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**GSC DT-1PAD**  
**(Issue #4)**

**SPECIFICATION FOR**

**LOW-PROFILE SINGLE PHASE PAD-MOUNTED TRANSFORMERS**

**Effective Date**

**August 2019**

**Approved by:** \_\_\_\_\_

Approval is given in accordance with Ontario Regulation 22/04.

**Date:** \_\_\_\_\_

**SPECIFICATION FOR**  
**LOW PROFILE SINGLE PHASE PAD-MOUNTED TRANSFORMERS**

**1. Scope**

This specification covers the requirements for standard low-profile single-phase pad-mounted 60 Hz, ONAN distribution transformers manufactured and tested in accordance with CSA C227.3.

Where conflict exists between this specification and CSA C227.3, this specification will govern.

Quantities, sizes, and voltage ratings shall be specified in the request for quotation. Bidders must detail any variations from this specification when submitting their quotes. Quotes containing unacceptable variations from the requirements of this specification shall be rejected.

**2. Reference Publications**

Reference to CSA C227.3 implies also latest revision.

In addition to all Publications listed in CSA C227.3, transformers shall meet the requirements of ISO 9001-00 Quality Management Systems.

Stainless steel shall meet the requirements of American Iron and steel Institute (AISI) Type 304L.

**3. Rated Voltages**

In addition to rated voltages listed in table 1 of CSA C227.3, dual voltage transformers may be specified. Designation of HV winding will be in the form of V x V1; example: 8320 GrdY/4800 x 27600 GrdY/16000 V.

**4. Electrical Characteristics**

**4.1 kVA Ratings**

The kVA ratings at rated voltages shall be 25, 50, 75, 100, and 167.

**4.2 Voltage Taps**

Transformers shall have  $\pm 2.5\%$  voltage taps, 2 full capacity above and 2 reduced capacity below normal voltage, as per CSA C227.3 Clause 4.4.2. Taps shall be labeled numerically on the nameplate as follows:

Numerical	1	2	3	4	5
% of High Voltage Winding	105	102.5	100	97.5	95

If required, high voltage taps for designated dual voltage transformers may be specified by the individual utility.

#### **4.3 Impedance**

Transformers will have guaranteed minimum impedance to limit short-circuit current at the service entrance equipment as follows:

- (a) Up to and including 50 kVA: 1.5%
- (b) 75 kVA: 2.0%
- (c) 100: 2.5%
- (d) 167 kVA: 4.25%

The above values are the default values unless the Purchaser specifies an alternate minimum impedance to accommodate a specific field or system condition.

### **5. Electrical Connection and Mechanical Features**

#### **5.1 Dimensions**

All transformers shall be low-profile and have dimensions as per CSA C227.3.

#### **5.2 Transformer Tank, Hood and Sill**

The Transformer tank, hood and sill shall be constructed from Stainless Steel Type 304L.

#### **5.3 Additional Features**

1. One drain plug and one filler plug shall be provided per CSA C227.3 Clause 11(b), and they shall be located in the cable entrance compartment.
2. 1 - 25mm diameter hole, covered with a removable stainless-steel plate, to be used for a remote fault indicator light – see CSA 227.3 Figure 10,
3. Load-break switch nameplate. To be part of the transformer nameplate depicting an electrical schematic of each switch position.

## **5.4 Fusing**

Bayonet fuse assembly and warning labels shall conform to CSA C227.3 Clause 5.3, and all sub clauses including 5.3.1 for dual voltage transformers. Transformers shall be protected by a removable “Bay-O-Net” expulsion fuse link, in series with a partial range current-limiting fuse.

## **5.5 Oil Level Sight Gauge**

All units shall be equipped with an oil level sight gauge complete with indicating float ball, located at the cold oil level as per CSA C227.3 Clause 11(o). It must be completely visible when cables and accessories are in place.

## **6. Bushings, Terminals, and Grounding**

### **6.1 High Voltage Bushings Inserts**

High voltage bushing inserts shall not be supplied.

### **6.2 Low-Voltage Bushings**

All low-voltage bushings shall conform to CSA C227.3 Clause 6.3, in addition transformers with ratings of 100kVA or less shall be equipped with a threaded stud complete with a jam nut, to allow tightening and setting the angle of orientation in accordance with Clause 6.3.1. A removable 7-hole secondary spade shall be provided except that transformers with ratings of 167kVA shall have low-voltage bushings with 4-hole secondary spades

## **7. Switches**

### **7.1 Load Break Switches**

Transformers with a primary voltage below 15kV shall be supplied with a single load break switch, the Transformer winding switch, SWT, in conformance with CSA C227.3 Clause 7.2 and Figure 3 unless otherwise specified.

