

# Oil Immersed Transformer



INTEGRATION  
OF POWER SYSTEM

# We Light Up the Taipei 101, Once the highest building in the world



## 22.8KV Substation in every 10 floor.

- CRTR :3P 22.8KV 2~4MVA \* 70 PCS
- PANEL :3P HV&LV\* 1780 SETS



## 161KV Substation in B4 Belong to TPC

- TR :3P 161/22.8KV 60MVA \* 4 PCS
- GIS:3P 161/22.8KV 60MVA \* 4 PCS

# Contents

## **Oil-Immersed Distribution Transformer**

(1) Features	2
(2) Specifications & Characteristic	4
(3) The outline dimension oil quantity & total weight	8
(4) Size of Bushing Terminal	8
(5) Accessories of Standard and Option parts	9
(6) Connecting Duct, Terminal & Foundation Bilts	10

## **Energy Efficiency & Environmental Protection Transformer**

(1) Preface	11
(2) Features	12
(3) Total owning cost	13
(4) Characteristic	14
(5) The outline dimension oil quantity & total weight	15
(6) Size of bushing Terminal	19
(7) Dimension of connecting Duct	20
(8) Accessories	20
Main Domestic Customers	21
Main Export Customers	21



## Oil-Immersed Distribution Transformer

### (1) Features

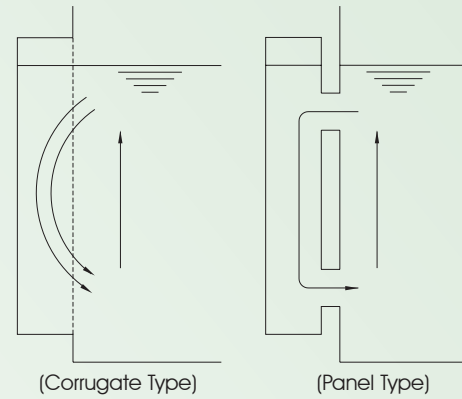
- **Energy Saving**

The design and production goal of Shihlin oil-immersed distribution transformers is to reduce the power losses and to provide economical and energy-efficiency solutions to customer.

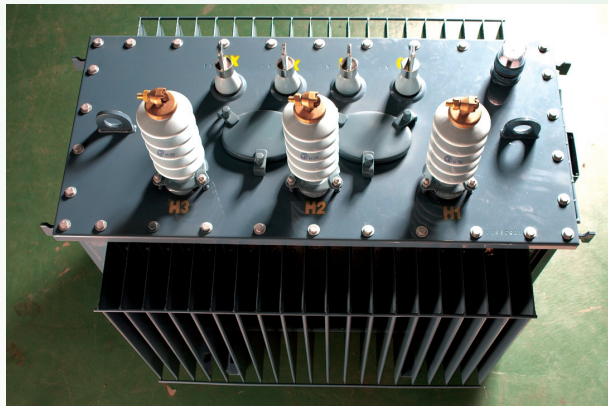
- **Extraordinary corrugated heat sink**

Shihlin oil-immersed distribution transformer has a high performance corrugated tank that has the following benefits:

- (1) Excellent heat dissipation ability shall be obtained.
- (2) The welding path cut in half to reduce possible oil leak.
- (3) An Excellent extendable strain ability
- (2) Unique heat sink design for more efficiency in heat dissipation.



Oil Flow



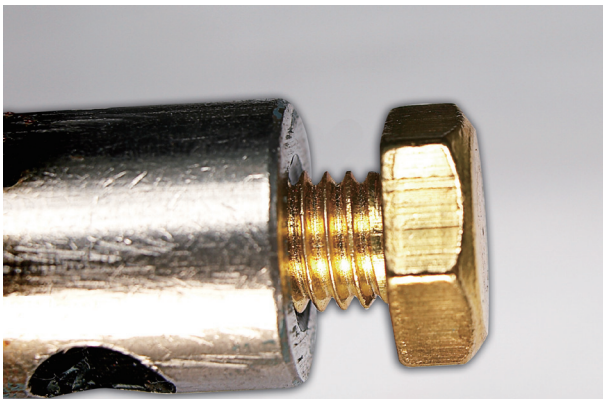
- **Remarkable fully sealed structure**

Shihlin oil-immersed distribution transformer uses good quality moisture-proof gasket to provide tight sealing completely between the top cover and tank to keep the insulation oil tighted from outside air then a good insulation ability of oil could be run in good condition.



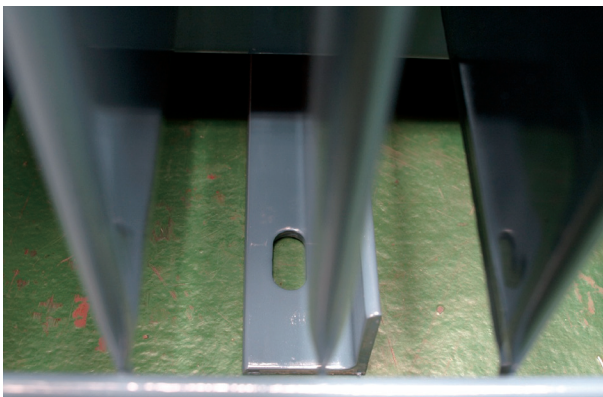
- **The tanks painted with weather resistant coating**

Using high weather resistant paint to increase the ability of transformers weather protection.



• **Simplified device to operation**

Grounding operation is simplified by well designed grounding terminal structure



• **Easy installation**

The long-hole type foundation screw design provides better workability

(2) Specifications & Characteristic

[Typical Specification]

Type	Oil-Immersed ONAN (Out Door) Transformer
Frequency	50/60Hz
Oil Temp. Rises / windings temp. Rises	60°C / 65°C
Paint Color	(Munsell No. 10 BG 4/2)
Standard mounting	Base Type Setting

A. Tolerance refer to IEC 60076

- Total Loss less than 6%
- Load loss (Copper loss) less than 10%
- No Load Loss (Iron loss) less than 10%
- No Load Current
- Voltage Regulation
- Noise

B. Rating Current Calculation

- Single phase Transformer

$$\text{Rated Current} = \frac{(\text{kVA}) \times 1000}{\text{Rated Voltage (V)}}$$

- Three Phase Transformers

$$\text{Rated Current} = \frac{(\text{kVA}) \times 1000}{\sqrt{3} \times \text{Rated Voltage (V)}}$$

(3) The outline dimension, oil quantity & total weight

[Three Phase 11.4kV/220V Transformers (150~2000kVA)]

