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Report No. 103832235CRT-001

Bildal Electricals Pvt Ltd

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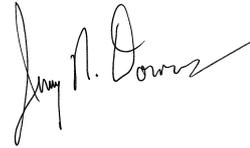
Standards	
U.S. Department of Transportation, Federal Aviation Administration, Advisory Circular, Specification for Series to Series Isolation Transformers for Airport Lighting Systems, AC No. 150/5345-47C dated 7/22/2011.	

Test Purpose	FAA certification testing of L-830 & L-831 isolation transformer.
Test Dates	March 20, 2019 through February 19, 2021

Revision Note
2-26-21 Report revised to change the rendered to client name / address and client contact.



Christopher W Metcalf
Engineering Supervisor
Lighting



Jeremy N Downs, P.E.
Senior Staff Engineer
Lighting

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Test Plan and Datasheets			
Client	Bildal Electricals Pvt Ltd	Engineer	Christopher W Metcalf
Report #	103832235CRT-001	Reviewer	Jeremy N Downs, P.E.
Product	L-830/31	Model(s)	See Sample Page
Standard	FAA AC No. 150/5345-47C dated 7/22/2011		

Spec	Test name	Clause	L-831	L-830
47C	Visual Exam	3.0	Pass	Pass
47C	Characteristics Test	4.2.1	Pass	Pass
47C	Shock Test	4.2.2	NT	Pass
47C	Transformer Lead Rigidity Test	4.2.2.1	NT	Pass
47C	Post Shock / Rigidity Test	4.2.3	NT	Pass
47C	Insulation Resistance	4.2.4	NT	Pass
47C	Temperature Rise	4.2.5	NT	Pass

Results Key	
Pass	Compliant
Fail	Non-compliant
NT	Not tested in this project
NA	Test not applicable

Sample Information				
Date Rec.	Intertek ID	Description	Condition	Model No.
3/11/2019	CRT1903111051-001-1	L-831 45W 50Hz/60Hz	production	FAA-L-831-1 / 830-1
3/11/2019	CRT1903111051-001-2	L-831 45W 50Hz/60Hz	production	FAA-L-831-1 / 830-1
3/11/2019	CRT1903111051-001-3	L-831 45W 50Hz/60Hz	production	FAA-L-831-1 / 830-1
12/9/2020	CRT2012091014-001-1	L-831 45W 50Hz/60Hz	production	FAA-L-831-1 / 830-1
12/9/2020	CRT2012091014-001-2	L-831 45W 50Hz/60Hz	production	FAA-L-831-1 / 830-1
12/9/2020	CRT2012091014-001-3	L-831 45W 50Hz/60Hz	production	FAA-L-831-1 / 830-1
12/9/2020	NA	(3) Style 1,2,9 connectors	production	mate for dielectric

Further Sample Description	
Type:	L-831
Options:	None
Electrical Input:	6.6A, Bildal L-823 Style 2 & 9
Electrical Output:	6.6A, Bildal L-823 Style 7
Casting Material:	Molding Material Santoprene™ 101-73

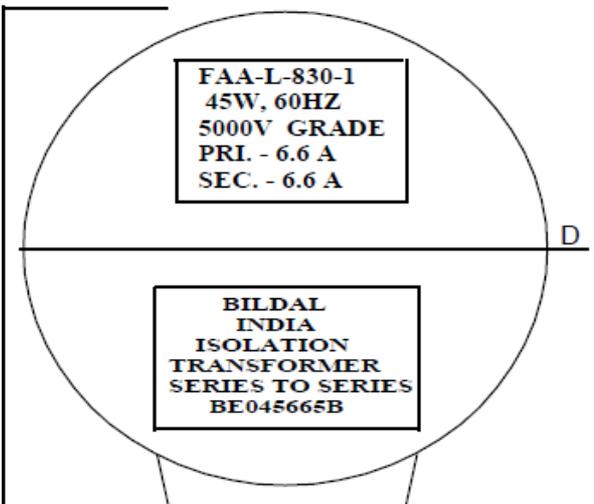
Sample Modification Log	
Date	Modification description
12/9/20	New FAA compliant L-823 connectors

