

# ECMA

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

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## SAFETY VERIFICATION (SAVE) REPORT ECMA-57/IEC 435

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TR/28

September 1985

## FOREWORD

This document provides a test protocol for safety verification of equipment complying with IEC Publication 435, 2nd edition, 1983, or with ECMA-57. Such equipment includes all data processing equipment from small desk-top units to large main-frame systems.

This protocol is presented in the form of a check list for type approval in the following logical sequence:

- visual inspection,
- non-destructive testing,
- destructive testing.

Adopted as an ECMA Technical Report by the General Assembly of ECMA on June 13, 1985.

ECMA-57/IEC 435

SAFETY VERIFICATION (SAVE) REPORT

OF \_\_\_\_\_

SOURCE ORGANIZATION : \_\_\_\_\_

Prepared by: \_\_\_\_\_

(Name)	(Title)	(Date)
_____	_____	_____

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

_____	_____	_____
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\_\_\_\_\_

## PRODUCT SAFETY FEATURES

The following items are examples of information describing how safety is achieved. They are intended to assist the test engineer in verifying compliance of the equipment with IEC Publication 435.

### 1. GENERAL

- Statement that equipment has been designed and built according to IEC 435, Second edition, 1983.
- Statement about classification of equipment (electrical, moisture, mobility, etc.)
- Supply connection (directly or indirectly to supply)

### 2. ELECTRICAL SAFETY

- How protection from electrical shock and energy hazards are achieved
- Description of power supply (e.g. insulation system, primary and secondary circuits, etc.)
- Supply disconnection (mains switch, plug, etc.)
- Safety interlocks
- Ground fault circuit interrupters

### 3. CONSTRUCTION

- Main points of construction which have product safety implications (e.g. mechanical strength, CRT implosion, motors/moving parts etc.)
- Enclosure design (e.g. metal or plastic, openings etc.)
- Stability
- Safety interlocks

### 4. FIRE PREVENTION

- Risk assessment
- Description of approach chosen (e.g. fault conditions, temperature control, classification of enclosure materials etc.)

### 5. SPECIAL CONSIDERATIONS

- Chemical hazards (emissions, materials etc.)
  - Radiation hazards (UV, laser, bright light etc.)
-



LIST OF DOCUMENTS TO BE PROVIDED WITH THE  
SAFETY VERIFICATION (SAVE) REPORT

The following documents should be provided with the SAVE Report and listed on page iii:

- General description of the equipment tested
- Description of how safety is achieved (see Page i)
- Operator instructions
- Installation instructions
- Service instructions

In addition, the following documentation may be required and, if applicable, should be listed on page iii:

- Component data sheets
  - Capacitor discharge test results
  - Limited current circuit test results
  - Wire data sheets
  - Interlock test results
  - Wire insulation test results
  - Stability test results
  - Mechanical strength test results
  - Flammability test results and/or data sheets
  - Enclosure flammability test results and/or material data sheets
  - Comparative tracking indices of printed wiring board materials
  - Data sheets or test results for cathode ray tubes (CRT)
  - Constructional drawings for transformers
  - Test results for abnormal operation and fault conditions
  - Scale prints of printed wiring boards with primary and secondary hazardous voltages showing all voltages on the tracks
  - Circuit schematics and assembly drawings of these printed wiring boards
-



## SAFETY VERIFICATION

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### INTRODUCTION

The unit was checked for compliance with IEC Publication 435, second edition 1983.

A summary of the results is shown on page I-2.

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### SECTION I - GENERAL INFORMATION

1. PRODUCT NAME:
  2. MODEL/TYPE REF.:
  3. TRACER NO./SERIAL NO.:
  4. DEVELOPMENT ORGANISATION:
  5. MANUFACTURING ORGANISATION:
  6. BLOCK DIAGRAM:
-

SECTION II - SUMMARY OF VISUAL INSPECTION

C1. 1.5	Components	Pass [ ]	Fail [ ]	N/A [ ]
1.7	Marking and instructions	Pass [ ]	Fail [ ]	N/A [ ]
2.1	Protection against electric shock and energy hazards	Pass [ ]	Fail [ ]	N/A [ ]
2.2	Insulation	Pass [ ]	Fail [ ]	N/A [ ]
2.3	SELV circuits	Pass [ ]	Fail [ ]	N/A [ ]
2.5	Provisions for (protective) earthing	Pass [ ]	Fail [ ]	N/A [ ]
2.6	Primary power isolation	Pass [ ]	Fail [ ]	N/A [ ]
2.7	Protection of internal wiring	Pass [ ]	Fail [ ]	N/A [ ]
3.1	Internal wiring	Pass [ ]	Fail [ ]	N/A [ ]
3.2	Supply connection	Pass [ ]	Fail [ ]	N/A [ ]
3.3	Terminals for primary supply conductors	Pass [ ]	Fail [ ]	N/A [ ]
4.1	Stability and mechanical hazards	Pass [ ]	Fail [ ]	N/A [ ]
4.3	Construction details	Pass [ ]	Fail [ ]	N/A [ ]

RESULT OF SECTION II: Pass [ ] Fail [ ]

SECTION III - SUMMARY OF NON-DESTRUCTIVE TESTING

1.6	Power interface	Pass [ ]	Fail [ ]	N/A [ ]
1.7	Marking and instructions	Pass [ ]	Fail [ ]	N/A [ ]
2.1	Protection against electric shock and energy hazards	Pass [ ]	Fail [ ]	N/A [ ]
2.3	SELV circuits	Pass [ ]	Fail [ ]	N/A [ ]
2.4	Limited current circuits	Pass [ ]	Fail [ ]	N/A [ ]
2.5	Provisions for (protective) earthing	Pass [ ]	Fail [ ]	N/A [ ]
2.8	Safety interlocks	Pass [ ]	Fail [ ]	N/A [ ]
3.1	Internal wiring	Pass [ ]	Fail [ ]	N/A [ ]
3.2	Supply connection	Pass [ ]	Fail [ ]	N/A [ ]
4.1	Stability and mechanical hazards	Pass [ ]	Fail [ ]	N/A [ ]
4.3	Construction details	Pass [ ]	Fail [ ]	N/A [ ]
5.1	Heating	Pass [ ]	Fail [ ]	N/A [ ]
5.2	Earth leakage current	Pass [ ]	Fail [ ]	N/A [ ]
5.3	Electric strength	Pass [ ]	Fail [ ]	N/A [ ]

