SUMMARY OF TESTS 31009211-4GB

PERFORMED TEST

The test object was submitted to an internal arc test with an expected current value of 21 kA and an expected peak current value of 54.6 kA during 1 second.

The indicators used in the test were A accessibility class as indicated in clause A3.3 of annex A IEC 62271-200:2003.

RESULTS TABLE

Register number			T31009211_16
	R	kA	45.38
Peak value of current	S	kA	42.74
	T	kA	-55.60
	R	kA	21.90
Symmetrical current, phase average	S	kA	21.91
	T	kA	21.64
Duration		s	0.965

CONCLUSIONS

The acceptance criterions from IEC 62271-200:2003 Annex A clause. A.6 are applied:

-A accessibility:

Criterion No. 1: Correctly secured doors and covers do not open. PASSED

Criterion No. 2: No material fragmentation of the enclosure occurs within the time specified for the test. Projections of small parts, up to an individual mass of 60g, are accepted. PASSED

Criterion No. 3: Arcing does not cause holes in the accessible sides up to a height of 2m. PASSED

Criterion No. 4:Indicators do not ignite due to the effect of hot gases. PASSED

Criterion No. 5: The enclosure remains connected to its earthing point. PASSED

The test was PASSED.

Ormazabal
Corporate Technology
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ВЯРНО С ОРИГИНАЛА

ЛИГ 23 ЕООД СОФИЯ LIG 23 LTD

This Document is an English translation, performed by ORMAZABAL, of the original Technical Annex of Accreditation Rev.5, dated 08/09/14.

https://www.enac.es/documents/7020/b5adee99-debf-4f8c-b788-6f21f82a1132

(UNE-EN Standards, are the official versions of the corresponding edition of EN Standards)

SCOPE OF ACCREDITATION

ORMAZABAL CORPORATE TECHNOLOGY A.I.E.

Address: Parque Empresarial Boroa, Parcela 3A; 48340 Amorebieta-Etxano (Bizkaia) SPAIN

Is accredited by the **ENTIDAD NACIONAL DE ACREDITACIÓN**, according the criteria collected in EN ISO/IEC 17025:2005 (CGA-ENAC-LEC), for performing the following tests on:

Electrical Distribution Equipment

Category 0 (Tests in the permanent laboratory)

PRODUCT / TEST OBJECT	TEST	STANDARD / PROCEDURE
High-voltage/low voltage prefabricated substation	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV Temperature-rise tests Short-time and peak withstand current tests on main and earthing circuits: up to 80kA/3s Internal arcing test: up to 40kA/1s	IEC 62271-202:2006 IEC 62271-202:2014. UNE-EN 62271-202:2007.
	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	IEC 60529 :2001 IEC 60529 :2003 CORR. IEC 60529 :2007 CORR.
	Degrees of Protection IK: from 06 up to 10	IEC 62262 :2002

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ВЯРНО С ОРИГИНАЛ

ЕИГ 23 ЕООД СОФИЯ EIG 23 LTD.

Alternating current disconnectors and earthing switches	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC Temperature-rise tests Measurement of the resistance of circuits Operating and mechanical endurance tests Short-time and peak withstand current tests on main and earthing circuits: up to 80kA Test to prove the short-circuit making performance of earthing switches: up to 40kA	**IEC 62271-102:2001** **IEC 62271-102: 2002** **CORRIGENDUM 1** **IEC 62271-102: 2003** **CORRIGENDUM 2** **IEC 62271-102: 2005** **CORRIGENDUM 3** **IEC 62271-102/A1: 2011** **IEC 62271-102/A1: 2012** **CORRIGENDUM 1** **IEC 62271-102/A1&A2:2013** UNE-EN 62271-102:2005 UNE-EN 62271-102:2005 ERRATUM 2011 UNE-EN 62271-102/A1:2012
	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	**IEC 60529 :2001** **IEC 60529 :2003 CORR.** **IEC 60529 :2007 CORR.**
	Degrees of Protection IK: from 06 up to 10	**IEC 62262 :2002**
High-voltage switches for rated voltages above 1 kV and less than 52 kV	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC Temperature-rise tests Measurement of the resistance of circuits Mechanical operating tests Short-time and peak withstand current tests on main and earthing circuits: up to 80kA Making and breaking tests: up to 2500MVA, 36kV	**IEC 60265-1:1998** **IEC 60265-1:2000** **CORRIGENDUM** **IEC 62271-103:2011** **IEC 62271-103** **CORRIGENDUM 1: 2013.** UNE 60265-1:1999. UNE 60265-1:2005 CORRIGENDUM UNE-EN 62271-103 :2012
	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	**IEC 60529 :2001** **IEC 60529 :2003 CORR.** **IEC 60529 :2007 CORR.**
	Degrees of Protection IK: from 06 up to 10	**IEC 62262 :2002**

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ВЯРНО С ОРИГИНАЛА

МАГ 23 ЕООД София 23 LTD.

High-voltage Alternating current circuit-breakers	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC Temperature-rise tests Measurement of the resistance of circuits Mechanical operating tests Short-time and peak withstand current tests: up to 80kA Making and breaking tests: up to 2500MVA, 36kV	**IEC 62271-100:2008** **IEC 62271-100/A1:2012** **IEC62271-100/A1** **CORRIGENDUM 1 :2012** UNE-EN 62271-100:2003. UNE-EN 62271-100/A1:2004 UNE-EN 62271-100:2004 ERRATUM UNE-EN 62271-100/A2:2007 UNE-EN 62271-100:2011 UNE-EN 62271-100:2011/ Versión Corregida Abril 2014
	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	**IEC 60529 :2001** **IEC 60529 :2003 CORR.** **IEC 60529 :2007 CORR.**
	Degrees of Protection IK: from 06 up to 10	**IEC 62262 :2002**
A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC Temperature-rise tests Measurement of the resistance of circuits Mechanical operating tests Short-time and peak withstand current tests: up to 80kA Internal fault test: up to 40kA/1s	**IEC 62271-200: 2003** **IEC 62271-200: 2011.** UNE-EN 62271-200:2005 UNE-EN 62271-200:2012.
	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	**IEC 60529 :2001** **IEC 60529 :2003 CORR.** **IEC 60529 :2007 CORR.**
	Degrees of Protection IK: from 06 up to 10	**IEC 62262 :2002**

High-voltage switchgear and controlgear	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC	**IEC 62271-1:2007** **IEC 62271-1/A1:2011**
	Temperature-rise tests	UNE-EN 62271-1:2009 UNE-EN 62271-1/A1:2011.
	Measurement of the resistance of circuits	UNE-EN 60694:1998. UNE-EN 60694:1999 CORRIGENDUM UNE-EN 60694/A1:2002 UNE-EN 60694/A2:2002
	Mechanical operating tests	
	Short-time and peak withstand current tests: up to 80kA	
	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	**IEC 60529 :2001** **IEC 60529 :2003 CORR.** **IEC 60529 :2007 CORR.**
	Degrees of Protection IK: from 06 up to 10	**IEC 62262 :2002**
Power transformers	Routine tests	**IEC 60076-1:1993.** **IEC 60076-1/A1:1999** **IEC 60076-1:1997 CORRIGENDUM 1** **IEC 60076-1:2011** UNE-EN 60076-1:1998. UNE-EN 60076-1/A1:2001 UNE-EN 60076-1/A12:2002 UNE-EN 60076-1:2013
	Temperature-rise tests	**IEC 60076-2:1998.** **IEC 60076-2:1 IEC 60076-3:2013998 ERRATUM 2006** **IEC 60076-2:2011** UNE-EN 60076-2:2013.
	Dielectric tests: ▪ Separate source AC: up to 100kV ▪ Induced AC ▪ Lightning Impulse: up to 288kV	**IEC 60076-3:2000.** **IEC 60076-3:2000 CORRIGENDUM 1** **IEC 60076-3:2013** UNE-EN 60076-3:2002. UNE-EN 60076-3:2006 ERRATUM
	Ability to withstand short circuit	**IEC 60076-5:2006** UNE-EN 60076-5:2002 UNE-EN 60076-5:2008

	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	**IEC 60529 :2001** **IEC 60529 :2003 CORR.** **IEC 60529 :2007 CORR.**
	Degrees of Protection IK: from 06 up to 10	**IEC 62262 :2002**
Requirements for Subsurface, vault and Pad-Mounted Load-Interrupter switch-gear and fused load-interrupter switch-gear for alternating current systems up to 38 kV	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC Temperature-rise tests Measurement of the resistance of circuits Mechanical operating tests Short-time and peak withstand current tests on main and earthing circuits: up to 80kA Making and breaking tests: up to 2500MVA, 38kV	**IEEE C37.74:2003.**
Automatic circuit reclosers and fault interrupters for alternating current Systems up to 38 kV	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC Temperature-rise tests Measurement of the resistance of circuits Mechanical operating tests Short-time and peak withstand current tests on main and earthing circuits: up to 80kA Making and breaking tests: up to 2500MVA, 38kV: ▪ Line charging current and cable charging current interruption tests ▪ Making current capability ▪ Rated symmetrical interrupting current tests Degrees of Protection	**IEEE C37.60:2012** **IEC 62271-111:2012**

Metal-Enclosed Interrupter Switchgear (1kV – 38kV)	Dielectric tests: ▪ Power Frequency: up to 100 kV ▪ Lightning Impulse: up to 288 kV ▪ Partial discharge measurement: up to 100 kV and up to 2pC Temperature-rise tests Measurement of the resistance of circuits Mechanical operating tests Short-time and peak withstand current tests on main and earthing circuits: up to 80kA Making and breaking tests: up to 2500MVA, 38kV: ▪ Line charging current and cable charging current interruption tests ▪ Making current capability ▪ Rated symmetrical interrupting current tests Degrees of Protection	**IEEE C37.20.3:2013** **IEEE C37.100.1:2007**
Electric and Electronic Equipment	Degrees of Protection IP: from 2X up to 4X from X3 up to X6	**IEC 60529:2001** **IEC 60529:2001** **CORRIGENDUM 1:2003** **IEC 60529:2001** **CORRIGENDUM 2:2007**
	Degrees of Protection IK: from 06 up to 10	**IEC 62262:2002**

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Списък на протоколи от типови изпитания на КРУ CGCOSMOS, производство на ORMAZABAL

Сериен No	Описание	Стандарт	Акредитирана лаборатория
24507001	Изпитание на вътрешно к.с. с електрическа дъга, класификация IAC AFL 16 kA/1 s	IEC 62271-200, Annex A	KEMA
31745101	Изпитание на вътрешно к.с. с електрическа дъга, класификация IAC AFL 20/21 kA/1 s	IEC 62271-200, Annex A	KEMA
31756402	Изпитание на вътрешно к.с. с електрическа дъга, класификация IAC AFL 20/21 kA/1 s	IEC 62271-200, Annex A	KEMA
K12520001	Изпитание на вътрешно к.с. с електрическа дъга, класификация IAC AF 20 kA/1 s	IEC 62271-200, Annex A	KEMA
31009211-M5	Изпитание на вътрешно к.с. с електрическа дъга, класификация IAC AFL 21 kA/1 s	IEC 62271-200	ORMAZABAL Corporate Technology
31009211-M6	Изпитание на вътрешно к.с. с електрическа дъга, класификация IAC AFL 21 kA/1 s	IEC 62271-200	ORMAZABAL Corporate Technology

000651

ВЯРНО С ОРИГИНАЛА

6.7. ekorSPC - PHASE COMPARATOR

The **ekorSPC** phase comparator is used to check that the MV cables are correctly connected. It is connected between the test points of the **ekorVPIS** unit.

This phase comparator has been developed in accordance with standard IEC 61958, and is therefore guaranteed to operate within the range laid down by this standard.

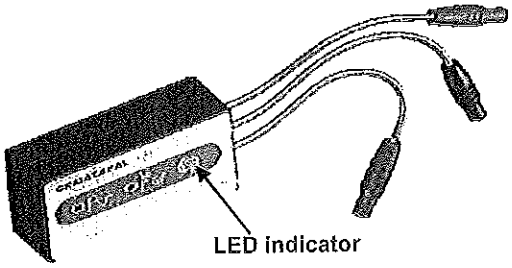


Figure 6.2: *ekorSPC*

Characteristic	Value
Rated frequency	50 Hz
IP rating	IP2X
Maintenance	Not required

NOTE:
Optional unit supplied on demand.

6.8. ekorSAS - ACOUSTIC EARTHING PREVENTION ALARM UNIT

The **ekorSAS** earthing prevention alarm is an acoustic indicator which works in association with the earthing shaft lever and the **ekorVPIS** voltage presence indicator. Both thus operate within the same range.

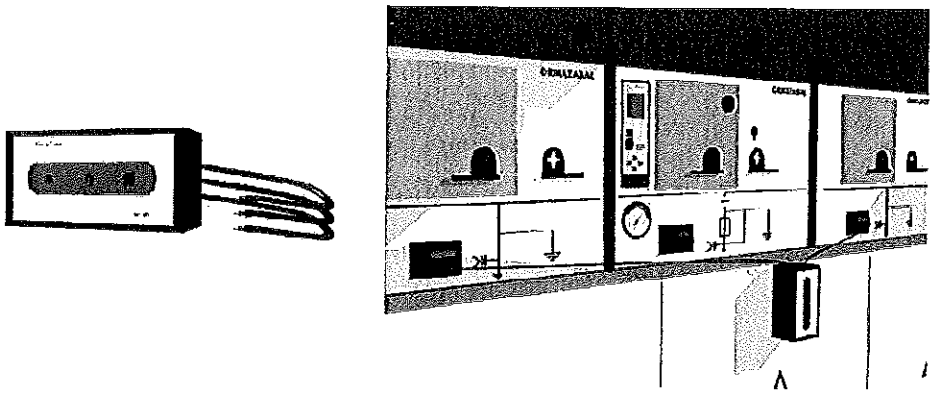
The alarm is activated when there is voltage in the cubicle's MV feeder and the lever is inserted in the earthing switch shaft. A sound then warns the operator that if he performs the operation, a short-circuit in the network might occur.

NOTE:
Optional element supplied when ordered, except in feeder functional units where they are standard.

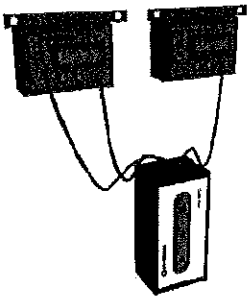
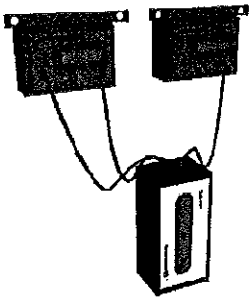
4.8. ПРОВЕРКА ЗА НАЛИЧИЕТО НА НАПРЕЖЕНИЕ И СЪГЛАСУВАНЕТО НА ФАЗИТЕ

За да се потвърди правилното свързване на кабелите за СН към шкафовете с изводи в трансформаторната подстанция, трябва да се използва уредът за сравняване на фазите **ekorSPC**[17] от Ormazabal.

Най-напред свържете червените кабели на модула ekorSPC към точките за изпитване на същата фаза на съответните модули ekorVPIS[18], а черния кабел – към точката за изпитване на заземяването. Това действие трябва да се повтори за всички фази L1, L2 и L3.



Фигура 4.46: *ekorSPC*

Съгласуване на фазите при сравняване	Несъгл. на фазите при сравняване
	
НЯМА индикация на уреда за сравняване.	**ИМА** индикация на уреда за сравняване.

[17] Опционално могат да се използват и други уреди за сравняване на фази, съвместими с IEC 61958.
[18] Вж. раздел *1.1.1. ekorVPIS – Модул за индикация на наличие на напрежение.*

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ДЕКЛАРАЦИЯ

Долуподписаната НАТАША КОСТАДИНОВА НЕШЕВА, притежаваща лична карта № 644480794, издадена на 14.03.2013г. от МВР гр. София, адрес: гр. София 1408, ул.»Забърде» 1, в качеството си на Изпълнителен директор на „БИ-ПАУЪР" АД,

Декларирам, че:

Предвидените за доставка от нас КРУ СрН отговарят на приложимите български и международни стандарти, включително на посочените по-долу и на техните валидни изменения и поправки:

- БДС EN 60099-4:2006 Вентилни отводи. Част 4: Метало-оксидни вентилни отводи без разрядници за електрически системи за променливо напрежение (IEC 60099-4:2004, с промени)
- БДС EN 60265-1:2003 Превключватели високо напрежение. Част 1: Превключватели за обявени напрежения над 1 kV и по-ниски от 52 kV (IEC 60265-1:1998)
- БДС EN 60282-1:2010 Предпазители за високо напрежение. Част 1: Токоограничаващи предпазители (IEC 60282-1:2009)
- БДС EN 60529:1991/A1:2004 Степени на защита, осигурени от обвивката (IP код) (IEC 60529:1989 + A1:1999)
- БДС EN 62271-1:2008 Комутационни апарати за високо напрежение. Част 1: Общи технически изисквания
- БДС EN 62271-102:2007 Комутационни апарати за високо напрежение. Част 102: Разединители и заземителни разединители за променлив ток (IEC 62271-102:2001 + поправка 1, април 2002 + поправка 2, май:2003)
- БДС EN 62271-105:2003 „Комутационни апарати високо напрежение. Част 105: Комутационни апарати за променливо напрежение комбинирани с предпазител (IEC 62271-105:2002)".
- БДС EN 62271-200:2006 „Комутационни апарати за високо напрежение. Част 200: Променливотокови комутационни апарати в метална обвивка за обявени напрежения над 1 kV и по-високи, включително 52 kV (IEC 62271-200:2003)";
- БДС IEC 60050 (441) „Международен електротехнически речник Глава 441: Комутационни апарати за разпределение, комутационни апарати за управление и стопяеми предпазители

гр. София

23.10.2015 г.