Sample Information
Picture(s)

Original



Sample Information



Sample Information

w/ new connectors



Sample Information



Visual Exam

Ref. Para.	Requirement	Measured or Observed	Result (P/F)
3.1	Encapsulated in a watertight case with rubber (or an equivalent rubber-like material)	Observed	Pass
	Connectors molded on the primary and secondary leads	Observed	Pass
3.3	Transformers must be designed and constructed so that no parts will work loose in service	Observed	Pass
	All transformer electrical connections must be permanent	Observed	Pass
	Transformers must be designed to meet this specification when operated in any orientation	Observed	Pass
3.3.1	The transformer primary and secondary windings must be insulated from each other and the core	Documented	Pass
3.4.1 Case	Transformers must be encapsulated in a permanently sealed watertight case	Observed	Pass
	No portion of the transformer case may be less than 0.25 inch (6.35 mm) thick	Observed	Pass
	Must be free of any cracks, blisters, and holes.	Observed	Pass
	Material formed directly on the core/coil assembly or pre-formed and compound filled.	Documented	Pass
	Must be a black	Observed	Pass
	Durometer hardness must be 75 ± 10 measured per procedure in ASTM D 2240	NA	NA
	Must easily fit into a cylinder 8 inches (20.3 cm) diameter by 10 inches (25.4 cm) height	Observed	Pass
	Lead reinforcing area must be at least 25% greater than the outside diameter of the connecting lead	250%	Pass
	Reinforcement may be a cone around individual leads or a continuous ridge enclosing all three leads	Continuous	Pass
Reinforced area must form an integral bond with the cable sheath inside the cone or ridge	Observed	Pass	
	The case of the completed transformer must be firm to the touch at all points and show no permanent indentation marks when subjected to finger pressure	Observed	Pass
3.4.2 Leads	The transformer must be provided with a two conductor secondary lead and two single conductor primary leads	Observed	Pass
	All three leads must emerge from one end of the transformer	Observed	Pass
3.4.2.1 Primary Leads	Equip one primary lead (H1) with a Style 2 plug type connector per AC 150/5345-26	Observed	Pass
	Equip the other primary lead (H2) with a Style 9 receptacle per AC 150/5345-26	Observed	Pass
	Use No. 8 American Wire Gauge (AWG) wire (minimum 6 millimeters squared (mm ²)), 19 strand minimum cable insulated for not less than 5,000 volts and conforming to:	19 strand 0.75mm	Pass
	ICEA S-96-659/NEMA WC 71, Standard for Non-shielded Cables Rated 2001-5000 Volts for use in the Distribution of Electrical Energy. Other insulation materials may be used provided that they meet or exceed the physical and electrical requirements	Declaration	Pass
	Extend each primary winding lead, including the connector, 24.0 inches \pm 3.0 inches (60 cm \pm 7.5 cm) beyond the transformer housing	24"	Pass