RESULT OF SECTION III: Pass [ ] Fail [ ]

SECTION IV - SUMMARY OF DESTRUCTIVE TESTING

2.9	Creepage distances, clearances and distances through insulation	Pass [ ]	Fail [ ]	N/A [ ]
4.2	Mechanical strength	Pass [ ]	Fail [ ]	N/A [ ]
4.4	Resistance to fire	Pass [ ]	Fail [ ]	N/A [ ]
4.5	Resistance to tracking	Pass [ ]	Fail [ ]	N/A [ ]
4.6	Mechanical strength of CRT's and protection against the effect of implosion	Pass [ ]	Fail [ ]	N/A [ ]
5.4	Abnormal operating and fault conditions	Pass [ ]	Fail [ ]	N/A [ ]

RESULT OF SECTION IV: Pass [ ] Fail [ ]

Action No.	Ref. Clause	Action Required	Result	P/F

SECTION II

SUMMARY OF VISUAL INSPECTION

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CLAUSE 1.5 - COMPONENTS

Notes: - Use page II-3 to list the critical components

- Indicate below any relevant information on components and their documentation.

Comments:

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LIST OF CRITICAL COMPONENT

PART REF.	PART NUMBER	MANUFACTURER'S NAME	MANUF. TYPE NO.	RATINGS	MARK APPROVAL

Note 1 - List all different suppliers of above components.

Note 2 - Use separate lists for different schematics.

Reference Schematic \_\_\_\_\_

Legend, e.g.:

- W = Power Cord (Set)
- I = Indicator
- TB = Terminal Block
- J = Feed Through
- FL = RFI Filter
- F = Primary Fuse
- F = Secondary Fuse
- XF = Fuse Holder
- C = RFI Capacitor
- L = RFI Choke
- R = Resistor

- S = Mains Switch
- S = Interlock
- SI = Safety Interlock
- CB = Circuit Breaker
- VS = Voltage Selector
- OC = Opto Coupler
- B = Fan

- T = Transformer
- PrT = Thermal Protector
- SSR = Solid State Relay
- M = Motor
- PrM = Thermal Protector
- C = Motor Capacitor



CLAUSE 1.7 - MARKING AND INSTRUCTIONSApplicable  Not Applicable 

Comments:

(e.g. affix copy of rating plate(s), list markings of fuses, etc.)

	P	F	N/A
1.7.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1.7.12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Results of Clause 1.7:

Pass  Fail

CLAUSE 2.1 - PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS

			P	F	N/A
Applicable	<input type="checkbox"/>	Not Applicable	<input type="checkbox"/>		
			2.1.1		
			2.1.2	<input type="checkbox"/>	<input type="checkbox"/>
			2.1.3	<input type="checkbox"/>	<input type="checkbox"/>
			2.1.4	<input type="checkbox"/>	<input type="checkbox"/>
			2.1.5	<input type="checkbox"/>	<input type="checkbox"/>
			2.1.6	<input type="checkbox"/>	<input type="checkbox"/>
			2.1.9	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

---

Results of Clause 2.1:

Pass  Fail

---

CLAUSE 2.2 - INSULATION

2.2.7 P F N/A  
[ ] [ ] [ ]

Applicable [ ] Not Applicable [ ]

Note: General information on insulation is given in Subclauses 2.2.1 - 2.2.6

Comments:  
(describe materials used)

---

Results of Clause 2.2.7

Pass [ ] Fail [ ]

---

CLAUSE 2.3 - SELV CIRCUITS

2.3.2 P F N/A  
[ ] [ ] [ ]  
2.3.3 [ ] [ ] [ ]  
2.3.5 [ ] [ ] [ ]  
2.3.7 [ ] [ ] [ ]

Applicable [ ] Not Applicable [ ]

Comments:

---

Results of Clause 2.3:

Pass [ ] Fail [ ]

---

CLAUSE 2.5 - PROVISIONS FOR PROTECTIVE EARTHING

Applicable  Not Applicable

Comments:

	P	F	N/A
2.5.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.5.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.5.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.5.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

---

Results of Clause 2.5

Pass  Fail

---

CLAUSE 2.6 - PRIMARY POWER ISOLATIONApplicable  Not Applicable Comments:  
(describe implementation)

	P	F	N/A
2.6.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.6.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.6.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.6.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.6.5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Results of Clause 2.6:

Pass  Fail CLAUSE 2.7 - PROTECTION OF INTERNAL WIRINGApplicable  Not Applicable 

Comments:

	P	F	N/A
2.7.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.7.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.7.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.7.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.7.5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.7.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Results of Clause 2.7:

Pass  Fail

CLAUSE 3.1 - INTERNAL WIRING

	P	F	N/A
3.1.1	[ ]	[ ]	[ ]
3.1.2	[ ]	[ ]	[ ]
3.1.3	[ ]	[ ]	[ ]
3.1.4	[ ]	[ ]	[ ]
3.1.5	[ ]	[ ]	[ ]
3.1.6	[ ]	[ ]	[ ]

Applicable [ ] Not Applicable [ ]

Note: Specify type of wire used and describe insulation properties.

Comments:

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Results of Clause 3.1:

Pass [ ] Fail [ ]

CLAUSE 3.2 - SUPPLY CONNECTION

	P	F	N/A
3.2.1	[ ]	[ ]	[ ]
3.2.2	[ ]	[ ]	[ ]
3.2.3	[ ]	[ ]	[ ]
3.2.6	[ ]	[ ]	[ ]
3.2.7	[ ]	[ ]	[ ]
3.2.8	[ ]	[ ]	[ ]

Applicable [ ] Not Applicable [ ]

Comments:

---

Results of Clause 3.2:

Pass [ ] Fail [ ]

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CLAUSE 3.3 - TERMINALS FOR PRIMARY POWER SUPPLY CONDUCTORSApplicable  Not Applicable 

Note: Specify type of terminations used.