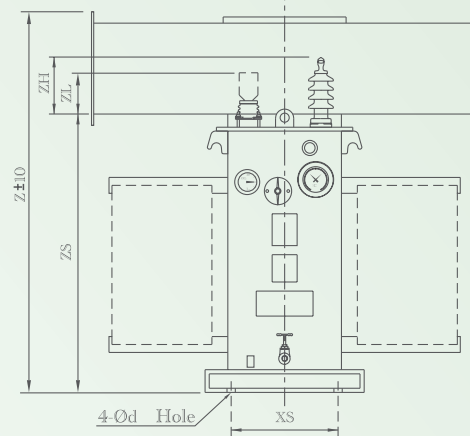
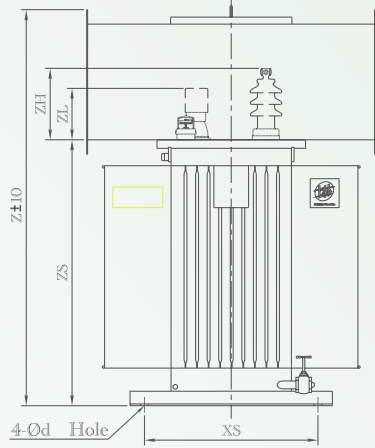
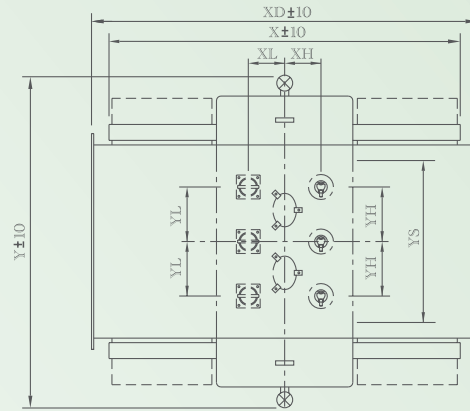
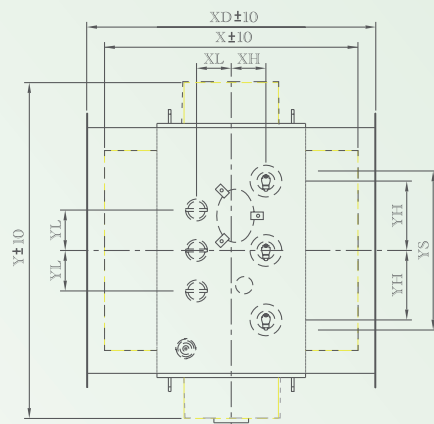
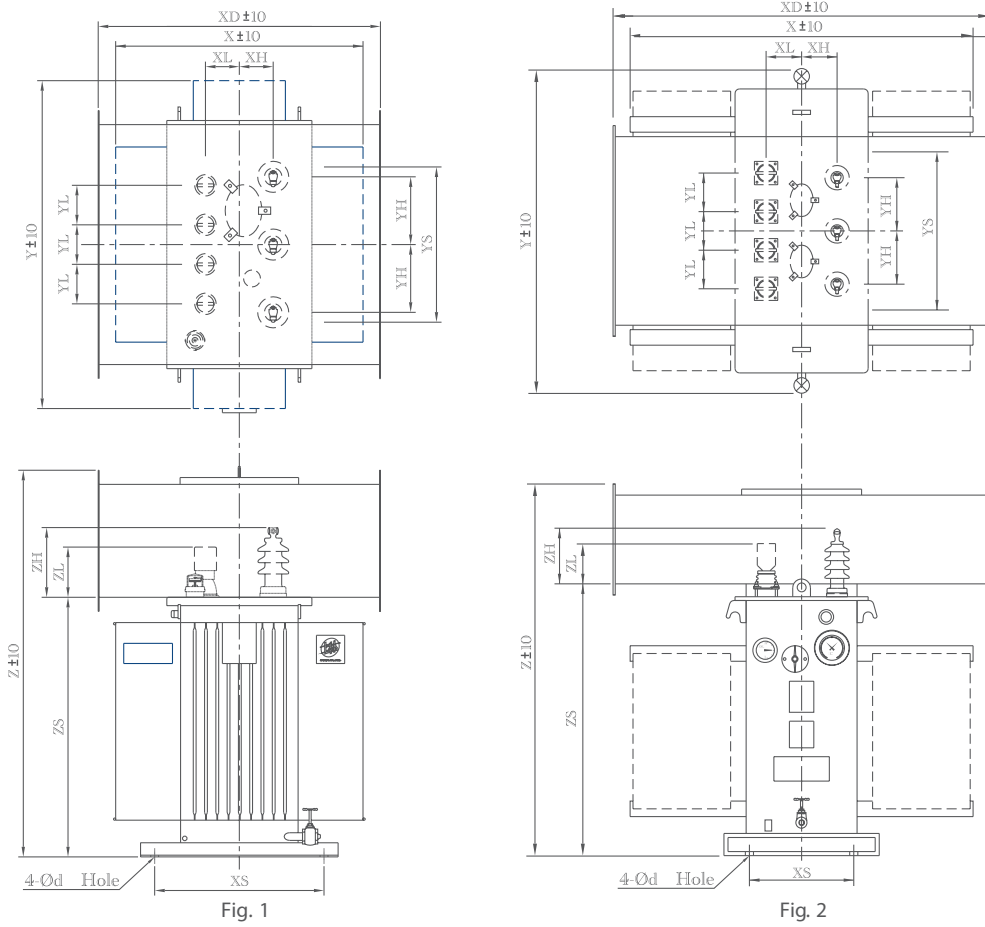


Fig. 1

Fig. 2

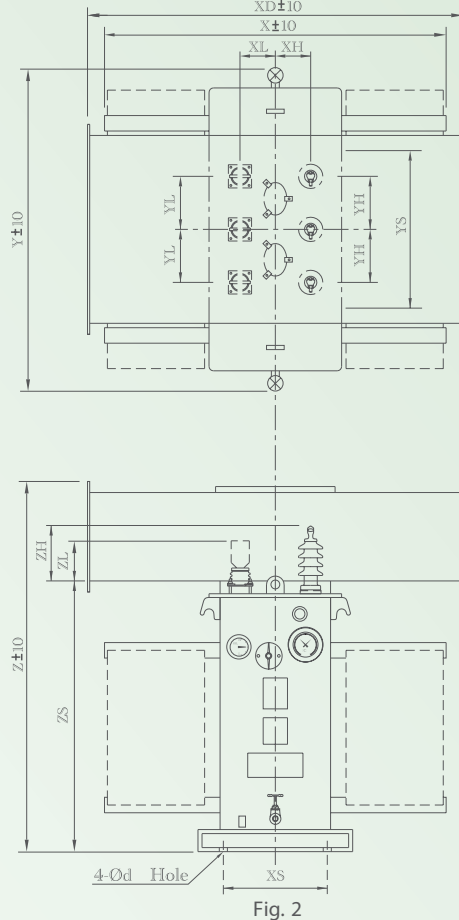
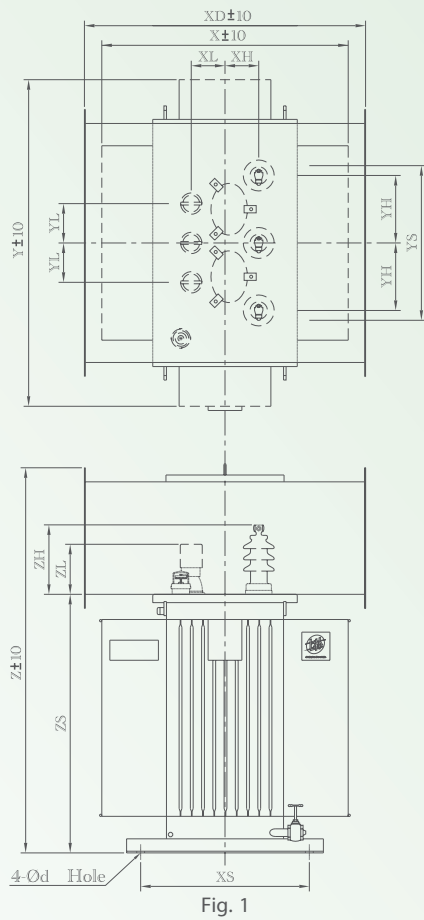
Phase	Cap. (kVA)	Ref. Fig.	Standard Type											Duct Type								
			(mm) Outline Dimensions					(mm) Foundation Bolts Distance			(mm) Bushing Distance & Height			Oil (l)	Net Wz	(mm) Outline Dimensions			Net Weigh (kg)	Terminal Dim		
			X	Y	ZS	ZH	ZL	XS	YS	d	XH	XL	YH			YL	XD	Y		Z	P.V	S.V
3	150	Fig.1	700	1200	810	247	150	500	450	14x28	110	120	240	240	170	605	900	1200	1260	665	Fig.L7	
	200	Fig.1	820	1340	810	247	150	500	450	14x28	115	115	240	240	170	685	1000	1340	1260	760	Fig.L7	
	300	Fig.1	880	1180	793	247	173	600	550	14x28	120	120	240	140	200	860	1000	1180	1245	920	Fig.H2	Fig.L9
	400	Fig.1	840	1240	923	247	173	600	550	14x28	120	120	240	140	280	1185	1000	1240	1375	1250	Fig.L9	
	500	Fig.1	1040	1380	923	247	273	600	550	14x28	120	120	240	140	335	1300	1200	1380	1375	1380	Fig.L10	
	750	Fig.1	1100	1810	1110	300	293	700	800	18x36	160	160	240	240	555	2130	1300	1810	1620	2250	Fig.L11	
	1000	Fig.1	1190	1940	1210	300	323	700	800	18x36	160	160	240	240	655	2630	1400	1940	1720	2750	Fig.L12	
	1500	Fig.1	1370	2120	1210	300	323	700	800	18x36	160	160	240	240	900	3350	1500	2120	1720	3500	Fig.L13	
2000	Fig.1	1480	2250	1310	300	323	700	800	18x36	160	160	240	240	1290	4300	1600	2250	1820	4450	Fig.L12*2		