3.4.2.2 Secondary Leads	The transformer secondary lead must be equipped with a Style 7 or 8 receptacle per AC 150/534	Observed	Pass
	The transformer secondary leads must be two-conductor No. 12 or 14 AWG (minimum 2 mm2) 600 volt rated cable.	37 strand 0.3mm	Pass
	Meeting the requirements of ICEA S-95-658/NEMA WC-70. Other insulation materials may be used provided that they meet or exceed the physical and electrical requirements in the ICEA specification	Declaration	Pass
	The secondary lead cable, including the cable connector, must be extended 48.0 in. ± 3.0 in. (120 cm ± 7.5 cm) from the transformer housing	48"	Pass
3.4.2.3 Protective Caps	A water resistant cap must be supplied that protects the transformer lead connectors mating parts from both moisture and dirt during shipping and handling	Observed	Pass
	Caps must be securely held in place by cap friction fit, heat shrink tubing, or electrical tape	friction	Pass
	If electrical tape is used to secure a cap, the tape adhesive must not leave residues that collect dirt or inhibit the adhesion of cable wraps	NA	NA
3.6 Nameplate	Transformer markings must be molded on the surface of the transformer case	Observed	Pass
	Character Height (inches): Recommended 0.08 / Minimum 0.05	0.12"	Pass
	Specification _____ L-831 _____ (L-830 or L-831)	Observed	Pass
	Transformer Rating _____ 45W_50Hz _____ (Watts - Frequency)	Observed	Pass
	Federal Stock Number _____ (Optional)	NA	NA
	Manufacturer's Part No. _____ FAA-L-831-1 _____	Observed	Pass
	Manufacturer's Name or Trademark _____ BILDAL _____	Observed	Pass
	Made in _____ India _____ (Country of origin)	Observed	Pass
	Primary amperes _____ 6.6 _____	Observed	Pass
	Secondary amperes _____ 6.6 _____	Observed	Pass
	Volts 5000 _____ Hz	Observed	Pass
(Optional) Order/Contract No. _____	NA	NA	

Complies: YES NO

Tested By:	NA	Signature or initials:	NA
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	1,2,3	Sample No:	CRT1903111051-001-1
Amb (°C):	25	RH%	22.6
		Completion Date:	2/19/2021

Characteristics Test

The samples must be tested to demonstrate their electrical characteristics are per Table 2

The transformers must be operated at room temperature (in an area as draft free as possible) with their rated load (see Table 2) connected to the secondary winding

Measurements must be taken only when the transformer windings have reached their normal operating temperature

Results

Type	Wattage	Primary	Secondary	Frequency	Full Load
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz	1.3 Ohms

Measured	Sample			Req.
	1	2	3	
Frequency (Hz)	60.0	60.0	60.0	NA
Input Volts (Vac)	8.36	8.39	8.38	NA
Input Amps (Aac)	6.60	6.60	6.60	NA
Input Watts (W)	54.5	54.7	54.7	NA
Input PF	0.986	0.988	0.988	≥0.95
Output Volts (Vac)	6.79	6.77	6.82	NA
Output Amps (Aac)	6.63	6.63	6.64	6.53-6.67
Output Watts (W)	45.0	44.9	45.3	NA
Efficiency	0.83	0.82	0.83	≥80
Short Circuit Current (Aac)	6.67	6.68	6.69	6.6-7.1
Open Circuit Voltage (Vac)	14.0	13.8	14.6	25
Full Load Resistance	1.15	1.15	1.15	NA

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>SH</i>
Engineer:	cwm	Signature or initials:	<i>AWM</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	3,4,5,6,7,8	Sample No:	CRT1903111051-001-1,2,3
Amb (°C):	20.5	RH%	19
		Completion Date:	3/20/2019

Results

Type	Wattage	Primary	Secondary	Frequency	Full Load
L-831	45 Watts	6.6 Amps	6.6 Amps	50 Hertz	1.3 Ohms

Measured	Sample			Req.
	1	2	3	
Frequency (Hz)	50.0	50.0	50.0	NA
Input Volts (Vac)	8.30	8.46	8.39	NA
Input Amps (Aac)	6.60	6.57	6.61	NA
Input Watts (W)	54.2	55.3	54.9	NA
Input PF	0.989	0.990	0.991	≥0.95
Output Volts (Vac)	6.78	6.86	6.86	NA
Output Amps (Aac)	6.61	6.61	6.63	6.53-6.67
Output Watts (W)	44.8	45.3	45.5	NA
Efficiency	0.83	0.82	0.83	≥80
Short Circuit Current (Aac)	6.67	6.69	6.68	6.6-7.1
Open Circuit Voltage (Vac)	11.9	11.8	12.2	25
Full Load Resistance	1.15	1.15	1.15	NA

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>SH</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	3,4,5,6,7,8	Sample No:	CRT1903111051-001-1,2,3
Amb (°C):	20.5	RH%	19
		Completion Date:	3/20/2019