Comments:

	P	F	N/A
3.3.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.3.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Results of Clause 3.3:

Pass  Fail CLAUSE 4.1 - STABILITY AND MECHANICAL HAZARDSApplicable  Not Applicable 

Comments:

	P	F	N/A
4.1.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.1.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.1.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Results of Clause 4.1

Pass  Fail

CLAUSE 4.3 - CONSTRUCTION DETAILS

Applicable [ ] Not Applicable [ ]

Comments:

	P	F	N/A
4.3.1	[ ]	[ ]	[ ]
4.3.2	[ ]	[ ]	[ ]
4.3.3	[ ]	[ ]	[ ]
4.3.4	[ ]	[ ]	[ ]
4.3.6	[ ]	[ ]	[ ]
4.3.7	[ ]	[ ]	[ ]
4.3.8	[ ]	[ ]	[ ]
4.3.9	[ ]	[ ]	[ ]
4.3.10	[ ]	[ ]	[ ]
4.3.11	[ ]	[ ]	[ ]
4.3.12	[ ]	[ ]	[ ]
4.3.14	[ ]	[ ]	[ ]
4.3.15	[ ]	[ ]	[ ]
4.3.16	[ ]	[ ]	[ ]
4.3.17	[ ]	[ ]	[ ]
4.3.18	[ ]	[ ]	[ ]
4.3.19	[ ]	[ ]	[ ]

---

Results of Clause 4.3:

Pass [ ] Fail [ ]

---



SECTION III

SUMMARY OF NON-DESTRUCTIVE TESTING

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CLAUSE 1.6 - POWER INTERFACE

Applicable [ ] Not Applicable [ ]

Note: Measure input current and compare it  
with the value on the rating plate.

	P	F	N/A
1.6.1	[ ]	[ ]	[ ]
1.6.2	[ ]	[ ]	[ ]
1.6.3	[ ]	[ ]	[ ]
1.6.4	[ ]	[ ]	[ ]
1.6.5	[ ]	[ ]	[ ]

Comments:

---

Results of Clause 1.6Pass [ ] Fail [ ]

---

CLAUSE 1.7 - MARKING AND INSTRUCTIONS

1.7.13 P F N/A  
[ ] [ ] [ ]

Applicable [ ] Not Applicable [ ]

Comments:

---

Results of Clause 1.7.1:

Pass [ ] Fail [ ]

---

CLAUSE 2.1 - PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS

Applicable	[ ]	Not Applicable	[ ]			
				2.1.7	P [ ]	F [ ] N/A [ ]
				2.1.8	[ ]	[ ] [ ]

- Notes: - If applicable, test 2.1.7 according to 5.3.  
- If applicable, provide capacitor discharge test results

Comments:

---

Results of Clause 2.1:

Pass [ ] Fail [ ]

---

CLAUSE 2.3 - SELV CIRCUITSApplicable  Not Applicable 

	P	F	N/A
2.3.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.3.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.3.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: Measure the voltage of each SELV circuit under normal conditions.

Comments:

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Results of Clause 2.3:Pass  Fail CLAUSE 2.4 - LIMITED CURRENT CIRCUITSApplicable  Not Applicable 

	P	F	N/A
2.4.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.4.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.4.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.4.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

---

Results of Clause 2.4:Pass  Fail

CLAUSE 2.5 - PROVISIONS FOR PROTECTIVE EARTHING

P F N/A  
2.5.5 [ ] [ ] [ ]

Applicable [ ] Not Applicable [ ]

Comments:

---

Results of Clause 2.5

Pass [ ] Fail [ ]

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CLAUSE 2.8 - SAFETY INTERLOCKS

Applicable  Not Applicable

Comments:

	P	F	N/A
2.8.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.8.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.8.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.8.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.8.5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.8.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

---

Results of Clause 2.8:

Pass  Fail

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CLAUSE 3.1 - INTERNAL WIRING

			P	F	N/A
Applicable	[ ]	Not Applicable	[ ]	[ ]	[ ]
Comments:			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]

---

 Results of Clause 3.1:

 Pass [ ] Fail [ ]
 

---

CLAUSE 3.2 - SUPPLY CONNECTION

			P	F	N/A
Applicable	[ ]	Not Applicable	[ ]	[ ]	[ ]
Comments:			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]

---

 Results of Clause 3.2:

 Pass [ ] Fail [ ]
 

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CLAUSE 4.1 - STABILITY AND MECHANICAL HAZARDS

	P	F	N/A
4.1.1	[ ]	[ ]	[ ]

Applicable [ ] Not Applicable [ ]

Comments:

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Results of Clause 4.1.1

Pass [ ] Fail [ ]

CLAUSE 4.3 - CONSTRUCTION DETAILS

	P	F	N/A
4.3.5	[ ]	[ ]	[ ]
4.3.13	[ ]	[ ]	[ ]

Applicable [ ] Not Applicable [ ]

Note: For 4.3.13 reference may be made to a separate report

Comments:

---

Results of Clause 4.3:Pass [ ] Fail [ ]

---

CLAUSE 5.1 - HEATING

Applicable [ ] Not Applicable [ ]

- Notes:
- Wirewound components are normally measured by the change of resistance method (see test sheet on page III-11). Deviation from this method shall be explained.
  - If thermocouples are used describe their position.

Comments:

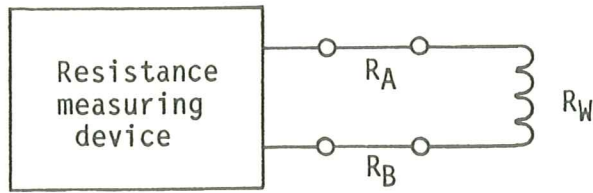
---

Results of Clause 5.1:

Pass [ ] Fail [ ]

---

TEMPERATURE RISE OF WINDINGS (Clause 5.1)



$R_L$  = Resistance of measuring leads

$R_L = R_A + R_B$

$R_T = R_W + R_L$

$$\Delta t = \frac{R_{W2} - R_{W1}}{R_{W1}} (234.5 + t_1) - (t_2 - t_1)$$

Measuring set-up for resistance method

Winding tested	Cold Condition				Hot Condition				$\Delta t$
	$R_{T1}$	$R_L$	$R_{W1}$	$t_1$	$R_{T2}$	$R_L$	$R_{W2}$	$t_2$	

Winding diagram:

Component part number: \_\_\_\_\_  
 Manufacturer's name: \_\_\_\_\_  
 Manufacturer's designation: \_\_\_\_\_

Insulation class: \_\_\_\_\_ Temp. limit: \_\_\_\_\_ °C  
 Test voltage: \_\_\_\_\_ VAC  
 Means of internal/external protection: \_\_\_\_\_

Results

Pass [ ] Fail [ ]

CLAUSE 5.2 - EARTH LEAKAGE CURRENT

Applicable [ ] Not Applicable [ ]

	P	F	N/A
5.2.1	[ ]	[ ]	[ ]
5.2.2	[ ]	[ ]	[ ]
5.2.3	[ ]	[ ]	[ ]
5.2.4	[ ]	[ ]	[ ]

Note: Indicate which limit applies and which test equipment has been used.