Наташа Нешева

/Изпълнителен директор/

B-POWER JSC 2 БИ-ПАУЪР АД

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

000651

INFORME DEL ENSAYO DE CUALIFICACIÓN SÍSMICA DEL *"SISTEMA CGM COSMOS L+P+V"*, DE ORMAZABAL, S.A.

NOTA: De acuerdo con lo indicado en el Apartado 5.10.2 de la Norma ISO-IEC 17025:2005, se hace constar:

- *Los resultados del presente informe conciernen, única y exclusivamente a las muestras sometidas a ensayo.*
- *Queda prohibida la reproducción parcial de este documento sin la autorización por escrito del Laboratorio.*

Fecha	Realizado por	Revisado por
27.09.11	Juan Antonio PEREZ	Alberto CORRAL

VIRLAB, S.A.
División de URBAR INGENIEROS, S.A.
Polígono Industrial de Asteasu
Zona B, Pabellón 44
20159 Asteasu (Guipúzcoa)
ESPAÑA
www.virlab.es
E-mail: virlab@urbar.com
Tel.: +34 943 69 15 00
Fax: +34 943 69 26 67

LABORATORIO DE ENSAYOS DE VIBRACIONES

000655

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ

12,0,- CONCLUSIONES

Un Cuadro Eléctrico "***SISTEMA CGMCOSMOS L+P+V***" de **ORMAZABAL, S.A.**, formado por tres (3) ***Celdas***, según plano nº DOC-3410, Revisión 01, de fecha 08/04/11, cuyas características se describen en el punto 3,0, destinado a **SUBESTACIONES Y CENTROS DE TRANSFORMACIÓN ELECTRICOS**, ha sido sísmicamente ensayado tal y como se indica en el procedimiento descrito en el punto 8,0, conforme a la norma europea **UNE EN 60068-3-3 de 1994**, la norma **NSR-98** (Colombia), las especificaciones **ETGI-1020** (Chile), **E-SE-010** (Enersis) y **NSP-420** (Venezuela), apoyándose igualmente en las normas norteamericanas **IEEE-344** de 2004 e **IEEE-693** de 2005.

En el punto 11,0 se describen los resultados de los ensayos a los que ha sido sometido el Cuadro. Este equipo ha soportado satisfactoriamente los ensayos sin que se haya detectado anomalía ni deterioro estructural alguno en el mismo.

La única incidencia significativa habida en estos ensayos se ha presentado en el ensayo nº 21, ensayo sísmico multifrecuencial de nivel **S2** realizado en dirección YZ, *lado-lado* al Cuadro y *vertical* simultáneamente, en el que se han alcanzado microdeformaciones de valor superior a 1000 (1198), valor considerado como el máximo admisible, en una (G4) de las cuatro bandas colocadas en la base del equipo.

Con objeto de reducir las tensiones en el equipo se ha aumentado el nº de tornillos desde 12 hasta 18 (**dos** (2) por Celda), reduciéndose el nº máximo de microdeformaciones desde 1198 hasta 719 en el ensayo nº 22, realizado con el mismo nivel que el ensayo nº 21.

En el **APÉNDICE I**, se encuentran dibujados los registros de las galgas extensométricas obtenidos de los ensayos sísmicos realizados, tanto de tipo multifrecuencial como de tipo senoidal, a las frecuencias de resonancia del Cuadro, no superándose, excepción hecha del caso citado, el 80% del límite de fluencia del material, definido por 1000 microdeformaciones.

En el **APÉNDICE II** se encuentran dibujados los espectros de frecuencia, integrados por valores máximos, del grupo 1 de acelerómetros, colocado sobre la plataforma vibrante, en los que se refleja el nivel aplicado en los ensayos exploratorios realizados antes y después de los ensayos sísmicos.

En este mismo **APÉNDICE** se encuentran dibujados los espectros de frecuencia del grupo 1 de acelerómetros, colocado sobre la plataforma vibrante; y del grupo 2, colocado en el Centro de Gravedad del Conjunto, en los que se refleja el nivel aplicado en los ensayos sísmicos senoidales realizados en dirección Y (*lado-lado*) y X (*frente-atrás*) al equipo.

En el **APÉNDICE III**, se encuentran las Funciones de Transferencia (*módulo y fase*) obtenidas en los ensayos exploratorios iniciales y finales, realizados con un nivel de aceleración de 0,1 g, de los que se han deducido las frecuencias de resonancia más significativas de las ***Celdas***, en el rango de 0,5 a 35 Hz.

VIRLAB LABORATORIO DE ENSAYOS DE VIBRACIONES

000656

ВЯРНО С ОРИГИНАЛА

En la tabla que se acompaña a continuación se muestran las resonancias del punto 2 obtenidas en los ensayos exploratorios iniciales y finales.

PUNTO NUMERO	RESONANCIA (Hz)			
	Dirección Horizontal "X" (*frente-atrás*)		Dirección Horizontal "Y" (*lado-lado*)	
	Inicial	Final	Inicial	Final
2 (CDG)	12,87	10,49	6,68	7,63

Del análisis de estos resultados se deduce que las desviaciones entre las resonancias finales y las iniciales son del orden del 14,2% en dirección Y del orden del 18,5% en dirección X, por debajo del 20% de las admitidas por la norma IEEE693/2005.

No obstante, hay que decir a este respecto que estas desviaciones son más pequeñas si se consideran los resultados obtenidos en los ensayos realizados después de colocar los seis tornillos adicionales, resultados que se encuentran en el **APÉNDICE IV** sintetizan en la tabla siguiente:

PUNTO NUMERO	RESONANCIA (Hz)			
	Dirección Horizontal "X" (*frente-atrás*)		Dirección Horizontal "Y" (*lado-lado*)	
	Inicial	Final	Inicial	Final
2 (CDG)	11,03 (*0,15 g*)	10,49 (*0,1 g*)	7,37 (*0,15 g*)	7,63 (*0,1 g*)

Estas resonancias suponen unas desviaciones del orden del 4,9% en dirección X del orden del 3,5% en dirección Y.

En el **APÉNDICE IV**, se encuentran las funciones de transmisibilidad (*módulo*) del punto 2 (CDG) obtenidas mediante el Controlador de Vibraciones de los ensayos exploratorios locales, realizados con un nivel de aceleración de 0,15 g, a partir de las cuales se ha obtenido el amortiguamiento del equipo, asociado a sus correspondientes modos de vibración (*calculados por el Método del Ancho de Banda*), tal y como se resume a continuación:

PUNTO NUMERO	RESONANCIA (Hz) / *Amortiguamiento (%)*	
	Dirección Horizontal "X" (*frente-atrás*)	Dirección Horizontal "Y" (*lado-lado*)
2 (CDG)	10,15 / *13,45%*	6,12 / *16,11%*

En dirección vertical no se ha encontrado resonancia significativa alguna.

Por otro lado, después de colocar los seis tornillos adicionales y antes de realizar los ensayos sísmicos de tipo senoidal, se han vuelto a repetir los ensayos exploratorios locales, debido al aumento de rigidez de la unión del Cuadro a la plataforma de ensayos, habiéndose obtenido los valores de amortiguamiento, asociados a sus correspondientes modos de vibración, que se resumen en la tabla siguiente:

PUNTO NUMERO	RESONANCIA (Hz) / *Amortiguamiento (%)*	
	Dirección Horizontal "X" (*frente-atrás*)	Dirección Horizontal "Y" (*lado-lado*)
2 (CDG)	11,03 / *9,46%*	7,37 / *10,04%*

Todos estos valores se han calculado con los *Interruptores Conectados*. Por último, se ha realizado un ensayo exploratorio local con los *Interruptores Desconectados* en dirección X, ya que se ha observado una variación significativa en esta dirección, al realizar el ensayo sísmico senoidal. La frecuencia y amortiguamiento obtenidos han sido de 10,54 Hz y *6,82%*.

En el **APÉNDICE V**, se encuentran dibujados los Espectros de Respuesta de Ensayo (TRS), del grupo 1 de acelerómetros, colocado sobre la plataforma de ensayos, obtenidos de los ensayos sísmicos multifrecuenciales realizados sobre las ***Celdas***.

Estos espectros, obtenidos con el Controlador de Vibraciones, se han calculado para el 2% amortiguamiento y por 1/24 de octava; y se encuentran superpuestos sobre los Espectros de Respuesta Requeridos (RRS).

En el **APÉNDICE VI**, se encuentran dibujados los Espectros de Respuesta de Ensayo (TRS), del grupo 1 de acelerómetros, calculados para el 5% amortiguamiento por 1/24 de octava, obtenidos de los ensayos sísmicos realizados sobre las ***Celdas***. Estos espectros, obtenidos con el Analizador de Vibraciones, se encuentran igualmente superpuestos sobre los Espectros de Respuesta Requeridos (RRS).

En el **APÉNDICE VII**, se encuentran dibujados los acelerogramas del grupo 1 de acelerómetros obtenidos de los Ensayos Sísmicos realizados con excitación tipo multifrecuencial.

Asteasu, 27 de Septiembre, 2011
VIRLAB, S,A,
División de URBAR INGENIEROS, S,A,

Revisado por:

Alberto CORRAL
Ingeniero del Laboratorio

Realizado por:

Juan Antonio PEREZ
Jefe del Laboratorio

VIRLAB · LABORATORIO DE ENSAYOS DE VIBRACIÓN

000653

ВЯРНО С ОРИГИНАЛА · ВИГ 23 ЕООД · СОФИЯ

ДОКЛАД ОТ ИЗПИТВАНЕТО ЗА ОЦЕНКА НА СЕЙЗМИЧНАТА УСТОЙЧИВОСТ НА *„СИСТЕМАТА CGM COSMOS L+P+V“* НА ОРМАСАБАЛ, С.А.

ЗАБЕЛЕЖКА: *Съгласно разпоредбите на точка 5.10.2 от Стандарта ISO-IEC 17025:2005 следва да се направи следното предупреждение:*

- *Резултатите от настоящия доклад се отнасят единствено и изключително за подложените на изпитване образци.*
- *Забранява се частичното или цялостно възпроизвеждане на този документ без писменото разрешение от страна на лабораторията.*

Дата	Извършил:	Проверил:
	нечетлив подпис	*нечетлив подпис*
27.09.11	*Хуан Антонио ПЕРЕС*	*Алберто КОРАЛ*

ВИРЛАБ, С.А.
Подразделение на УРБАР ИНХЕНИЕРОС, С.А.

Индустриална зона Астеасу
Зона Б, Сграда 44
20159 Астеасу (Гипускоа)
ИСПАНИЯ

www.virlab.es
Email:virlab@urbar.com
Тел.: +34 943 69 15 00
Факс: +34 943 69 26 67

Кръгъл печат на ВИРЛАБ, ЛАБОРАТОРИЯ ЗА ВИБРАЦИОННИ ИЗПИТВАНИЯ

000653

ВЯРНО С ОРИГИНАЛА

12.0.- ЗАКЛЮЧЕНИЯ

Разпределителната уредба ***„СИСТЕМА CGM COSMOS L+P+V“*** на **ОРМАСАБАЛ, С.А.**, съставена от три (3) ***Килии***, съгласно чертеж номер DOC-3410, Преразглеждане 01 от дата 08.04.11 год., с характеристики, описани в точка 3.0, която е предназначена **за ПОДСТАНЦИИ И ТРАФОПОСТОВЕ**, е подложена на сеизмични изпитвания, както е посочено в обяснената в точка 8.0 процедура, в съответствие с европейския стандарт **UNE EN 60068-3-3 от 1994 год.**, стандарта **NSR-98** (Колумбия), спецификациите **ETGI-1020** (Чили), **E-SE-010** (Enersis) и **NSP-420** (Венецуела), както и въз основа на американските стандарти **IEEE-344** от 2004 год. и **IEEE-693** от 2005 год.

В точка 11.0 са описани резултатите от изпитванията, извършени по отношение на разпределителната уредба. Съоръжението е издържало удовлетворително изпитванията, без по него да са открити аномалии или структурни повреди.

Единственото отклонение, отчетено по време на изпитванията, се наблюдава при изпитване N° 21, многочестотно сеизмично изпитване от ниво **S2**, извършено по посока YZ, *странично* спрямо разпределителната уредба и едновременно с това *вертикално*, в резултат на което са получени микродеформации със стойност по-висока от 1000 (1198), тоест по-висока от максимално допустимата стойност, по една от четирите ленти (G4), поставени в основата на съоръжението.

С цел намаляване на напрежението в съоръжението е увеличен броят на болтовете от 12 на 18 (с по **два** (2) на клетка), с което максималният брой микродеформации при изпитване N° 22 спада от 1198 на 719 при прилагане на същото ниво като при изпитване N° 21.

В **ПРИЛОЖЕНИЕ I** са представени в графична форма данните от сензорите за измерване на механични деформации, отчетени в резултат на многочестотните и синусоидалните сеизмични изпитвания, по време на които са прилагани резонансните честоти на уредбата. Резултатите от тези изпитвания, с изключение на горецитирания случай, не надвишават 80% от максималната граница на провлачване на материала, дефинирана посредством 1000 микродеформации.

В **ПРИЛОЖЕНИЕ II** са отразени честотните спектри, интегрирани по максимални стойности, на акселерометрите от Група 1, закрепени върху вибрираща платформа, като е посочено нивото, приложено по време на скрининга преди и след сеизмичните изпитвания.

В същото това **ПРИЛОЖЕНИЕ** е отразен честотният спектър не само на Група 1 акселерометри, закрепени върху вибрираща платформа; но и на Група 2, която е поставена в Центъра на тежест на съоръжението. Посочено е и нивото, приложено при синусоидалните сеизмични изпитвания, осъществени по посока Y (*странично*) и X (*отпред-назад*) спрямо разпределителната уредба.

В **ПРИЛОЖЕНИЕ III** са представени предавателните функции *(модул и фаза)*, получени при първоначалния и крайния скрининг при ниво на ускорение 0,1 g, като въз основа на тези функции се прави извод, че най-значимите резонансни честоти на ***Килиите*** са в диапазона от 0.5 до 35 Hz.

Кръгъл печат на ВИРЛАБ, ЛАБОРАТОРИЯ ЗА ВИБРАЦИОННИ ИЗПИТВАНИЯ

000660

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ МИГ 23 LTD

В приложената по-долу таблица са показани резонансите на точка 2, получени при началния и крайния скрининг.

ТОЧКА НОМЕР	РЕЗОНАНС (Hz)			
	Хоризонтална посока „X“ *(отпред - назад)*		Хоризонтална посока „Y“ *(странично)*	
	Начален скрининг	Краен скрининг	Начален скрининг	Краен скрининг
2 (ЦЕНТЪР НА ТЕЖЕСТТА)	12,87	10,49	6,68	7,63

От анализа на тези резултати се стига до извода, че отклоненията между крайните и началните резонанси са в порядъка на 14,2% в посока Y и в порядъка на 18,5% в посока X, при всички случаи под 20-те %, които представляват допустимата стойност на отклонение съгласно стандарт IEEE 693/2005.

Независимо от това следва да се отбележи, че посочените отклонения реално са по-ниски, ако се вземат предвид резултатите от изпитванията, извършени след поставяне на шестте допълнителни болта. Тези резултати са представени в **ПРИЛОЖЕНИЕ IV**, като в обобщен вид са отразени в таблицата по-долу:

ТОЧКА НОМЕР	РЕЗОНАНС (Hz)			
	Хоризонтална посока „X“ *(отпред - назад)*		Хоризонтална посока „Y“ *(странично)*	
	Начален скрининг	Краен скрининг	Начален скрининг	Краен скрининг
2 (ЦЕНТЪР НА ТЕЖЕСТТА)	11,03 *(0,15 g)*	10,49 *(0,1 g)*	7,37 *(0,15 g)*	7,63 *(0,1 g)*

В този случай при резонансите се наблюдава отклонение от порядъка на 4,9% в посока X и от порядъка на 3,5% в посока Y.

В **ПРИЛОЖЕНИЕ IV** са отразени трансмисионните функции (*модул*) на точка 2 (център на тежестта), получени с помощта на виброметър по време на локалния скрининг, при ниво на ускорения 0,15 g. Въз основа на тези функции е изчислена способността на съоръжението за поглъщане на вибрации, съответстваща на различните режими на вибриране *(изчислени по метода **Широчина на лентата**)*, както е показано в обобщен вид по-долу:

ВЯРНО С ОРИГИНАЛА

000661

ТОЧКА НОМЕР	**РЕЗОНАНС (Hz) / *Способност за вибропоглъщане (%)***	
	Хоризонтална посока „X“ *(отпред - назад)*	**Хоризонтална посока „Y“** *(странично)*
2 (ЦЕНТЪР НА ТЕЖЕСТТА)	**10,15** / *13,45%*	**6,12** / *16,11 %*

Във вертикална посока не е отчетен значителен резонанс.

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От друга страна, след поставяне на шестте допълнителни болта и преди извършване на синусоидалните сеизмични изпитвания са повторени локалните изпитвания, тъй като е повишена здравината на връзките между разпределителната уредба и изпитвателното оборудване. Способността на уредбата за поглъщане на вибрациите, съответстваща на отделните режими на вибриране и получена в резултат на горното изпитване, е представена в долната таблица:

ТОЧКА НОМЕР	**РЕЗОНАНС (Hz) / *Способност за вибропоглъщане %***	
	Хоризонтална посока „X“ *(отпред - назад)*	**Хоризонтална посока „Y“** *(странично)*
2 (ЦЕНТЪР НА ТЕЖЕСТТА)	**11,03** / *9,46%*	**7,37** / *10,04 %*

Всички тези стойности са изчислени при *Включени разединители.* Накрая е извършен локален скрининг в посока X с *Изключени разединители,* тъй като е забелязана значителна промяна в тази посока при извършване на синусоидалното сеизмично изпитване. Честотата и способността за вибропоглъщане, получени в резултат на това изпитване, са **10,54** Hz и *6,82%.*

В **ПРИЛОЖЕНИЕ V** са показани спектрите на реагиране на изпитванията (TRS) за Група 1 акселерометри, закрепени върху изпитвателното оборудване, които са резултат от многочестотните сеизмични изпитвания върху ***Килиите.***

Тези спектри, получени с помощта на Виброметъра, са изчислени за вибропоглъщане от 2% при 1/24 октави; те са нанесени на графиката върху изискуемите спектри на реагиране (RRS).