Shock Test

The sample isolation transformers must be dropped twice from a height of 6 feet (2 meters) onto a smooth hardwood floor

The first drop must orient the transformer so it strikes on a bottom corner or location where damage from the core cutting into the case is most likely

The second drop must orient the transformer so it impacts on a side or location where damage to the windings is most likely to occur

Results

Type	Wattage	Primary	Secondary	Frequency	Full Load
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz	1.3 Ohms

Drop	Sample		
	1	2	3
1	✓	✓	✓
2	✓	✓	✓

Drop Height
6.0 Ft.

Note: Drop one was on the corner.
 Drop two was on the windings.

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>S.H.</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	3,13	Sample No:	CRT1903111051-001-1,2,3
Amb (°C):	17.9	RH%	22.7
		Completion Date:	3/25/2019

Results - pre insulation

Type	Wattage	Primary	Secondary	Frequency	Full Load
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz	1.3 Ohms

Drop	Sample		
	1	2	3
1	✓	✓	✓
2	✓	✓	✓

Drop Height
6.0 Ft.

Note: Drop one was on the corner.
 Drop two was on the windings.

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>S.H.</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	14,15	Sample No:	CRT2012091014-001-1,2,3
Amb (°C):	19	RH%	22
		Completion Date:	12/15/2020

Transformer Lead Rigidity Test

All transformers leads must also be tested for lead rigidity after the shock test

Sequentially secure each transformer lead just below the connector in a clamp fastened to a vertical support

The transformer body must be released and allowed to free-fall from the clamp height

Repeat the test for each transformer lead

Results

Type	Wattage	Primary	Secondary	Frequency	Full Load
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz	1.3 Ohms

	Sample								
	1			2			3		
	Pri. 1	Pri. 2	Sec.	Pri. 3	Pri. 4	Sec.	Pri. 5	Pri. 6	Sec.
Drop	✓	✓	✓	✓	✓	✓	✓	✓	✓
Damage	None	None	None	None	None	None	None	None	None

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>Sett</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	3,	Sample No:	CRT1903111051-001-1,2,3
Amb (°C):	17.9	RH%	22.7
		Completion Date:	3/25/2019

Results pre insulation test

Type	Wattage	Primary	Secondary	Frequency	Full Load
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz	1.3 Ohms

	Sample								
	1			2			3		
	Pri. 1	Pri. 2	Sec.	Pri. 3	Pri. 4	Sec.	Pri. 5	Pri. 6	Sec.
Drop	✓	✓	✓	✓	✓	✓	✓	✓	✓
Damage	None	None	None	None	None	None	None	None	None

Complies: YES NO

Tested By:	S.Hammond	Signature or initials:	<i>Sett</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	14	Sample No:	CRT2012091014-001-1,2,3
Amb (°C):	19	RH%	22
		Completion Date:	12/15/2020

Post Shock / Rigidity Test

After the completion of tests in paragraphs 4.2.2 and 4.2.2.1, the transformers must be tested to ensure they meet the secondary current requirements at full load (see Table 2).

A change of more than one percent from the test per paragraph 4.2.1 or evidence of damage to the case and attaching leads must be cause for rejection

Results

Type	Wattage	Primary	Secondary	Frequency	Full Load
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz	1.3 Ohms

Measured	Sample			Req.
	1	2	3	
Frequency (Hz)	60.0	60.0	60.0	
Input Amps (Aac)	6.60	6.60	6.60	
Output Volts (Vac)	7.07	7.02	7.07	
Output Amps (Aac)	6.62	6.60	6.61	
Output Watts (W)	46.8	46.4	46.7	
Full Load Resistance	1.3	1.3	1.3	
Initial Output Amps (Aac)	6.63	6.63	6.64	Req.
Percent Change (%)	0.1%	0.5%	0.3%	≤ 1%

