



DPC: 24 / 30498340 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Part 3: Additional requirements for inductive voltage transformers

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Responsible Committee Secretary: Lilly Malik (BSI)

Direct tel:

E-mail: lilly.malik@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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UK Vote

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



38/800/CD

COMMITTEE DRAFT (CD)

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SECRETARIAT:

Italy

SECRETARY:

Mr Filippo Frugoni

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 13, SC 17C, TC 85, TC 95

HORIZONTAL FUNCTION(S):

ASPECTS CONCERNED:

Electricity transmission and distribution

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TITLE:

Instrument transformers - Part 3: Additional requirements for inductive voltage transformers

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CONTENTS

1		
2		
3	FOREWORD.....	8
4	INTRODUCTION.....	11
5	1 Scope.....	12
6	2 Normative references	12
7	3 Terms, definitions, symbols and abbreviated terms	12
8	3.1 Terms and definitions.....	12
9	3.2 Symbols and abbreviated terms	13
10	4 Normal and special environmental conditions	13
11	5 Ratings.....	13
12	5.1 General.....	13
13	5.2 Voltage ratings.....	14
14	5.2.1 Highest voltage for equipment (U_m).....	14
15	5.2.2 Power system earthing	14
16	5.2.3 Standard values for rated primary voltage (U_{pr}).....	14
17	5.2.4 Standard values for rated secondary voltage (U_{sr})	15
18	5.2.5 Rated auxiliary power supply voltage (U_{ar}).....	16
19	5.2.301 Standard values for rated voltage factor (F_v)	16
20	5.3 Current ratings.....	16
21	5.3.1 Standard values for rated primary current (I_{pr})	16
22	5.3.2 Standard values for rated secondary current (I_{sr}).....	16
23	5.3.3 Standard values for rated continuous thermal current (I_{cth}).....	16
24	5.3.4 Short-time current ratings	16
25	5.4 Dielectric ratings	17
26	5.4.1 General	17
27	5.4.2 Rated primary terminal insulation level	17
28	5.4.3 Other requirements for primary terminal insulation.....	17
29	5.4.4 Between-section insulation requirements	17
30	5.4.5 Insulation requirements for secondary terminals and low-voltage	
31	components.....	17
32	5.5 Rated frequency (f_r).....	17
33	5.6 Output ratings	17
34	5.6.1 Rated output for inductive instrument transformers and CVT	17
35	5.6.2 Rated burden for LPITs	18
36	5.6.3 Standard values for the rated delay time for EITs (t_{dr}).....	18
37	5.7 Accuracy requirements	19
38	5.7.1 General	19
39	5.7.2 Rated accuracy classes	19
40	5.7.3 Accuracy class extension for harmonics	21
41	5.7.4 Accuracy requirements for harmonics	21
42	5.7.5 Harmonic requirements for LPIT protection accuracy classes	21
43	5.7.6 Anti-aliasing filter for EIT using digital data processing	21
44	6 Design and construction	21

45	6.1	Requirements for liquids used in equipment	21
46	6.2	Requirements for gases used in equipment	21
47	6.3	Requirements for solid materials used in equipment	21
48	6.4	Requirements for temperature rise of parts and components	21
49	6.4.1	General	21
50	6.4.2	Influence of altitude on temperature rise	22
51	6.5	Requirements for earthing of equipment	22
52	6.5.1	General	22
53	6.5.2	Earthing of the enclosure	22
54	6.5.3	Electrical continuity	22
55	6.6	Requirements for the external insulation	22
56	6.7	Mechanical requirements	22
57	6.8	Multiple chopped impulses on primary terminals	22
58	6.9	Internal arc fault protection requirements	22
59	6.10	Degrees of protection by enclosures	22
60	6.11	Electromagnetic compatibility (EMC)	22
61	6.11.1	General	22
62	6.11.2	Requirements for immunity	23
63	6.11.3	Requirements for emission	23
64	6.11.4	Requirements for transmitted overvoltage (TOV)	23
65	6.11.5	Requirements for radio interference voltage (RIV)	23
66	6.12	Corrosion	23
67	6.13	Markings	23
68	6.13.1	General	23
69	6.13.2	Terminal markings	23
70	6.13.3	Rating plate markings	27
71	6.14	Requirements for LPIT secondary terminal connection	28
72	6.15	EIT secondary signal noise	28
73	6.16	Fire hazard	28
74	6.17	Pressure withstand of gas-filled enclosures	28
75	6.18	Failure detection of EIT	28
76	6.19	Operability	28
77	6.20	Reliability and dependability of EIT	28
78	6.21	Vibration requirements	28
79	6.22	Storage climatic conditions withstand capability	28
80	6.301	Short-circuit withstand capability	28
81	6.302	Capacitive discharge capability	29
82		Maximum instantaneous error $\hat{\varepsilon}_F$ after duration time T_F	29
83		where	29
84		Table 308 – Maximum time for sustained ferro-resonance	30
85	7	Tests	30
86	7.1	General	30
87	7.1.1	Classification of tests	30
88	7.1.2	List of tests	30
89	7.1.3	Sequence of tests	31
90	7.1.4	Testing conditions	32
91	7.2	Type tests	32
92	7.2.1	General	