Comments:



CLAUSE 5.2 - EARTH LEAKAGE CURRENT

---

Results of Clause 5.2:

Pass [ ] Fail [ ]

---

CLAUSE 5.3 - ELECTRIC STRENGTH

Applicable [ ] Not Applicable [ ]

	P	F	N/A
5.3.1	[ ]	[ ]	[ ]
5.3.2	[ ]	[ ]	[ ]
5.3.3	[ ]	[ ]	[ ]

- Note: - If equipment is of Class II, check whether 2.1.7 is also applicable.
- List all points of applications, including all individual components.
  - Use pages III-14 and III-15 for construction details and test results respectively.

Comments:

Results of Clause 5.3:

Pass [ ] Fail [ ]

ELECTRIC STRENGTH AND SPACINGS OF TRANSFORMERS (Clause 2.9, 5.3 & Appendix C)

Winding diagram:

Requirements:

LOCATION	INSULATION	ELECTRIC STRENGTH	TERMINAL SPACINGS	CR. DIST.	CLEARANCE	DIST. THRU INSULATION
1						
2						
3						
4						
5						
6						
7						
8						
9						

Test Results:

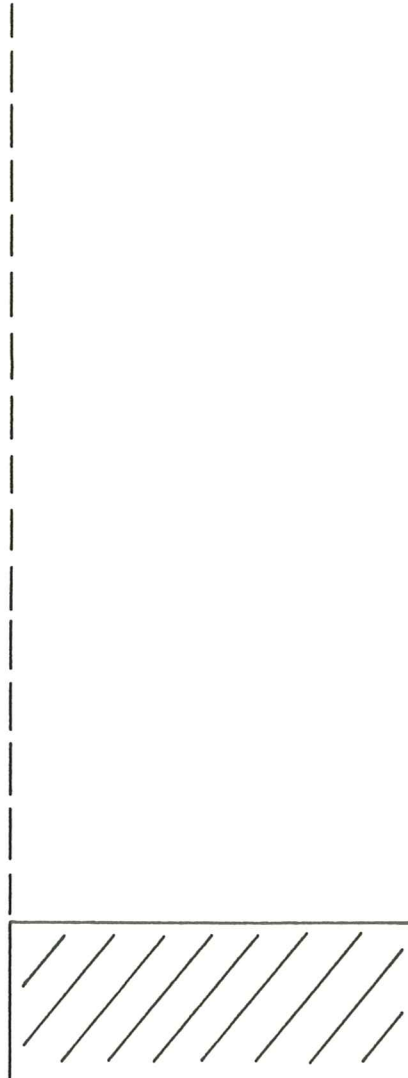
LOCATION	PASS/FAIL	mm	mm	mm	# layers mm
1					
2					
3					
4					
5					
6					
7					
8					
9					

Component part number: \_\_\_\_\_  
 Manufacturer's name: \_\_\_\_\_  
 Manufacturer's designation: \_\_\_\_\_

Results

Pass [ ] Fail [ ]

CONSTRUCTION OVERVIEW OF TRANSFORMERS



Component part number: \_\_\_\_\_  
Manufacturer's name: \_\_\_\_\_  
Manufacturer's designation: \_\_\_\_\_

Results

Pass [ ] Fail [ ]



SECTION IV

SUMMARY OF DESTRUCTIVE TESTING

---

CLAUSE 2.9 - CREEPAGE DISTANCES, CLEARANCES AND DISTANCES THROUGH INSULATION

Applicable [ ] Not Applicable [ ]

Note: For transformers, use pages III-15 and III-16

Comments:

	P	F	N/A
2.9.1			
2.9.2	[ ]	[ ]	[ ]
2.9.3	[ ]	[ ]	[ ]
2.9.4	[ ]	[ ]	[ ]
2.9.5	[ ]	[ ]	[ ]
2.9.6	[ ]	[ ]	[ ]
2.9.7	[ ]	[ ]	[ ]
2.9.8			

---

Results of Clause 2.9:

Pass [ ] Fail [ ]

---

CLAUSE 4.2 - MECHANICAL STRENGTH

Applicable [ ]      Not Applicable [ ]

Comments:

---

Results of Clause 4.2

Pass [ ]      Fail [ ]

---

CLAUSE 4.4 - RESISTANCE TO FIRE

	P	F	N/A
4.4.1	[ ]	[ ]	[ ]
4.4.2	[ ]	[ ]	[ ]
4.4.3	[ ]	[ ]	[ ]
4.4.4	[ ]	[ ]	[ ]
4.4.5	[ ]	[ ]	[ ]
4.4.6	[ ]	[ ]	[ ]

Applicable [ ] Not Applicable [ ]

Note: Conclusion on compliance with 4.4.6 shall be based on the results of 4.4.1 through 4.4.5.

Comments:

---

Results of Clause 4.4:

Pass [ ] Fail [ ]

---

CLAUSE 4.5 - RESISTANCE TO TRACKING

Applicable [ ] Not Applicable [ ]

Comments:

---

Results of Clause 4.5:

Pass [ ] Fail [ ]

---

CLAUSE 4.6 - MECHANICAL STRENGTH OF CRT'S AND PROTECTION AGAINST THE EFFECT  
OF IMPLOSION

Applicable [ ] Not Applicable [ ]

Comments:

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Results of Clause 4.6

Pass [ ] Fail [ ]

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CLAUSE 5.4 - ABNORMAL OPERATING AND FAULT CONDITIONS

Applicable [ ] Not Applicable [ ]

Note: - List all simulated fault conditions  
and describe the results on page IV.7

- For temperature rise test of transformer  
windings and motor locked rotor tests  
use pages IV-8 and IV-9 respectively.