[Three Phase 11.4kV/380Y-220V Transformers (150~3000kVA)]



Phase	Cap. (kVA)	Ref. Fig.	Standard Type											Duct Type			Terminal Dim				
			(mm) Outline Dimensions			(mm) Foundation Bolts Distance		(mm) Bushing Distance & Height				Oil (l)	Net Weight (kg)	(mm) Outline Dimensions					Net Weigh (kg)		
			X	Y	ZS	ZH	ZL	XS	YS	d	XH			XL	YH	YL				XD	Y
3	150	Fig.1	700	1200	810	247	150	500	450	14x28	110	120	240	180	170	605	900	1200	1260	665	Fig. L6
	200	Fig.1	820	1340	810	247	150	500	450	14x28	115	115	240	180	170	685	1000	1340	1260	760	Fig. L7
	300	Fig.1	880	1180	793	247	150	600	550	14x28	120	120	240	140	200	860	1000	1180	1245	920	Fig. H2, Fig. L7
	400	Fig.1	840	1240	923	247	163	600	550	14x28	120	120	240	140	300	1185	1000	1240	1375	1250	Fig. L8
	500	Fig.1	1040	1810	1098	247	173	600	550	14x28	120	120	240	140	335	1300	1200	1380	1375	1380	Fig. L9
	750	Fig.1	1100	1810	1110	300	237	700	800	18x36	160	160	240	180	555	2130	1300	1810	1620	2250	Fig. L10
	1000	Fig.1	1190	1940	1210	300	237	700	800	18x36	160	160	240	180	655	2630	1400	1940	1720	2750	Fig. L10
	1500	Fig.1	1370	2120	1210	300	293	700	800	18x36	160	160	240	180	900	3350	1500	2120	1720	3500	Fig. L11
	2000	Fig.1	1480	2250	1310	300	323	700	800	18x36	160	160	240	180	1290	4300	1600	2250	1820	4450	Fig. H3, Fig. L12
	2500	Fig.2	2350	1680	1365	300	323	700	800	18x36	160	160	240	180	1000	4700	2500	1680	1875	4900	Fig. L13
3000	Fig.2	2440	1765	1565	300	323	800	800	18x36	160	160	240	180	1290	5750	2600	1765	2075	5950	Fig. L14	

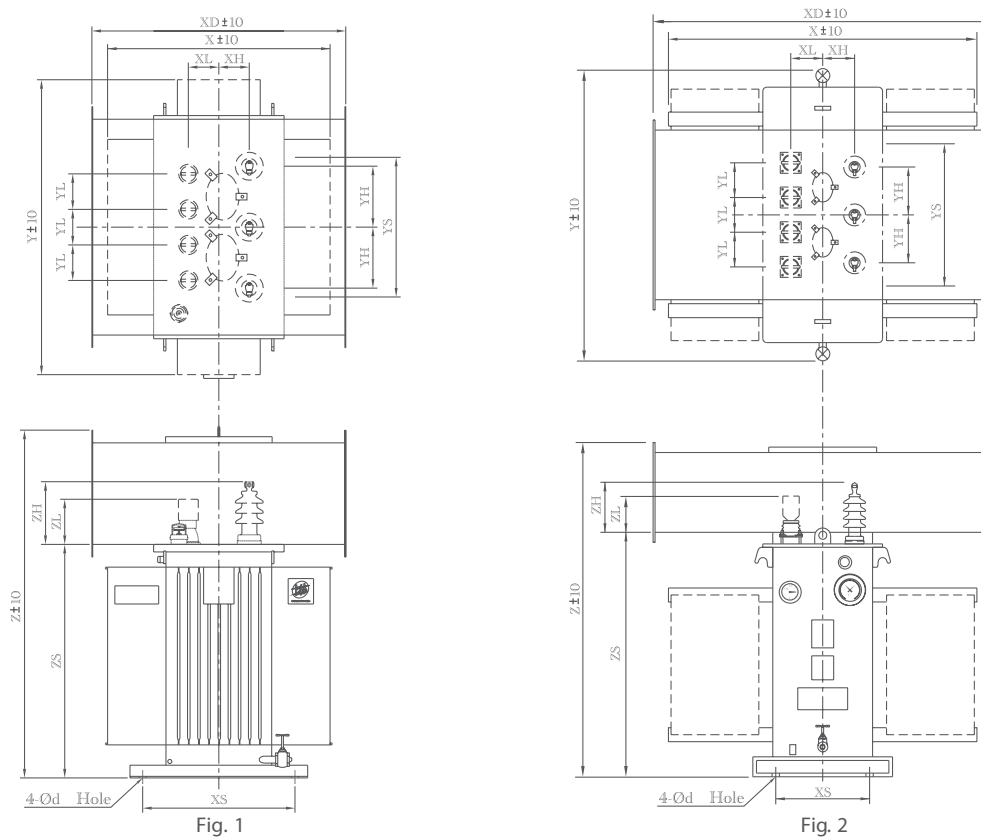
[Three Phase 22.8kV/220V Transformers (150~2000kVA)]



Phase	Cap. (kVA)	Ref. Fig.	Standard Type												Duct Type			Terminal Dim (mm)			
			(mm) Outline Dimensions				(mm) Foundation Bolts Distance				(mm) Bushing Distance & Height				Oil (l)	Net Weight (kg)	(mm) Outline Dimensions			Net Weigh	
			X	Y	ZS	ZH	ZL	XS	YS	d	XH	XL	YH	YL			XD	Y	Z		
	150	Fig.1	660	1180	863	327	150	500	450	14x28	110	120	290	240	170	650	900	1180	1460	730	Fig.L7
	200	Fig.1	770	1280	863	327	150	500	450	14x28	110	120	290	240	200	760	900	1280	1460	835	Fig.L7
	300	Fig.1	800	1200	893	327	173	600	550	14x28	120	120	290	140	295	1010	1000	1200	1495	1085	Fig. H2 Fig.L9
	400	Fig.1	730	1360	1023	327	173	600	550	14x28	120	120	290	140	370	1320	1000	1360	1625	1400	Fig.L9
3	500	Fig.1	930	1360	1023	327	237	600	550	14x28	120	120	290	140	400	1460	1200	1360	1625	1550	Fig.L10
	750	Fig.1	1060	1770	1164	346	293	700	800	18x36	160	160	290	240	660	2330	1300	1770	1820	2450	Fig.L11
	1000	Fig.1	1150	1910	1219	346	323	700	800	18x36	160	160	290	240	795	2900	1300	1910	1870	3000	Fig.L12
	1500	Fig.1	1410	2120	1214	346	323	700	800	18x36	160	160	290	240	1025	3750	1600	2120	1870	3900	Fig. H3 Fig.L13
	2000	Fig.1	1480	2250	1314	346	323	700	800	18x36	160	160	290	240	1230	4500	1600	2250	1970	4650	Fig. L12*2



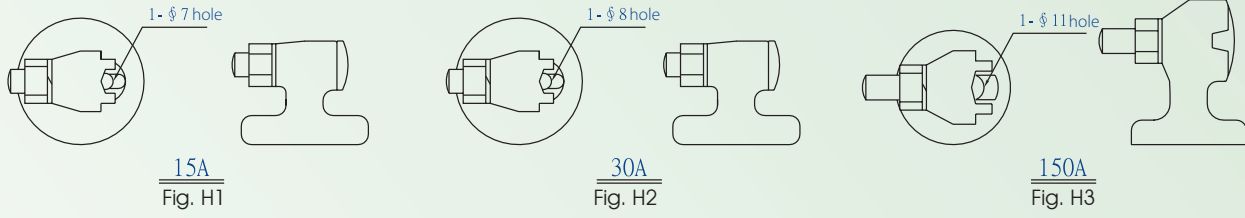
[Three Phase 22.8kV/380Y-220V Transformers (150~3000kVA)]