93	7.2.2	Temperature rise test	32
94	7.2.3	Impulse voltage withstand test on primary terminals	34
95	7.2.4	Wet test for outdoor type instrument transformers	34
96	7.2.5	Electromagnetic compatibility (EMC) tests	34
97	7.2.6	Tests for accuracy	35
98	7.2.7	Verification of the degree of protection by enclosures	35
99	7.2.8	Enclosure tightness test at ambient temperature	35
100	7.2.9	Proof test for the gas-filled enclosure	35
101	7.2.10	Mechanical tests	35
102	7.2.11	Voltage withstand test of low-voltage components and secondary	
103		terminals	36
104	7.2.12	Storage climatic environmental tests	36
105	7.2.13	Vibration test	36
106	7.2.14	Durability of markings	36
107	7.2.15	Tests for accuracy for harmonics and low frequencies	36
108	7.2.16	Test for anti-aliasing	36
109	7.2.301	Short circuit withstand capability test	36
110	7.3	Routine tests	37
111	7.3.1	Power-frequency voltage withstand tests on primary terminals	37
112	7.3.2	Partial discharge measurement	40
113	7.3.3	Power-frequency voltage withstand tests between sections	40
114	7.3.4	Power-frequency voltage withstand tests on secondary terminals	40
115	7.3.5	Power-frequency voltage withstand test for low-voltage components	40
116	7.3.6	Test for accuracy	40
117	7.3.7	Verification of markings	40
118	7.3.8	Enclosure tightness test at ambient temperature	40
119	7.3.9	Pressure test for the gas-filled enclosure	40
120	7.3.10	Measurement of capacitance and dielectric dissipation factor	41
121	7.4	Special tests	43
122	7.4.1	Multiple chopped impulse test on primary terminals	43
123	7.4.2	Transmitted overvoltage test	43
124	7.4.3	Internal arc fault test	43
125	7.4.4	Enclosure tightness test at low and high temperatures	43
126	7.4.5	Insulation resistance measurement on secondary terminals	43
127	7.4.6	Corrosion test	43
128	7.4.7	Fire hazard test	43
129	7.4.8	Thermo-mechanical endurance test	43
130	7.4.9	Vibration and shock tests	43
131	7.4.10	Tests for accuracy versus harmonics and low frequencies	43
132	7.4.11	Seismic qualification	43
133	7.4.302	Capacitive discharge test	43
134	7.5	Commissioning tests	45
135	7.6	Sample tests	45
136	8	Rules for transport, storage, erection, operation and maintenance	45
137	9	Safety	45
138	10	Influence of products on the natural environment	45
139	Annex A (normative)	Identification of test specimen	46
140	Annex B (informative)	Recommendation for contents of failure reports	47

141	Annex C (informative) Fire hazard	48
142	Annex D (informative) Sample test	49
143	Annex E (informative) Technique used in temperature rise test of transformers to	
144	determine the thermal time constant by an experimental estimation	50
145	Annex F (informative) Guidance for the extension of validity of type tests or special	
146	tests of instrument transformers	51
147	F.1 General	51
148	F.2 Information needed for extension of type test validity	51
149	F.3 Application of extension criteria	51
150	F.3.1 Short-circuit withstand capability test	51
151	F.3.2 Capacitive discharge test	51
152	Annex G (informative) Guidance for the calculation of equivalent diameter in case of	
153	irregular shape of insulating part	53
154	Annex H (informative) Test circuits	54
155	Annex I (normative) Seismic qualification of instrument transformers	55
156	Annex 3A (informative) Information about residual voltage winding	56
157	Annex 3B	58
158	(normative)	58
159	Legacy Burden Values and Accuracy Definitions	58
160	3B.1 Legacy output values	58
161	3B.2 Legacy thermal limiting output values	58
162	3B.3 Legacy output values for residual voltage windings	58
163	3B.4 Legacy thermal limiting output values for residual voltage windings	58
164	3B.4 Legacy limits of voltage error and phase displacement for measuring voltage	
165	transformers	59
166	3B.5 Legacy limits of voltage error and phase displacement for protective voltage	
167	transformers	59
168	Annex 3C	60
169	(normative)	60
170	Accuracy of inductive voltage transformers with simultaneous burden	60
171	C.1 3C.1 General	60
172	3C.2 Load distribution according to the procedure a)	61
173	3C.3 Load distribution according to procedure b)	61
174	Annex 3D (informative) Assessment of accuracy for different burden and power factor	
175	from the measured data	63
176	Annex 3E (informative) Parameters of capacitive discharge through voltage	
177	transformers	71
178	3E.1 Basic Theory and Considerations	71
179	3E.2 Influencing parameters	72
180	3E.3 Guidance on selection of discharge parameters	73
181	3E.4 Calculation of adiabatic temperature rise during capacitive discharge	74
182	3E.5 Mechanical considerations	75
183	3E.6 Test setup example	75
184	Annex 3F (informative) Considerations for ferro-resonance performance qualification	77
185	3F.1 General notes	77
186	3F.2 Example of configurations for qualification of ferro-resonance performance	77
187	3F.3 Test setup example, influencing parameters and considerations	78
188	3F.4 Example of result interpretation and presentation	82