В **ПРИЛОЖЕНИЕ VI** са отразени спектрите на реагиране на изпитванията (TRS) за Група 1 акселерометри, изчислени за вибропоглъщане от 5% при 1/24 октави и получени в резултат на сеизмичните изпитвания върху ***Килиите***. Тези спектри, изчислени с помощта на Виброметъра, също са нанесени на графиката върху изискуемите спектри на реагиране (RRS).

В **ПРИЛОЖЕНИЕ VII** са отразени акселограмите на Група 1 акселерометри, резултат от сеизмичните изпитвания, осъществени с многочестотно възбуждане.

Астеасу, 27 септември 2011 год.
ВИРЛАБ, С.А.
Подразделение на УРБАР ИНХЕНИЕРОС, С.А.

Проверил:
нечетлив подпис

Алберто КОРАЛ
Лабораторен инженер

Извършил:
нечетлив подпис

Хуан Антонио ПЕРЕС
Ръководител на Лабораторията

Кръгъл печат на ВИРЛАБ, ЛАБОРАТОРИЯ ЗА ВИБРАЦИОННИ ИЗПИТВАНИЯ

000663

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД · СОФИЯ · MIG 23 LTD

Наименование на материала:

Триполюсни автоматични прекъсвачи НН с лят корпус, от 160 А до 1250 А, с електронна защита, категория А

Номер на техническа спецификация на стандарт - 20 17 60zz към

БКТП 800(630) kVA – TS-1

и

БКТП 800(630) kVA – TS-2

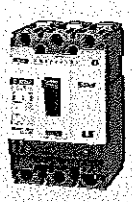
000684

№ по ред	Документ	Приложение № или текст
1.	Точно означение на типа, производителя и страната на производство (произход) и последно издание на каталога на производителя	Susol, LS Industrial Systems, Южна Корея, TS 1250H Приложение 1
2.	Техническо описание и чертежи с нанесени на тях размери	Приложение 2
3.	ЕО декларация за съответствие	Приложение 3
4.	Протоколи от типови изпитвания на английски или български език, проведени от независима изпитвателна лаборатория – заверени копия, с приложен списък на отделните изпитвания на български език	Приложение 4
5.	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания по т. 4 – заверено копие	Приложение 5
6.	Техническо описание и чертежи с нанесени размери на монтажни планки, единичната цена на които не се включва в цената на прекъсвачите	Не са необходими монтажни планки

Управител:.....
/Антон Илиев/

000665

TD series

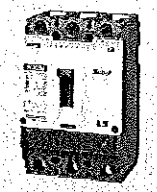


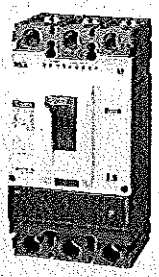
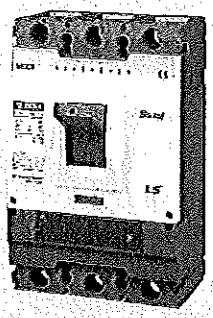
				TD160NA	TS100NA	TS160NA
Frame size			[AF]	160	100	160
Conventional thermal current, Ith			[A]	160	100	160
No. of poles				2, 3, 4	2, 3, 4	2, 3, 4
Rated operational voltage, Ue	AC		[V]	690	690	690
	DC		[V]	500	500	500
Rated operational current, Ie				160	100	160
Rated impulse withstand voltage, Uimp			[kV]	8	8	8
Rated insulation voltage, Ui			[V]	750	750	750
Rated short-circuit making capacity, Icm			[kA peak]	3.1	2.8	3.6
Rated short-time withstand current, Icw	1s		[A rms]	2200	2000	2500
	3s		[A rms]	2200	2000	2500
	20s		[A rms]	960	690	960
Isolation behavior				●	●	●
Trip unit (release)						
●disconnector unit			DSU	●	●	●
Connection	fixed	front-connection		●	●	●
		rear-connection		●	●	●
	plug-in	front-connection		●	●	●
		rear-connection		●	●	●
Mechanical life			[operations]	25000	25000	25000
Electrical life @415 V AC			[operations]	10000	10000	10000
Basic dimensions, W×H×D (front connection)	3-pole		[mm]	90×140 86	105×160×86	105 160×86
	4-pole		[mm]	120 140×86	140×160×86	140 160×86
Weight (front connection)	3-pole		[kg]	1.5	2	2
	4-pole		[kg]	1.8	2.6	2.6
Reference standard				IEC60947-3	IEC60947-3	IEC60947-3

The switch-disconnectors are different from the circuit-breakers in the absence of the conventional protection unit. They keep the overall dimensions, connection systems and accessories unchanged from the corresponding circuit-breakers. Installation standards require upstream protection. However, thanks to their high-set magnetic release, TD160 ... TS800 DSU are self protected.

000666

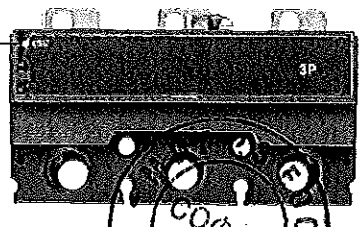
TS series



TS250NA	TS400NA	TS630NA	TS800NA
250	400	630	800
250	400	630	800
2, 3, 4	2, 3, 4	2, 3, 4	2, 3, 4
690	690	690	690
500	500	500	500
250	400	630	800
8	8	8	8
750	750	750	750
4.9	7.1	8.5	12
3500	5000	6300	8000
3500	5000	6300	8000
1350	1930	2320	2560
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
●	●	●	●
25000	20000	20000	10000
10000	6000	6000	3000
105 160 86	140×260×110	140 260 110	210 320 135
140 160 86	186.5 260 110	186.5 260×110	280 320 135
2	5.4	5.4	15.1
2.6	7.2	7.2	19.6
IEC60947-3	IEC60947-3	IEC60947-3	IEC60947-3

Trip unit Identification



000667

Electrical characteristics

			TE100	TE160	TD100	TD160
Frame size		[AF]	100	160	100	160
Rated current, In +		[A]	16~100	100,125,160	16, 20, 25, 32, 40, 50, 63, 80, 100	1P: 16, 20, 25, 32, 40, 50, 63, 80, 100,125, 160
No. of poles			3,4	3,4	2*, 3, 4	1, 2*, 3, 4
Rated operational voltage, Ue	AC	[V]	690	690	690	240(1P), 690
	DC	[V]	500	500	500	250(1P), 500
Rated impulse withstand voltage, Uimp		[kV]			8	8
Rated insulation voltage, Ui		[V]	8	8	750	750
Rated ultimate short-circuit breaking capacity, Icu			S	N	S	N	N	H	L	N	H	L
AC 50/60Hz	220/240V	[kA]	50	85	50	85	85	100	200	30(1P) 85	50(1P) 100	200
	380/415V	[kA]	37	50	37	50	50	85	150	50	85	150
	440/460V	[kA]	25	37	25	37	50	70	130	50	70	130
	480/500V	[kA]	18	25	18	25	30	50	65	30	50	65
	660/690V	[kA]	6	8	6	8	5	8	10	5	8	10
DC	250V	[kA]	37	50	37	50	42	65	100	16(1P) 42	25(1P) 65	100
	500V(2poles in series)	[kA]	37	50	37	50	42	65	100	42	65	100
Rated service breaking capacity, Ics		[%Icu]	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Rated short-circuit making capacity Icm												
AC 50/60Hz	220/240V	[kA]	105	187	105	187	187	220	440	105(1P) 187	105(1P) 220	440
	380/415V	[kA]	77.7	105	77.7	105	105	187	330	105	187	330
	440/460V	[kA]	52.5	77.7	52.5	77.7	105	154	286	105	154	286
	480/500V	[kA]	36	52.5	36	52.5	63	105	143	63	105	143
	660/690V	[kA]	9.2	13.6	9.2	13.6	8	14	17	8	14	17
Category of utilization			A		A			A			A	
Isolation behavior			●		●			●			●	
Trip unit (release)												
Thermal-Magnetic												
●fixed-thermal, fixed-magnetic		FTU	●		●			●			●	
●adjustable-thermal, fixed-magnetic		FMU	●		●			●			●*****	
●adjustable-thermal, adjustable-magnetic		ATU	-		-			-			-	
●magnetic only		MTU ***	-		-			-			-	
Electronic												
●LSI		ETS ***	-		-			-			-	
●LSI		ETM ***	-		-			-			-	
Option	Earth-fault protection, Ig		-		-			-			-	
	Zone selective interlocking, ZSI		-		-			-			-	
	Ammeter		-		-			-			-	
	Communication		-		-			-			-	
	Earth-leakage protection module ****		-		-			-			-	
Connection	fixed	front-connection	●		●			●			●	
		rear-connection	●		●			●			●*****	
	plug-in	front-connection	-		-			●			●*****	
		rear-connection	-		-			●			●*****	
Mechanical life		[operations]	25000		25000			25000			25000	
Electrical life @ 415 V AC		[operations]	10000		10000			10000			10000	
Basic dimensions, W×H×D (front connection)	1-pole	[mm]	-		-			-		35	140	86
	3-pole	[mm]	76	130	82	76	130	82	90	140	86	90	140	86
	4-pole	[mm]	101	130	82	101	130	82	120	140	86	120	140	86
Weight (front connection)	1-pole	[kg]	-		-			-			0.57	
	3-pole	[kg]	1.05		1.05			1.5			1.5	
	4-pole	[kg]	1.35		1.35			1.8			1.8	
Reference standard			IEC60947-2		IEC60947-2			IEC60947-2			IEC60947-2	

*Applicable to MCCBs equipped with FTU, FMU, ATU
*2 pole MCCB in 3pole frame size
**700A only available for TS800FTU
*** Available for 3pole circuit breakers
**** Under development
***** Not applicable to 1pole

MCCBs for power distribution

Susol

	TS100			TS160			TS250			TS400			TS630			TS800	
	100			160			250			400			630			800	
	40, 50, 63, 80, 100			(100)※, 125, 160			125, 160, 200, 250			300, 400			500, 630			700**, 800	
	2*, 3, 4			2*, 3, 4			2*, 3, 4			2*, 3, 4			2*, 3, 4			2*, 3, 4	
	690			690			690			690			690			690	
	500			500			500			500			500			500	
	8			8			8			8			8			8	
	750			750			750			750			750			750	
N	H	L	N	H	L	N	H	L	N	H	L	N	H	L	N	H	L
100	120	200	100	120	200	100	120	200	100	120	200	100	120	200	100	120	200
50	85	150	50	85	150	50	85	150	65	85	150	65	85	150	65	100	150
50	70	130	50	70	130	50	70	130	65	85	130	65	85	130	65	100	130
42	65	85	42	65	85	42	65	85	42	65	85	42	65	85	42	85	100
10	15	20	10	15	20	10	15	20	10	20	35	10	20	35	10	20	35
50	85	100	50	85	100	50	85	100	50	85	100	50	85	100	50	85	100
50	85	100	50	85	100	50	85	100	50	85	100	50	85	100	50	85	100
100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
220	264	440	220	264	440	220	264	440	220	264	440	220	264	440	220	264	440
105	187	330	105	187	330	105	187	330	143	187	330	143	187	330	143	220	330
105	154	286	105	154	286	105	154	286	143	187	286	143	187	286	143	220	286
88	143	187	88	143	187	88	143	187	88	143	187	88	143	187	88	187	220
17	30	40	17	30	40	17	30	40	17	40	74	17	40	74	17	40	74
	A			A			A			A			A			A	
	●			●			●			●			●			●	
	●			●			●			●			●			●	
	●			●			●			●			●			●	
	-			●			●			●			●			●	
	●			●			●			●			●			●	
	●			●			●			●			●			●	
	-			-			-			●			●			●	
	-			-			-			●			●			●	
	-			-			-			●			●			●	
	-			-			-			●			●			●	
	-			-			-			●			●			●	
	-			-			-			●			●			●	
	●			●			●			●			●			●	
	●			●			●			●			●			●	
	●			●			●			●			●			●	
	●			●			●			●			●			●	
	25000			25000			25000			20000			20000			10000	
	10000			10000			10000			6000			6000			3000	
	-			-			-			-			-			-	
	105 160 86			105 160 86			105×160×86			140 260 110			140 260×110			210×320×135	
	140 160 86			140 160×86			140×160×86			186.5 260 110			186.5 260 110			280×320 135	
	-			-			-			-			-			-	
	2			2			2			5.4			5.4			15.1	
	2.6			2.6			2.6			7.2			7.2			19.6	
	IEC60947-2			IEC60947-2			IEC60947-2			IEC60947-2			IEC60947-2			IEC60947-2	

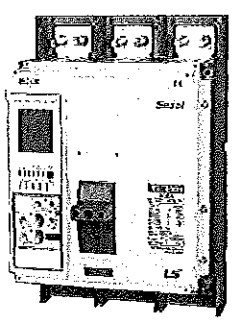
1. The breakers with electronic trip units are available only at 3-pole version. (Only for AC supply)

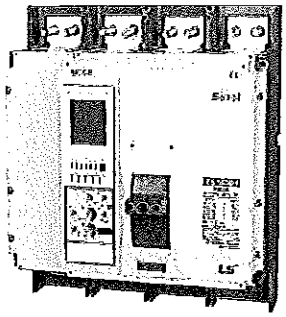
※ The trip unit ATU is available from 125A

MCCBs for power distribution up to 1600A

Susol

Electrical characteristics





				TS1000		TS1250			TS1600	
Type				TS1000		TS1250			TS1600	
Ampere frame				1000		1250			1600	
Pole				3, 4		3, 4			3, 4	
Rated current,(A)		In	-5~40°C	800, 1000		1250			1600	
			50°C	800, 1000		1250			1560	
			65°C	800, 1000		1240			1420	
Rated insulation voltage, (V)		Ui		1000		1000			1000	
Rated impulse withstand voltage, (kV)		Uimp		8		8			8	
Rated operational voltage, (V)		Ue	AC50/60Hz	690		690			690	
			DC	-		-			-	
Rated short-circuit breaking capacity				N	H	L	N	H	N	H
IEC60947-2	Rated ultimate short-circuit		220/240V	55	75	200	55	75	55	75
AC50/60Hz	breaking capacity, (kA) (Icu)		380/415V	50	70	150	50	70	50	70
(sym)			440/460V	50	65	130	50	65	50	65
			480/500V	40	50	100	40	50	40	50
			660/690V	35	45	50	35	45	35	45
		DC	250V 2P	-	-	-	-	-	-	-
			500V 2P	-	-	-	-	-	-	-
			750V 3P	-	-	-	-	-	-	-
	Rated service breaking capacity (Ics)	%Icu		100%	75%	100%	100%	75%	100%	75%
	Rated short-circuit making capacity (kA) (Icw)	AC50/60Hz	1s	25		12	25		25	
			3s	-			-		-	
Overriding instantaneous protection			kA peak	50		30	50		50	
Isolation				O			O		O	
Category				B		A	B		B	
	Mechanical life (operations)			10000		4000	10000		10000	
(Life cycle)	Electrical life	440V	In/2	6000		4000	5000		5000	
	(operations)		In	5000		3000	4000		2000	
		690V	In/2	4000		3000	3000		2000	
			In	2000		2000	2000		1000	
Pollution degree				3			3		3	
Dimension (mm)			3-pole	327×210×152.5						
(H W D)			4-pole	327 280 152.5						
Weight (kg)			3-pole	13						
			4-pole	16.8						

ТЕХНИЧЕСКО ОПИСАНИЕ

I. Триполюсни автоматични и товарови прекъсвачи серия Susol 1250A,

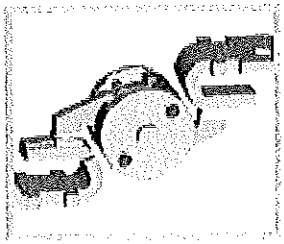
Автоматични прекъсвачи серия Susol TS са произведени от фирма LS Industrial Systems и представляват механични комутационни апарати, способни да провеждат и да включват/изключват ръчно електрически токове до 1250 А във вериги при нормални условия и да провеждат за определено време и да изключват автоматично токове във вериги при условията на претоварване и късо съединение.
Тялото на автоматични прекъсвачи е изработено чрез формоване на устойчив на нагряване, на огън и на механични удари изолационен материал. В монтирано състояние съгласно инструкциите на производителя и след опроводяване активните части на миниатюрните автоматични прекъсвачи не са достъпни.

При вертикално монтиране на автоматични и товарови прекъсвачи лостът се движи в направление „нагоре - надолу", при което контактите се затварят при движение „нагоре". Автоматични прекъсвачи са снабдени с ясно видимо от челната страна средство за указване на затвореното и отвореното положение на контактната система- Означение „ON/OFF" върху лоста за управление. При задействане на защитата (или натискане на специален бутон на лицевата страна) лоста застава в „Trip" положение, което е оказано със символ на челната страна. За да се включи прекъсвача от „Trip" положение лостът първо трябва да се придвижи надолу към положение „OFF", а след това нагоре до положение „ON". Устройствата отговарят на следните стандарти: EN/IEC 60947-1, EN/IEC 60947-2, EN/IEC 60947-3, EN/IEC 60947-4.

Прекъсвачите са маркирани с CE маркировка за съответствие и на лицевия панел на устройството са отпечатани следните основни параметри:

- Разривен ток при различни напрежения
- Допустимо импулсно напрежение на изолацията
- Номинален ток
- Номинално напрежение
- Краткотрайно издържан ток
- Работна изключвателна възможност

Автоматични и товарови прекъсвачи серия Susol са снабдени с ротационна контактна система и имат повишена изключвателна възможност поради двойното разкъсване всеки полюс.