- Check for possible reductions in  
creepage distances and clearances  
resulting from fault condition tests.

- Carry out electric strength tests  
after all abnormal tests with 0.6  
times the voltages of 5.3.3.

	P	F	N/A
5.4.1	[ ]	[ ]	[ ]
5.4.2	[ ]	[ ]	[ ]
B1	[ ]	[ ]	[ ]
B2	[ ]	[ ]	[ ]
B3	[ ]	[ ]	[ ]
B4	[ ]	[ ]	[ ]
B5	[ ]	[ ]	[ ]
B6	[ ]	[ ]	[ ]
5.4.3	[ ]	[ ]	[ ]
C1	[ ]	[ ]	[ ]
C2	[ ]	[ ]	[ ]
5.4.4	[ ]	[ ]	[ ]
5.4.5	[ ]	[ ]	[ ]
5.4.6	[ ]	[ ]	[ ]
5.4.7	[ ]	[ ]	[ ]
2.3.4	[ ]	[ ]	[ ]
2.3.6	[ ]	[ ]	[ ]

Comments:

Results of Clause 5.4:

Continued on page 7 [ ]

Pass [ ]

Fail [ ]

CLAUSE 5.4 - ABNORMAL OPERATING AND FAULT CONDITIONS (Continued)

List of simulated faults

<u>No.</u>	<u>Simulated fault</u>	<u>Assy affected</u>	<u>Result</u>	<u>Pass/Fail</u>
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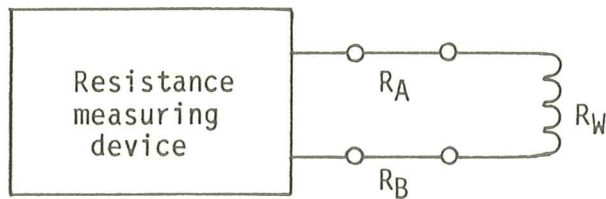
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Results of Clause 5.4:

Pass [ ] Fail [ ]

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TEMPERATURE RISE OF TRANSFORMER WINDINGS (Clause 5.4.3 & Appendix C)



$R_L$  = Resistance of measuring leads

$R_L = R_A + R_B$

$R_T = R_W + R_L$

$$\Delta t = \frac{R_{W2} - R_{W1}}{R_{W1}} (234.5 + t_1) - (t_2 - t_1)$$

Measuring set-up for resistance method

Winding short-circuited:	_____	$I_k =$ _____	mA	Results lines	A, _____
" " "	_____	$I_k =$ _____	mA	Results lines	_____
" " "	_____	$I_k =$ _____	mA	Results lines	_____
" " "	_____	$I_k =$ _____	mA	Results lines	_____

Winding tested	Cold condition				Hot condition				$\Delta t$
	$R_{T1}$	$R_L$	$R_{W1}$	$t_1$	$R_{T2}$	$R_L$	$R_{W2}$	$t_2$	
A	_____	_____	_____	_____	_____	_____	_____	_____	_____
B	_____	_____	_____	_____	_____	_____	_____	_____	_____
C	_____	_____	_____	_____	_____	_____	_____	_____	_____
D	_____	_____	_____	_____	_____	_____	_____	_____	_____
E	_____	_____	_____	_____	_____	_____	_____	_____	_____
F	_____	_____	_____	_____	_____	_____	_____	_____	_____
G	_____	_____	_____	_____	_____	_____	_____	_____	_____
H	_____	_____	_____	_____	_____	_____	_____	_____	_____
I	_____	_____	_____	_____	_____	_____	_____	_____	_____
J	_____	_____	_____	_____	_____	_____	_____	_____	_____
K	_____	_____	_____	_____	_____	_____	_____	_____	_____
L	_____	_____	_____	_____	_____	_____	_____	_____	_____

Component part number: \_\_\_\_\_  
 Manufacturer's name: \_\_\_\_\_  
 Manufacturer's designation: \_\_\_\_\_

Insulation class: \_\_\_\_\_ Temp. limit: \_\_\_\_\_ °C  
 Test voltage: \_\_\_\_\_ VAC

Means of internal/external protection: \_\_\_\_\_

Results

Pass [ ] Fail [ ]



TEMPERATURE RISE OF MOTOR WINDINGS (Clause 5.4.2 & Appendix B)

$\Omega$  ↑

LOCKED ROTOR TEST		Duration: _____ days
Component part number: _____		
Manufacturer's name: _____		
Manufacturer's designation: _____		
Insulation class: _____	Temp. limit: _____ °C	
Test voltage: _____ VAC		
Means of internal/external protection: _____		

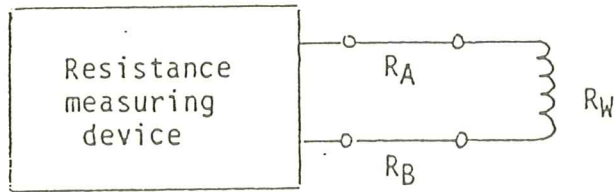
A	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	minutes
B	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	hours
C	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	days

APPENDIX

EXAMPLES OF TEST SHEETS

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TEMPERATURE RISE OF WINDINGS (Clause 5.1)



$R_L$  = Resistance of measuring leads

$R_L = R_A + R_B$

$R_T = R_W + R_L$

$$\Delta t = \frac{R_{W2} - R_{W1}}{R_{W1}} (234.5 + t_1) - (t_2 - t_1)$$

Measuring set-up for resistance method

Winding tested	Cold Condition				Hot Condition				$\Delta t$
	$R_{T1}$	$R_L$	$R_{W1}$	$t_1$	$R_{T2}$	$R_L$	$R_{W2}$	$t_2$	
X1-X2	1688	0.3	1688	20°C	1828	0.3	1828	20°C	21.1°C
Y1-Y2	38.7	"	38.4	"	40.8	"	40.5	"	13.9
Y3-Y4	38.6	"	38.3	"	40.7	"	40.4	"	13.9
Y5-Y6	28.4	"	28.1	"	30.6	"	30.3	"	22.6

Note: All resistance values are in Ohms.