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>SH</i>
Engineer:	cwm	Signature or initials:	<i>AWM</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	3,4,5,6,7,8	Sample No:	CRT1903111051-001-1,2,3
Amb (°C):	17.9	RH%	22.7
		Completion Date:	3/25/2019

Insulation Resistance

The sample transformers must be subjected to a 20-cycle insulation test

Mating test harness connectors that were previously subjected to "go" and "no go" gauges must be installed in the transformer lead connectors

The mating connectors must not be removed before completion of the 20 cycle testing. If the connectors are removed for any reason, tests must be repeated so both the transformers and connectors satisfactorily pass 20 continuous cycles

Transformers must be operated, with mating connectors installed, for a minimum of 6 hours at room temperature with the rated current in primary winding (see Table 2). The secondary windings of the transformers must be open-circuited

As soon as possible following the heating cycle, the transformers, with leads and connectors, must be completely submerged in water that is grounded at room temperature for 12 hours minimum

Ensure that all molded connections on the transformer leads and test harness are completely immersed in water during this test

The insulation resistance of each coil and lead assembly must be measured immediately after immersion with voltage applied per Table 3

Table 3. Insulation Resistance

Winding under Test	Voltage Applied (kV DC)	Minimum Insulation Resistance (Megohms)	Maximum Leakage Current (Micro amps)
Hot/Cold Primary for transformers up to 150 W	15.0	7500	2.0
Hot/Cold Secondary for transformers up to 150 W	5.0	2500	2.0
Hot/Cold Primary for transformers over 150 W	15.0	3000	5
Hot/Cold Secondary for transformers over 150W	5.0	1000	5

All measurements of the transformer insulation resistance must be made with direct current

The test voltage must be applied for 1 minute between each transformer winding and ground

The transformer winding not under test must be grounded and its connectors submerged in water

Insulation resistance at the test voltage must equal or exceed the minimum resistance values per Table 3. Alternatively, the leakage current must be less than or equal to the maximum leakage current values per Table 3

Results

Type	Wattage	Primary	Secondary	Frequency
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz

Cycle	Heating Cycle Start		Immediately After Immersion				Immersion Start		After Soaking			
			Primary		Secondary				Primary		Secondary	
			Isulation Resistance	Isulation Resistance	Isulation Resistance	Isulation Resistance			Isulation Resistance	Isulation Resistance		
Date	Time	μA	GΩ	μA	GΩ	Date	Time	μA	GΩ	μA	GΩ	
1	12/29/20	9:00	0.01	1500	0.04	125	12/29/20	15:00	0.02	750	0.02	250
2	12/30/20	7:45	0.01	1500	0.01	500	12/30/20	14:00	0.06	250	0.01	500
3	12/31/20	7:20	0.01	1500	0.01	500	1/3/21	15:00	0.02	750	0.01	500
4	1/4/21	7:45	0.02	750	0.01	500	1/4/21	14:00	0.01	1500	0.01	500
5	1/5/21	7:45	0.01	1500	0.01	500	1/5/21	14:00	0.01	1500	0.01	500
6	1/6/21	7:45	0.01	1500	0.01	500	1/6/21	15:00	0.01	1500	0.01	500
7	1/7/21	8:15	0.01	1500	0.01	500	1/7/21	15:00	0.01	1500	0.01	500
8	1/8/21	7:30	0.01	1500	0.01	500	1/10/21	14:00	0.02	750	0.01	500
9	1/11/21	7:15	0.01	1500	0.02	250	1/11/21	14:00	0.01	1500	0.01	500
10	1/12/21	7:45	0.01	1500	0.01	500	1/12/21	14:30	0.01	1500	0.01	500
11	1/13/21	7:45	0.01	1500	0.01	500	1/13/21	16:45	0.01	1500	0.01	500
12	1/14/21	7:45	0.01	1500	0.01	500	1/14/21	15:00	0.01	1500	0.01	500
13	1/15/21	7:30	0.01	1500	0.01	500	1/17/21	15:30	0.01	1500	0.01	500
14	1/18/21	7:30	0.02	750	0.01	500	1/18/21	14:00	0.01	1500	0.01	500
15	1/19/21	8:00	0.01	1500	0.01	500	1/19/21	14:30	0.01	1500	0.01	500
16	1/20/21	7:30	0.01	1500	0.01	500	1/20/21	14:00	0.01	1500	0.01	500
17	1/21/21	7:30	0.01	1500	0.01	500	1/21/21	14:30	0.01	1500	0.01	500
18	1/22/21	7:30	0.01	1500	0.01	500	1/24/21	15:00	0.01	1500	0.01	500
19	1/25/21	7:30	0.01	1500	0.01	500	1/25/21	14:30	0.01	1500	0.01	500
20	1/26/21	7:30	0.01	1500	0.01	500	1/26/21	14:30	0.01	1500	0.01	500
Specification Max.			2.0	7.5	2.0	2.5			2.0	7.5	2.0	2.5