189	3F.5 Qualification through calculation	82
190	Bibliography	85
191		
192	Figure 301 – Single-phase transformer with fully insulated terminals and a single	
193	secondary	24
194	Figure 302 – Single-phase transformer with a neutral primary terminal with reduced	
195	insulation and a single secondary	24
196	Figure 303 – Three-phase assembly with a single secondary	24
197	Figure 304 – Single-phase transformer with two secondaries	25
198	Figure 305 – Three-phase assembly with two secondaries	25
199	Figure 306 – Single-phase transformer with one multi-tap secondary	25
200	Figure 307 – Three-phase assembly with one multi-tap secondary	25
201	Figure 308 – Single-phase transformer with two multi-tap secondaries	26
202	Figure 309 – Single-phase transformer with one residual voltage winding	26
203	Figure 310 – Three-phase transformer with one residual voltage winding	26
204	Figure 311 – Common mode (separate source) test voltage application	38
205	Figure 312 – Differential mode (induced) test voltage application – Primary excitation	39
206	Figure 313 – Differential mode (induced) test voltage application – Secondary	
207	excitation	39
208	Figure 314 (a) – Test arrangements for measurement of capacitance and dielectric	
209	dissipation factor on earthed voltage transformers	41
210	Figure 314 (b) – Test arrangements for measurement of capacitance and dielectric	
211	dissipation factor on unearthed voltage transformers with the tank insulated from earth	42
212	Figure 314 (c) – Test arrangements for measurement of capacitance and dielectric	
213	dissipation factor on unearthed voltage transformers with the tank connected to the	
214	earth (when a dissipation factor measurement terminal is available)	42
215	Figure 3A.301 – Open-delta connection as defined in IEC (IEV ref 421-10-03)	56
216	Figure 3A.302 – “V-V” connection using 2 single-phase transformers	57
217	Figure 3D.301: Calculation sequence	64
218	Figure 3D.302: Calculated voltage and phase error at zero burden	66
219	Figure 3D.303: Voltage and phase errors at 50 VA, 5 VA measured at unity power	
220	factor and 50 VA and 0 VA calculated at power factor of 0,8	67
221	Figure 3D.304: Voltage and phase errors using combination of measurement and	
222	calculation, for different burdens and power factors	68
223	Figure 3E.301 – Basic representation of capacitive discharge	71
224	Figure 3E.302: Dependence of discharge parameters on C_L (a) Discharge current	
225	Waveshapes (B) Discharge voltage Waveshapes (C) I_D dependence on C_L (D) E_D	
226	Dependence on C_L	72
227	Figure 3E.303: Dependence of discharge parameters on U_L (a) Discharge current	
228	Waveshapes (B) Discharge voltage Waveshapes (C) I_D dependence on U_L (D) E_D	
229	Dependence on U_L	72
230	Figure 3E.304: Dependence of discharge parameters on winding geometry (a)	
231	discharge current waveshapes (b) discharge voltage waveshapes (c) I_D dependence	
232	on winding geometry (d) E_D dependence on winding geometry	72
233	Figure 3E.305: Simplified test circuit	75
234	Figure 3F.301: Example test circuit	78
235	Figure 3F.302: Oscillogram example for successfully damped ferro-resonance: (a)	
236	Voltage of the high voltage source, (b) Secondary voltage (c) Primary current	80

237	Figure 3F.303: Oscillogram example for sustained ferro-resonance: (a) Voltage of the	
238	high voltage source, (b) Secondary voltage (c) Primary current.....	81
239	Figure 3F.304: Example of model for simulation of IVT ferroresonance performance	83
240		
241	Table 301 – Rated primary voltage (U_{pr}) levels for instrument transformers for AC	
242	applications	14
243	Table 302 – Standard values of rated voltage factors	16
244	Table 303 – Limits of voltage error and phase displacement for measuring voltage	
245	transformers	19
246	Table 304 – Limits of voltage error and phase displacement for protective voltage	
247	transformers	20
248	Table 305 – Example of a correctly denoted accuracy class	27
249	Table 306 – Example of a correctly denoted accuracy class	27
250	Table 307 – Example of a correctly denoted accuracy class	28
251	Table 308 – Maximum time for sustained ferro-resonance	30
252	Table 20 – List of tests.....	30
253	Table 22 – Required routine tests	32
254	Table 309 – Allowable limits of error change after the short-circuit test	37
255	Table F.301 – Extension criteria for short-circuit withstand capability test	51
256	Table F.302 – Extension criteria for capacitive discharge test	52
257	Table 3C.301 – Example of a VT with three windings	60
258	Table 3C.302 – Example of testing points according to procedure a)	61
259	Table 3C.303 – Example of testing points according to procedure b)	61
260	Table 3D.301 – Input data for calculation example	66
261	Table D.302 – Calculated voltage and phase errors at power factor of 0.8	67
262	Table D.303 – Calculated voltage and phase errors at different burdens and power	
263	factors	68
264	Table 3D.304 – Measured errors at two burdens with the same power factor	69
265	Table 3D.305 – Comparison of errors calculated for actual zero burden and measured	
266	at bridge burden	69
267	Table 3D.306 – Calculated errors at different burdens and power factors using bridge	
268	burden and actual zero burden	69
269	Table 3E.301 – Example values of C_L	73
270	Table 3F.301 – Example of specified capacitance combinations	77
271	Table 3F.302 – Example of result summary	82
272		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INSTRUMENT TRANSFORMERS –

Part 3: Additional requirements of inductive voltage transformers

FOREWORD

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IEC 61869-3 has been prepared by IEC technical committee 38: Instrument transformers. It is an International Standard.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

The text of this International Standard is based on the following documents:

Draft	Report on voting
38/XX/FDIS	38/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This standard is Part 3 of IEC 61869, published under the general title Instrument transformers.

This part 3 is to be read in conjunction with, and is based on, IEC 61869-1, General Requirements - second edition (2023) - however the reader is encouraged to use its most recent edition.

This Part 3 follows the structure of IEC 61869-1:2023 and supplements or modifies its corresponding clauses.

For additional clauses, subclauses, figures, tables, annexes or note, the following numbering system is used:

- clauses, subclauses, tables and figures and notes that are numbered starting from 501 are additional to those in Part 1;
- additional annexes are lettered 3A, 3B, etc.

A list of all parts in the IEC 61869 series, published under the general title *Instrument transformers*, can be found on the IEC website. An overview of the planned set of standards at the date of publication of this document is given below.

The updated list of standards issued by IEC TC 38 is available at the website: <https://www.iec.ch>

Product family standard	Product standard	Title
61869-1 General requirements	61869-2	Additional requirements for current transformers
	61869-3	Additional requirements for inductive voltage transformers
	61869-4	Additional requirements for combined transformers
	61869-5	Additional requirements for capacitive voltage transformers
	61869-7	Additional requirements for low-power voltage transformers
	61869-8	Additional requirements for low-power current transformers
	61869-9	Digital interface for instrument transformers
	61869-10	Additional requirements for current sensors
	61869-11	Additional requirements for voltage sensors
	61869-12	Additional requirements for combined low-power instrument transformers
	61869-13	Stand-alone merging unit
	61869-14	Additional requirements for current transformers for DC applications
	61869-15	Additional requirements for voltage transformers for DC applications
	61869-16	TEDS (Transducer Electronic Data Sheet) for instrument transformers
	61869-99	Instrument transformers: Glossary

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

349

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350

351

INTRODUCTION

This document is the first revision of the standard IEC 61869-3, defining additional requirements for inductive voltage transformers.