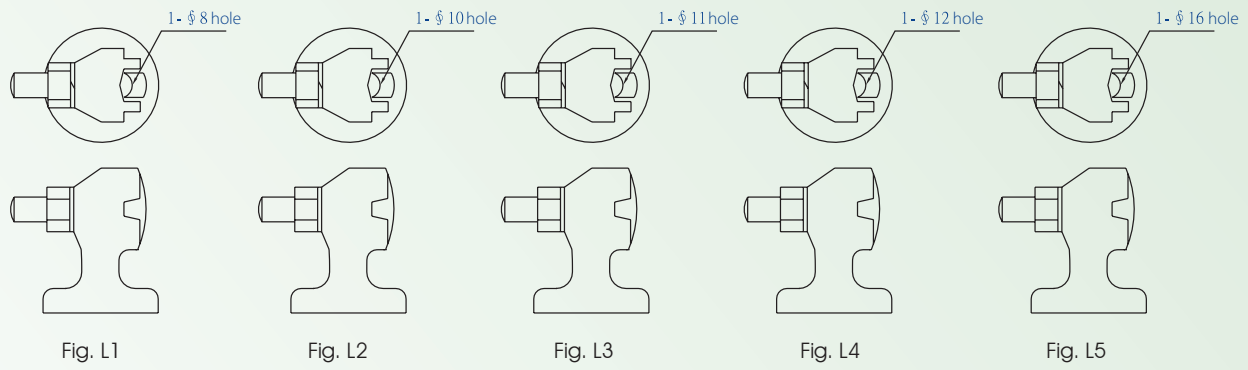
Phase	Cap. (kVA)	Ref. Fig.	Standard Type											Duct Type			Terminal Dim				
			(mm) Outline Dimensions			(mm) Foundation Bolts Distance			(mm) Bushing Distance & Height					Oil (l)	Net Weight (kg)	(mm) Outline Dimensions			Net Weigh (kg)		
			X	Y	ZS	ZH	ZL	XS	YS	d	XH	XL	YH			YL	XD	Y		Z	
																			P.V	S.V	
3	150	Fig.1	660	1180	863	327	150	500	450	14x28	110	120	290	180	170	650	900	1180	1460	730	Fig. L6
	200	Fig.1	770	1280	863	327	150	500	450	14x28	110	120	290	180	200	760	900	1280	1460	835	Fig. L7
	300	Fig.1	800	1200	893	327	150	600	550	14x28	120	120	290	140	275	1010	1000	1200	1495	1085	Fig. H2, Fig. L7
	400	Fig.1	730	1360	1023	327	163	600	550	14x28	120	120	290	140	370	1320	1000	1360	1625	1400	Fig. L8
	500	Fig.1	930	1360	1023	327	173	600	550	14x28	120	120	290	140	400	1460	1200	1360	1625	1550	Fig. L9
	750	Fig.1	1060	1770	1164	346	237	700	800	18x36	160	160	290	180	660	2330	1300	1770	1820	2450	Fig. L10
	1000	Fig.1	1150	1910	1219	346	237	700	800	18x36	160	160	290	180	795	2900	1300	1910	1870	3000	Fig. L10
	1500	Fig.1	1410	2120	1214	346	293	700	800	18x36	160	160	290	180	1025	3750	1600	2120	1870	3900	Fig. L11
	2000	Fig.1	1480	2250	1314	346	323	700	800	18x36	160	160	290	180	1230	4500	1600	2250	1970	4650	Fig. H3, Fig. L12
	2500	Fig.2	2280	1905	1465	346	323	700	800	18x36	160	160	290	180	1245	5350	2400	1905	2125	5550	Fig. L13
3000	Fig.2	2480	1885	1565	346	293	800	800	18x36	160	160	290	180	1430	6050	2600	1885	2225	6250	Fig. L14	

(4) Size of Bashing Terminal

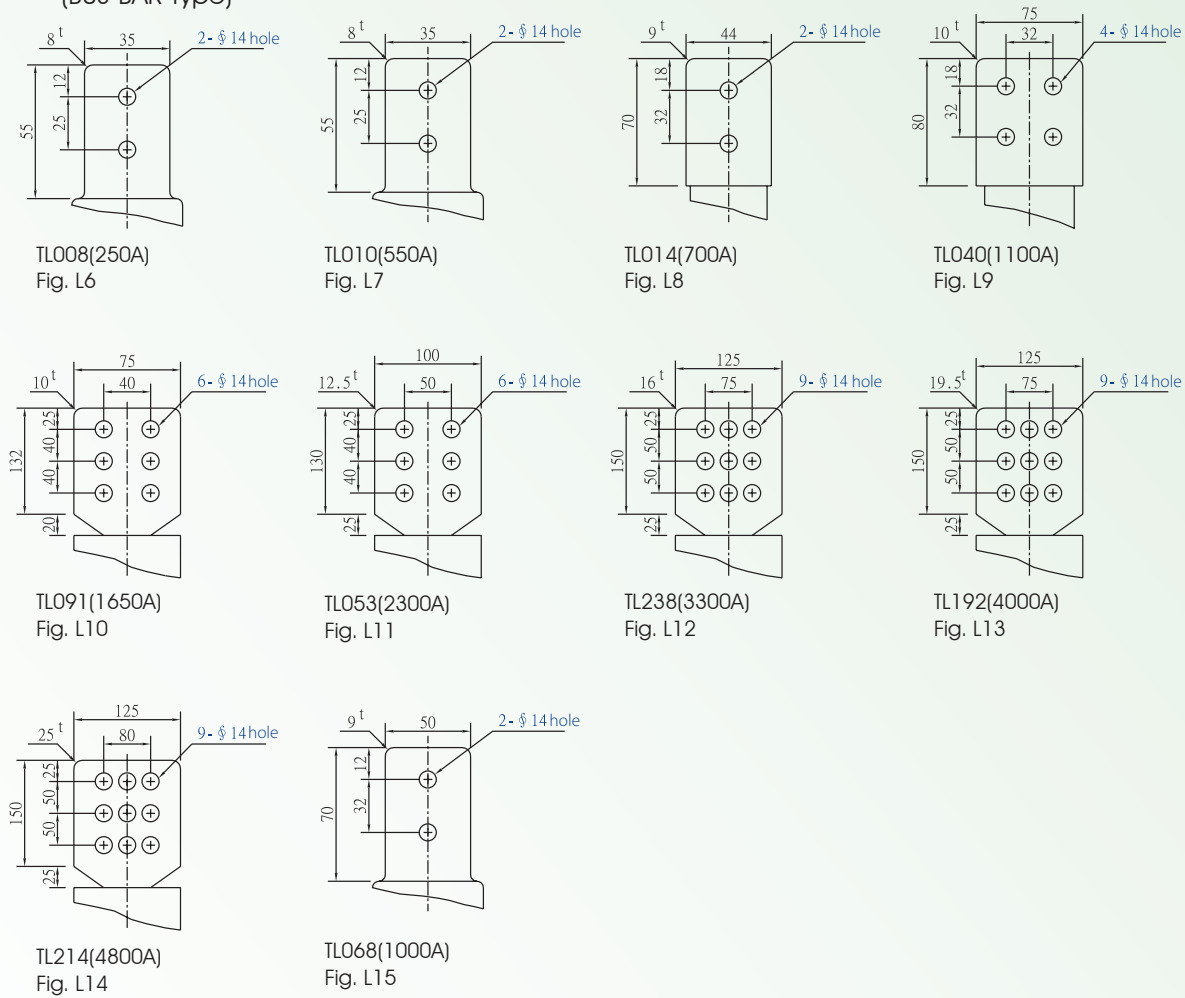
[HV Terminal] (Cramp Type)



[LV Terminal] (Cramp Type)



(BUS-BAR Type)