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	S.H.
Engineer:	cwm	Signature or initials:	cwm
Reviewed By:	JND	Signature or initials:	JND
Test Equipment Used:	14,16,17	Sample No:	CRT2012091014-001-1
Amb (°C):	18	RH%:	na
		Completion Date:	1/27/2021

Cycle	Heating Cycle Start		Immediately After Immersion				Immersion Start		After Soaking			
			Primary		Secondary				Primary		Secondary	
			Isulation Resistance	Isulation Resistance	Isulation Resistance	Isulation Resistance			Isulation Resistance	Isulation Resistance	Isulation Resistance	Isulation Resistance
Date	Time	μ A	G Ω	μ A	G Ω	Date	Time	μ A	G Ω	μ A	G Ω	
1	12/29/20	9:00	0.01	1500	0.08	62.5	12/29/20	15:00	0.01	1500	0.01	500
2	12/30/20	7:45	0.01	1500	0.01	500	12/30/20	14:00	0.02	750	0.01	500
3	12/31/20	7:20	0.01	1500	0.01	500	1/3/21	15:00	0.02	750	0.01	500
4	1/4/21	7:45	0.02	750	0.01	500	1/4/21	14:00	0.01	1500	0.01	500
5	1/5/21	7:45	0.03	500	0.01	500	1/5/21	14:00	0.01	1500	0.01	500
6	1/6/21	7:45	0.02	750	0.01	500	1/6/21	15:00	0.01	1500	0.01	500
7	1/7/21	8:15	0.01	1500	0.01	500	1/7/21	15:00	0.01	1500	0.01	500
8	1/8/21	7:30	0.01	1500	0.01	500	1/10/21	14:00	0.01	1500	0.01	500
9	1/11/21	7:15	0.01	1500	0.01	500	1/11/21	14:00	0.01	1500	0.01	500
10	1/12/21	7:45	0.01	1500	0.01	500	1/12/21	14:30	0.01	1500	0.01	500
11	1/13/21	7:45	0.01	1500	0.01	500	1/13/21	16:45	0.01	1500	0.01	500
12	1/14/21	7:45	0.02	750	0.01	500	1/14/21	15:00	0.01	1500	0.02	250
13	1/15/21	7:30	0.01	1500	0.01	500	1/17/21	15:30	0.01	1500	0.01	500
14	1/18/21	7:30	0.01	1500	0.01	500	1/18/21	14:00	0.01	1500	0.01	500
15	1/19/21	8:00	0.01	1500	0.01	500	1/19/21	14:30	0.01	1500	0.01	500
16	1/20/21	7:30	0.01	1500	0.02	250	1/20/21	14:00	0.01	1500	0.01	500
17	1/21/21	7:30	0.01	1500	0.01	500	1/21/21	14:30	0.01	1500	0.02	250
18	1/22/21	7:30	0.01	1500	0.01	500	1/24/21	15:00	0.01	1500	0.01	500
19	1/25/21	7:30	0.02	750	0.01	500	1/25/21	14:30	0.01	1500	0.01	500
20	1/26/21	7:30	0.01	1500	0.01	500	1/26/21	14:30	0.01	1500	0.01	500
Specification Max.			2.0	7.5	2.0	2.5			2.0	7.5	2.0	2.5