The main modifications of this revision are listed below:

- adaptation to the new structure and requirements of IEC 61869-1:2023, common requirements for instrument transformers
- definition of two ranges for the standard values for rated secondary voltage to accommodate fixed-ratio applications
- standard values of rated output limited to 25 VA, all of them with unity power factor
- annex to be used to specify 0,8 power factor burdens if necessary
- Informative annex on calculation methods for accuracy performance at different burdens and power factors
- clarification on simultaneous loading
- new rated thermal limiting output values
- annex to clarify the open-delta connection
- accuracy class 3,0 excluded
- compliance of the accuracy classes from 0 VA to 100 % of the rated output for the standard values of rated output values with unity power factor
- capacitive discharge capability requirements and tests
- ferro-resonance performance requirements
- annex with guidance for assessment of ferro-resonance performance
 - simplification of the temperature rise test avoiding the need to perform several tests
 - updated approval criteria for short-circuit withstand test
- clarification on test arrangements for capacitance and dielectric dissipation factor measurement
- annex for assessment of accuracy for different burden and power factor from the measured data

INSTRUMENT TRANSFORMERS –

Part 3: Additional requirements for inductive voltage transformers

1 Scope

Clause 1 of IEC 61869-1:2023 is replaced by the following:

This part of IEC 61869 applies to newly manufactured inductive voltage transformers intended for applications where the nominal voltage is higher than 1 kV AC for use with electrical measuring instruments and electrical protective devices at rated frequencies from 15 Hz to 400 Hz.

The requirements for inductive voltage transformers for applications in LV systems (nominal voltage ≤ 1 kV AC) are covered by the standard IEC 61869-203.

NOTE 301 Requirements specific to three-phase voltage transformers are not included in this standard but, so far as they are relevant, the requirements in clauses 4 to 10 apply to these transformers and a few references to them are included in those clauses.

All voltage transformers shall be suitable for measurement applications, but in addition certain types may be suitable for protection applications. Voltage transformers for dual application of measurement and protection shall comply with all clauses of this standard.

2 Normative references

Clause 2 of IEC 61869-1:2023 applies with the following addition:

IEC 60028, *International standards for resistance of copper*

IEC 60038, *IEC standard voltages*

IEC 61869-1:2023, *Instrument transformer – Part 1: General requirements*

IEC 60050-601, *International Electrotechnical Vocabulary (IEV) – Chapter 601: Generation, transmission and distribution of electricity – General*

IEC 60050-604, *International Electrotechnical Vocabulary (IEV) – Chapter 604: Generation, transmission and distribution of electricity – Operation*

IEC 62641:2022, *Conductors for overhead lines - Aluminium and aluminium alloy wires for concentric lay stranded conductors*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions of IEC 61869-99 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>

- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.2 Symbols and abbreviated terms

C_L	specified line capacitance
AIS	air-insulated switchgear
E_D	discharge energy
EMC	electromagnetic compatibility
F	mechanical load
F_r	rated frequency
F_{rel}	relative leakage rate
F_V	rated voltage factor
GIS	gas-insulated switchgear
I_{arc}	rated internal arc fault current
I_{rth}	current related with the thermal limiting output S_{th}
IT	instrument transformer
K_r	rated transformation ratio
K_{se}	superelevation factor
PD	partial discharge
U_m	highest voltage for equipment
U_L	specified line discharge voltage
U_{pr}	rated primary voltage
U_{sr}	rated secondary voltage
U_{sys}	highest voltage of the system
S_r	rated output – rated output power
S_{sim}	rated simultaneous burden
S_{th}	rated thermal limiting output of the winding
S_{tth}	rated thermal limiting output of the equipment
VT	voltage transformer
Z_{br}	rated burden
ZPA	zero period acceleration
E	ratio error
E_c	composite error
$\Delta\phi$	phase displacement

4 Normal and special environmental conditions

Clause 4 of IEC 61869-1:2023 applies.

5 Ratings

5.1 General

Clause 5.1 of IEC 61869-1:2023 applies with the following addition:

NOTE 301 Please note that additional voltage ratings, to be considered together with subclause **Error! Reference source not found.**: Highest voltage for equipment, are given in subclause **Error! Reference source not found.**: Standard values of rated voltages.

5.2 Voltage ratings

5.2.1 Highest voltage for equipment (U_m)

Subclause 5.2.1 of IEC 61869-1:2023 applies.

5.2.2 Power system earthing

Subclause 5.2.2 of IEC 61869-1:2023 applies.

5.2.3 Standard values for rated primary voltage (U_{pr})

The standard values of rated primary voltage of an inductive voltage transformer connected between one line of a three-phase system and earth or between a system neutral point and earth shall be $1/\sqrt{3}$ times the values of nominal system voltage as described in IEC 60038.

Preferred values are given in Table 301 and are based on IEC 60038.

Table 301 – Rated primary voltage (U_{pr}) levels for instrument transformers for AC applications

Highest voltage for equipment U_m (RMS) kV	Rated primary voltage U_{pr} phase to ground (RMS) kV
3,6	$3,3/\sqrt{3}$
7,2	$6,6/\sqrt{3}$
12	$11/\sqrt{3}$
17,5	$15/\sqrt{3}$
24	$22/\sqrt{3}$
36	$33/\sqrt{3}$
52	$45/\sqrt{3}$
72,5	$66/\sqrt{3}$ $69/\sqrt{3}$
100	$95/\sqrt{3}$
123	$110/\sqrt{3}$ $115/\sqrt{3}$
145	$132/\sqrt{3}$ $138/\sqrt{3}$
170	$154/\sqrt{3}$
245	$220/\sqrt{3}$ $230/\sqrt{3}$
300	$275/\sqrt{3}$ $285/\sqrt{3}$

362	$345/\sqrt{3}$ $330/\sqrt{3}$
-----	----------------------------------

Continuation of Table 301

Highest voltage for equipment U_m (RMS) kV	Rated primary voltage U_{pr} phase to ground (RMS) kV
420	$380/\sqrt{3}$ $400/\sqrt{3}$
550	$525/\sqrt{3}$ $500/\sqrt{3}$
800	$765/\sqrt{3}$
1 100	$1\,050/\sqrt{3}$
1 200	$1\,140/\sqrt{3}$

The standard values for rated primary voltages U_{pr} given in Table 301 cover the individual country-dependent values with a tolerance of $\pm 10\%$ limited to U_m value. Within the range of $\pm 10\%$ limited to U_m value all country-dependent primary voltage levels are allowed to use.