Ротационната контактна система има следните преимущества:

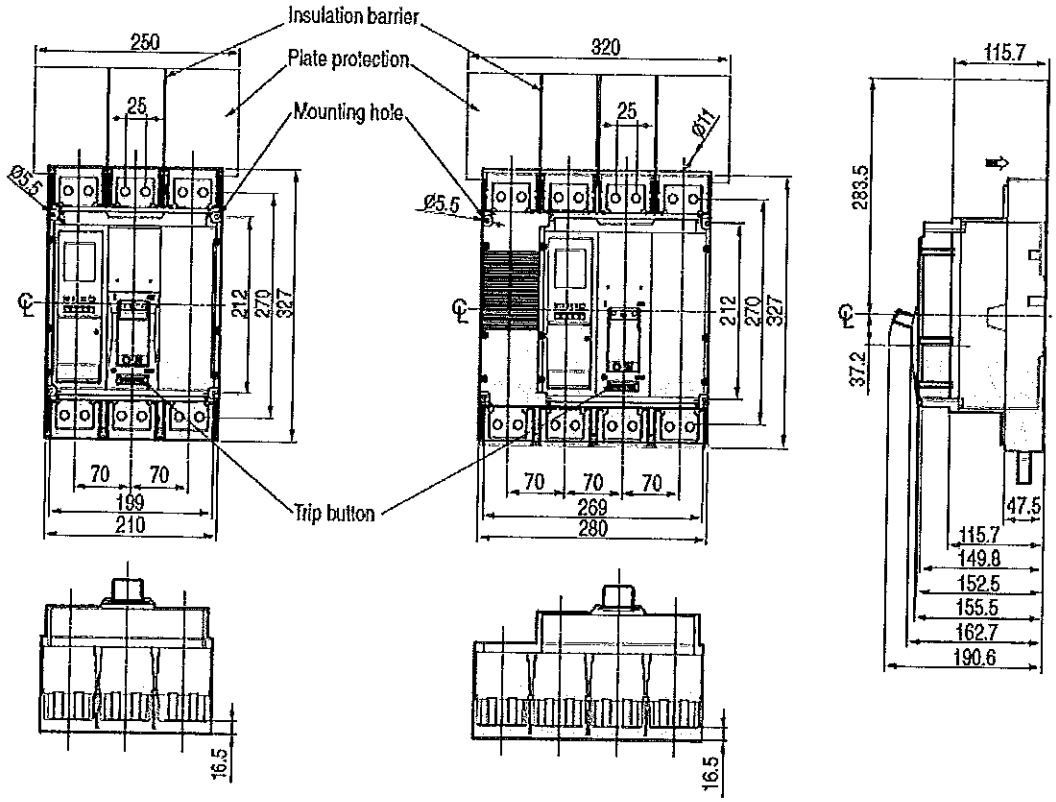
- Двойно разкъсване на всеки полюс
- Мигновенно отвеждане на дъгата към дъгогасителните камери
- Повишава дълготрайността на контактите като ги предпазва от износване
- Отлични токоограничаващи свойства
- Висока изключвателна възможност при компатни размери

000671

TS 1000, 1250, 1600A

Front Type

[mm]



000672

ДЕКЛАРАЦИЯ ЗА СЪОТВЕТСТВИЕ

Долуподписаният Владимир Лазаров,

Управител на фирма "ВиВ Изоматик" ООД, София, ул. Пирин 40А

В качеството си на търговски представители на LS Industrial Systems Co., Ltd.

Декларираме, че продуктът:

Марка:	LS Industrial Systems
Продукт:	Автоматичен прекъсвач TS1000N, TS1250N, TS1600N TS1000H, TS1250H, TS1600H TS1000L, TS1250L, TS1600L TS1000NA, TS1250NA, TS1600NA
Серия:	SuSol

За който се отнася тази декларация, при условие, че е инсталиран, обслужван и използван за приложения, за които е предназначен, е в съответствие със следните стандарти, технически одобрения или други нормативни актове:

IEC 60947-1
IEC 60947-2

София, 18.01.2012

ВиВ ИЗОМАТИК ООД

София

Владимир Лазаров, управител
ВиВ Изоматик ООД

000673

ВЯРНО С ОРИГИНАЛА

ВиВ ИЗОМАТИК ООД София

IEC | IECEE CB SCHEME

CB TEST CERTIFICATE

Ref. Certificate No.

NL-20335

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

Issued by:	DEKRA Certification B.V.		
Product:	Moulded-case circuit-breaker		
Applicant:	LS Industrial Systems Co., Ltd.	1026-6, Hogye-dong, Dong-an-gu Anyang-si, Gyeonggi-do	Korea, Republic of
Manufacturer:	LS Industrial Systems Co., Ltd.	1026-6, Hogye-dong, Dong-an-gu Anyang-si, Gyeonggi-do	Korea, Republic of
Factory:	LS Industrial Systems Co., Ltd.	1026-6, Hogye-dong, Dong-an-gu Anyang-si, Gyeonggi-do	Korea, Republic of
Rating and principal characteristics:	3P/3P+N MCCB (electronic); Ue = 220/240, 380/415, 440/460, 480/500, 660/690 V; Ie = 630, 800, 1000, 1250, 1600 A; Uimp = 8 kV; Ui = 1000 V; TS1000H, TS1250H, TS1600H: Icu = 75 kA at 220/240 V, 70 kA at 380/415 V, 65 kA at 440/460 V, 50 kA at 480/500 V, 45 kA at 660/690 V; Ics = 75% of Icu; Icw = 25 kA – 1 s; TS1000N, TS1250N, TS1600N: Icu = 55 kA at 220/240 V, 50 kA at 380/415 V, 50 kA at 440/460 V, 40 kA at 480/500 V, 35 kA at 660/690 V; Ics = 100% of Icu; Icw = 25 kA – 1 s; IP30; 50/60 Hz; Utilization category B;		
Trade mark (if any):	LS		
Type of Manufacturer's Testing Laboratories used:	WMT		
Model/Type reference:	TS1000N, TS1250N, TS1600N, TS1000H, TS1250H, TS1600H		
Additional information:	-		
Sample of product tested to be in conformity with IEC:	60947-2(ed.4);am1		
Test Report Ref. No:	2131728.51		

This CB Test Certificate is issued by the National Certification Body:

DEKRA Certification B.V.
Utrechtseweg 310
P.O. Box 5185
6802 ED Arnhem
The Netherlands

Signed by: H.R.M. Barends

Date of issue: 2011-04-19

DEKRA

DEKRA Certification is former KEMA Quality

000674

ВЯРНО С ОРИГИНАЛА

Test Report issued under the responsibility of:

DEKRA

TEST REPORT
IEC 60947-2
Low-voltage switchgear and controlgear - Part 2: Circuit-breakers

Report Reference No. ..... :	2131728.51
Date of issue ..... :	2011-04-19
Total number of pages	133
CB Testing Laboratory ..... :	DEKRA Certification B.V.
Address ..... :	Utrechtseweg 310, 6812 ARNHEM, The Netherlands
Applicant's name ..... :	LS Industrial Systems Co., Ltd.
Address ..... :	1026-6, Hogye-dong, Dong-an-gu Anyang-si, Gyeonggi-do,Korea
Test specification:	
Standard ..... :	IEC 60947-2:2006 (4th Edition) + amendment 1: 2009
Test procedure ..... :	CB
Non-standard test method ..... :	N/A
Test Report Form No ..... :	IEC60947_2F
Test Report Form(s) Originator ..... :	KEMA Quality BV
Master TRF ..... :	Dated 2010-01

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

Test item description ..... :	Moulded-case circuit-breaker
Trade Mark ..... :	LS
Manufacturer ..... :	LS Industrial Systems Co., Ltd.
Model/Type reference ..... :	TS1000N, TS1250N, TS1600N, TS1000H, TS1250H, TS1600H
Ratings ..... :	630, 800, 1000, 1250, 1600 A

000675

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД • СОФИЯ • MIG 23 LTD

Testing procedure and testing location:	
☐ **CB Testing Laboratory:**	
Testing location/ address.....:	
☐ **Associated CB Laboratory:**	
Testing location/ address.....:	
Tested by (name + signature).....:	
Approved by (+ signature) .....:	
☐ Testing procedure: TMP	
Tested by (name + signature).....:	
Approved by (+ signature) .....:	
Testing location/ address.....:	
☒ Testing procedure: WMT	
Tested by (name + signature).....:	Oh Junsick
Witnessed by (+ signature).....:	F.S.Strikwerda
Approved by (+ signature) .....:	H.G.M. Kormelink
Testing location/ address.....:	LS Industrial Systems Co., Ltd. CheongJu Plant 1, Songjeong-dong, Heungdeok-gu Cheongju-si, Chungcheongbuk-do, Korea
☐ Testing procedure: SMT	
Tested by (name + signature).....:	
Approved by (+ signature) .....:	
Supervised by (+ signature).....:	
Testing location/ address.....:	
☐ Testing procedure: RMT	
Tested by (name + signature).....:	
Approved by (+ signature) .....:	
Supervised by (+ signature).....:	
Testing location/ address.....:	

000673

ВЯРНО С ОРИГИНАЛ

MIG 23 LTD. ЕООД София

Summary of testing:

Tests performed (name of test and test clause):

8.3.3 Test sequence I: General performance characteristics

8.3.4 Test sequence II: Rated service short-circuit breaking capacity

8.3.5 Test sequence III: Rated ultimate short-circuit breaking capacity

8.3.6 Test sequence IV: Rated short-time withstand current

Annex F : Additional tests for circuit-breakers with electronic over-current protection

4pole is covered by tests of Annex F on the TS1600H 3pole because the construction is identical.

Annex H: Test sequence for circuit-breakers for IT systems.

4pole is covered by tests of Annex H on the TS1600H 3pole because the construction is identical.

Ground fault release was not tested because the min. fault current is > 30A

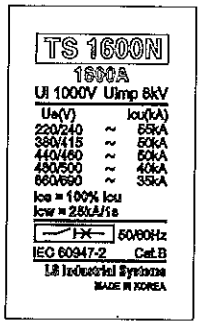
H-type covers the N-type because the construction is identical, only difference in marking

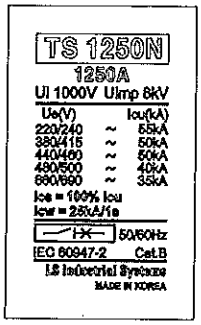
Testing location:

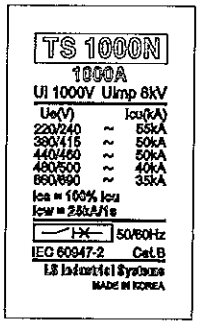
LS Industrial Systems Co., Ltd. CheongJu Plant
1, Songjeong-dong, Heungdeok-gu Cheongju-si, Chungcheongbuk-do, Korea, Republic Of

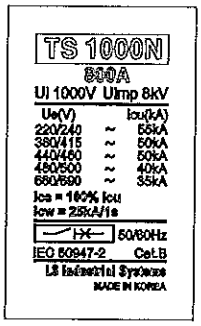
Summary of compliance with National Differences: N/A

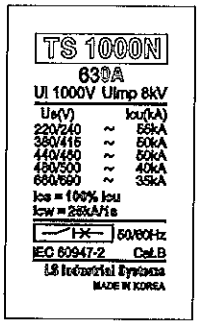
Copy of marking plate

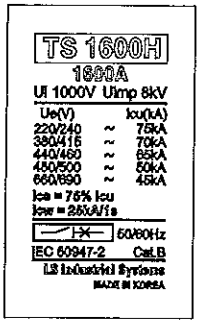


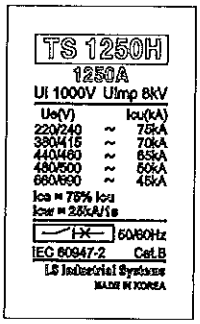


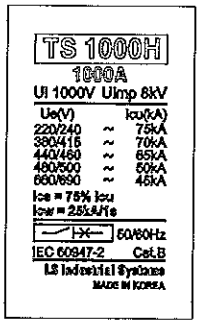


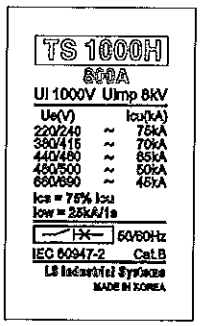


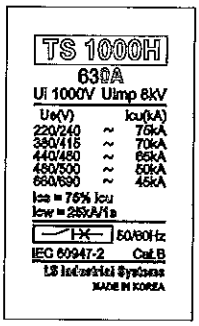












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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД • МИГ 23 LTD • СОФИЯ

Test item particulars: test item vs. test requirements	
3. Classification	
3.1. Utilization category: (A or B) :	B
3.2. Interruption medium: (air, vacuum, gas Break) :	Air
3.3. Design: (open construction, moulded case) :	Moulded case
3.4. Method of controlling the operation mechanism: (dependent manual, independent manual, dependent power, independent power) :	Independent manual
3.5. Suitability for insulation: (suitable, not -suitable) :	Suitable
3.6. Provision for maintenance: (maintainable, non maintainable) :	Maintainable
3.7. Method of installation: (fixed, plug in, withdrawable:	Fixed
3.8. Degree of protection: (IP code) :	IP30
4.7. Type of release (thermo-magnetic / electronic) :	Electronic
4.8. Integral fuses (integrally fused circuit-breakers) Type and characteristics of SCPD :	N/A
7.3 Electromagnetic compatibility (EMC) Environment A or B :	A
Circuit-breaker for use on phase-earthed systems :	N/A
Circuit-breaker for use in IT systems :	P
Rated and limiting values, main circuit :	
- rated operational voltage: Ue (V) :	220/240, 380/415, 440/460, 480/500, 660/690 V
- rated insulation voltage: Ui (V) :	1000 V
- rated impulse withstand voltage: Uimp (kV) :	8 kV
- rated operational current: Ie (A) :	630, 800, 1000, 1250, 1600 A
- kind of current :	AC
- conventional free air thermal current: Ith (A) :	1600 A
- conventional enclosed thermal current: Ithe (A) :	N/A
- current rating for four-pole circuit-breakers: (A) :	N/A
- number of poles :	3/4P
- rated frequency: (Hz) :	50/60 Hz
- integral fuses (rated values) :	N/A
Rated duty :	
- eight-hour duty :	N/A
- uninterrupted duty: Iu (A) :	1600 A

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Short-circuit characteristic :	
rated short-time making capacity: Icm (kA) ..... :	165 kA
rated ultimate short-circuit breaking capacity: Icu (kA).. ..... :	TS1000H, TS1250H, TS1600H 75 kA / 220&240 V, 70 kA / 380&415 V, 65 kA / 440&460 V, 50 kA / 480&500 V , 45 kA / 660&690 V TS1000N, TS1250N, TS1600N 55 kA/220&240 V, 50 kA/380&415 V 50 kA/440&460 V, 40 kA/480&500 V 35 kA/660&690 V
rated service short-circuit breaking capacity: Ics (kA) ..... :	Ics = 75% Icu (H-type), Ics = 100% Icu (N-type)
rated short-time withstand current: Icw (kA/s) ..... :	25 kA 1s
Control circuits :	
Electrical control circuits :	
- kind of current: (AC, DC)..... :	N/A
- rated frequency: (Hz)..... :	N/A
- rated control circuit voltage: Uc (nature, frequency, V) ... :	N/A
- rated control supply voltage: Us (nature, frequency V) ... :	N/A
Air supply control circuits: (pneumatic or electro-pneumatic) :	N/A
- rated pressure and its limit..... :	N/A
- volumes of air, at atmospheric pressure, required for each closing and each opening operation ..... :	N/A
Auxiliary circuits :	
Rated and limiting values, auxiliary circuits..... :	N/A
- rated operational voltage Ue (V)..... :	N/A
- rated insulation voltage: Ui (V)..... :	N/A
- rated operational current: Ie (A)..... :	N/A
- kind of current..... :	N/A
- rated frequency: (Hz)..... :	N/A
- number of circuits..... :	N/A
- number and kind of contact elements ..... :	N/A
- rated uninterrupted current: Iu (A)..... :	N/A
- utilization category: (AC, DC, current and voltage)..... :	N/A
Short-circuit characteristic :	
- Rated conditional short-circuit current (kA) ..... :	N/A
- kind of protective device..... :	N/A

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Releases :		
1) shunt release	:	N/A
2) Over-current release	:	
a) instantaneous	:	P
b) definite time delay	:	P
c) inverse time delay	:	P
- independent of previous load	:	P
- dependent on previous load; (for example thermal type release)	:	N/A
3) Undervoltage release (for opening)	:	N/A
4) Other releases	:	N/A
Characteristics :		
1) Shunt release and undervoltage release (for opening)	:	
- rated control circuit voltage: Uc (nature, frequency, V)	:	N/A
- kind of current	:	N/A
- rated frequency: (if AC)	:	N/A
2) Over-current release	:	
- rated current	:	630, 800, 1000, 1250,1600 A
- kind of current	:	AC
- rated frequency: (if AC)	:	50/60 Hz
- current setting (or range of settings)	:	0,4~1,0 In
- time settings (or range of settings)	:	50, 100, 200, 300, 400 ms @ 1,5 ~ 10 Ir

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

Classification of installation and use ..... :	Moulded case circuit breaker
Supply Connection..... :	3 phase + N
..... :	
..... :	
Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing ..... :	
Date of receipt of test item ..... :	July 10, 2010
Date (s) of performance of tests ..... :	July 12, 2010~ August 30,2010

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a comma (point) is used as the decimal separator.