Winding diagram:

See Page III-3

EXAMPLE

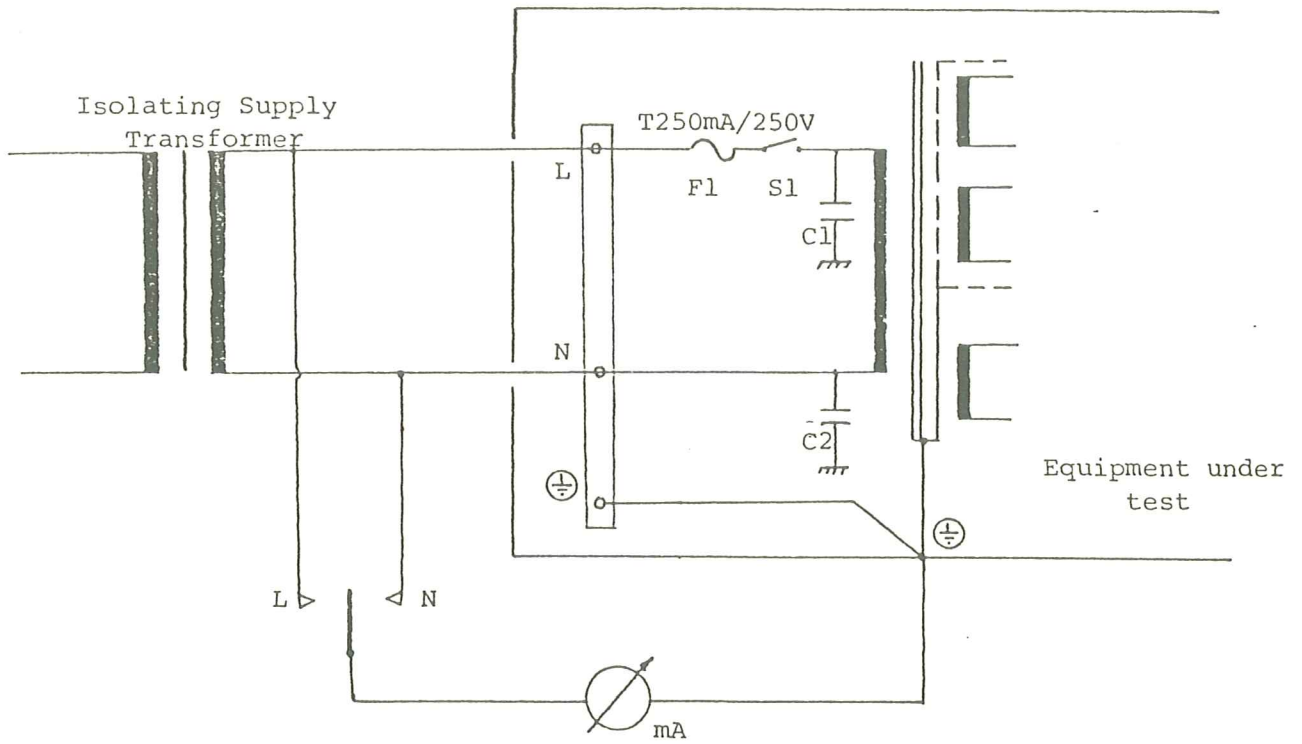
Component part number: 008-1234567  
 Manufacturer's name: Transformer Inc.  
 Manufacturer's designation: XFMR 1-12A

Insulation class: E Temp. limit: 90 °C at 25°C ambient  
 Test voltage: 254.5 VAC  
 Means of ~~internal~~/external protection: fuse T250mA/250V

Results

Pass [x] Fail [ ]

CLAUSE 5.2 - EARTH LEAKAGE CURRENT



Test Results:

	S1 open	S1 closed
L	0.005mA	0.55 mA
N	0.004mA	0.54 mA

Limit: 3.5 mA

**EXAMPLE**

Results of Clause 5.2:

Pass [ x ] Fail [ ]

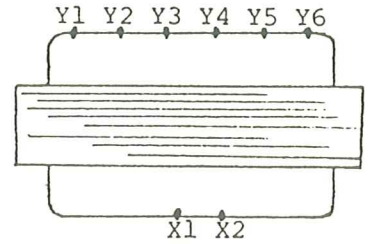
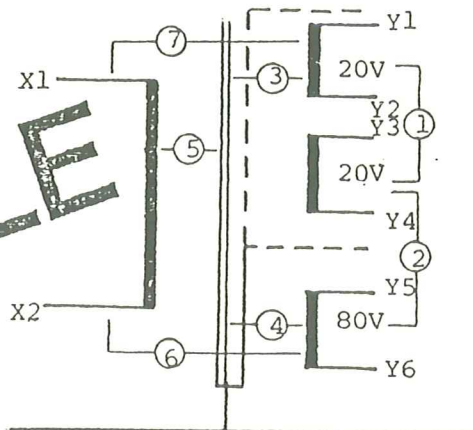


ELECTRIC STRENGTH AND SPACINGS OF TRANSFORMERS (Clause 2.9, 5.3 & Appendix C)

Winding diagram:

**EXAMPLE**

220-240V



GND

Requirements:

LOCATION	INSULATION	ELECTRIC STRENGTH	TERMINAL SPACINGS	CR. DIST.	CLEARANCE	DIST. TH. INSULATION
1	Operat.	500V	No Requ.	No Requ.	No Requ.	No Requ.
2	Suppl.	2500V	4 mm	4 mm	4 mm	2 layers
3	Operat.	500V	No Requ.	No Requ.	No Requ.	No Requ.
4	Basic	1250V	2 mm	1.5 (1) mm	2 (1.5) mm	No Requ.
5	Basic	1250V	3 mm	4 (3) mm	3 (2) mm	No Requ.
6	Basic	1250V	3 mm	4 (3) mm	3 (2) mm	No Requ.
7	Suppl.	2500V	4 mm	4 mm	4 mm	2 layers
8						
9						

( ) for enamelled windings.