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>SH</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	14,16,17	Sample No:	CRT2012091014-001-2
Amb (°C):	18	RH%:	na
		Completion Date:	1/27/2021

Cycle	Heating Cycle Start		Immediately After Immersion				Immersion Start		After Soaking			
			Primary		Secondary				Primary		Secondary	
			Isulation Resistance	Isulation Resistance	Isulation Resistance	Isulation Resistance			Isulation Resistance	Isulation Resistance	Isulation Resistance	Isulation Resistance
Date	Time	μ A	G Ω	μ A	G Ω	Date	Time	μ A	G Ω	μ A	G Ω	
1	12/29/20	9:00	0.02	750	0.02	250	12/29/20	15:00	0.02	750	0.02	250
2	12/30/20	7:45	0.02	750	0.01	500	12/30/20	14:00	0.02	750	0.01	500
3	12/31/20	7:20	0.01	1500	0.01	500	1/3/21	15:00	0.02	750	0.01	500
4	1/4/21	7:45	0.01	1500	0.01	500	1/4/21	14:00	0.01	1500	0.01	500
5	1/5/21	7:45	0.02	750	0.01	500	1/5/21	14:00	0.01	1500	0.02	250
6	1/6/21	7:45	0.02	750	0.01	500	1/6/21	15:00	0.01	1500	0.01	500
7	1/7/21	8:15	0.01	1500	0.01	500	1/7/21	15:00	0.01	1500	0.01	500
8	1/8/21	7:30	0.01	1500	0.01	500	1/10/21	14:00	0.01	1500	0.01	500
9	1/11/21	7:15	0.01	1500	0.01	500	1/11/21	14:00	0.01	1500	0.01	500
10	1/12/21	7:45	0.01	1500	0.01	500	1/12/21	14:30	0.01	1500	0.01	500
11	1/13/21	7:45	0.01	1500	0.01	500	1/13/21	16:45	0.01	1500	0.01	500
12	1/14/21	7:45	0.01	1500	0.01	500	1/14/21	15:00	0.01	1500	0.01	500
13	1/15/21	7:30	0.01	1500	0.01	500	1/17/21	15:30	0.01	1500	0.01	500
14	1/18/21	7:30	0.01	1500	0.01	500	1/18/21	14:00	0.04	375	0.01	500
15	1/19/21	8:00	0.01	1500	0.01	500	1/19/21	14:30	0.01	1500	0.01	500
16	1/20/21	7:30	0.01	1500	0.01	500	1/20/21	14:00	0.01	1500	0.01	500
17	1/21/21	7:30	0.01	1500	0.01	500	1/21/21	14:30	0.01	1500	0.01	500
18	1/22/21	7:30	0.01	1500	0.01	500	1/24/21	15:00	0.01	1500	0.01	500
19	1/25/21	7:30	0.01	1500	0.01	500	1/25/21	14:30	0.01	1500	0.01	500
20	1/26/21	7:30	0.01	1500	0.01	500	1/26/21	14:30	0.01	1500	0.01	500
Specification Max.			2.0	7.5	2.0	2.5			2.0	7.5	2.0	2.5

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>SH</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	14,16,17	Sample No:	CRT2012091014-001-3
Amb (°C):	18	RH%:	na
		Completion Date:	1/27/2021

Temperature Rise

The temperature rise of the sample transformers must be determined by the resistance method

The transformer temperature rise must be kept at least 9 degrees F (5 degrees C) below the maximum continuous duty temperature of the most critical insulating materials used

Transformers must be tested under (1) Rated Load, (2) Short Circuit (3) Open Circuit