General product information:

Subject	Molded-case circuit-breaker	
Manufacturer	LS Industrial Systems Co., Ltd.	
Type designation	TS1000N, TS1250N, TS1600N TS1000H, TS1250H, TS1600H	
Frame size	1000, 1250, 1600 AF	
Number of poles	3/4P	
Rated frequency	50/60 Hz	
Rated operational voltage	AC 220/240, 380/415, 440/460, 480/500, 660/690 V	
/ated insulation voltage	AC 1000 V	
Rated impulse withstand voltage	8 kV	
Suitability for isolation	Yes	
Rated current	630, 800, 1000, 1250, 1600A	
Rated ultimate short-circuit breaking capacity	H	N
	75 kA/220&240 V	55 kA/220&240 V
	70 kA/380&415 V	50 kA/380&415 V
	65 kA/440&460 V	50 kA/440&460 V
	50 kA/480&500 V	40 kA/480&500 V
	45 kA/660&690 V	35 kA/660&690 V
Rated service short-circuit breaking capacity	Ics = 75% Icu	Ics = 100% Icu
Rated short-time withstand current	25 kA 1sec	
Utilization category	B	
Type of tripping device	Electronics Trip Device	
Short time releases:		
Current setting (or range of settings)	1.5-2-3-4-5-6-8-10 Ir (adjustable-8 settings)	
Time setting (or range of setting)	I^2t off : 0.05-0.1-0.2-0.3-0.4 (adjustable-5 settings) I^2t on : 0.1-0.2-0.3-0.4 (adjustable-4 settings)	
Instantaneous releases:	Electronics Trip Device	
Current setting (or range of settings)	2-3-4-6-8-10-12-15 In (adjustable-8 settings)	
Time setting (or range of setting)	Fixed (<50ms)	
Long time release:		
Current setting (or range of settings)	0.4~1.0 In (adjustable-54 settings)	
Time setting (or range of setting)	0.5-1-2-4-8-12-16-20 (adjustable-8 settings)	
Type of neutral	Over-current release	
Release dependent on ambient air temperature	No	
Reference temperature	40 °C	
Dimension of specimen	327(H)X210(W)X152.5(D)[3P] / 327(H)X280(W)X152.5(D)[4P]	
Dimension □f metal screen	644(H)X357(W)X152.5(D)[3P] / 644(H)X427(W)X152.5(D)[4P]	

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ВЯРНО С ОРИГИНАЛА

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
5.2	MARKING		
a)	The following data shall be marked on the circuit-breaker itself or on a name plate or nameplates attached to the circuit-breaker, and located in a place such that they are visible and legible when the circuit-breaker is installed.		
	- rated current:	630, 800, 1000, 1250, 1600 A	P
	- suitability for isolation, if applicable, with the symbol 	Compliance	P
	- indication of the open and closed position: with O and I respectively, if symbols are used	Compliance	P
b)	Marking on equipment not needed to be visible after mounting:		
	- manufacturer's name or trademark	LS	P
	- type designation or serial number	TS1000N, TS1250N, TS1600NTS1 000H, TS1250H, TS1600H	P
	- IEC 60947-2 if the manufacturer claims compliance with this standard.	IEC 60947-2	P
	- utilization category	B	P
	- rated operational voltage(s) Ue	220/240, 380/415, 440/460, 480/500, 660/690 V	P
	- Circuit-breaker for use in IT systems: Circuit-breaker for which all values of rated voltage have not been tested according to annex H or are not covered by such testing, shall be identified by the symbol ⊗ which shall be marked on the circuit-breaker immediately following these values of rated voltage	Compliance	P
	- value (or range) of the rated frequency and/or the indication DC (or symbol)	50/60 Hz	P
	- rated ultimate short-circuit breaking capacity. Icu	TS1000H, TS1250H, TS1600H 75kA/220&240V, 70kA /380& 415V, 65kA/440&460V, 50kA/480&500V, 45kA / 660&690V TS1000N, TS1250N, TS1600N 55kA/220&240V, 50 kA/380& 415V, 50kA/440&460V, 40 kA/480&500V, 35kA/660&690V	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- rated service short-circuit breaking capacity. Ics	Ics = 75% Icu (H-type), Ics = 100% Icu (N-type)	P
	- rated short-time withstand current, (Icw) and associated short-time delay, for utilization category B	25 kA 1 s	P
	- line and load terminals, unless their connection is immaterial	Immaterial	P
	- neutral pole terminals, if applicable, by the letter N	-	N/A
	- protective earth terminal, where applicable, by the symbol acc. 7.1.9.3 of part 1	-	N/A
	- ref. temperature for non-compensated thermal releases, if different from 30°C	-	N/A
c)	Marked on the circuit-breaker as specified in item b), or shall be made available in the manufacturer's published information:		
	- rated short-circuit making capacity (Icm) (if higher than specified in 4.3.5.1)	165 kA	P
	- rated insulation voltage. (Ui) if higher than the maximum rated operational voltage)	1000 V	P
	- rated impulse withstand voltage (Uimp), when declared.	8 kV	P
	- pollution degree if other than 3	3	P
	- conventional enclosed thermal current (Ithe) if different from the rated current:	-	N/A
	- IP Code, where applicable:	IP30	P
	- minimum enclosure size and ventilation data (if any) to which marked ratings apply:	-	N/A
	- details of minimum distance between circuit-breaker and earthed metal parts for circuit-breaker intended for use without enclosure:	Compliance	P
	- r.m.s sensing if applicable, according to F.4.1.1	-	N/A
	- suitability for environment A or B	A	P
d)	The following data concerning the opening and closing devices of the circuit-breaker shall be placed either on their own nameplates or on the nameplate of the circuit-breaker:		
	- rated control circuit voltage of the closing device, and rated frequency for AC:	-	N/A

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ВЯРНО С ОРИГИНАЛА МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- rated control circuit voltage of the shunt release and/or of the under-voltage release, and rated frequency:	-	N/A
	- rated current of indirect over-current releases:	-	N/A
	- number and type of auxiliary contacts and kind of current, rated frequency (if AC) and rated voltages of the auxiliary switches, if different from those of the main circuit.	-	N/A
e)	Terminal shall be clearly and permanently identified in acc. with IEC 60445 and annex L :		
	- line terminal	-	N/A
	- load terminal	-	N/A
	- neutral pole terminal "N"	N	P
	- protective earth terminal ⏚	-	N/A
	- terminal of coils (A/B)	-	N/A
	- terminal of shunt release (B)	-	N/A
	- terminals of under-voltage release (D)	-	N/A
	- terminals of interlocking electromagnets (E)	-	N/A
	- terminals of indicated light devices (X)	-	N/A
	- terminals of contact elements for switching devices (no)	-	N/A
7.1	CONSTRUCTION		
7.1.1	Withdrawable circuit-breaker	-	N/A
	In the disconnected position (main- and auxiliary circuits)		
	Isolating distances for circuit-breaker suitable for isolating warranted:	-	N/A
	Mechanism fitted with a reliable indicating device with indicates the position of the isolating contacts.	-	N/A
	Mechanism fitted with interlocks which only permit the isolating contacts to be separate or re-closed when main contacts are open	-	N/A
	Mechanism fitted with interlock, which only permit the main contacts to be closed when the isolating contacts are fully closed.	-	N/A

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ МИГ 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Mechanism fitted with interlock, which only permit the main contacts to be closed when in disconnected position.	-	N/A
	The isolating distances between the isolating contacts cannot be inadvertently reduced.	-	N/A
7.1.2.1 part 1	Resistance to abnormal heat and fire	-	N/A
7.1.3 part 1	Current-carrying parts and their connection	Compliance	P
7.1.4	Clearances and creepage distances:		
	For circuit-breakers for which the manufacturer has declared a value of rated impulse withstand voltage. (Uimp.)		
	Clearances distances:		
	- Uimp is given as:	8 kV	
	- max. value of rated operational voltage to earth.....	399 V	
	- nominal voltage of supply system:	690 V	
	- overvoltage category:	IV	
	- pollution degree:	3	
	- field-in or homogeneous:	Inhomogeneous	
	- minimum clearances (mm):	8 mm	
	- measured clearances (mm):	31,3 mm	P
	Creepage distances:		
	- rated insulation voltage Ui (V)	1000V	
	- pollution degree	3	
	- comparative tracking index (V)	175≤ CTI < 400	
	- material group	IIIa	
	- minimum creepage distances (mm)	16 mm	
	- measured creepage distances (mm)	32,9 mm	P
7.1.5 part 1	Actuator		
7.1.5.1 part 1	Insulation		
	The actuator of the equipment shall be insulated from the live parts for the rated insulation voltage and, if applicable, the rated impulse withstand voltage	Compliance	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If it is made of metal, it shall be capable of being satisfactorily connected to a protective conductor unless it is provided with additional reliable insulation	-	N/A
	If it is made of or covered by insulating material, any internal metal part, which might become accessible in the event of insulation failure, shall also be insulated from live parts for the rated insulation voltage	Compliance	P
7.1.5.2	Direction of movement		
	The direction of operation for actuators of devices shall normally conform to IEC 60447.	Compliance	P
	Where devices cannot conform to these requirements, e.g. due to special applications or alternative mounting positions, they shall be clearly marked such that there is no doubt as to the "I" and "O" positions and the direction of operation	Compliance	P
7.1.6 part 1	Indication of contact position		
7.1.6.1 part 1	Indicating means		
	When an equipment is provided with means for indicating the closed and open positions, these positions shall be unambiguous and clearly indicated	Compliance	P
	This is done by means of a position indicating device (see 2.3.18)	Compliance	P
	If symbols are used, they shall indicate the closed and open position respectively, in accordance with IEC 60417-2:		
	- 60417-2-IEC-5007 **I** On (power)	Compliance	P
	- 60417-2-IEC-5007 **O** Off (power)	Compliance	P
	For equipment operated by means of two push-buttons, only the push-button designated for the opening operation shall be red or marked with the symbol "O"	-	N/A
	Red colour shall not be used for any other push-button	-	N/A
	The colours of other push-buttons, illuminated push-buttons and indicator lights shall be in accordance with IEC 60073	-	N/A
7.1.6.2 part 1	Indication by the actuator		

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	When the actuator is used to indicate the position of the contacts, it shall automatically take up or stay, when released, in the position corresponding to that of the moving contacts; in this case, the actuator shall have two distinct rest positions corresponding to those of the moving contacts, but for automatic opening a third distinct position of the actuator may be provided	On position Off position Trip position	P
7.1.7	Additional safety requirements for equipment suitable for isolation		
7.1.7.1	Additional constructional requirements for equipment suitable for isolation (Ue > 50 V):		
	Equipment suitable for isolation shall provide in the open position an isolation distance in acc. with the requirements necessary to satisfy the isolating function. Indication of the main contacts shall be provide by one or more of the following means:		
	- the position of the actuator	Compliance	P
	- a separate mechanical indicator	-	N/A
	- visibility of the moving contacts	-	N/A
	When means are provided or to lock the equipment in the open position, locking only be possible when contacts are in the open position	-	N/A
	Actuator front-plate fitted to the equipment in a manner which ensures correct contact position indication and locking	-	N/A
	The indicated open position is the only position in which the specified isolation distances between the contacts is ensured.	Compliance	P
	- minimum clearances across open contacts (see Table XIII, Part 1) (mm) :	8 mm	
	- measured clearances (mm) :	31,3 mm	P
	- test Uimp across gap (kV) :	12,3 kV	P
7.1.7.2	Supplementary requirements for equipment with provision for electrical interlocking with contactors or circuit-breakers:		
	auxiliary switch shall be rated according to IEC 60 947-5-1	-	N/A
	If equipment suitable for isolation is provided with an auxiliary switch for the purpose of electrical interlocking with contactor (s) or circuit-breaker(s) and intended to be used in motor circuits, the following requirements shall apply unless the equipment is rated for AC-23 utilization category	-	N/A

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ВЯРНО С ОРИГИНАЛА

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The time interval between the opening of the contacts of the auxiliary switch and the contacts of the main poles shall be sufficient to ensure that the associated contactor or circuit-breaker interrupts the current before the main poles of the equipment open	-	N/A
	Unless otherwise stated in the manufacturer's technical literature, the time interval shall be not less than 20 ms when the equipment is operated according to the manufacturer instructions	-	N/A
	Compliance shall be verified by measuring the time interval between the instant of opening of the auxiliary switch and the instant of opening of the main poles under no-load conditions when the equipment is operated according to the manufacturer's instructions	-	N/A
	During the closing operation the contacts of the auxiliary switch shall close after or simultaneously with the contacts of the main poles	-	N/A
	A suitable opening time interval may also be provided by an intermediate position (between the ON and OFF position) at which the interlocking contact(s) is (are) open and the main poles remain closed	-	N/A
7.1.7.3	Supplementary requirements for equipment provided with means for padlocking the open position:		
	the locking means shall be designed in such a way that it cannot be removed with the appropriate padlock(s) installed	-	N/A
	Alternatively, the design may provide padlockable means to prevent access to the actuator	-	N/A
	test force F applied to the actuator in an attempt to operate to the closed position (N) :	-	N/A
	rated impulse withstand voltage (kV) :	-	N/A
	test Uimp on open main contacts at the test force	-	N/A
7.1.8	Terminals		
7.1.8.1	All parts of terminals which maintain contact and carry current shall be of metal having adequate mechanical strength	Compliance	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Terminal connections shall be such that necessary contact pressure is maintained	Compliance	P
	Terminals shall be so constructed that the conductor is clamped between suitable surfaces without damage to the conductor and terminal	Compliance	P
	Terminal shall not allow the conductor to be displaced or to be displaced themselves in a manner detrimental to the operator of equipment and the insulation voltage shall not be reduced below the rated value	Compliance	P
7.1.8.2	Connection capacity		
	type of conductors :	Flexible and stranded type/ Copper bars	P
	minimum cross-sectional area of conductor (mm^2) :	400 mm^2 or 2x(40 mm x 5 mm)	P
	maximum cross-sectional area of conductor (mm^2) :	1000 mm^2 or 2x(50 mmx10 mm)	P
	number of conductors simultaneously connectable to the terminal :	2	P
7.1.8.3	Connection		
	terminals for connection to external conductors shall be readily accessible during installation	Compliance	P
	clamping screws and nuts shall not serve to fix any other component	Compliance	P
7.1.8.4	Terminal identification and marking		
	terminal intended exclusively for the neutral conductor	N	P
	protective earth terminal	-	N/A
	other terminals	-	N/A
7.1.9 part 1	Additional requirements for equipment provided with a neutral pole		
	When equipment is provided with a pole intended only for connecting the neutral, this pole shall be clearly identified to that effect by the letter N (see 7.1.7.4.).	-	N/A
	A switched neutral pole shall break not before and shall make not after the other poles	-	N/A

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For equipment having a value of conventional thermal current (free air or enclosed, see 4.3.2.1 and 4.3.2.2) not exceeding 63 A, this value shall be identical for all poles	-	N/A
	For higher conventional thermal current values, the neutral pole may have a value of conventional thermal current different from that of the other poles, but not less than half that value or 63 A, whichever is the higher	-	N/A
	if a pole with an appropriate making and breaking capacity is used as a neutral pole, then all poles, incl. the neutral pole, shall operate substantially together.	-	N/A
7.1.10	Provisions for protective earthing		
7.1.10.1	The exposed conductive parts (e.g. chassis, framework and fixed parts of metal enclosures) other than those which cannot constitute a danger shall be electrically interconnected and connected to a protective earth terminal for connection to an earth electrode or to an external protective conductor	-	N/A
part 1	This requirement can be met by the normal structural parts providing adequate electrical continuity and applies whether the equipment is used on its own or incorporated in an assembly	-	N/A
	Exposed conductive parts are considered not to constitute a danger if they cannot be touched on large areas or grasped with the hand or if they are of small size (approximately 50 mm x 50 mm) or are so located as to exclude any contact with live parts	-	N/A
7.1.10.2 part 1	Protective earth terminal		
	The protective earth terminal shall be readily accessible and so placed that the connection of the equipment to the earth electrode or to the protective conductor is maintained when the cover or any other removable part is removed	-	N/A
	The protective earth terminal shall be suitably protected against corrosion	-	N/A
	In the case of equipment with conductive structures, enclosures, etc., means shall be provided, if necessary, to ensure electrical continuity between the exposed conductive parts the equipment and the metal sheathing of connecting conductors	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The protective earth terminal shall have no other function, except when it is intended to be connected to a PEN conductor (see 2.1.1.5 – Note). In this case, it shall also have the function of a neutral terminal in addition to meeting the requirements applicable to the protective earth terminal	-	N/A
7.1.10.3	Protective earth terminal marking and identification	-	
	The protective earth terminal shall be clearly and permanently identified by its marking	-	N/A
	The identification shall be achieved by colour (green-yellow mark) or by the notation PE, or PEN, as applicable, in accordance with IEC 60445, subclause 5.3, or, in the case of PEN, by a graphical symbol for use on equipment	-	N/A
	Graphical symbol to be used: 60417-2-IEC-5019 ⏚ Protective earth (ground) in accordance with IEC 60417-2	-	N/A
7.1.11	Enclosure for equipment		
7.1.11.1	Design		
	The enclosure, when it is opened: all parts requiring access for installation and maintenance are readily accessible	-	N/A
	Sufficient space shall be provided inside the enclosure	-	N/A
	The fixed parts of a metal enclosure shall be electrically connected to the other exposed conductive parts of the equipment and connected to a terminal which enables them to be earthed or connected to a protective conductor	-	N/A
	Under no circumstances shall a removable metal part of the enclosure be insulated from the part carrying the earth terminal when the removable part is in place	-	N/A
	The removable parts of the enclosure shall be firmly secured to the fixed parts by a device such that they cannot be accidentally loosened or detached owing to the effects of operation of the equipment or vibrations	-	N/A