(5) Accessories

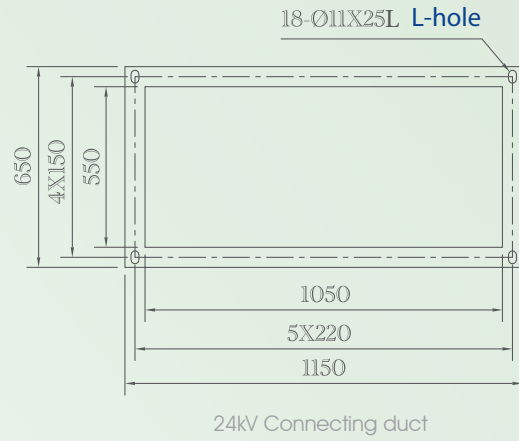
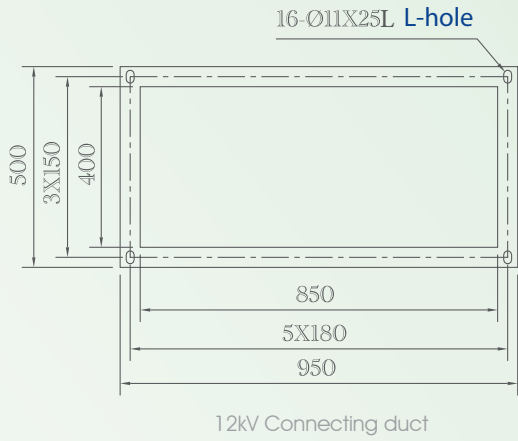
kVA	Phase	Single Phase						Three Phase							
		3	15	75	150	600	1000	3	15	75	150	250	600	1000	2500
		{	{	{	{	{	{	{	{	{	{	{	{	{	{
Item	10	50	100	500	750		10	50	100	200	500	750	2000	3000	
1 Name Plate	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
2 Marking	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
3 Earth Terminal	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
4 H.V Bushing	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
5 L.V Bushing	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
6 Hand Hole	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
7 Lifting Lug	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
8 Setting Base	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
9 Foundation Bolts	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
10 Oil Level Line	●	●	●				●	●	●						
11 Oil Level Gauge														●	
12 Oil Thermometer Gauge				●	●	●				●	●	●	●		
13 Oil Drain Valve				●	●	●				●	●	●	●	●	
14 Oil Filter Valve						●							●	●	
15 Press. Rel. Valve				●	●	●				●	●	●	●	●	
16 Tap Plate (11.4kV Inside Use)		●	●	●				●	●	●					
17 Tap Plate (22.8kV Inside Use)			●	●	●	●			●	●	●	●	●	●	
18 No Voltage Tap Changer (11.4kV Outside Use)				○	●	●				○	●	●	●	●	
19 Oil Thermometer Gauge (Alarm)				○	○	○				○	○	○	○		
20 Support Lug														○	
21 Lifting Lug (HV-LV)	○	○	○				○	○	○						
22 Supporter (LV-LV) *註1	○	○					○	○							
23 Wheel					○	○				○	○	○	○	○	
24 Standard DUCT				○	○	○				○	○	○	○	○	
25 Single Elephant DUCT				○	○	○				○	○	○	○	○	
26 LV with Bus Bar				○	○	○				○	○	○	○	○	
27 Special color	○	○	○	○	○	○	○	○	○	○	○	○	○	○	

( for LV/LV TR.)

● (standard parts)

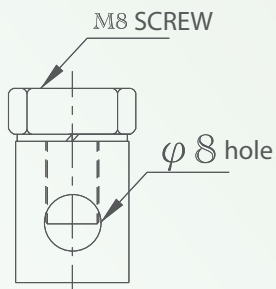
○ (option parts)

[Dimension of duct]

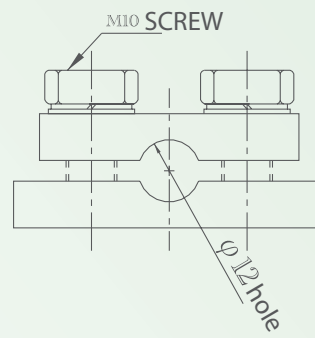


[Earth Terminal]

Apply to 1,3Φ 3~500kVA

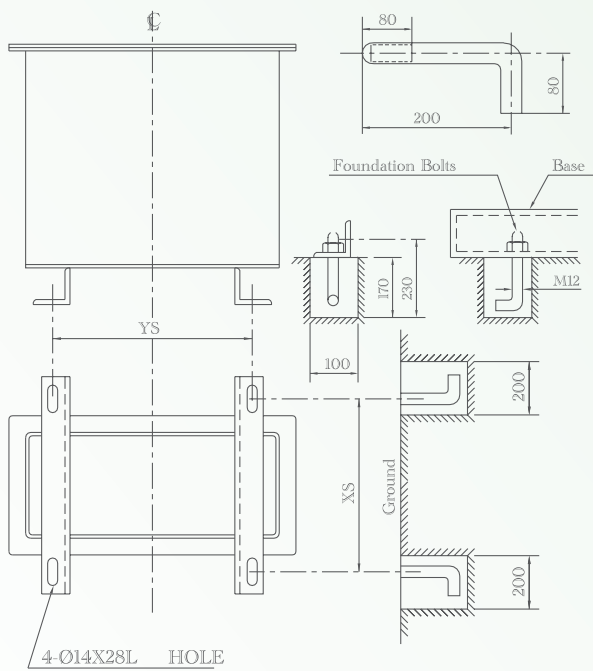


Apply to 1,3Φ 600~3000kVA

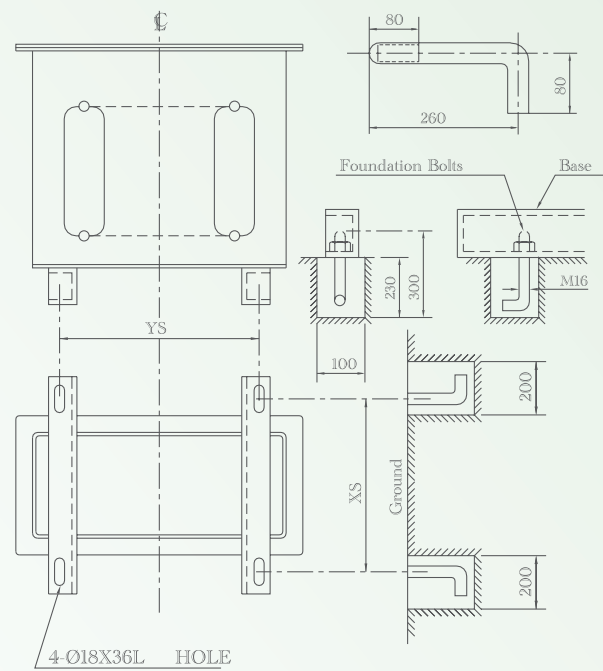


[Foundation Bolts]

Apply to 3Φ 150~500kVA



Apply to 3Φ 600~3000kVA





# Energy Efficiency & Environmental Protection Transformer

## (1) Preface

The government is persistently promoting the "Energy Saving" policy as Taiwan belongs to a high energy cost area. To comply the policy, Shihlin Electric & Engineering Corporation has introduced the "Energy Efficiency & environmental protection Transformer", a distribution transformer with "super low loss" and "super high efficiency". This product not only can help customer save energy but also can greatly reduce the operation cost. It is no doubt the best product an customer can select.



3500kVA Energy Efficiency & Environmental Protection Transformer

## (2) Features

### A. Energy saving realization

- The iron core is made of high permeability silicon steel sheets (that are also called the "HI-B Core") to greatly reduce iron loss (no-load loss).
- Improvements have been made on coil structure to reduce copper loss (load loss) sharply.
- By reducing copper and iron losses, the purpose of "energy saving" can be realized.
- Please refer to Figure 1~3 (Losses Comparison Figure) .

### B. Space saving realization

Since the losses incurred during operation have been lessened, the size of radiator in the transformer can be relatively cut down. Consequently the space required for installation of this special transformer can be reduced by some 5%~15% in comparison with other Shihlin general type transformers.