For transformers with a primary voltage greater than 15kV, or where the purchaser requires, transformers shall be supplied with 3 load break switches, in accordance with CSA 227.3 Figure 3. Load break switches shall conform to CSA C227.3 Clause 7.2 and all sub clauses with clear nomenclature indicating open and closed positions. A load break switch nameplate detailing SWA, for H1A switch, SWB, for H1B switch, and SWT for the Transformer winding switch shall be included as per CSA C227.3 Clause 11(p).

## **8. Losses**

### **8.1 Loss Formula**

For the purpose of tender comparison, the LDC shall use the following formula for the evaluation of transformer losses:

$$\text{Present value of losses} = 1.7 \times L + 22.4 \times N (\$) \quad \text{①}$$

Where:

L = Full load losses in Watts @ rated voltage and kVA, corrected to 85°C

N = No load losses in Watts @ 105% of rated voltage, corrected to 85°C

### **8.2 Total Owning cost**

The present value of losses (see formula ①) shall be added to the tender price to arrive at the Total Owning Cost (TOC). Tender award not necessarily depend on the lowest TOC, but shall also include other considerations such as delivery, manufacturing quality, and historical quality of contract performance.

### **8.3 Guaranteed Losses**

The manufacturer shall provide the guaranteed values for no-load and full load losses. For dual voltage transformers, losses are to be specified for each voltage. A penalty will be imposed using the above equation if the no-load losses or the load losses exceed the guaranteed value. No credit will be given if the losses are lower than the guarantees.

In cases where the final average measured losses of identical units exceed the guaranteed values, the purchaser reserves the right to reject all of said units. If the purchaser should choose to accept these units, the manufacturer shall reimburse the purchaser for the additional cost of the transformer losses, which will be deducted from the manufacturer's invoice.

In order to assess the value of non-guarantee, the average value of the measured no load and full load losses, taken from all of the identical units or order, will be used as the basis for the losses calculation. In recognition of the inconsistent quality of the core steel, however, the cost of losses will be calculated as follows:

1. If the no load losses exceed the guarantee while the full load losses are within the guarantee, the calculation for the cost of losses will be based on the no load losses component of formula ②.

2. If the no load losses are within guarantee while the full load losses exceed the guarantee, the calculation for the additional cost of losses will be based on the full load losses component of formula ② only.
3. If both no load and full load losses exceed the guarantee, the calculation for the cost of losses will be based on formula ②.

$$\text{Loss Penalty} = (1.7 \times \Delta L + 22.4 \times \Delta N) \times (\# \text{ of Units in Order}) \quad \text{②}$$

Where:

$\Delta N = (\text{Average Actual No Load Losses in Watts}) - (\text{Guaranteed No Load Losses in Watts})$

$\Delta L = (\text{Average Actual Full Load Loss in Watts}) - (\text{Guaranteed Full Load Loss in Watts})$

## **9. Exterior Finish**

The exterior finish colour shall be Equipment Green Munsell 9GY1.5/2.6 as per CSA C227.3 Clause 9.2.

## **10. Drawings**

When tendering, 2 copies of the following drawings shall be submitted. One copy will be returned to the manufacturer with comments/approval. Drawing re-submission may be necessary if major changes are necessary. Final approved drawings must be secured before start of manufacturing.

- Outline and dimensions
- Name plate data as detailed in CSA C227.3

## **11. Tests and Inspection**

### **11.1 Type Tests**

Upon request, the manufacturer shall supply a record of type tests listed Clause 8.4.2 of CSA C227.3. Test data may be provided from tests performed on other unit's equivalent to those being purchased.

### **11.2 Routine Tests**

All routine tests listed in Clause 8.2 of CSA C227.3 shall be performed on each unit and a report shall be submitted to the LDC for approval prior to delivery of the transformers. The LDC reserves the right to reject any units that do not comply with the requirements stated herein.

### **11.3 Variations**

The purchaser has the right to reject any unit whose test results are outside the allowable tolerance limits stated in CSA C227.3.

### **11.4 Inspection**

Transformers may be inspected or test-witnessed by the LDC representative. The manufacturer shall advise the LDC of four production days prior to test dates.