NOTE 301 The performance of an inductive voltage transformer as a measuring or protection transformer is based on the rated primary voltage U_{pr} whereas the rated insulation level is based on one of the highest voltages for equipment U_m of IEC 60071-1.

5.2.4 Standard values for rated secondary voltage (U_{sr})

The rated secondary voltage shall be chosen according to the practice at the location where the transformer is to be used. The standard value for single-phase voltage transformers in single-phase systems or connected line-to-line in three-phase systems and for three-phase voltage transformers is

110 V, 220 V.

The standard value 110 V covers the former secondary voltage levels 100 V, 115 V and 120 V, as well as, 200 V, 220 V and 230 V within a range of $\pm 10\%$. Within the range of $\pm 10\%$ all secondary voltage levels are allowed to use.

NOTE 301: The actual secondary voltage level can vary in a range of $\pm 10\%$ based on the given values above. The value of $\pm 10\%$ has nothing to do with a tolerance of the given values! This approach allows to standardise future secondary voltages and consider given ratio factors between primary and secondary voltages.

NOTE 302 In order to accommodate fixed-ratio applications the following two ranges are permitted (99 V to 121 V) and (198 V to 242 V), respectively, and are covered by the range of $\pm 10\%$ of standard secondary voltages. This approach allows to standardise future secondary voltages and consider given ratio factors between primary and secondary voltages.

For single-phase transformers intended to be used phase-to-earth in three-phase systems where the rated primary voltage is a number divided by $\sqrt{3}$, the rated secondary voltage shall be divided by $\sqrt{3}$, thus retaining the value of the rated transformation ratio.

For secondary windings intended to be connected in open delta circuit with similar windings to generate a residual voltage, the rated secondary voltage can be divided by 1, $\sqrt{3}$, or 3. The division factor depends on the used application.

More information about residual voltage windings is in Annex 3A.

5.2.5 Rated auxiliary power supply voltage (U_{ar})

Subclause 5.2.5 of IEC 61869-1:2023 is not applicable.

5.2.301 Standard values for rated voltage factor (F_v)

The voltage factor is determined by the maximum operating voltage which, in turn, is dependent on the system and the voltage transformer primary winding earthing conditions.

The standard voltage factors appropriate to the different earthing conditions are given in Table 302, together with the permissible duration of maximum operating voltage (i.e. rated time).

Table 302 – Standard values of rated voltage factors

Rated voltage factor	Rated time	Method of connecting the primary winding and system earthing conditions
1,2	Continuous	Between phases in any network Between transformer star-point and earth in any network
1,2	Continuous	Between phase and earth in an effectively earthed neutral system (IEC 61869-99, 3.1.5) with an earth fault factor which does not exceed 1.4
1,5	30 s	
1,2	Continuous	Between phase and earth in a non-effectively earthed neutral system (IEC 61869-99, 3.1.5) with an earth fault factor that may exceed 1.4 with automatic earth-fault tripping
1,9	30 s	
1,2	Continuous	Between phase and earth in an isolated neutral system (IEC 61869-99, 3.1.9) without automatic earth-fault tripping or in a resonant earthed neutral system (IEC 61869-99, 3.1.8) without automatic earth-fault tripping
1,9	8 h	
NOTE 301 Reduced rated times are permissible by agreement between manufacturer and purchaser.		

The highest continuous operating voltage for a VT is U_m (divided by $\sqrt{3}$ for transformers connected between a phase of a three-phase system and earth). The rated voltage factor 1,2 related to U_{PR} is defined for accuracy and temperature rise performances.

5.3 Current ratings

5.3.1 Standard values for rated primary current (I_{pr})

Subclause 5.3.1 of IEC 61869-1:2023 is not applicable.

5.3.2 Standard values for rated secondary current (I_{sr})

Subclause 5.3.2 of IEC 61869-1:2023 is not applicable.

5.3.3 Standard values for rated continuous thermal current (I_{cth})

Subclause 5.3.3 of IEC 61869-1:2023 is not applicable.

5.3.4 Short-time current ratings

5.3.4.1 Rated short-time thermal current (I_{th})

Subclause 5.3.4.1 of IEC 61869-1:2023 is not applicable.

5.3.4.2 Rated dynamic current (I_{dyn})

Subclause 5.3.4.2 of IEC 61869-1:2023 is not applicable.

5.3.4.3 Rated internal arc fault current (I_{arc})

Subclause 5.3.4.3 of IEC 61869-1:2023 applies.

5.4 Dielectric ratings**5.4.1 General**

Subclause 5.4.1 of IEC 61869-1:2023 applies.

5.4.2 Rated primary terminal insulation level

Subclause 5.4.2 of IEC 61869-1:2023 applies.

5.4.3 Other requirements for primary terminal insulation

Subclause 5.4.3 of IEC 61869-1:2023 applies.

5.4.4 Between-section insulation requirements

Subclause 5.4.4 of IEC 61869-1:2023 applies.

5.4.5 Insulation requirements for secondary terminals and low-voltage components**5.4.5.1 General requirements**

Subclause 5.4.5.1 of IEC 61869-1:2023 applies.

5.4.5.2 Special requirements for LPITs

Subclause 5.4.5.2 of IEC 61869-1:2023 is not applicable.