### C. Electricity cost saving realization

- Due to the sharp decrease in total losses (by as much as 40%~55%), a huge cut on annual electricity cost can be achieved.
- Short investment return period can be expected (2~5 years approximately).

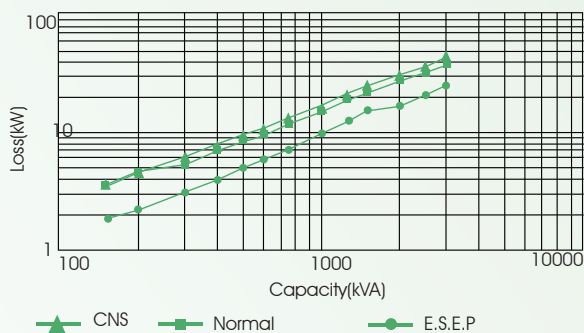


Fig.1 Total Loss

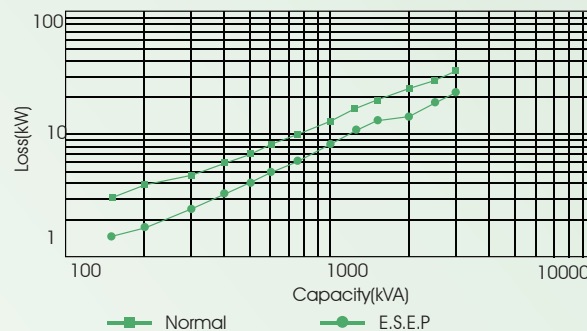


Fig.2 Load Loss

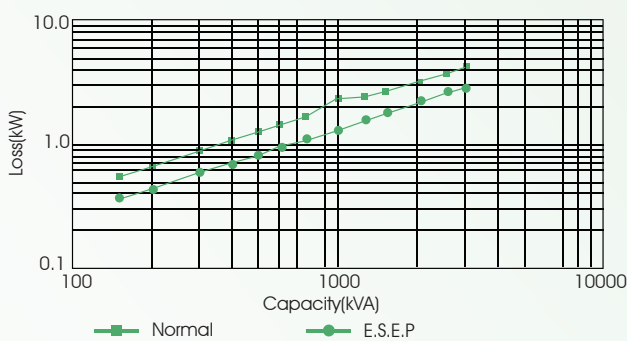


Fig.3 No-Load Loss

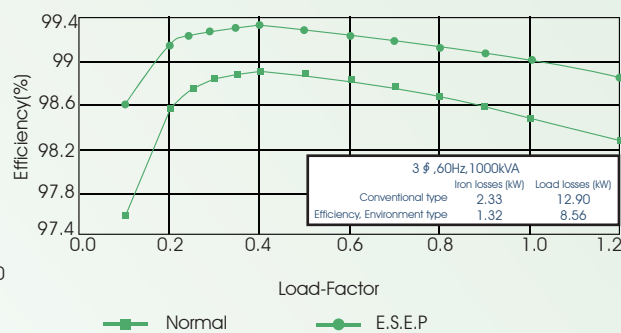


Fig.4 efficiency Compare

### (3) Total owning cost

#### 1. Transformer operation cost

(The calculation of transformer operation cost should consider not only the purchasing price but also the factors such as efficiency, load factor, electricity consumption and interest. The operation cost should be calculated based on compound interest. The formula is shown as below:

$$C = A(1+i)^n + \sum_{m=1}^{m=n} \{ [Wfe + (Wcu \times L.F^2)] \times 24 \times 30 \times k\} (1+i)^{n-m}$$

C: The Nth year operation cost of the transformer (thousand)

A: Cost in purchasing the transformer (thousand)

Wfe: Iron loss (No-load loss) (kW)

Wcu: Copper loss (Load loss) (kW)

L.F: Average load factor (calculated at 0.85)

N: The number of years that the transformer has been operating

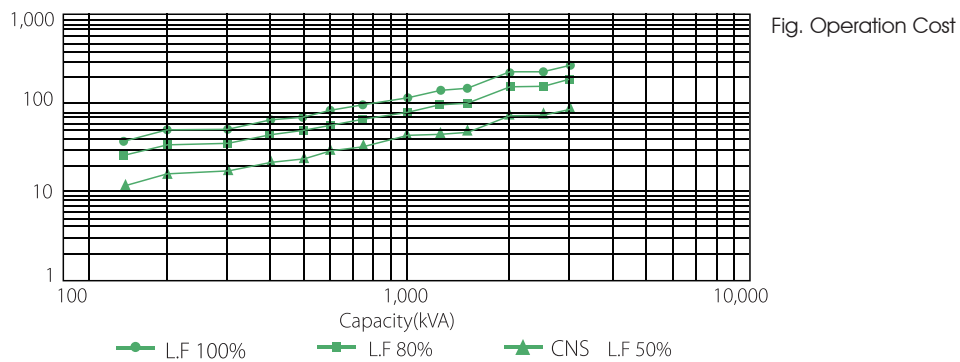
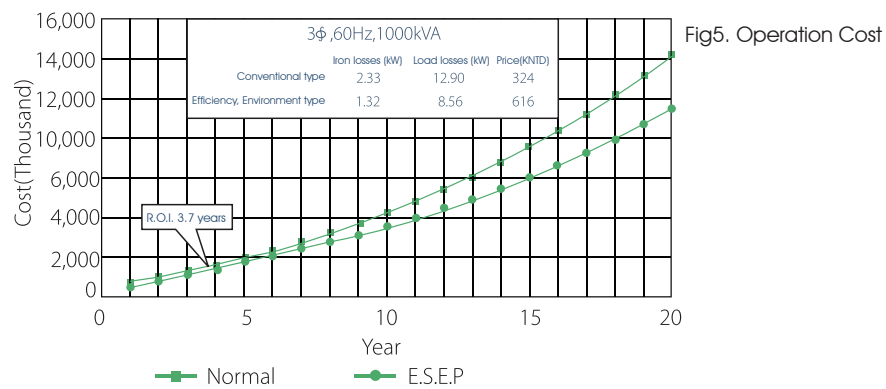
n: The number of months that the transformer has been operating

K: Average electricity cost per kWh (calculated at NT\$2.5)

i: Annual interest rate (calculated at 7.0%), Monthly interest rate (calculated at 7.0%/12)

2. The 3 φ 60Hz 1000kVA 11.4kV/220V transformer used as an example. Please refer to Figure 5 for its operation cost.

3. Refer to Figure 6 for the saving of annual electricity cost. (based on NT\$2.5/kWh)



#### (4) Characteristic

3  $\phi$  60Hz 11.4kV / 220V or 380Y-220V

Capacity (kVA)	No-Load Current (%)	No-Load Loss (w)	Load Loss at 75°C(W)	Full Loss (W)	Efficiency (%)	Voltage Regulation PF=1.0 (%)	Impedance (%)
150	2.0	350	1,495	1,845	98.78	1.15	2.8 - 4.0
200	2.0	430	1,785	2,215	98.90	1.10	2.8 - 4.0
300	1.6	570	2,515	3,085	98.98	1.00	2.8 - 4.0
400	1.6	695	3,285	3,980	99.01	1.00	3.0 - 4.5
500	1.6	815	4,135	4,950	99.02	1.00	3.0 - 4.5
600	1.3	925	4,855	5,780	99.05	1.00	3.5 - 5.0
750	1.3	1,080	6,185	7,265	99.04	1.10	4.0 - 5.5
1000	1.3	1,320	8,560	9,880	99.02	1.10	4.0 - 5.5
1250	1.1	1,540	10,910	12,450	99.01	1.10	4.5 - 6.0
1500	1.1	1,750	13,285	15,035	99.01	1.15	5.0 - 7.0
2000	1.1	2,140	14,510	16,650	99.17	1.00	5.0 - 7.0
2500	1.0	2,500	18,320	20,820	99.17	1.00	5.5 - 7.5
3000	1.0	2,840	22,160	25,000	99.17	1.00	6.0 - 8.0

