**:** IP00 / IP20 / IP23

kV	kVA	Po (W)	Pcc (75°C) (W)	Pcc (120°C) (W)	η 3/4 Cosφ 1 (%)	η 3/4 Cosφ 0.9 (%)	ZI (%)	Io (%)	Icc (kA)	In-rush (Ir/In)	Lpa (dB)	IP-00			IP-20			Est Weight (kg) without Enclosure	Est Weight (kg) with Enclosure
												A1	B1	C1	A2	B2	C2		
12	100	530	1850	2100	97.77	97.53	6	2.3	2.4	10	48	1100	650	1100	1600	1100	1700	590	710
	250	770	3900	4450	98.28	98.09		1.8	6.0		54	1170	650	1200				940	1100
	315	950	4700	5380	98.34	98.16		1.7	7.6		56	1200	650	1320				1080	1350
	500	1300	5950	6800	98.65	98.50		1.4	12.0	9.5	57	1350	800	1560	1950	1200	1950	1420	1620
	630	1550	7200	8040	98.71	98.56		1.3	15.2		58	1400	800	1600				1680	1800
	800	1800	8600	9840	98.79	98.66		1.2	19.2		59	1470	800	1670				1900	2150
	1000	2100	9800	11200	98.89	98.77		1.1	24.1		60	1530	950	1760				2250	2430
	1250	2400	12000	13700	98.93	98.81		1.0	30.1	9	62	1590	950	1850	2100	1350	2500	2700	2970
	1600	2950	13200	15200	99.05	98.94		0.9	38.5		62	1740	950	1900				3450	3680
	2000	3200	16500	18850	99.09	98.99		0.8	48.1		63	1700	1200	2300				3900	4250
	2500	3600	19500	22300	99.15	99.05		0.7	60.1	8.5	65	1790	1200	2350	2500	1600	2700	4500	4800
	3150	4300	21800	24960	99.23	99.14	7	0.6	65.0	8	66	1940	1200	2450				5500	5850
24	100	550	1800	2000	97.81	97.60	6	2.3	2.4	10	52	1130	740	1175	1700	1200	1800	630	780
	250	800	3800	4400	98.28	98.09		1.8	6.0		55	1215	830	1220				1000	1240
	315	1000	4600	5200	98.36	98.18		1.7	7.6		56	1260	830	1300				1150	1380
	500	1300	6200	7000	98.62	98.47		1.4	12.0	9.5	57	1350	920	1550	2000	1300	2050	1550	1720
	630	1650	6950	8000	98.71	98.57		1.3	15.2		58	1470	940	1600				1800	1980
	800	1850	8300	9500	98.81	98.68		1.2	19.2		59	1500	950	1670				2100	2340
	1000	2200	9500	10800	98.91	98.79		1.1	24.1		60	1590	1040	1800				2500	2720
	1250	2600	11000	12500	98.98	98.87		1.0	30.1	9	61	1650	1050	1850	2150	1450	2600	2950	3180
	1600	3150	13000	14500	99.06	98.96		0.9	38.5		62	1830	1080	1930				3700	3980
	2000	3500	16200	18000	99.08	98.98		0.8	48.1		63	1770	1200	2300				4100	4320
	2500	4000	18500	21000	99.16	99.07		0.7	60.1	8.5	64	1860	1200	2350	2550	1700	2800	4900	5260
	3150	4600	21000	23500	99.31	99.23	7	0.6	65.0	8	65	1950	1200	2450				5600	5930
36	100	900	2800	3200	96.53	96.15	5	2.5	2.9	9.5	52	1400	930	1250	1800	1400	1900	950	1180
	250	1150	3500	4000	98.24	98.05	6	2.0	6.0		54	1500	950	1250				1310	1500
	315	1300	3800	4300	98.45	98.28		1.9	7.6		55	1560	960	1300				1480	1670
	500	1650	4900	5600	98.74	98.60		1.6	12.0		56	1650	1100	1500	2100	1500	2150	2000	2230
	630	2000	6000	6800	98.78	98.65		1.5	15.2	9	57	1770	1120	1550				2300	2580
	800	2500	6600	7500	98.89	98.77		1.4	19.2		58	1830	1150	1600				2750	2920
	1000	3400	7900	9000	98.94	98.82		1.3	24.1		59	1880	1150	1700				3100	3360
	1250	4000	9300	10650	99.01	98.90		1.2	30.1		60	1920	1200	1800	2250	1600	2750	3500	3780
	1650	4900	10900	12500	99.09	98.99		1.1	38.5		61	2000	1200	2200				4150	4400
	2000	5500	13100	15000	99.12	99.02		1.0	48.1	8.5	62	2100	1300	2300				4900	5120
	2500	5900	16200	18500	99.16	99.06	6.5	0.8	55.5	7.5	63	2190	1300	2350	2400	1800	2950	5900	6320
	3150	5900	20200	23000	99.21	99.12	8	0.7	70.0	7	65	2340	1300	2670				7100	7480

Note: The technical specifications provided above are based on Bulox's standard Solid Cast Resin Transformers and are used for guidance only. Manufacturer reserved the rights to change technical specifications without giving prior notice. All other customized or non-standard design technical specifications can be provided separately upon request before manufacture.

TESTING SCHEDULE – FACTORY ROUTINE TEST/SITE TEST

All Transformers are singularly tested with factory routine test and site test, according to **IEC 60076 - 11 standards**. Upon request the type test can be carried out: partial discharge measurement, temperature rise test and sound level test. Type testing takes place on all new products and where required test results and certificates of conformity are provided.

The following tests are performed according to **IEC standards:**

Standard Factory Routine Test (FAT)
- Measurement of no load losses and no load current
- Measurement of short-circuit impedance and load loss
- Separate-source ac voltage with stand test
- Induced AC voltage test
- Voltage ratio measurement and check of polarities and connections
- Winding resistance measurement
- Insulating liquids - determination of puncture voltage in the power frequency

Special / Type Test (Optional Cost)
- Partial Discharge measurement
- Temperature rise measurement
- Sound level measurement

Site Acceptance Test (SAT)
- Ratio Test
- Winding Resistance Test
- Vector Group Test
- AC Hi-Pot Test
- Insulation Resistance Test
- Polarization Index test
- Functionality Test




BULOX ADVANCED REMOTE MONITORING (ARM) SYSTEM

The **Bulox ARM System** is the latest state of art innovation from **Bulox Corporation**. It is a universally accepted condition monitoring system which helps to monitor your critical Equipment assets such as HV Switchgears, Transformers and Main switchboard 24/7 using latest IOT technologies through clouds system. It is very safe and reliable and will help owner's peace of mind and security on their equipment before any failure and/ or mishap can occur. The **Bulox ARM system** uses different type of sensors with different technologies for different equipment. The system also allows the owner as well as the service agent to keep a proper record of all the equipment automatically - as well as allow remote troubleshoot and schedule all the maintenance regularly – all through digital platform. It is an extension of the conventional BMS System – in line with latest **Industry 4.0** requirements. **Please contact with our sales for more information about this Bulox ARM System.**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