5.4.5.3 DC insulation resistance requirement

Subclause 5.4.5.3 of IEC 61869-1:2023 applies.

5.5 Rated frequency (f_r)

Subclause 5.5 of IEC 61869-1:2023 applies.

5.6 Output ratings**5.6.1 Rated output for inductive instrument transformers and CVT****5.6.1.1 General**

Subclause 5.6.1.1 of IEC 61869-1:2023 applies.

5.6.1.2 Rated output values

The standard values of rated output, expressed in voltamperes, are:

1,0 - 10 - 25 VA

521 The power factor shall be 1,0.

522 The rated output of a three-phase transformer shall be the rated output per phase.

523 For legacy burden definitions, see Annex 3B. If legacy burdens are specified, Annex 3B shall
524 be mentioned in the enquiry and on the nameplate.

525 For information on simultaneous loading of multiple windings and its implications see Annex
526 3C.

527 For information on calculation methods for accuracy performance at different burdens and
528 power factors, see Annex 3D.

529 The values listed above shall be assigned to each of the windings within a transformer,
530 accompanied by its associated accuracy class.

531 **5.6.1.301 Additional output values**

532 **5.6.1.301.1 Rated thermal limiting output**

533 The rated thermal limiting output shall be specified in voltamperes; the standard values are:

534 100 - 250 - 500 VA

535 related to the rated secondary voltage with unity power factor.

536 Thermal limiting output shall be specified for each winding and as a total value the unit can
537 thermally withstand.

538 For legacy burden definitions, see Annex 3B.

539 **5.6.1.301.2 Rated output values for residual voltage windings**

540 The rated output of windings intended to be connected in open-delta with similar windings to
541 produce a residual voltage shall be specified in voltamperes and the value shall be chosen from
542 the values specified in 5.6.1.2.

543 More information about residual voltage windings is in Annex 3A.

544 **5.6.1.301.3 Rated thermal limiting output for residual voltage windings**

545 The rated thermal limiting output of the residual voltage winding shall be specified in
546 voltamperes; the standard values are:

547 100 - 250 - 500 VA

548 related to the rated secondary voltage with unity power factor.

549 Where a thermal limiting output is assigned to a residual voltage winding connected in an open
550 delta, it should be noted that these windings are only loaded under fault conditions and intended
551 for short term operation.

5.6.2 Rated burden for LPITs

Subclause 5.6.2 of IEC 61869:2023 is not applicable.

5.6.3 Standard values for the rated delay time for EITs (t_{dr})

Subclause 5.6.3 of IEC 61869:2023 is not applicable.

5.7 Accuracy requirements**5.7.1 General**

Subclause 5.7.1 of IEC 61869-1:2023 applies.

5.7.2 Rated accuracy classes**5.7.2.301 Accuracy requirements for inductive measuring voltage transformers****5.7.2.301.1 Standard accuracy classes for measuring voltage transformers**

For measuring voltage transformers, the accuracy class is designated by the highest permissible percentage voltage error at rated voltage and with rated output, prescribed for the accuracy class concerned.

The standard accuracy classes for single-phase inductive measuring voltage transformers are:

$$0,1 - 0,2 - 0,5 - 1,0$$

5.7.2.301.2 Limits of voltage error and phase displacement for measuring voltage transformers

The voltage error and phase displacement at rated frequency shall not exceed the values given in Table 303 at any voltage between 80 % and 120 % of rated voltage.

The connected output of 0 VA and 100 % of the rated output, at a power factor equal to 1,0 shall be used for measurements.

For legacy burdens and accuracy class definition refer to Annex 3B.

For an output or power factor outside these ranges the accuracy of the voltage transformer is not guaranteed, even though it might be inherently achievable. For assessing expected accuracy performance at outputs and/or power factors exceeding the nominal range, see Annex 3D.

The errors shall be determined at the terminals of the transformer and shall include the effects of any fuses or resistors as an integral part of the transformer.

Table 303 – Limits of voltage error and phase displacement for measuring voltage transformers

Class	Voltage (ratio) error ε_u $\pm\%$	Phase displacement $\Delta\phi$	
		$\pm$ Minutes	$\pm$ Centiradians
0,1	0,10	5,0	0,15
0,2	0,20	10,0	0,3
0,5	0,50	20,0	0,6
1,0	1,00	40,0	1,2

NOTE 301 Voltage (ratio) error is considered with 2 digit measurement resolution.

5.7.2.302 Additional requirements for inductive protective voltage transformers

5.7.2.302.1 Accuracy class designation for protective voltage transformers

All voltage transformers intended for protection application shall be assigned one of the accuracy classes 5.7.2.302.2.

The accuracy class for a protective voltage transformer is designated by the highest permissible percentage voltage error prescribed for the accuracy class concerned, from 5 % of rated voltage to a voltage corresponding to the rated voltage factor (see 5.2.301).

5.7.2.302.2 Limits of voltage error and phase displacement for protective voltage transformers

The standard accuracy classes for protective voltage transformers are

3P - 6P

The same limits of voltage error and phase displacement will normally apply at both 5 % of rated voltage and at the voltage corresponding to the rated voltage factor.

The voltage error and phase displacement at rated frequency shall not exceed the values in Table 304 at 5 % of rated voltage and at rated voltage multiplied by the rated voltage factor (1,2, 1,5 or 1,9).

The connected output of 0 VA and 100 % of the rated output, at a power factor equal to 1 shall be used for measurements.

At 2 % of rated voltage, the limits of voltage error and phase displacement will be twice as high as those given in Table 304.

Table 304 – Limits of voltage error and phase displacement for protective voltage transformers

Protection classes	% of rated voltage											
	2	5	100	X	2	5	100	X	2	5	100	X
	Voltage (ratio) error ε_U ± %				Phase displacement, $\Delta\phi$ ± Minutes				Phase displacement, $\Delta\phi$ ± Centiradians			
3P	6,00	3,00	3,00	3,00	240,0	120,0	120,0	120,0	7,0	3,5	3,5	3,5
6P	12,00	6,00	6,00	6,00	480,0	240,0	240,0	240,0	14,0	7,0	7,0	7,0
NOTE 301 $X = F_V \cdot 100$ (rated voltage factor multiplied by 100).												
NOTE 302 Voltage (ratio) error is considered with 2 digit measurement resolution												

5.7.2.302.3 Accuracy class for residual voltage windings

The accuracy class for a residual voltage winding shall be 6P or better, as defined in 5.7.2.302.2.