Tolerance refer to CNS

3  $\phi$  60Hz 22.8kV / 220V or 380Y-220V

Capacity (kVA)	No-Load Current (%)	No-Load Loss (w)	Load Loss at 75°C(W)	Full Loss (W)	Efficiency (%)	Voltage Regulation PF=1.0 (%)	Impedance (%)
150	2.0	385	1,460	1,845	98.78	1.15	2.8 - 4.0
200	2.0	485	1,740	2,215	98.90	1.10	2.8 - 4.0
300	1.6	630	2,455	3,085	98.98	1.00	2.8 - 4.0
400	1.6	765	3,215	3,980	99.01	1.00	3.0 - 4.5
500	1.6	895	4,055	4,950	99.02	1.00	3.0 - 4.5
600	1.3	1,020	4,760	5,780	99.05	1.00	3.5 - 5.0
750	1.3	1,190	6,075	7,265	99.04	1.10	4.0 - 5.5
1000	1.3	1,450	8,430	9,880	99.02	1.10	4.0 - 5.5
1250	1.1	1,695	10,755	12,450	99.01	1.10	4.5 - 6.0
1500	1.1	1,925	13,110	15,035	99.01	1.15	5.0 - 7.0
2000	1.1	2,350	14,300	16,650	99.17	1.00	5.0 - 7.0
2500	1.1	2,750	18,070	20,820	99.17	1.00	5.5 - 7.5
3000	1.1	3,120	21,880	25,000	99.17	1.00	6.0 - 8.0

Tolerance refer to CNS









3 φ 60Hz 22.8kV / 380Y-220V

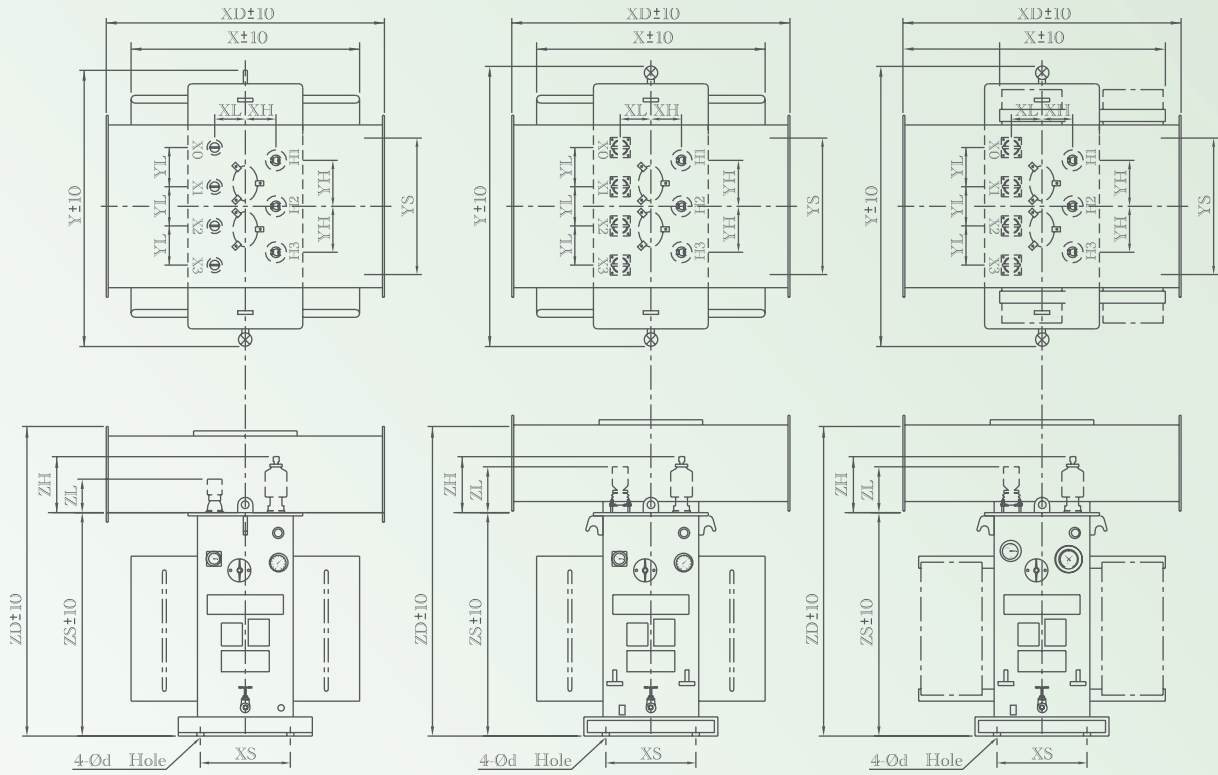


Fig. 1

Fig. 2

Fig. 3

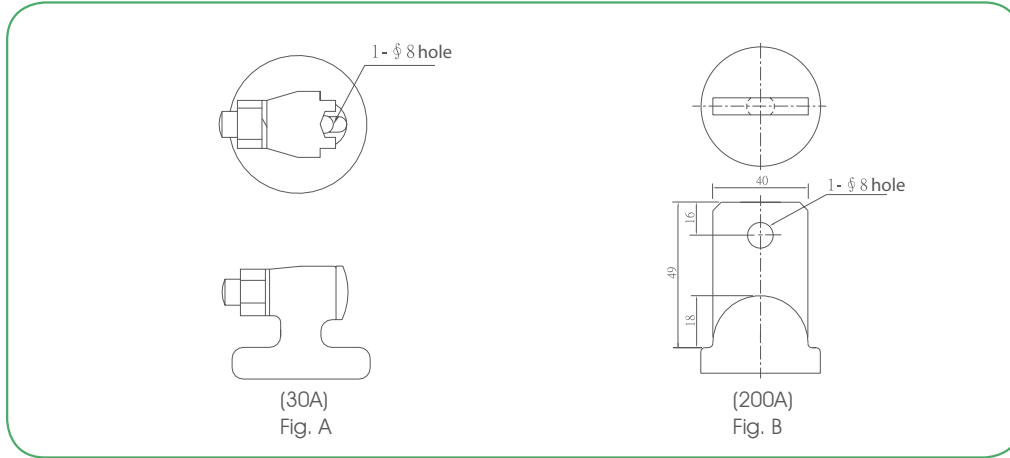
Capacity (kVA)	Fig.	Standard Type												Oil (l)	Weight (kg)	Duct Type			Weight (kg)
		(mm) Outline Dimensions					(mm) Foundation Pitch			(mm) Bushing Pitch						(mm) Dimension			
		X	Y	ZS	ZH	ZL	XS	YS	d	XH	XL	YH	YL			XD	Y	ZD	
150	Fig. 1	565	1325	1060	327	155	500	600	14x28	160	160	290	140	340	1110	700	1325	1660	1180
200	Fig. 1	605	1345	1060	327	155	500	600	14x28	160	160	290	140	370	1240	800	1345	1660	1320
300	Fig. 1	645	1445	1115	327	155	500	600	14x28	160	160	290	140	430	1530	800	1445	1715	1610
400	Fig. 1	795	1450	1115	327	168	600	600	14x28	160	160	290	140	475	1720	900	1450	1715	1810
500	Fig. 1	815	1450	1215	327	178	600	600	14x28	160	160	290	140	520	1990	1000	1450	1815	2090
600	Fig. 2	895	1710	1415	350	178	700	800	18x36	160	160	290	140	770	2800	1000	1710	2075	2900
750	Fig. 2	1015	1710	1415	350	242	700	800	18x36	160	160	290	140	785	2970	1200	1710	2075	3090
1000	Fig. 3	1195	1770	1415	350	242	700	800	18x36	160	160	290	140	810	3240	1300	1770	2075	3370
1250	Fig. 3	1395	1770	1415	350	298	700	800	18x36	160	160	290	200	880	3570	1500	1770	2075	3720
1500	Fig. 3	1585	1830	1415	350	298	800	800	18x36	160	160	290	200	965	3970	1700	1830	2075	4140
2000	Fig. 3	1620	1890	1615	350	323	800	800	18x36	160	160	290	200	1200	5190	1800	1890	2275	5370
2500	Fig. 3	1780	1940	1615	350	323	800	800	18x36	200	200	290	200	1410	5890	1900	1940	2275	6080
3000	Fig. 3	1990	1940	1615	350	323	900	800	18x36	200	200	290	200	1510	6540	2100	1940	2275	6750

The size of duct type transformer, except those being labeled, is the same as standard transformer.