Test Results:

LOCATION	PASS/FAIL	mm	mm	mm	# layers mm
1	Pass	5 mm	4.6 mm	4.6 mm	2x 0.1 mm
2	Pass	5 mm	5.8 mm	5.8 mm	2x 0.1/Sh/2x 0.1mm
3	Pass	7 mm	2.3 mm	2.3 mm	N/A
4	Pass	7 mm	2.5 mm	2.5 mm	N/A
5	Pass	7 mm	4.4 mm	4.4 mm	2x 0.1 mm
6	Pass	34 mm	7.8 mm	7.8 mm	3x 0.1 mm
7	Pass	34 mm	9.5 mm	9.5 mm	N/A
8					
9					

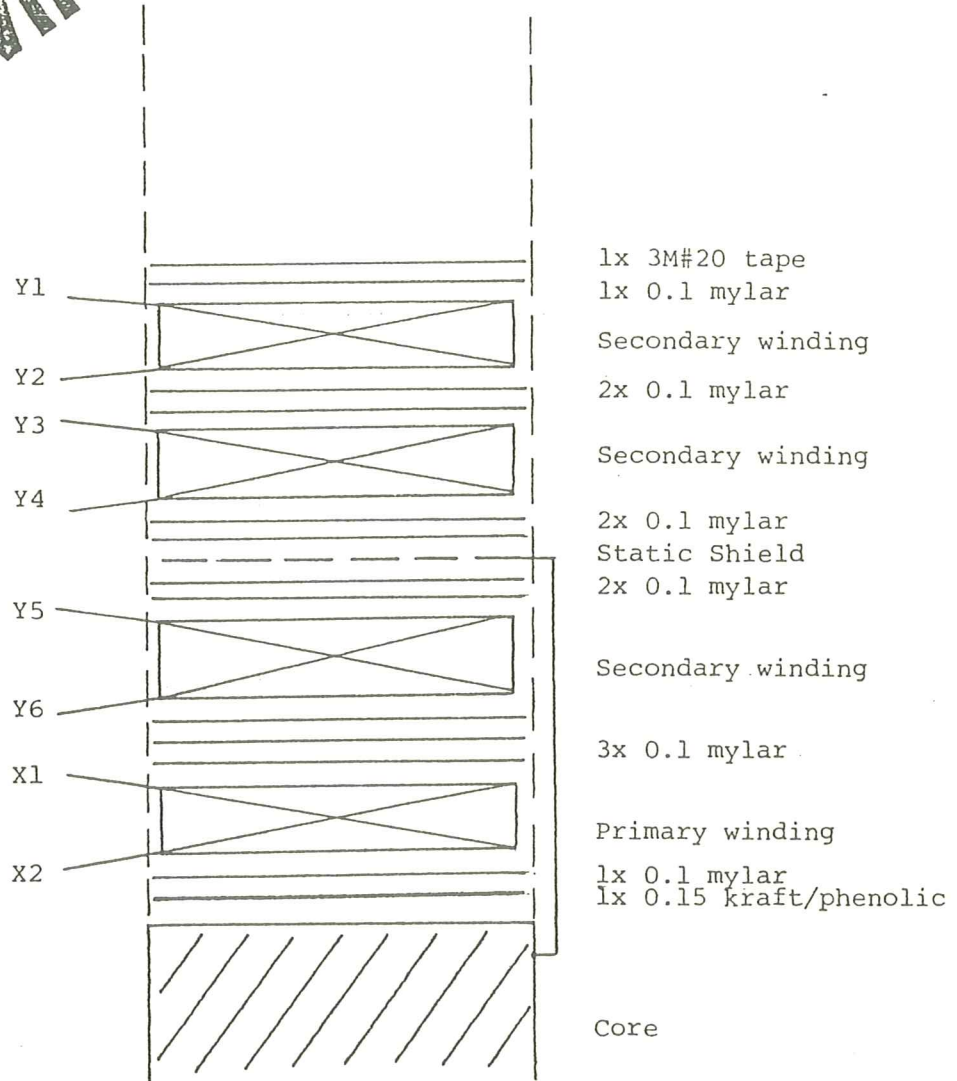
Component part number: 008-1234567  
 Manufacturer's name: Transformer Inc.  
 Manufacturer's designation: XFMR 1-12A

Results

Pass [x] Fail [ ]

CONSTRUCTION OVERVIEW OF TRANSFORMERS

EXAMPLE

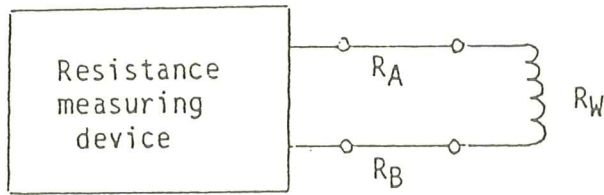


Component part number: 008-1234567  
 Manufacturer's name: Transformer Inc.  
 Manufacturer's designation: XFMR 1-12A

Results

Pass [x] Fail [ ]

TEMPERATURE RISE OF TRANSFORMER WINDINGS (Clause 5.4.2 & Appendix C)



$R_L$  = Resistance of measuring leads

$R_L = R_A + R_B$

$R_T = R_W + R_L$

$$\Delta t = \frac{R_{W2} - R_{W1}}{R_{W1}} (234.5 + t_1) - (t_2 - t_1)$$

Measuring set-up for resistance method

EXAMPLE

Winding short-circuited:	<u>Y1-Y2</u>	$I_k =$	<u>170</u>	mA	Results lines	<u>A,B,C</u>
"	<u>Y3-Y4</u>	$I_k =$	<u>170</u>	mA	Results lines	<u>E,F,G</u>
"	<u>Y5-Y6</u>	$I_k =$	<u>220</u>	mA	Results lines	<u>I,J,K</u>
"		$I_k =$		mA	Results lines	