If the residual voltage winding is used only for ferroresonance damping purposes, an accuracy class designation is not mandatory.

5.7.2.303 Accuracy of tapped windings

The accuracy shall be specified for full and tapped windings. If not, the accuracy requirements refer to full tap (i.e., lowest transformation ratio).

5.7.2.304 Simultaneous loading of voltage transformer windings

Transformers that have more than one secondary winding may have those windings loaded simultaneously. A guaranteed simultaneous output range S_{sim} for each winding shall be specified in VA and indicated on the nameplate if simultaneous loading is expected.

If a simultaneous output range is specified each winding shall meet the accuracy requirements of the specified simultaneous output range, with the untested windings at any burden from zero to rated value.

Alternatively, the test may be performed with the simultaneous output value applied to the winding itself.

The output of the residual winding shall not to be considered due to the occasional loading of the residual winding, present only in fault conditions.

For more information see Annexes 3C and 3D.

5.7.3 Accuracy class extension for harmonics

Subclause 5.7.3 of IEC 61869-1:2023 applies.

5.7.4 Accuracy requirements for harmonics

Subclause 5.7.4 of IEC 61869-1:2023 applies.

5.7.5 Harmonic requirements for LPIT protection accuracy classes

Subclause 5.7.5 of IEC 61869-1:2023 is not applicable.

5.7.6 Anti-aliasing filter for EIT using digital data processing

Subclause 5.7.6 of IEC 61869-1:2023 is not applicable.

6 Design and construction**6.1 Requirements for liquids used in equipment**

Subclause 6.1 of IEC 61869-1:2023 applies.

6.2 Requirements for gases used in equipment

Subclause 6.2 of IEC 61869-1:2023 applies.

6.3 Requirements for solid materials used in equipment

Subclause 6.3 of IEC 61869-1:2023 applies.

6.4 Requirements for temperature rise of parts and components**6.4.1 General**

Subclause 6.4.1 of IEC 61869-1:2023 applies with the following additional text:



Unless otherwise specified, the temperature rise of a voltage transformer at the specified voltage, at rated frequency and at rated burden, or at the highest rated burden if there are several rated burdens, at any power factor between 0,8 lagging and unity, shall not exceed the appropriate value given in Table 12 of IEC 61869-1:2023.

When the transformer is fitted with a conservator tank or has an inert gas above the oil, it is considered as hermetically sealed, and the same limit applies as per table 12 in IEC 61869-1:2023.

The temperature rise measured on the external surface of the core and other metallic parts where in contact with, or adjacent to, insulation shall not exceed the appropriate value in Table 12 of IEC 61869-1:2023.

6.4.2 Influence of altitude on temperature rise

Subclause 6.4.2 of IEC 61869-1:2023 applies.

6.5 Requirements for earthing of equipment

6.5.1 General

Subclause 6.5.1 of IEC 61869-1:2023 applies.

6.5.2 Earthing of the enclosure

6.5.2.1 GIS enclosure

Subclause 6.5.2.1 of IEC 61869-1:2023 applies.

6.5.2.2 Enclosure of low-voltage components

Subclause 6.5.2.2 of IEC 61869-1:2023 is not applicable.

6.5.3 Electrical continuity

Subclause 6.5.3 of IEC 61869-1:2023 applies.

6.6 Requirements for the external insulation

Subclause 6.6 of IEC 61869-1:2023 applies.

6.7 Mechanical requirements

Subclause 6.7 of IEC 61869-1:2023 applies.

6.8 Multiple chopped impulses on primary terminals

Subclause 6.8 of IEC 61869-1:2023 applies.

6.9 Internal arc fault protection requirements

Subclause 6.9 of IEC 61869-1:2023 applies.

6.10 Degrees of protection by enclosures

Subclause 6.10 of IEC 61869-1:2023 applies.

6.11 Electromagnetic compatibility (EMC)**6.11.1 General**

Subclause 6.11.1 of IEC 61869-1:2023 is replaced by the following:

For inductive voltage transformers, the following EMC requirements are specified:

- requirements for transmitted overvoltage (6.11.4);
- requirements for radio interference voltage (RIV), applicable to high-voltage parts of the equipment (6.11.5).

6.11.2 Requirements for immunity

Subclause 6.11.2 of IEC 61869-1:2023 is not applicable.

6.11.3 Requirements for emission

Subclause 6.11.3 of IEC 61869-1:2023 is not applicable.

6.11.4 Requirements for transmitted overvoltage (TOV)

Subclause 6.11.4 of IEC 61869-1:2023 applies.

6.11.5 Requirements for radio interference voltage (RIV)

Subclause 6.11.5 of IEC 61869-1:2023 applies.

6.12 Corrosion

Subclause 6.12 of IEC 61869-1:2023 applies.

6.13 Markings**6.13.1 General**

Subclause 6.13.1 of IEC 61869-1:2023 applies.

6.13.2 Terminal markings**6.13.2.1 General rules**

Subclause 6.13.2.1 of IEC 61869-1:2023 applies with the following additional text:

These markings are applicable to single-phase voltage transformers and also to sets of single-phase voltage transformers assembled as one unit and connected as a three-phase voltage transformer or to a three-phase voltage transformer having a common core for the three phases.

6.13.2.2 Method of marking

Subclause 6.13.2.2 of IEC 61869-1:2023 applies.

6.13.2.3 Markings to be used

Capital letters A, B, C and N denote the primary-winding terminals and the lower-case letters a, b, c and n denote the corresponding secondary-winding terminals.