IEEE Standard C57.12.91, IEEE Standard Test Code for Dry-Type Distribution and Power Transformers, Section 11, Temperature Test, for temperature rise formulas and guidance in the determination of transformer

$$Tr = R1/Ro (Tk + To) - (Tk + Ta), \text{ where}$$

- Tr - Temperature rise
- Ro - Cold resistance of a coil, Ohms
- To - Ambient temperature corresponding to the cold resistance, Ro
- R1 - Hot resistance of a coil, Ohms
- Tk - 234.5°C for copper
- Ta - Ambient temperature corresponding to the hot resistance, R1

Results

Type	Wattage	Primary	Secondary	Frequency
L-830	45 Watts	6.6 Amps	6.6 Amps	60 Hertz

Maximum continuous duty temperature of the most critical insulating material.	
Material	Temperature
insulating tape of Garware	130 °C

Sample	Parameter	Rated Load		Short Circuit		Open Circuit		Pass / Fail
		Primary	Secondary	Primary	Secondary	Primary	Secondary	
1	Ro (mΩ)	69.6	97.4	69.6	97.4	69.6	97.4	Pass
	R1 (mΩ)	78.7	103.2	78.6	109.5	81.0	101.6	
	Tr (°C)	29.5	11.3	30.6	29.3	41.2	10.2	
2	Ro (mΩ)	67.8	110.4	67.8	110.4	67.8	110.4	Pass
	R1 (mΩ)	78.6	116.1	77.2	117.9	80.4	116.8	
	Tr (°C)	36.8	9.3	33.0	14.9	46.8	14.0	
3	Ro (mΩ)	68.9	109.4	68.9	109.4	68.9	109.4	Pass
	R1 (mΩ)	78.6	115.9	76.4	120.2	81.4	109.4	
	Tr (°C)	32.0	11.3	25.4	22.8	45.5	10.4	

Calculated Maximum Internal Operating Temperature @ 65°C Ambient						
Sample	Rated Load		Short Circuit		Open Circuit	
	Primary	Secondary	Primary	Secondary	Primary	Secondary
1	94.5	76.3	95.6	94.3	106.2	75.2
2	101.8	74.3	98.0	79.9	111.8	79.0
3	97.0	76.3	90.4	87.8	110.5	75.4

Complies: YES NO

Tested By:	S. Hammond	Signature or initials:	<i>SH</i>
Engineer:	cwm	Signature or initials:	<i>cwm</i>
Reviewed By:	JND	Signature or initials:	<i>JND</i>
Test Equipment Used:	3,4,5,6,7,8,9,10,11,12	Sample No:	CRT1903111051-001-1,2,3
Amb (°C):	20.7	RH%	28
		Completion Date:	3/21/2019

Equipment list				
#	Intertek ID No.	Description	Manufacturer	Calibration Due
1	N973	Caliper	Fowler	10-May-2019
2	L171	Tape Measure	US Tape	14-Dec-2019
3	L190	Thermo-Hygrometer	Testo	26-Feb-2020
4	A195	Current Monitor, Wideband	Pearson Electronics, Inc.	18-Jan-21
5	A198	Current Monitor, Wideband	Pearson Electronics, Inc.	17-May-19
6	E489	Power Meter, Digital	Yokogawa Corporation	12-Jul-19
7	U091	Power Meter, Digital	Yokogawa Corporation	28-Jun-19
8	M236	Multimeter, Digital	Fluke Corporation	28-Apr-19
9	A204	Current Monitor, Wideband	Pearson Electronics, Inc.	18-Dec-2019
10	B031	DLRO	Biddle	14-May-2019
11	N1340	Stopwatch	Cole-Parmer	24-Mar-2019
12	T1421	IR thermometer	Fluke Corporation	11-Sep-2019
13	N1293	Tape Measure	US Tape	25-Oct-19
14	L190	Thermo-Hygrometer	Testo	11-Mar-2021
15	N1441	Tape Measure	Stanley	15-Jun-2021
16	E431	Portable DC Test Set	VLF Hipot Instruments	17-Aug-21
17	M309	Stopwatch	Control Company	12-Nov-21
18				
19				
20				

Note: For measurement uncertainty, refer to the calibration certificates for all the test equipment located in the equipment files