### **12. Delivery and Shipping**

The manufacturer shall quote a guaranteed delivery date(s). Transformers shall be ready for shipment on time as noted on the P.O., but shipment will only be made when authorization is given by the LDC. Authorization may be dependent on review and approval of routine tests provided in 11.2. Any delay preventing the LDC from meeting customer's requirement will cause a penalty of maximum 10% of the price of delayed shipment.

The manufacturer shall take all necessary precautions to avoid, and will be responsible for, any damage to the unit, both internally and externally during shipment.

### **13. Guarantees**

Any transformer found damaged upon arrival, or malfunction under normal operating conditions for a period of one year from its in-service date or 24 months after delivery will be returned to the manufacturer for repair or replacement at the manufacturer expenses. Any claims against the transport company will be the responsibility of the manufacturer.



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**GSC DT-POLE**  
**(Issue #4)**

**SPECIFICATION FOR**  
**SINGLE PHASE POLE-MOUNTED TRANSFORMERS**

**Effective Date**

**August 2019**

**Approved by:** \_\_\_\_\_

Approval is given in accordance with Ontario Regulation 22/04.

**Date:** \_\_\_\_\_



**SPECIFICATION FOR**  
**SINGLE PHASE POLE-MOUNTED TRANSFORMERS**

**1. Scope**

This specification covers the requirements for standard single-phase pole-mounted distribution transformers manufactured and tested in accordance with CSA C2.2.

Where conflict exists between this specification and CSA C2.2, this specification will govern.

Quantities, sizes and voltage ratings shall be specified in the request for quotation. Bidders must detail any variations from this specification when submitting their quotes. Quotes containing unacceptable variations from the requirements of this specification shall be rejected.

**2. Reference Publications**

Reference to CSA C2.2 implies also latest revision.

In addition to all Publications listed in CSA C2.2, transformers shall meet the requirements of ISO 9001-00 Quality Management Systems.

Stainless steel, where utilized, shall meet the requirements of American Iron and steel Institute (AISI) Type 304L

**3. Rated Voltages**

In addition to rated voltages listed in table 1 of CSA C2.2, dual voltage transformers may be specified. Designation of HV winding will be in the form of V x V<sub>1</sub>; example:  
8320 GrdY/4800 x 27600 GrdY/16000 V.

**4. Impedance**

Transformers will have guaranteed minimum impedance to limit short-circuit current at the service entrance equipment as follows:

- (a) Up to and including 50 kVA: 1.5%
- (b) 75 kVA: 2.0%
- (c) 100 and 167 kVA: 2.5%

## **5. Voltage Taps**

Transformers will have  $\pm 2.5\%$  voltage taps, 2 full capacity above and 2 reduced capacity below normal voltage, as per CSA C2.2 Clause 4.4.2. Taps shall be labeled numerically on the nameplate as follows:

Numerical	1	2	3	4	5
% of High Voltage Winding	105	102.5	100	97.5	95

If required, high voltage taps for designated dual voltage transformers may be specified by the individual utility.

## **6. Low Voltage straps**

Grounding and series/parallel straps for the low voltage bushings shall be tin-plated copper.

## **7. Electrical Connection and Mechanical Features**

### **7.1 Low-voltage Terminals**

All Low-voltage terminals shall be Spade Type II (4 Hole) as per CSA C2.2 Figure 3.

All transformers shall be supplied with the number of secondary terminals specified in CSA C2.2 Clause 6.2.2 and Figure 5 unless otherwise specified.

### **7.2 Dimensions**

All transformers shall have dimensions as per CSA C2.2. In addition the maximum tank height for 50 kVA and 75 kVA units shall be 840mm and 880mm respectively.

### **7.3 Pressure-Relief Device with Internal Fault Detector (IFD)**

In addition to the Pressure-relief requirements of CSA C2.2 Clause 8.3, A non-resettable device that detects internal transformer faults, incorporates pressure relief, and provides an external indication visible from the ground shall be supplied with each transformer as per CSA C2.2 Clause 11(o). The approved device is manufactured by IFD Corporation.

### **7.4 Arrester Bracket**

All units shall have provision for mounting arrester brackets. Brackets and arresters will be added by the LDC.

The arrester bracket boss will double as the H2 ground lug, as per CSA C2.2.

## 7.5 Exterior Fins

Only if specified by the purchaser shall transformers be manufactured with cooling fins.