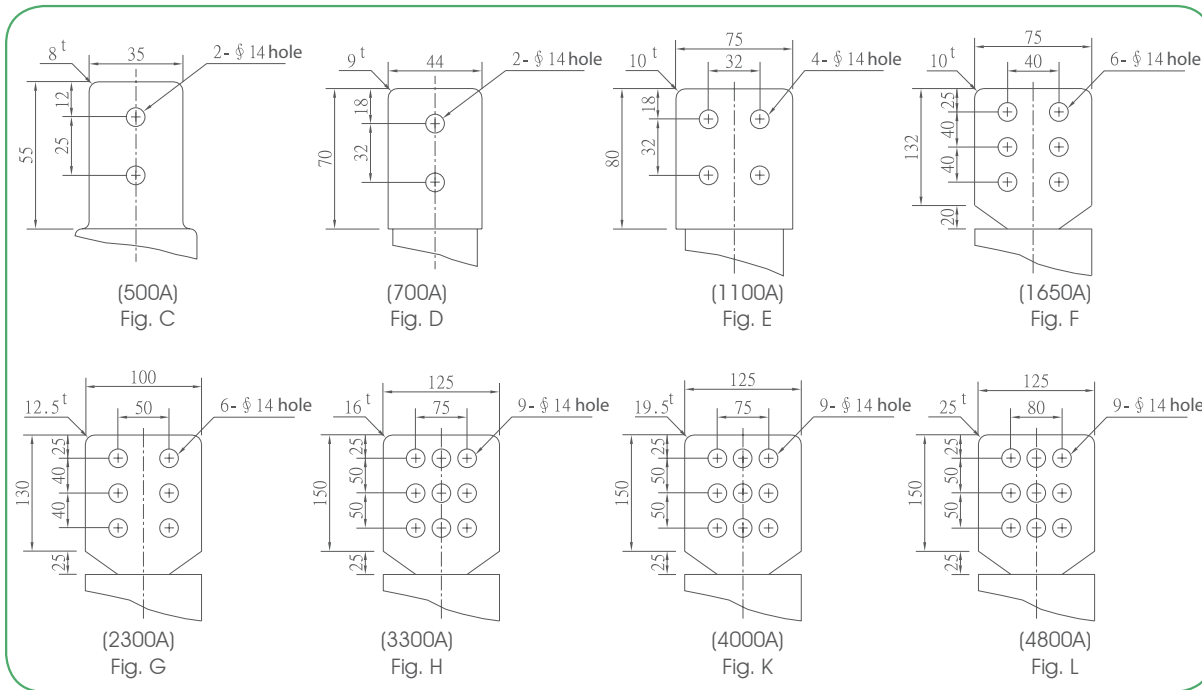


(6) Size of bushing terminal

1. H.V terminal



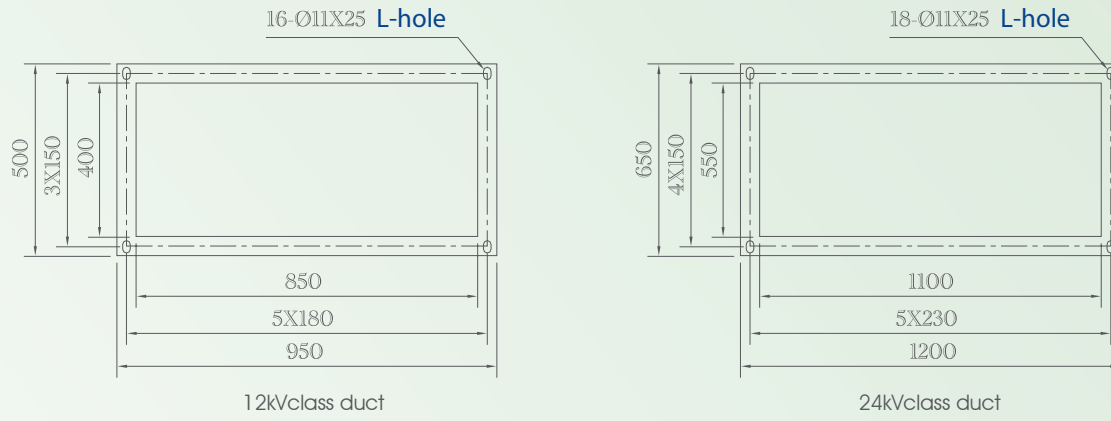
2. L.V terminal



3. Terminal select for three phase transformer

V	kVA													
	Fig	150	200	300	400	500	600	750	1000	1250	1500	2000	2500	3000
11400 Δ	Fig.A	Fig.A	Fig.A	Fig.A	Fig.A	Fig.A	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B
22800 Δ	Fig.A	Fig.A	Fig.A	Fig.A	Fig.A	Fig.A	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B	Fig.B
220 Δ	Fig.C	Fig.D	Fig.E	Fig.E	Fig.F	Fig.F	Fig.G	Fig.H	Fig.H	Fig.K	Fig.H <sup>x2</sup>	--	--	--
380 Y	Fig.C	Fig.C	Fig.C	Fig.D	Fig.E	Fig.E	Fig.F	Fig.F	Fig.G	Fig.G	Fig.H	Fig.K	Fig.L	Fig.L

(7) Dimension of connecting duct



※ 2000kVA with 220V secondary voltage, For special duct size please contact local representative

(8) Accesories

Accesories	Capacity (kVA)		
	150~500	600~750	1000~3000
Name Plate	●	●	●
Shihlin Marking	●	●	●
Energy Saving Marking	●	●	●
Earth Terminal	●	●	●
Oil Drain Valve	●	●	●
Oil Filter Valve		●	●
Lifting Lug	●	●	●
Oil Gauge	●	●	●
Thermometer	●	●	
Thermometer with Alarm			●
Hand Hole	●	●	●
Press. Ref. Device	●	●	●
Off-Circuit Tap-Changer	●	●	●
Corrugate Wall	●	●	
Radiator			●
Jacking Pads		●	●
Setting Base	●	●	●

(Paint color) : (Munsell 2. 5BG7/4)

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LIANZHONG STAINLESS STEEL CORPORATION
HUALON CORPORATION ( M ) SDN. BHD
VEDAN VIETNAM ENTERPRISECORP. LTD.
DUBAI ELECTRICITY & WATER AUTHORITY

## Main Domestic Customers

Taiwan Power Company
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ChinaSteel Corp.
Taiwan Semiconductor Manufacturing Company Limited
Powerchip Semiconductor Corp.
Inotera Memories.
Chunghwa Telecom
Chi Mei Corp.
Sino American Silicon Products Inc.
Corning Display Technologies
Feng Hsin Iron & Steel Co., Ltd.
DragonSteel Corp.
Feng Hsin Iron & Steel Co., Ltd.
Veterans General Hospital
China American Petrochemical Corp.
Lee Chang Yung Chemical Industry Corp.
Chang Chun Plastics Corp.
San Fu Chemical Co., Ltd
Formosa Plastics Group
Taiwan Scott paper Corp.
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Lian Hwa Foods Corp.
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Tainan Spin Corp.
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CATHAY PACIFIC STEEL  
SKK STEEL CORP.  
YAMAHA INC.  
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KANSAI ELECTRIC POWER CO. INC  
KYUSHU ELECTRIC POWER CO. INC  
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CHUGOKU ELECTRIC POWER CO. LTD.  
MITSUBISHI ELECTRIC CORP.  
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JFE GROUP  
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KINDEN CORP.

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SCECO (EASTERN)  
SWCC  
MARAFIQ YANBU/JUBAIL  
MINISTRY OF ENERGY IN KUWAIT

## Australia

POWERCOR  
SP-AUSNET  
ALINTA ENERGY

## Africa

GOVERNMENT OF BENIN  
MITSUBISHI ELECTRIC CORP.  
SOTCO

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