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	When an enclosure is so designed as to allow the covers to be opened without the use of tools, means shall be provided to prevent loss of the fastening devices	-	N/A
	If the enclosure is used for mounting push-buttons, it shall not be possible to remove the buttons from the outside of the enclosure	-	N/A
7.1.11.2	Insulation		
	If, in order to prevent accidental contact between a metallic enclosure and live parts, the enclosure is partly or completely lined with insulating material, then this lining shall be securely fixed to the enclosure	-	N/A
7.1.12	Degree of protection of enclosed equipment		
	Degree of protection.	IP30	
	Test for first characteristic.	IP3X	
	Test for first numeral	1 2 3:Compliance 4 5 6	P
	Test for second characteristic	IPX0	
	Test for second numeral	1 2 3 4 5 6 7 8	P
7.1.13 part 1	Conduit pull-out, torque and bending with metallic conduits		
	Polymeric enclosures of equipment, whether integral or not, provided with threaded conduit entries, intended for the connection of extra heavy duty, rigid threaded metal conduits complying with IEC 60981, shall withstand the stresses occurring during its installation such as pull-out, torque, bending	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
7.2	Performance requirements		
7.2.1	Operating condition		
7.2.1.1	Closing		
	For a circuit-breaker to be closed safely on to the making current corresponding to its rated short-circuit making capacity, it is essential that it should be operated with the same speed and the same firmness as during the type test for proving the short-circuit making capacity	Compliance	P
7.2.1.1.1	Dependent manual closing		
	For a circuit-breaker having a dependent manual closing mechanism, it is not possible to assign a short-circuit making capacity rating irrespective of the conditions of mechanical operation	-	N/A
	Such a circuit-breaker should not be used in circuits having a prospective peak making current exceeding 10 kA	-	N/A
	However, this does not apply in the case of a circuit-breaker having a dependent manual closing mechanism and incorporating an integral fast-acting opening release which causes the circuit-breaker to break safely, irrespective of the speed and firmness with which it is closed on to prospective peak currents exceeding 10 kA; in this case, a rated short-circuit making capacity can be assigned	-	N/A
7.2.1.1.2	Independent manual closing		
	A circuit-breaker having an independent manual closing mechanism can be assigned a short-circuit making capacity rating irrespective of the conditions of mechanical operation	Compliance	P
7.2.1.1.3	Dependent power closing		
	At 110% of the rated control supply voltage, the closing operation performed on no-load shall not cause any damage to the circuit-breaker.	-	N/A
	At 85% of the rated control supply voltage, the closing operation shall be performed when the current established by the circuit-breaker is equal to its rated making capacity within the limits allowed by the operation of its relays or releases and, if a maximum time is stated for the closing operation, in a time not exceeding this maximum time limit.	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
7.2.1.1.4	Independent power closing		
	A circuit-breaker having an independent power closing operation can be assigned a rated short-circuit making capacity irrespective of the conditions of power closing	-	N/A
	Means for charging the operating mechanism, as well as the closing control components, shall be capable of operating in accordance with the manufacturer's specification	-	N/A
7.2.1.1.5	Stored energy closing		
	Capable ensuring closing of the circuit-breaker in any condition between no-load and its rated making capacity	-	N/A
	- when the stored energy is retained within the circuit-breaker, a device is provided which indicates when the storing mechanism is fully charged.	-	N/A
	- means for charging the operating mechanism and closing control components operates when auxiliary supply voltage is between 85% and 110% of the rated control supply voltage.	-	N/A
	- not possible for the moving contacts to move from the open position, unless the charge is sufficient for satisfactory completion of the closing operation.	-	N/A
	- by manually operated circuit-breaker is the direction of operation indicated. (not for circuit-breaker with an independent manual closing operation.)	-	N/A
	- For trip free circuit-breaker it shall not be possible to maintain the contacts in the touching or closed position when the release is in the position to trip the circuit-breaker.	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
7.2.1.2	Opening		
7.2.1.2.1	Circuit-breakers which open automatically shall be trip-free and, unless otherwise agreed between manufacturer and user, shall have their energy for the tripping operation stored prior to the completion of the closing operation		
7.2.1.2.2	Opening by undervoltage releases		
7.2.1.3. a part 1	Operating voltage		
	An under-voltage relay or release, when associated with a switching device, shall operate to open the equipment even on a slowly falling voltage within the range between 70% and 35% of its rated voltage	-	N/A
	An under-voltage relay or release shall prevent the closing of the equipment when the supply voltage is below 35% of the rated voltage of the relay or release; it shall permit closing of the equipment at supply voltages equal to or above 85% of its rated value	-	N/A
	Unless otherwise stated in the relevant product standard, the upper limit of the supply voltage shall be 110% of its rated value	-	N/A
7.2.1.3. b part 1	Operating time		
	For a time-delay under-voltage relay or release, the time-lag shall be measured from the instant when the voltage reaches the operating value until the instant when the relay or release actuates the tripping device of the equipment	-	N/A
7.2.1.2.3	Opening by shunt releases	-	N/A
7.2.1.4 part 1	Limits of operation of shunt releases		
	A shunt release for opening shall cause tripping under all operating conditions of an equipment when the supply voltage of the shunt release measured during the tripping operation remains between 70% and 110% of the rated control supply voltage and, if a.c., at the rated frequency	-	N/A
7.2.1.5 part 1	Limits of operation of current operated relays and released		
	Limits of operation of current operated relays and releases shall be stated in the relevant product standard	-	N/A

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ВЯРНО С ОРИГИНАЛА

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
7.2.1.2.4	Opening by over-current releases		
a)	Opening under short-circuit conditions		
	The short-circuit release shall cause tripping of the circuit-breaker with an accuracy of 20% of the tripping current value of the current setting for all values of the current setting of the short-circuit current release	Compliance	P
	Where necessary for over-current co-ordination the manufacturer shall provide information (usually curves) showing	Compliance	P
	- maximum cut-off (let-through) peak current as a function of prospective current (r.m.s. symmetrical)	Compliance	P
	- I^2t characteristics for circuit-breakers of utilization category A and, if applicable, B for circuit-breakers with instantaneous override (see note to 8.3.5)	Compliance	P
b)	Opening under overload conditions		
1)	Instantaneous or definite time-delay operation	-	N/A
	The release shall cause tripping of the circuit-breaker with an accuracy of ± 10% of the tripping current value of the current setting for all values of current setting of the overload release	-	N/A
2)	Inverse time-delay operation		
	At the reference temperature and at 1,05 times the current setting with the conventional non-tripping current, the opening release being energized on all poles, tripping shall not occur in less than the conventional time from the cold state, i.e. with the circuit-breaker at the reference temperature	Compliance	P
	Moreover, when at the end of the conventional time the value of current is immediately raised to 1,30 times the current setting, i.e. with the conventional tripping current, tripping shall then occur in less than the conventional time later	Compliance	P
	If a release is declared by the manufacturer as substantially independent of ambient temperature, the current values of table 6 shall apply within the temperature band declared by the manufacturer, within a tolerance of 0,3%/K	Compliance	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The width of the temperature band shall be at least 10 K on either side of the reference temperature	Compliance	P
7.2.4.2	Operational performance capability		
7.2.4.2 part 1	The operational performance off-load for which the tests are made with the control circuits energized and the main circuit not energized, in order to demonstrate that the equipment meets the operating conditions specified at the upper and lower limits of supply voltage and/or pressure specified for the control circuit during closing and opening operations	Compliance	P
	The operational performance on-load during which the equipment shall make and break the specified current corresponding, where relevant, to its utilization category for the number of operations stated in the relevant product standard	Compliance	P
8	TESTS		
8.2.4	Mechanical properties of terminals		
	Mechanical strength of terminals		
	maximum cross-sectional area of conductor (mm^2) :	-	
	diameter of thread (mm) :	-	
	torque (Nm) :	-	
	5 times on 2 separate clamping units	-	-
	Testing for damage to and accidental loosening of conductor (flexion test)		
	conductor of the smallest cross-sectional area (mm^2) :	-	
	number of conductors of the smallest cross section :	-	
	diameter of bushing hole (mm) :	-	
	height between the equipment and the platen :	-	
	mass at the conductor(s) (kg) :	-	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit	-	N/A
	Pull-out test		
	force (N) :	-	

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit	-	N/A
	conductor of the largest cross-sectional area (mm^2) :	-	
	number of conductors of the largest cross section :	-	
	diameter of bushing hole (mm) :	-	
	height between the equipment and the platen :		
	mass at the conductor(s) (kg) :	-	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit	-	N/A
	Pull-out test		
	force (N) :	-	
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit	-	N/A
	conductor of the largest and smallest cross-sectional area (mm^2) :	-	
	number of conductors of the smallest cross section, number of conductors of the largest cross section :	-	
	diameter of bushing hole (mm) :	-	
	height between the equipment and the platen :	-	
	mass at the conductor(s) (kg) :	-	
	135 continuous revolutions: the conductor shall neither slip out of the terminal nor break near the clamping unit	-	N/A
	Pull-out test		
	force (N) :	-	
	1 min, the conductor shall neither slip out of the terminal nor break near the clamping unit	-	N/A

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ВЯРНО С ОРИГИНАЛА

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.3	TEST SEQUENCE I: GENERAL PERFORMANCE CHARACTERISTICS		
8.3.3.1	Tripping limits and characteristic		
8.3.3.1.2	Opening under short-circuit conditions		
	Manufacturer's name or trademark	LS	
	Type designation or serial number	TS1600H 3P	
	Sample no:	S1-1	
	Rated operational voltage: Ue (V)	690 V	
	Rated current: In (A)	1600 A	
	Ambient temperature 10-40 °C :	25 °C	P
	Value of the tripping current declared by the manufacturer for a single pole, at which value they shall operate.	3840 A(Ii=2XIn) 28800 A(Ii=15XIn)	P
	Range of adjustable setting current. (A)	Compliance	P
	Time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Electromagnetic overcurrent releases	-	
	Test current: 80% of the rated, or **minimum** adjustable setting current: (A)	-	N/A
	Operating time: >0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: 120% of the rated, or **minimum** adjustable setting current: (A)	-	N/A
	Operating time: <0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: 80% of the **maximum** adjustable setting current: (A)	-	N/A
	Operating time: >0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: 120% of the **maximum** adjustable setting current: (A)	Compliance	P
	Operating time: <0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: tripping current declared for single pole operation (A)	-	N/A
	Operating time: < 0,2 s in case of instantaneous release: L1: L2: L3: N:	-	N/A
	Operating time: < twice time delay stated by manufacturer in case of definite time delay releases L1: L2: L3: N:	-	N/A
	Electronic overcurrent releases		

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For circuit-breakers with an electronic overcurrent release, the operation of the short-circuit releases shall be verified by one test only on each pole individually.	Compliance	P
	Test current: 80% of the rated, or **minimum** adjustable setting current: (A)	2560 A	P
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: >0,2 s L2: >0,2 s L3: >0,2 s	P
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Test current: 120% of the rated, or **minimum** adjustable setting current: (A)	3840 A	P
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: 0,048 s L2: 0,049 s L3: 0,048 s	P
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Test current: 80% of the **maximum** adjustable setting current: (A)	19200 A	P
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: >0,2 s L2: >0,2 s L3: >0,2 s	P
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Test current: 120% of the **maximum** adjustable setting current: (A)	28800 A	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: 0,051 s L2: 0,052 s L2: 0,051 s	P
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Electronic overcurrent releases		
	For circuit-breakers with an electronic overcurrent release, the operation of the short-circuit releases shall be verified by one test only on each pole individually.	Compliance	P
	Test current: 80% of the rated, or **minimum** adjustable setting current: (A)	768 A(Isd=1,5X0,4XIn)	P
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	L1: >0,1 s L2: >0,1 s L3: >0,1 s	P
	Test current: 120% of the rated, or **minimum** adjustable setting current: (A)	1152 A(Isd=1,5X0,4XIn)	P
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	L1: 0,068 s L2: 0,068 s L3: 0,063 s	P
	Test current: 80% of the **maximum** adjustable setting current: (A)	12800 A(Isd=10X1,0XIn)	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	- 	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	 L1: >0,8 s L2: >0,8 s L3: >0,8 s 	N/A
	Test current: 120% of the **maximum** adjustable setting current: (A)	19200 A(Isd=10X1,0XIn)	P
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	 - 	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	 L1: 0,417 s L2: 0,417 s L3: 0,417 s 	P
8.3.3.1.3	Opening under overload conditions		
a)	Instantaneous or definite time-delay releases		
	Manufacturer's name or trademark		
	Type designation or serial number		
	Sample no:		
	Rated operational voltage: Ue (V)		
	Rated current: In (A)		
	Ambient temperature 10-40 °C :	-	N/A
	Value of the tripping current declared by the manufacturer for a single pole, at which value they shall operate.	-	N/A
	Range of adjustable setting current. (A)	-	N/A
	Time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Test current: 90% of the rated, or minimum adjustable setting current: (A)	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time: >0,2s in case of instantaneous releases:	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Test current: 90% of the maximum adjustable setting current: (A)	-	N/A
	Operating time: >0,2s in case of instantaneous releases	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Test current: 110% of the rated, or minimum adjustable setting current: (A) circuit-breaker with neutral pole: 1,2x110% (A)	-	N/A
	Operating time: <0,2s in case of instantaneous releases:	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Test current: 110% of the maximum adjustable setting current: (A) circuit-breaker with neutral pole: 1,2x110% (A)	-	N/A
	Operating time: <0,2s in case of instantaneous releases	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
b)	Inverse time delay releases		
	Manufacturer's name or trademark	LS	
	Type designation or serial number	TS1600H 3P	
	Sample no:	S1-1	
	Rated operational voltage: Ue (V)	690 V	
	Rated current: In (A)	1600 A	
	For releases dependent of ambient air temperature: Reference temperature	-	N/A
	Test ambient temperature (°C)	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For releases dependent on ambient air temperature, the operating characteristics shall be verified at the reference temperature, the release being energized on all phase poles. If the test made at a different ambient temperature, a correction shall be made in accordance with the manufacturer's correction temperature/current data	-	N/A
	For thermal-magnetic releases independent of ambient temperature: Tests shall be made at 30°C and 20°C or 40°C, the release being energized on all phase poles	-	N/A
	For electronic releases, the operating characteristic shall be verified at the ambient temperature of the test room (see 6.1.1 of IEC 60947-1), the release being energised on all phase poles.	Compliance	P
	Test ambient air temperature:	25 °C	P
	Range of adjustable setting current: (A)	0,4~1,0 x In	P
	Releases, dependent of ambient air temperature: Reference temperature (°C)	-	N/A
	Thermal Magnetic releases, independent of ambient air temperature: at 30°C	-	N/A
	Test current: 105% of the rated, or **minimum** adjustable setting current: (A)	672 A (Ir=0,4XIn)	P
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	2 h	P
	Test current: 130% of the rated, or **minimum** adjustable setting current: (A)	832 A (Ir=0,4XIn)	P
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	-	N/A
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	4 s	P
	Test current: 105% of the **maximum** adjustable setting current: (A)	1680 A (Ir=1,0XIn)	P
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	2 h	P
	Test current: 130% of the **maximum** adjustable setting current: (A)	2080 A (Ir=1,0XIn)	P
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	247 s	P
	Thermal Magnetic releases, independent of ambient air temperature: at 20°C or 40°C		
	Test ambient air temperature:	-	N/A
	Test current: 105% of the rated, or **minimum** adjustable setting current: (A)	-	N/A
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	-	N/A
	Test current: 130% of the rated, or **minimum** adjustable setting current: (A)	-	N/A
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	-	N/A
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	-	N/A
	Test current: 105% of the **maximum** adjustable setting current: (A)	-	N/A
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	-	N/A
	Test current: 130% of the **maximum** adjustable setting current: (A)	-	N/A
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	-	N/A
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	-	N/A
	An additional test, at a current specified by the manufacturer to verify the time/current characteristic of the releases conform to the curves provided by the manufacturer		
	Releases, dependent of ambient air temperature: Reference temperature (°C)	-	N/A
	Releases, independent of ambient air temperature: at 30°C	Compliance	P
	Test ambient air temperature:	25 °C	N/A
	Test current: at current specified by the manufacturer to verify the time/current characteristic of the releases conform to the curves provided by the manufacturer. % at the rated, or minimum adjustable setting current: (% or A)	1920 A (0,4 In X 300 %) 4800 A (1,0 In X 300 %)	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Tripping time acc. time/current characteristic of the releases conform to the curves provided by the manufacturer. (within the stated tolerances)	2 s (0,4 In) 88 s (1,0 In)	P
	Releases, independent of ambient air temperature: at 20°C or 40°C		
	Test ambient air temperature:	-	N/A
	Test current: at current specified by the manufacturer to verify the time/current characteristic of the releases conform to the curves provided by the manufacturer. % at the rated, or minimum adjustable setting current: (% or A)	-	N/A
	Tripping time acc. time/current characteristic of the releases conform to the curves provided by the manufacturer. (within the stated tolerances)	-	N/A
8.3.3.1.4	Additional test for definite time-delay releases		
a)	Time delay		
	Test is made at a current equal to 1,5 times the current setting. If the test current overlaps with another tripping characteristic (e.g. an instantaneous tripping characteristic), the trip setting and the test current shall be reduced as necessary to prevent premature tripping.		
	overload releases: (all phase poles loaded)	-	N/A
	for circuit-breakers having an identified neutral pole provided with an overload release, the test current for this release shall be 1,5 times the current setting;	-	N/A
	short-circuit releases	Compliance	P
	Electromagnetic release: two poles in series carrying the test current, using successively all possible combinations of poles having a short-circuit release.	-	N/A
	Electronic releases: on one pole chosen at random.	Compliance	P
	Test current: 1,5 times of the rated, or **minimum** adjustable setting current: (A)	1440 A (Isd=1,5X0,4XIn)	P
	Operating time, overload releases: (s)	-	N/A
	Time-delay: between the limits stated by the manufacturer:	-	N/A
	Operating time, short-circuit releases (electromagnetic): (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Time-delay: between the limits stated by the manufacturer:	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time, short-circuit releases (electronic): (s) L1: L2: L3:	 L1:0,069 s L2:0,060 s L3:0,063 s	P
	Time-delay: between the limits stated by the manufacturer:	0,025 s ~ 0,08 s	P
	Test current: 1,5 times of the **maximum** adjustable setting current: (A)	24000 A (Isd=10X1,0XIn)	P
	Operating time, overload releases: (s)	-	N/A
	Time-delay: between the limits stated by the manufacturer:	-	N/A
	Operating time, short-circuit releases (electromagnetic): (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Time-delay: between the limits stated by the manufacturer:	-	N/A
	Operating time, short-circuit releases (electronic): (s) L1: L2: L3:	 L1:0,417 s L2:0,418 s L3:0,418 s	P
	Time-delay: between the limits stated by the manufacturer:	0,36 ~ 0,44 s	P
b)	Non-tripping duration		
	Firstly, the test current equal to 1,5 times the current setting is maintained for a time interval equal to the non-tripping duration stated by the manufacturer.		
	Then, the current is reduced to the rated current and maintained at this value for twice the time-delay stated by the manufacturer. The circuit-breaker shall not trip.		
	overload releases: (all phase poles loaded)	-	N/A
	for circuit-breakers having an identified neutral pole provided with an overload release, the test current for this release shall be 1,5 times the current setting;	-	N/A
	short-circuit releases	Compliance	P
	Electromagnetic release: two poles in series carrying the test current, using successively all possible combinations of poles having a short-circuit release.	-	N/A
	Electronic releases: on one pole chosen at random.	Compliance	P
	Test current: 1,5 times of the **minimum** adjustable setting current: (A)	1440 A (Isd=1,5X0,4XIn)	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	non-tripping duration stated by the manufacturer for overload release: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release thermal magnetic: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release electronic: (s)	0,025 s	P
	Time duration of current when reduced to the rated current: shall be twice the delay-time stated by the manufacturer: (s)	0,1 s	P
	Rated current	640 A (Ir=0,4XIn)	P
	Operating time, overload releases: the circuit-breaker does not trip:	-	N/A
	Operating time, short-circuit releases (electromagnetic), shall not trip: (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Operating time, short-circuit releases (electronic), shall not trip: (s) L1: L2: L3:	L1: >0,1 s L2: >0,1 s L3: >0,1 s	P
	Test current: 1,5 times of **maximum** adjustable setting current: (A)	24000 A (Isd=10X1,0XIn)	P
	non-tripping duration stated by the manufacturer for overload release: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release thermal magnetic: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release electronic: (s)	0,2 s	P
	Time duration of current when reduced to the rated current: shall be twice the delay-time stated by the manufacturer: (s)	0,8 s	P
	Rated current	1600 A (Ir=1,0XIn)	P
	Operating time, overload releases: the circuit-breaker does not trip:	-	N/A
	Operating time, short-circuit releases (electromagnetic), shall not trip: (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Operating time, short-circuit releases (electronic), shall not trip: (s) L1: L2: L3:	L1: >0,8 s L2: >0,8 s L3: >0,8 s	P