## 8. MARKINGS

Same as CSA Standard C2.2 but with the following additional options:

- Black background nameplate
- Impedance rating marked on tank

## 9. Losses

### 9.1 Loss Formula

For the purpose of tender comparison, the LDC shall use the following formula for the evaluation of transformer losses:

$$\text{Present value of losses} = 1.7 \times L + 22.4 \times N \text{ (\$)} \quad \textcircled{1}$$

Where:

L = Full load losses in Watts @ rated voltage and kVA, corrected to 85°C

N = No load losses in Watts @ 105% of rated voltage, corrected to 85°C

### 9.2 Total Owning cost

The present value of losses (see formula  $\textcircled{1}$ ) shall be added to the tender price to arrive at the Total Owning Cost (TOC). Tender award not necessarily depend on the lowest TOC, but shall also include other considerations such as delivery, manufacturing quality, and historical quality of contract performance.

### 9.3 Guaranteed Losses

The manufacturer shall provide the guaranteed values for no-load and full load losses. For dual voltage transformers, losses are to be specified for each voltage. A penalty will be imposed using the above equation if the no-load losses or the load losses exceed the guaranteed value. No credit will be given if the losses are lower than the guarantees.

In cases where the final average measured losses of identical units exceed the guaranteed values, the purchaser reserves the right to reject all of said units. If the purchaser should choose to accept these units, the manufacturer shall reimburse the purchaser for the additional cost of the transformer losses, which will be deducted from the manufacturer's invoice.

In order to assess the value of non-guarantee, the average value of the measured no load and full load losses, taken from all of the identical units or order, will be used as the basis for

the losses calculation. In recognition of the inconsistent quality of the core steel, however, the cost of losses will be calculated as follows:

1. If the no load losses exceed the guarantee while the full load losses are within the guarantee, the calculation for the cost of losses will be based on the no load losses component of formula ②.
2. If the no load losses are within guarantee while the full load losses exceed the guarantee, the calculation for the additional cost of losses will be based on the full load losses component of formula ② only.
3. If both no load and full load losses exceed the guarantee, the calculation for the cost of losses will be based on formula ②.

$$\text{Loss Penalty} = (1.7 \times \Delta L + 22.4 \times \Delta N) \times (\# \text{ of Units in Order}) \quad \text{②}$$

Where:

$\Delta N = (\text{Average Actual No Load Losses in Watts}) - (\text{Guaranteed No Load Losses in Watts})$

$\Delta L = (\text{Average Actual Full Load Loss in Watts}) - (\text{Guaranteed Full Load Loss in Watts})$

## **10. Drawings**

When tendering, 2 copies of the following drawings shall be submitted. One copy will be returned to the manufacturer with comments/approval. Drawing re-submission may be necessary if major changes are necessary. Final approved drawings must be secured before start of manufacturing.

- Outline and dimensions
- Name plate data as detailed in CSA C2.2

## **11. Tests and Inspection**

### **11.1 Type Tests**

Upon request, the manufacturer shall supply a record of type tests listed Clause 9.4.2 of CSA C2.2. Test data may be provided from tests performed on other unit's equivalent to those being purchased.

### **11.2 Routine Tests**

All routine tests listed in Clause 9.2 of CSA C2.2 shall be performed on each unit and a report shall be submitted to the LDC for approval prior to delivery of the transformers. The LDC reserves the right to reject any units that do not comply with the requirements stated herein.

### **11.3 Variations**

The purchaser has the right to reject any unit whose test results are outside the allowable tolerance limits stated in CSA C2.2.

### **11.4 Inspection**

Transformers may be inspected or test-witnessed by the LDC representative. The manufacturer shall advise the LDC of four production days prior to test dates.

### **12. Delivery and Shipping**

The manufacturer shall quote a guaranteed delivery date(s). Transformers shall be ready for shipment on time as noted on the P.O., but shipment will only be made when authorization is given by the LDC. Authorization may be dependent on review and approval of routine tests provided in 11.2. Any delay preventing the LDC from meeting customer's requirement will cause a penalty of maximum 10% of the price of delayed shipment.

The manufacturer shall take all necessary precautions to avoid, and will be responsible for, any damage to the unit, both internally and externally during shipment.

### **13. Guarantees**

Any transformer found damaged upon arrival, or malfunction under normal operating conditions for a period of one year from its in-service date or 24 months after delivery will be returned to the manufacturer for repair or replacement at the manufacturer expense. Any claims against the transport company shall be the responsibility of the manufacturer.