The letters A, B and C denote fully insulated terminals and the letter N denotes a terminal intended to be earthed and the insulation of which is less than that of the other terminal(s).

709 The letters da and dn denote the terminals of windings intended to supply a residual voltage.

710 Markings shall be in accordance with Figures 301 to 310 as appropriate.

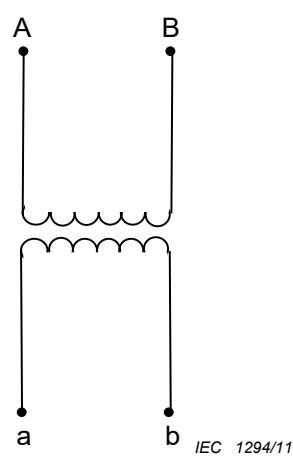


Figure 301 – Single-phase transformer with fully insulated terminals and a single secondary

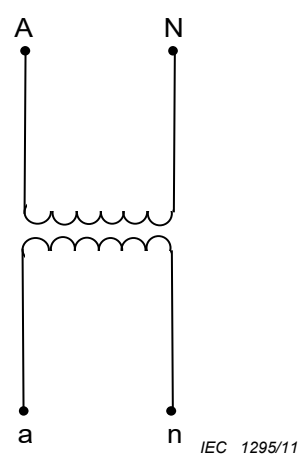
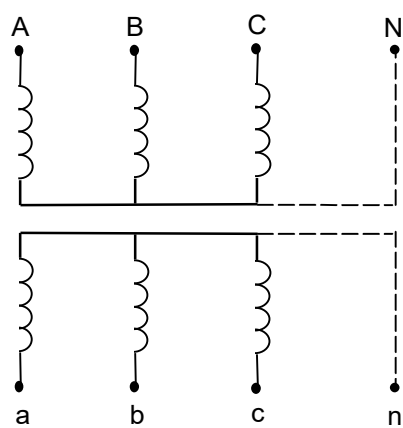


Figure 302 – Single-phase transformer with a neutral primary terminal with reduced insulation and a single secondary

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Figure 303 – Three-phase assembly with a single secondary

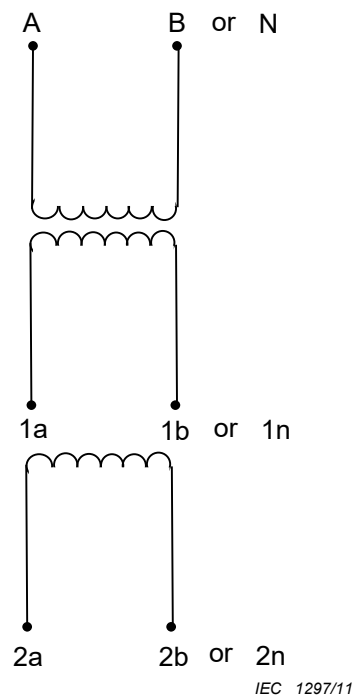


Figure 304 – Single-phase transformer with two secondaries

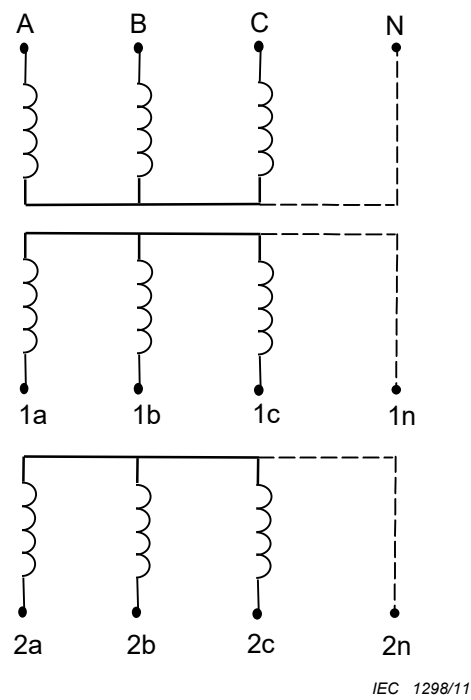


Figure 305 – Three-phase assembly with two secondaries

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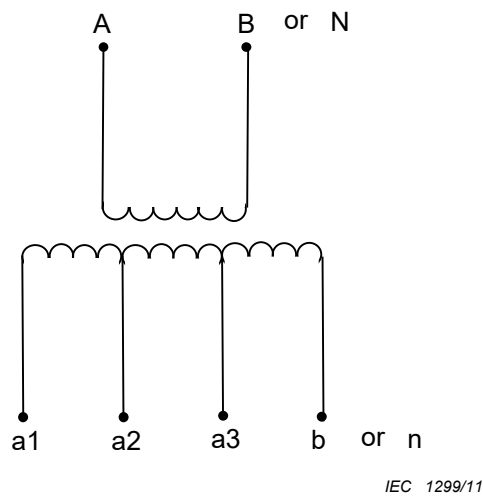


Figure 306 – Single-phase transformer with one multi-tap secondary

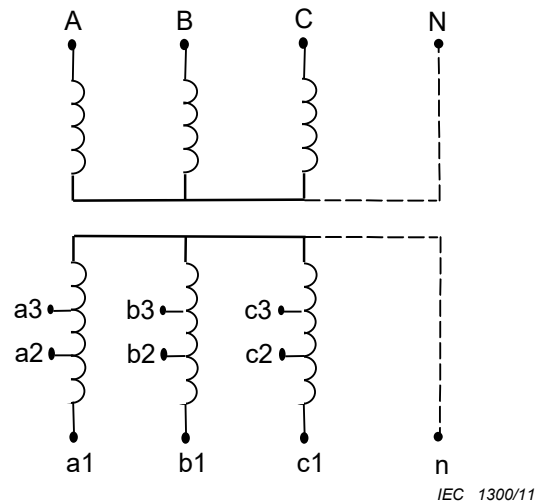


Figure 307 – Three-phase assembly with one multi-tap secondary

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