Winding tested	Cold condition				Hot condition				$\Delta t$	
	$R_{T1}$	$R_L$	$R_{W1}$	$t_1$	$R_{T2}$	$R_L$	$R_{W2}$	$t_2$		
A	<u>X1-X2</u>	<u>1688</u>	<u>0.3</u>	<u>1688</u>	<u>21°C</u>	<u>2260</u>	<u>0.3</u>	<u>2260</u>	<u>21°C</u>	<u>86.6°C</u>
B	<u>Y3-Y4</u>	<u>38.6</u>	<u>"</u>	<u>38.3</u>	<u>"</u>	<u>51.4</u>	<u>"</u>	<u>51.1</u>	<u>"</u>	<u>88.0</u>
C	<u>Y5-Y6</u>	<u>28.4</u>	<u>"</u>	<u>28.1</u>	<u>"</u>	<u>38.6</u>	<u>"</u>	<u>38.3</u>	<u>"</u>	<u>92.7</u>
D										
E	<u>X1-X2</u>	<u>1688</u>	<u>0.3</u>	<u>1688</u>	<u>21°C</u>	<u>2260</u>	<u>0.3</u>	<u>2260</u>	<u>21°C</u>	<u>86.6°C</u>
F	<u>Y1-Y2</u>	<u>38.7</u>	<u>"</u>	<u>38.4</u>	<u>"</u>	<u>51.4</u>	<u>"</u>	<u>51.1</u>	<u>"</u>	<u>84.5</u>
G	<u>Y5-Y6</u>	<u>28.4</u>	<u>"</u>	<u>28.1</u>	<u>"</u>	<u>38.6</u>	<u>"</u>	<u>38.3</u>	<u>"</u>	<u>92.7</u>
H										
I	<u>X1-X2</u>	<u>1688</u>	<u>0.3</u>	<u>1688</u>	<u>21°C</u>	<u>2379</u>	<u>0.3</u>	<u>2379</u>	<u>21°C</u>	<u>104.6°C</u>
J	<u>Y1-Y2</u>	<u>38.7</u>	<u>"</u>	<u>38.4</u>	<u>"</u>	<u>55.2</u>	<u>"</u>	<u>54.9</u>	<u>"</u>	<u>109.8</u>
K	<u>Y3-Y4</u>	<u>38.6</u>	<u>"</u>	<u>38.3</u>	<u>"</u>	<u>55.1</u>	<u>"</u>	<u>54.8</u>	<u>"</u>	<u>110.0</u>
L										

Note: All resistance values are in Ohms.

Component part number: 008-1234567  
 Manufacturer's name: Transformer Inc.  
 Manufacturer's designation: XFMR 1-12A

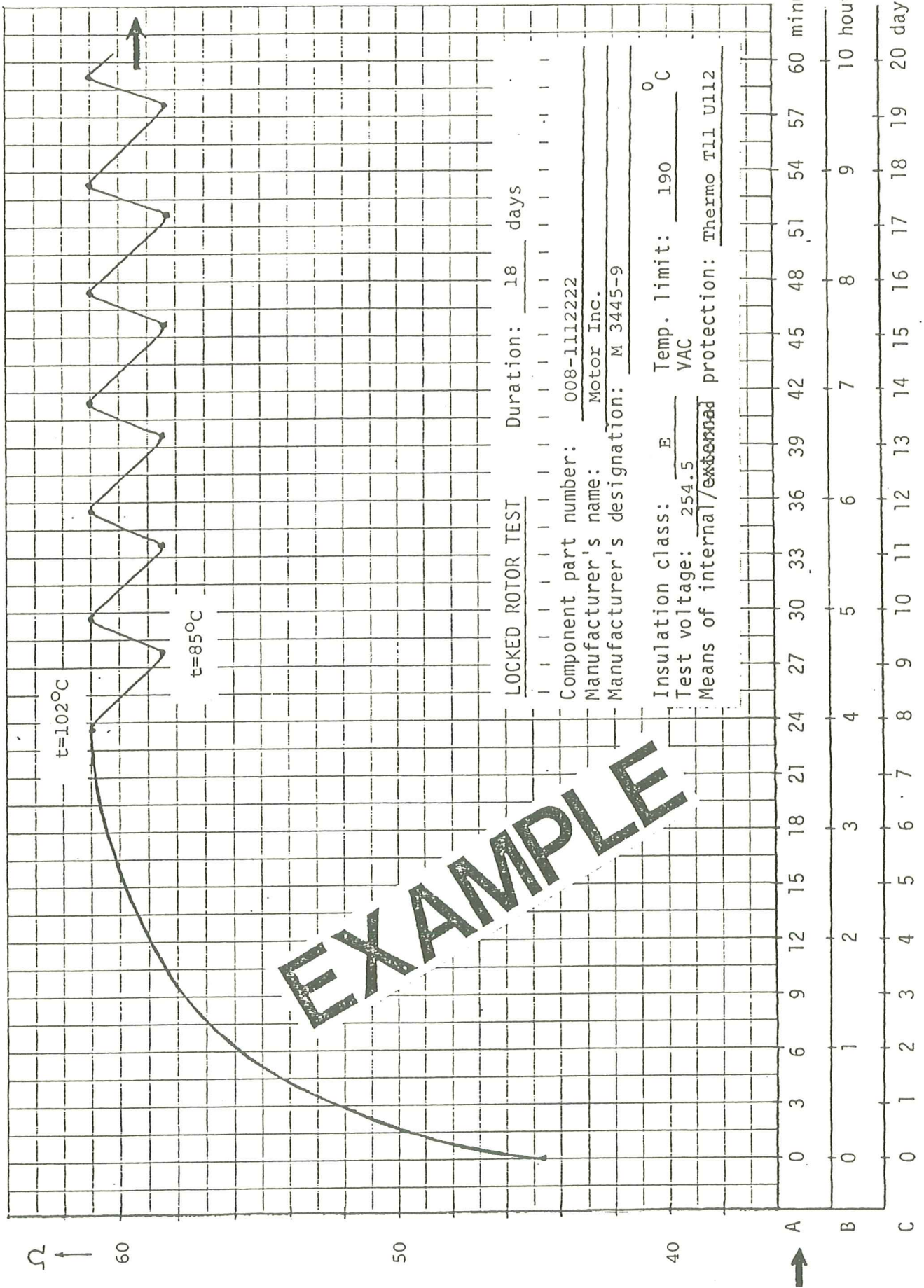
Insulation class: E Temp. limit: 140 °C at 25°C ambient  
 Test voltage: 254.4 VAC  
 Means of internal/external protection: fuse T250mA/250V

Results

Pass [] Fail []



TEMPERATURE RISE OF MOTOR WINDINGS (Clause 5.4.2 & Appendix B)



LOCKED ROTOR TEST      Duration: 18 days

Component part number: 008-1112222

Manufacturer's name: Motor Inc.

Manufacturer's designation: M 3445-9

Insulation class: E      Temp. limit: 190 °C

Test voltage: 254.5 VAC

Means of internal/external protection: Thermo T11 U112

A 0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 minutes

B 0 1 2 3 4 5 6 7 8 9 10 hours

C 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 days