**GSC DT-3PAD**  
**(Issue #4)**

**SPECIFICATION FOR**  
**THREE-PHASE PAD-MOUNTED LOOP FEED TRANSFORMERS**

**Effective Date**

**August 2019**

**Approved by:** \_\_\_\_\_

Approval is given in accordance with Ontario Regulation 22/04.

**Date:** \_\_\_\_\_

**SPECIFICATION FOR**  
**THREE-PHASE PAD-MOUNTED LOOP FEED TRANSFORMERS**

**1. Scope**

This specification covers the requirements for standard three-phase pad-mounted, 60 Hz, loop feed, ONAN distribution transformers manufactured and tested in accordance with CSA C227.4. Transformers shall be designed for operation on an effectively grounded wye system.

Where conflict exists between this specification and CSA C227.4, this specification will govern.

Quantities, sizes, and voltage ratings shall be specified in the request for quotation. Bidders must detail any variations from this specification when submitting their quotes. Quotes containing unacceptable variations from the requirements of this specification shall be rejected.

**2. Reference Publications**

Reference to CSA C227.4 implies also latest revision.

In addition to all Publications listed in CSA C227.4, transformers shall meet the requirements of ISO 9001-00 Quality Management Systems.

Stainless steel shall meet the requirements of American Iron and steel Institute (AISI) Type 304L.

**3. Rated Voltages**

In addition to rated voltages listed in table 1 of CSA C227.4, dual voltage transformers may be specified. Designation of HV winding will be in the form of V x V1; example: 8320 GrdY/4800 x 27600 GrdY/16000 V.

**4. Electrical Characteristics**

**4.1 kVA Ratings**

The kVA ratings at rated voltages shall be 75, 150, 225, 300, 500, 750, 1000, ~~1500, 2000, 2500, and 3000~~.

## **4.2 Voltage Taps**

Transformers shall have  $\pm 2.5\%$  voltage taps, 2 full capacity above and 2 reduced capacity below normal voltage, as per CSA C227.4 Clause 4.5.2. Taps shall be labeled numerically on the nameplate as follows:

Numerical	1	2	3	4	5
% of High Voltage Winding	105	102.5	100	97.5	95

If required, high voltage taps for designated dual voltage transformers may be specified by the individual utility.

## **4.3 Impedance**

Transformers will have guaranteed minimum impedance as per CSA C227.4 Clause 4.11, unless the Purchaser specifies an alternate minimum impedance to accommodate a specific field or system condition.

## **5. Electrical Connection and Mechanical Features**

### **5.1 Dimensions**

All transformers shall have dimensions as per CSA C227.4.

### **5.2 Transformer Tank, Doors and Sill**

The transformer tank, doors, and sill shall be manufactured as per CSA C227.4.

The purchaser may specify for the transformer tank, doors and sill to be constructed from Stainless Steel Type 304L.

### **5.3 Fusing**

Bayonet fuse assembly and warning labels shall conform to CSA C227.4 Clause 5.3, and all sub-clauses. Transformers shall be protected by a removable "Bay-O-Net" expulsion fuse link, in series with a partial range current-limiting fuse.

Each unit shall come fully equipped with an interlocking device such that the fuses cannot be removed unless the load break switch for the transformer winding is in the open position, as per CSA C227.4 Clause 10(c).



#### **5.4 Maximum Indicating Thermometer**

All units shall be equipped with a maximum indicating thermometer, as per CSA C227.4 Clause 10(j).

### **6. Bushings, Terminals, and Grounding**

#### **6.1 High Voltage Bushing Inserts**

High Voltage Busing inserts shall not be supplied.

#### **6.2 Low-Voltage Bushings**

Low voltage bushings must be spade type, and suitable for use with copper or aluminum cable lugs. They shall be in accordance with CSA C227.4 Clause 6.1.3 and all sub-clauses. All transformers shall have 8-hole spades as per CSA C227.4 Figure 11(c).

### **7. Switches**

#### **7.1 Load Break Switches**

All transformers shall be supplied with 3 load break switches, arranged in accordance with CSA 227.4 Figure 2. Load break switches shall conform to CSA C227.4 Clause 5.1.12. and all sub clauses with clear nomenclature indicating open and closed positions.

### **8. Losses**

#### **8.1 Loss Formula**

For the purpose of tender comparison, the LDC shall use the following formula for the evaluation of transformer losses:

$$\text{Present value of losses} = 7.4 \times L + 22.4 \times N (\$)$$

Where:

L = Full load losses in Watts @ rated voltage and kVA, corrected to 85°C

N = No load losses in Watts @ 105% of rated voltage, corrected to 85°C

#### **8.2 Total Owning cost**

The present value of losses (see formula ①) shall be added to the tender price to arrive at the Total Owning Cost (TOC). Tender award not necessarily depend on the lowest TOC, but shall also include other considerations such as delivery, manufacturing quality, and historical quality of contract performance.

### 8.3 Guaranteed Losses

The manufacturer shall provide the guaranteed values for no-load and full load losses. For dual voltage transformers, losses are to be specified for each voltage. A penalty will be imposed using the above equation if the no-load losses or the load losses exceed the guaranteed value. No credit will be given if the losses are lower than the guarantees.

In cases where the final average measured losses of identical units exceed the guaranteed values, the purchaser reserves the right to reject all of said units. If the purchaser should choose to accept these units, the manufacturer shall reimburse the purchaser for the additional cost of the transformer losses, which will be deducted from the manufacturer's invoice.

In order to assess the value of non-guarantee, the average value of the measured no load and full load losses, taken from all of the identical units or order, will be used as the basis for the losses calculation. In recognition of the inconsistent quality of the core steel, however, the cost of losses will be calculated as follows:

1. If the no load losses exceed the guarantee while the full load losses are within the guarantee, the calculation for the cost of losses will be based on the no load losses component of formula ②.
2. If the no load losses are within guarantee while the full load losses exceed the guarantee, the calculation for the additional cost of losses will be based on the full load losses component of formula ② only.
3. If both no load and full load losses exceed the guarantee, the calculation for the cost of losses will be based on formula ②.

$$\text{Loss Penalty} = (7.4 \times \Delta L + 22.4 \times \Delta N) \times (\# \text{ of Units in Order}) \quad \textcircled{2}$$

where:

$$\Delta N = (\text{Average Actual No Load Losses in Watts}) - (\text{Guaranteed No Load Losses in Watts})$$

$$\Delta L = (\text{Average Actual Full Load Loss in Watts}) - (\text{Guaranteed Full Load Loss in Watts})$$

### 9. Exterior Finish

The exterior finish colour shall be Equipment Green Munsell 9GY1.5/2.6 as per CSA C227.4 Clause 8.2.

## **10. Drawings**

When tendering, 2 copies of the following drawings shall be submitted. One copy will be returned to the manufacturer with comments/approval. Drawing re-submission may be necessary if major changes are necessary. Final approved drawings must be secured before start of manufacturing.

- Outline and dimensions
- Name plate data as detailed in CSA C227.4

## **11. Tests and Inspection:**

### **11.1 Type Tests**

Upon request, the manufacturer shall supply a record of type tests listed in Clause 7.4.2 of CSA C227.4. Test data may be provided from tests performed on other units equivalent to those being purchased.

### **11.2 Routine Tests**

All routine tests listed in Clause 7.2 of CSA C227.4 shall be performed on each unit and a report shall be submitted to the LDC for approval prior to delivery of the transformers. The LDC reserves the right to reject any units that do not comply with the requirements stated herein.

### **11.3 Variations**

The purchaser has the right to reject any unit whose test results are outside the allowable tolerance limits stated in CSA C227.4.

### **11.4 Inspection**

Transformers may be inspected or test-witnessed by the LDC representative. The manufacturer shall advise the LDC of four production days prior to test dates.

### **11.5 Delivery and Shipping**

The manufacturer shall quote a guaranteed delivery date(s). Transformers shall be ready for shipment on time as noted on the P.O., but shipment will only be made when authorization is given by the LDC. Authorization may be dependent on review and approval of routine tests provided in 11.2. Any delay preventing the LDC from meeting customer's requirement will cause a penalty of maximum 10% of the price of delayed shipment.

The manufacturer shall take all necessary precautions to avoid, and will be responsible for, any damage to the unit, both internally and externally during shipment.

## **12. Guarantees**

Any transformer found damaged upon arrival, or malfunction under normal operating conditions for a period of one year from its in-service date or 24 months after delivery will be returned to the manufacturer for repair or replacement at the manufacturer expense. Any claims against the transport company will be the responsibility of the manufacturer.