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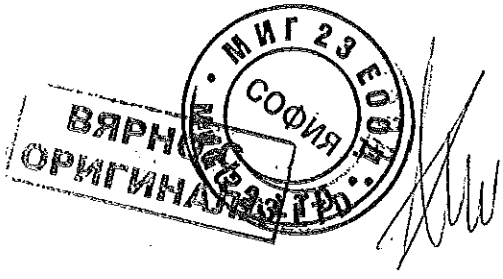
IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.3.2	Test of dielectric properties, impulse withstand voltage (Uimp indicated):		
8.3.3.4 part1	The 1,2/50µs impulse voltage shall be applied five times for each polarity at intervals of 1s minimum		
	- rated impulse withstand voltage (kV) :	8 kV	P
	- sea level of the laboratory:	60 m	P
	- test Uimp main circuits (kV) :	9,8 kV	P
	- test Uimp auxiliary circuits (kV) :	-	N/A
	- test Uimp control circuits (kV) :	-	N/A
	- test Uimp on open main contacts (equipment suitable for isolating) (kV) :	12,3 kV	P
a)	Application of test voltage		
	i) Between all terminals of the main circuit connected together (incl. control and auxiliary circuits connected to the main circuit) and the enclosure or mounting plate, with the contacts in all normal positions of operation.	Compliance	P
	ii) Between each pole of the main circuit and the other poles connected together and to the enclosure or mounting plate, with the contacts in all normal positions of operation.	Compliance	P
	iii) Between each control and auxiliary circuit not normally connected to the main circuit and: - the main circuit	Compliance	P
	- other circuits	-	N/A
	- exposed conductive parts	-	N/A
	- enclosure of mounting plate	-	N/A
	iv) equipment suitable for isolation	Compliance	P
	equipment not suitable for isolation	-	N/A
	- no unintentional disruptive discharge during the test's	Compliance	P
	Test of dielectric properties, dielectric withstand voltage (Uimp not indicated):		
	- rated insulation voltage (V) :	1000 V	P
	- main circuits, test voltage for 1 min (V)	2200 V	P
	- auxiliary circuits, test voltage for 1 min (V)	-	N/A
	- control circuits, test voltage for 1 min (V)	-	N/A



IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.3.2.2	Application of test voltage		
1)	with circuit-breaker in the closed position		
	- between all live parts of all poles connected together and the frame of the circuit-breaker .	Compliance	P
	- between each pole and all the other poles connected to the frame of the circuit-breaker	Compliance	P
2)	with the circuit-breaker in the open position and, additionally, in the tripped position, if any.		
	- between all live parts of all poles connected together and the frame of the circuit-breaker.	Compliance	P
	- between the terminals of one side connected together and the terminals of the other side connected together.	Compliance	P
b)	Control and auxiliary circuits		
1)	- between all the control and auxiliary circuits which are not normally connected to the main circuit, connected together, and the frame of the circuit-breaker.	-	N/A
2)	- where appropriate, between each part of the control an auxiliary circuits which may be isolated from the other parts during normal operation and all the other parts connected together.	-	N/A
	No unintentional disruptive discharge during the tests	Compliance	P
8.3.3.2	For circuit-breaker suitable for isolation, the leakage current shall be measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue, and shall not exceed 0,5mA.	≤ 0,01 mA./ 759 V	P
8.3.3.3	Mechanical operation and operational performance capability		
8.3.3.3.2	Construction and mechanical operation		
a)	Construction		
	A withdrawable circuit-breaker shall be checked for the requirements stated in 7.1.1	-	N/A
	A circuit-breaker with stored energy operation shall be checked for compliance with 7.2.1.1.5, regarding the charge indicator and the direction of operation of manual energy storing	-	N/A
b)	Mechanical operation		
	A circuit-breaker with dependent power operation shall comply with the requirements stated in 7.2.1.1.3	-	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	A circuit-breaker with dependent power operation shall operate with the operating mechanism charged to the minimum and maximum limits stated by the manufacturer	-	N/A
	A circuit-breaker with stored energy operation shall comply with the requirements stated in 7.2.1.5 with the auxiliary supply voltage at 85% and 110% of the rated control supply voltage.	-	N/A
	It shall also be verified that the moving contacts cannot be moved from the open position when the operating mechanism is charged to slightly below the full charge as evidenced by the indicating device	-	N/A
	For a trip-free circuit-breaker it shall not be possible to maintain the contacts in the touching or closed position when the tripping release is in the position to trip the circuit-breaker	-	N/A
	If the closing and opening times of a circuit-breaker are stated by the manufacturer, such times shall comply with the stated values	-	N/A
c)	Undervoltage releases		
	Undervoltage releases shall comply with the requirements of 7.2.1.3 of Part 1. For this purpose, the release shall be fitted to a circuit-breaker having the maximum current rating for which the release is suitable	-	N/A
i)	Drop out voltage		
	It shall be verified that the release operates to open the circuit-breaker between the voltage limits specified	-	N/A
	The voltage shall be reduced from rated voltage at a rate to reach 0 V in approximately 30 s	-	N/A
	The test for the lower limit is made without current in the main circuit and without previous heating of the release coil	-	N/A
	In the case of a release with a range of rated voltages, this test applies to the maximum voltage of the range	-	N/A
	The test for the upper limit is made starting from a constant temperature corresponding to the application of rated control supply voltage to the release and rated current in the main poles of the circuit-breaker	-	N/A
	This test may be combined with the temperature-rise test of 8.3.3.6	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	In the case of a release with a range of rated voltages, this test is made at both the minimum and maximum rated control supply voltages	-	N/A
ii)	Test for limits of operation		
	Starting with the circuit-breaker open, at the temperature of the test room, and with the supply voltage at 30% rated maximum control supply voltage, it shall be verified that the circuit-breaker cannot be closed by the operation of the actuator	-	N/A
	When the supply voltage is raised to 85% of the minimum control supply voltage, it shall be verified that the circuit-breaker can be closed by the operation of the actuator	-	N/A
iii)	Performance under overvoltage conditions		
	With the circuit-breaker closed and without current in the main circuit, it shall be verified that the undervoltage release will withstand the application of 110% rated control supply voltage for 4 h without impairing its functions	-	N/A
d)	Shunt releases		
	Shunt releases shall comply with the requirements of 7.2.1.4 of Part 1. For this purpose, the release shall be fitted to a circuit-breaker having the maximum rated current for which the release is suitable	-	N/A
	It shall be verified that the release will operate to open the circuit-breaker at 70% rated control supply voltage when tested at an ambient temperature of + 55 °C ± 2 °C without current in the main poles of the circuit-breaker	-	N/A
	In the case of a release having a range of rated control supply voltages, the test voltage shall be 70% of the minimum rated control supply voltage	-	N/A
8.3.3.3.3	Operational performance capability without current.		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S1-1	
	Rated current In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt releases: Uc (V)		

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Rated control supply voltage undervoltage releases: Uc (V)		
	Ambient temperature 10-40 °C :	25 °C	P
	Number of operating cycles per hour	20 Cycles per hour	P
	Number of cycles without current (total) (closing mechanism energized at the rated Uc)	-	N/A
	Number of cycles without current (without releases)	2500 Cycles	P
	Applied voltage: closing mechanism (V)	-	N/A
	10% of total cycles for circuit-breaker with fitted shunt release: (50% at the beginning- and 50% at the end of the test.) Energized at the rated Uc	-	N/A
	Applied voltage: shunt releases (V)	-	N/A
	10% of total cycles for circuit-breaker with undervoltage releases: (50% at the beginning- and 50% at the end of the test.) Energized at the minimum rated Uc	-	N/A
	10 cycles without applied voltage at the undervoltage releases. (Shall not possible to close the circuit-breaker.)	-	N/A
	Applied voltage: undervoltage releases (V)	-	N/A
	Electrical components do not exceed the value indicated in tab. 7.	Compliance	P
8.3.3.3.4	Operational performance capability with current.		
	Rated current: In (A)	1600 A	
	Maximum rated operational voltage: Ue (V)	690 V	
	Conductor cross-sectional area (mm²) :	500 mm² X 2	P
	Number of operating cycles per hour	20 Cycles per hour	P
	Number of cycles with current (total) (closing mechanism energized at the rated Uc)	500 Cycles	P
	Applied voltage: closing mechanism (V)	-	N/A
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload setting at maximum and short-circuit setting at minimum.	Compliance	P
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,0 (V) ..... L1: ..... L2: L3:	L1: 691,8 V L2: 700,8 V L3: 708,3 V	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- test current I/Ie = 1,0 (A)..... L1: ..... L2: L3:	L1: 1618 A L2: 1625 A L3: 1602 A	P
	- power factor/time constant:	0,73	P
	- frequency: (Hz)	60 Hz	P
	- on-time (ms):	1000 ms	P
	- off-time (s):	179 s	P
	Electrical components do not exceed the value indicated in tab. 7.	Compliance	P
8.3.3.3.5	Additional test of operational performance capability without current for withdrawable circuit-breaker.		
	Number of operations cycles : 100	-	N/A
	After test, the isolating contacts, withdrawable mechanism and interlocks shall be suitable for further service.	-	N/A
8.3.3.4	Overload performance		
	this test applies to circuit-breaker of rated current up to and including 630 A		
	Type designation or serial number		
	Sample no:		
	Rated current In (A)		
	Rated operational voltage: Ue (V)		
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt releases: Uc (V)		
	Rated control supply voltage undervoltage releases: Uc (V)		
	Ambient temperature 10-40 °C :	-	N/A
	Number of operating cycles per hour	-	N/A
	Maximum rated operational voltage: Ue (V)	-	N/A
	Number of operating cycles per hour	-	N/A
	Number of cycles with current (total) (closing mechanism energized at the rated Uc)	-	N/A
	Applied voltage: closing mechanism (V)	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload/short-circuit settings at maximum.	-	N/A
	Conditions, overload operations:		
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	-	N/A
	- test current AC/DC: I/Ie = 6,0/2.5 (A) ..... L1: ..... L2: L3:	-	N/A
	- power factor/time constant:	-	N/A
	- Number of cycles manually opened: 9	-	N/A
	- Number of cycles automatically opened by an overload release: 3	-	N/A
	- frequency: (Hz)	-	N/A
	- on-time max 2s:	-	N/A
8.3.3.5	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1380 V	P
	- no breakdown or flashover	No	P
	For circuit-breaker suitable for isolation, the leakage current shall be measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue, and shall not exceed 2 mA.	≤ 0,02 mA / 759 V	P
8.3.3.6	Verification of temperature-rise		
****	- the values of temperature-rise do not exceed those specified in tab. 7.	See table S1-1 (3P)	P
	Temperature rise of main circuit terminals ≤ 80 K (K) :	≤ 73,3 K	P
	conductor cross-sectional area (mm²) :	500 mm² x 2	P
	test current Ie (A) :	1600 A	P
8.3.3.7	Verification of overload releases		
	Test current: 1.45 times the value of their current setting at the reference temperature: (A)	2320 A	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	542 s	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.3.8	Verification of undervoltage and shunt releases		
	Circuit-breaker fitted with undervoltage releases. The release shall not operate at 70% of the minimum control supply voltage -	-	N/A
	and shall operate at 35% of the maximum control supply voltage.	-	N/A
	Circuit-breaker fitted with shunt releases. The release shall operate at 70% of the minimum rated control supply voltage. Test made at room temperature.	-	N/A
8.3.3.9	Verification of the main contact position for circuit-breakers for isolation		
	actuating force for opening (N) .....:	206 N	—
	test force with blocked main contacts for 10 s (N) .:	618 N	—
	Dependent power operation	-	N/A
	Supply voltage of 110% of rated voltage (V).....:	-	N/A
	Three attempts of 5 s to operate the equipment at intervals of 5 min.	-	N/A
	Independent power operation	-	N/A
	Three attempts to operate the equipment by the stored energy.	-	N/A
	Lock ability of driving mechanism in OFF-position at test force and blocked main contacts .....:	-	N/A
	Position indicator does not show OFF-position after capture of test force at blocked main contacts	Compliance	P

8.3.3	TEST SEQUENCE I: GENERAL PERFORMANCE CHARACTERISTICS		
8.3.3.1	Tripping limits and characteristic		
8.3.3.1.2	Opening under short-circuit conditions		
	Manufacturer's name or trademark	LS	
	Type designation or serial number	TS1600H 4P	
	Sample no:	S1-1	
	Rated operational voltage: Ue (V)	690 V	
	Rated current: In (A)	1600 A	
	Ambient temperature 10-40 °C :	25 °C	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Value of the tripping current declared by the manufacturer for a single pole, at which value they shall operate.	3840 A(Ii=2XIn) 28800 A(Ii=15XIn)	P
	Range of adjustable setting current. (A)	Compliance	P
	Time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Electromagnetic overcurrent releases		
	Test current: 80% of the rated, or **minimum** adjustable setting current: (A)	-	N/A
	Operating time: >0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: 120% of the rated, or **minimum** adjustable setting current: (A)	-	N/A
	Operating time: <0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: 80% of the **maximum** adjustable setting current: (A)	-	N/A
	Operating time: >0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: 120% of the **maximum** adjustable setting current: (A)	Compliance	P
	Operating time: <0,2s in case of instantaneous releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1-L2: L1-L3: L2-L3: N-Lx:	-	N/A
	Test current: tripping current declared for single pole operation (A)	-	N/A
	Operating time: < 0,2 s in case of instantaneous release: L1: L2: L3: N:	-	N/A
	Operating time: < twice time delay stated by manufacturer in case of definite time delay releases L1: L2: L3: N:	-	N/A
	Electronic overcurrent releases		
	For circuit-breakers with an electronic overcurrent release, the operation of the short-circuit releases shall be verified by one test only on each pole individually.	Compliance	P
	Test current: 80% of the rated, or **minimum** adjustable setting current: (A)	2560 A(Ii=2XIn)	P
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: >0,2 s L2: >0,2 s L3: >0,2 s	P

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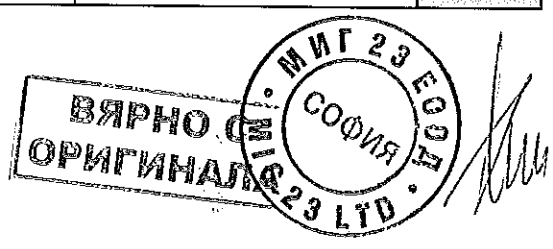
IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Test current: 120% of the rated, or **minimum** adjustable setting current: (A)	3840 A(Ii=2XIn)	P
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: 0,050 s L2: 0,049 s L3: 0,049 s	P
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Test current: 80% of the **maximum** adjustable setting current: (A)	19200 A(Ii=15XIn)	P
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: >0,2 s L2: >0,2 s L3: >0,2 s	P
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Test current: 120% of the **maximum** adjustable setting current: (A)	28800 A(Ii=15XIn)	P
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	L1: 0,050 s L2: 0,050 s L2: 0,049 s	P
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	-	N/A
	Electronic overcurrent releases		



IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For circuit-breakers with an electronic overcurrent release, the operation of the short-circuit releases shall be verified by one test only on each pole individually.	Compliance	P
	Test current: 80% of the rated, or **minimum** adjustable setting current: (A)	768 A(Isd=1,5X0,4XIn)	P
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	- 	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	 L1: >0,1 s L2: >0,1 s L3: >0,1 s 	P
	Test current: 120% of the rated, or **minimum** adjustable setting current: (A)	1152 A(Isd=1,5X0,4XIn)	P
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	- 	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	 L1: 0,068 s L2: 0,072 s L3: 0,065 s 	P
	Test current: 80% of the **maximum** adjustable setting current: (A)	12800 A(Isd=10X1,0XIn)	P
	Operating time: >0,2s in case of instantaneous releases: L1: L2: L3: N:	- 	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	 L1: >0,8 s L2: >0,8 s L3: >0,8 s 	N/A
	Test current: 120% of the **maximum** adjustable setting current: (A)	19200 A(Isd=10X1,0XIn)	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Operating time: <0,2s in case of instantaneous releases: L1: L2: L3: N:	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases: L1: L2: L3: N:	L1: 0,418 s L2: 0,418 s L3: 0,418 s	P
8.3.3.1.3	Opening under overload conditions		
a)	Instantaneous or definite time-delay releases		
	Manufacturer's name or trademark		
	Type designation or serial number		
	Sample no:		
	Rated operational voltage: Ue (V)		
	Rated current: In (A)		
	Ambient temperature 10-40 °C :	-	N/A
	Value of the tripping current declared by the manufacturer for a single pole, at which value they shall operate.	-	N/A
	Range of adjustable setting current. (A)	-	N/A
	Time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Test current: 90% of the rated, or minimum adjustable setting current: (A)	-	N/A
	Operating time: >0,2s in case of instantaneous releases:	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Test current: 90% of the maximum adjustable setting current: (A)	-	N/A
	Operating time: >0,2s in case of instantaneous releases	-	N/A
	Operating time: > twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A

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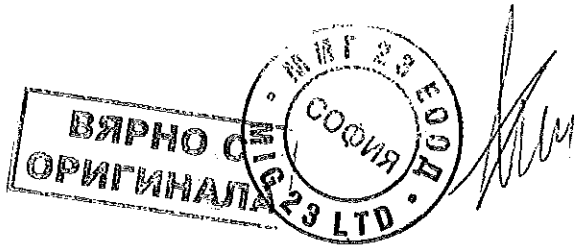

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Test current: 110% of the rated, or minimum adjustable setting current: (A) circuit-breaker with neutral pole: 1,2x110% (A)	-	N/A
	Operating time: <0,2s in case of instantaneous releases:	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
	Test current: 110% of the maximum adjustable setting current: (A) circuit-breaker with neutral pole: 1,2x110% (A)	-	N/A
	Operating time: <0,2s in case of instantaneous releases	-	N/A
	Operating time: < twice time delay stated by the manufacturer, in the case of definite time delay releases.	-	N/A
b)	Inverse time delay releases		
	Manufacturer's name or trademark	LS	
	Type designation or serial number	TS1600H 4P	
	Sample no:	S1-1	
	Rated operational voltage: Ue (V)	690 V	
	Rated current: In (A)	1600 A	
	For releases dependent of ambient air temperature: Reference temperature	-	N/A
	Test ambient temperature (°C)	-	N/A
	For releases dependent on ambient air temperature, the operating characteristics shall be verified at the reference temperature, the release being energized on all phase poles. If the test made at a different ambient temperature, a correction shall be made in accordance with the manufacturer's correction temperature/current data	-	N/A
	For thermal-magnetic releases independent of ambient temperature: Tests shall be made at 30°C and 20°C or 40°C, the release being energized on all phase poles	-	N/A
	For electronic releases, the operating characteristic shall be verified at the ambient temperature of the test room (see 6.1.1 of IEC 60947-1), the release being energised on all phase poles.	Compliance	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Test ambient air temperature:	25 °C	P
	Range of adjustable setting current: (A)	0,4~1,0 x In	P
	Releases, dependent of ambient air temperature: Reference temperature (°C)	-	N/A
	Thermal Magnetic releases, independent of ambient air temperature: at 30°C	-	N/A
	Test current: 105% of the rated, or **minimum** adjustable setting current: (A)	672 A (Ir=0,4XIn)	P
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	2 h	P
	Test current: 130% of the rated, or **minimum** adjustable setting current: (A)	832 A (Ir=0,4XIn)	P
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	998 A (Ir=0,4XIn)	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	5 s / 5 s	P
	Test current: 105% of the **maximum** adjustable setting current: (A)	1680 A (Ir=1,0XIn)	P
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	2 h	P
	Test current: 130% of the **maximum** adjustable setting current: (A)	2080 A (Ir=1,0XIn)	P
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	2496 A (Ir=1,0XIn)	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	318 s / 145 s	P
	Thermal Magnetic releases, independent of ambient air temperature: at 20°C or 40°C		
	Test ambient air temperature:	-	N/A
	Test current: 105% of the rated, or **minimum** adjustable setting current: (A)	-	N/A
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	-	N/A
	Test current: 130% of the rated, or **minimum** adjustable setting current: (A)	-	N/A

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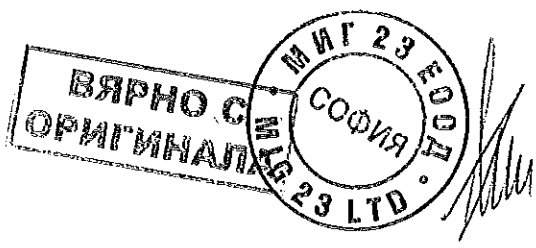

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	-	N/A
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	-	N/A
	Test current: 105% of the **maximum** adjustable setting current: (A)	-	N/A
	Conventional non-tripping time: 1h when In < 63A, 2h when In > 63 A	-	N/A
	Test current: 130% of the **maximum** adjustable setting current: (A)	-	N/A
	For circuit-breakers having an identified neutral pole provided with an overload release (see 8.3.3.1.1), the test current at the conventional tripping current shall be multiplied by the factor 1,2.	-	N/A
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	-	N/A
	An additional test, at a current specified by the manufacturer to verify the time/current characteristic of the releases conform to the curves provided by the manufacturer		
	Releases, dependent of ambient air temperature: Reference temperature (°C)	Compliance	P
	Releases, independent of ambient air temperature: at 30°C	Compliance	P
	Test ambient air temperature:	25 °C	N/A
	Test current: at current specified by the manufacturer to verify the time/current characteristic of the releases conform to the curves provided by the manufacturer. % at the rated, or minimum adjustable setting current: (% or A)	1920 A (0,4 In X 300 %) 4800 A (1,0 In X 300 %)	P
	Tripping time acc. time/current characteristic of the releases conform to the curves provided by the manufacturer. (within the stated tolerances)	2 s (0,4 In) 89 s (1,0 In)	P
	Releases, independent of ambient air temperature: at 20°C or 40°C		
	Test ambient air temperature:	-	N/A
	Test current: at current specified by the manufacturer to verify the time/current characteristic of the releases conform to the curves provided by the manufacturer. % at the rated, or minimum adjustable setting current: (% or A)	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Tripping time acc. time/current characteristic of the releases conform to the curves provided by the manufacturer. (within the stated tolerances)	-	N/A
8.3.3.1.4	Additional test for definite time-delay releases		
a)	Time delay		
	Test is made at a current equal to 1,5 times the current setting. If the test current overlaps with another tripping characteristic (e.g. an instantaneous tripping characteristic), the trip setting and the test current shall be reduced as necessary to prevent premature tripping.		
	overload releases: (all phase poles loaded)	-	N/A
	for circuit-breakers having an identified neutral pole provided with an overload release, the test current for this release shall be 1,5 times the current setting;	-	N/A
	short-circuit releases	Compliance	P
	Electromagnetic release: two poles in series carrying the test current, using successively all possible combinations of poles having a short-circuit release.	-	N/A
	Electronic releases: on one pole chosen at random.	Compliance	P
	Test current: 1,5 times of the rated, or **minimum** adjustable setting current: (A)	1440 A (Isd=1,5X0,4XIn)	P
	Operating time, overload releases: (s)	-	N/A
	Time-delay: between the limits stated by the manufacturer:	-	N/A
	Operating time, short-circuit releases (electromagnetic): (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Time-delay: between the limits stated by the manufacturer:	-	N/A
	Operating time, short-circuit releases (electronic): (s) L1: L2: L3:	 L1:0,067 s L2:0,067 s L3:0,068 s	P
	Time-delay: between the limits stated by the manufacturer:	0,025 s ~ 0,08 s	P
	Test current: 1,5 times of the **maximum** adjustable setting current: (A)	24000 A (Isd=10X1,0XIn)	P
	Operating time, overload releases: (s)	-	N/A

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Time-delay: between the limits stated by the manufacturer:	-	N/A
	Operating time, short-circuit releases (electromagnetic): (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Time-delay: between the limits stated by the manufacturer:	-	N/A
	Operating time, short-circuit releases (electronic): (s) L1: L2: L3:	L1:0,418 s L2:0,419 s L3:0,419 s	P
	Time-delay: between the limits stated by the manufacturer:	0,36 ~ 0,44 s	P
b)	Non-tripping duration		
	Firstly, the test current equal to 1,5 times the current setting is maintained for a time interval equal to the non-tripping duration stated by the manufacturer.		
	Then, the current is reduced to the rated current and maintained at this value for twice the time-delay stated by the manufacturer. The circuit-breaker shall not trip.		
	overload releases: (all phase poles loaded)	-	N/A
	for circuit-breakers having an identified neutral pole provided with an overload release, the test current for this release shall be 1,5 times the current setting;	-	N/A
	short-circuit releases	Compliance	P
	Electromagnetic release: two poles in series carrying the test current, using successively all possible combinations of poles having a short-circuit release.	-	N/A
	Electronic releases: on one pole chosen at random.	Compliance	P
	Test current: 1,5 times of the **minimum** adjustable setting current: (A)	1440 A (Isd=1,5X0,4XIn)	P
	non-tripping duration stated by the manufacturer for overload release: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release thermal magnetic: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release electronic: (s)	0,025 s	P
	Time duration of current when reduced to the rated current: shall be twice the delay-time stated by the manufacturer: (s)	0,1 s	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Rated current	640 A (Ir=0,4XIn)	P
	Operating time, overload releases: the circuit-breaker does not trip:	-	N/A
	Operating time, short-circuit releases (electromagnetic), shall not trip: (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Operating time, short-circuit releases (electronic), shall not trip: (s) L1: L2: L3:	L1: >0,1 s L2: >0,1 s L3: >0,1 s	P
	Test current: 1,5 times of **maximum** adjustable setting current: (A)	24000 A (Isd=10X1,0XIn)	P
	non-tripping duration stated by the manufacturer for overload release: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release thermal magnetic: (s)	-	N/A
	non-tripping duration stated by the manufacturer for short-circuit release electronic: (s)	0,2 s	P
	Time duration of current when reduced to the rated current: shall be twice the delay-time stated by the manufacturer: (s)	0,8 s	P
	Rated current	1600 A (Ir=1,0XIn)	P
	Operating time, overload releases: the circuit-breaker does not trip:	-	N/A
	Operating time, short-circuit releases (electromagnetic), shall not trip: (s) L1-L2: L1-L3: L2-L3:	-	N/A
	Operating time, short-circuit releases (electronic), shall not trip: (s) L1: L2: L3:	L1: >0,8 s L2: >0,8 s L3: >0,8 s	P
8.3.3.2	Test of dielectric properties, impulse withstand voltage (Uimp indicated):		
8.3.3.4 part1	The 1,2/50µs impulse voltage shall be applied five times for each polarity at intervals of 1s minimum		
	- rated impulse withstand voltage (kV) :	8 kV	P
	- sea level of the laboratory:	60 m	P
	- test Uimp main circuits (kV) :	9,8 kV	P
	- test Uimp auxiliary circuits (kV) :	-	N/A

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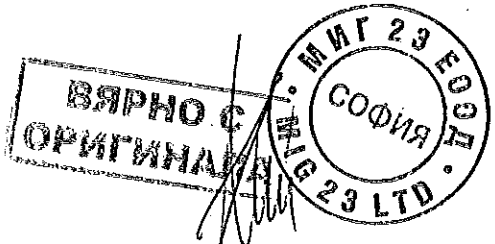

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- test Uimp control circuits (kV) :	-	N/A
	- test Uimp on open main contacts (equipment suitable for isolating) (kV) :	12,3 kV	P
a)	Application of test voltage		
	i) Between all terminals of the main circuit connected together (incl. control and auxiliary circuits connected to the main circuit) and the enclosure or mounting plate, with the contacts in all normal positions of operation.	Compliance	P
	ii) Between each pole of the main circuit and the other poles connected together and to the enclosure or mounting plate, with the contacts in all normal positions of operation.	Compliance	P
	iii) Between each control and auxiliary circuit not normally connected to the main circuit and: - the main circuit	Compliance	P
	- other circuits	-	N/A
	- exposed conductive parts	-	N/A
	- enclosure of mounting plate	-	N/A
	iv) equipment suitable for isolation	Compliance	P
	equipment not suitable for isolation		N/A
	- no unintentional disruptive discharge during the test's	Compliance	P
	Test of dielectric properties, dielectric withstand voltage (Uimp not indicated):		
	- rated insulation voltage (V) :	1000 V	P
	- main circuits, test voltage for 1 min (V)	2200 V	P
	- auxiliary circuits, test voltage for 1 min (V)	-	N/A
	- control circuits, test voltage for 1 min (V)	-	N/A
8.3.3.2.2	Application of test voltage		
1)	with circuit-breaker in the closed position		
	- between all live parts of all poles connected together and the frame of the circuit-breaker .	Compliance	P
	- between each pole and all the other poles connected to the frame of the circuit-breaker	Compliance	P
2)	with the circuit-breaker in the open position and, additionally, in the tripped position, if any.		
	- between all live parts of all poles connected together and the frame of the circuit-breaker.	Compliance	P

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Clause	Requirement + Test	Result - Remark	Verdict
	- between the terminals of one side connected together and the terminals of the other side connected together.	Compliance	P
b)	Control and auxiliary circuits		
1)	- between all the control and auxiliary circuits which are not normally connected to the main circuit, connected together, and the frame of the circuit-breaker.	-	N/A
2)	- where appropriate, between each part of the control an auxiliary circuits which may be isolated from the other parts during normal operation and all the other parts connected together.	-	N/A
	No unintentional disruptive discharge during the tests	Compliance	P
8.3.3.2	For circuit-breaker suitable for isolation, the leakage current shall be measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue, and shall not exceed 0,5mA.	≤ 0,01 mA./ 759 V	P
8.3.3.3	Mechanical operation and operational performance capability		
8.3.3.3.2	Construction and mechanical operation		
a)	Construction		
	A withdrawable circuit-breaker shall be checked for the requirements stated in 7.1.1	-	N/A
	A circuit-breaker with stored energy operation shall be checked for compliance with 7.2.1.1.5, regarding the charge indicator and the direction of operation of manual energy storing	-	N/A
b)	Mechanical operation		
	A circuit-breaker with dependent power operation shall comply with the requirements stated in 7.2.1.1.3	-	N/A
	A circuit-breaker with dependent power operation shall operate with the operating mechanism charged to the minimum and maximum limits stated by the manufacturer	-	N/A
	A circuit-breaker with stored energy operation shall comply with the requirements stated in 7.2.1.5 with the auxiliary supply voltage at 85% and 110% of the rated control supply voltage.	-	N/A
	It shall also be verified that the moving contacts cannot be moved from the open position when the operating mechanism is charged to slightly below the full charge as evidenced by the indicating device	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For a trip-free circuit-breaker it shall not be possible to maintain the contacts in the touching or closed position when the tripping release is in the position to trip the circuit-breaker	-	N/A
	If the closing and opening times of a circuit-breaker are stated by the manufacturer, such times shall comply with the stated values	-	N/A
c)	Undervoltage releases		
	Undervoltage releases shall comply with the requirements of 7.2.1.3 of Part 1. For this purpose, the release shall be fitted to a circuit-breaker having the maximum current rating for which the release is suitable	-	N/A
i)	Drop out voltage		
	It shall be verified that the release operates to open the circuit-breaker between the voltage limits specified	-	N/A
	The voltage shall be reduced from rated voltage at a rate to reach 0 V in approximately 30 s	-	N/A
	The test for the lower limit is made without current in the main circuit and without previous heating of the release coil	-	N/A
	In the case of a release with a range of rated voltages, this test applies to the maximum voltage of the range	-	N/A
	The test for the upper limit is made starting from a constant temperature corresponding to the application of rated control supply voltage to the release and rated current in the main poles of the circuit-breaker	-	N/A
	This test may be combined with the temperature-rise test of 8.3.3.6	-	N/A
	In the case of a release with a range of rated voltages, this test is made at both the minimum and maximum rated control supply voltages	-	N/A
ii)	Test for limits of operation		
	Starting with the circuit-breaker open, at the temperature of the test room, and with the supply voltage at 30% rated maximum control supply voltage, it shall be verified that the circuit-breaker cannot be closed by the operation of the actuator	-	N/A
	When the supply voltage is raised to 85% of the minimum control supply voltage, it shall be verified that the circuit-breaker can be closed by the operation of the actuator	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
iii)	Performance under overvoltage conditions		
	With the circuit-breaker closed and without current in the main circuit, it shall be verified that the undervoltage release will withstand the application of 110% rated control supply voltage for 4 h without impairing its functions	-	N/A
d)	Shunt releases		
	Shunt releases shall comply with the requirements of 7.2.1.4 of Part 1. For this purpose, the release shall be fitted to a circuit-breaker having the maximum rated current for which the release is suitable	-	N/A
	It shall be verified that the release will operate to open the circuit-breaker at 70% rated control supply voltage when tested at an ambient temperature of + 55 °C ± 2 °C without current in the main poles of the circuit-breaker	-	N/A
	In the case of a release having a range of rated control supply voltages, the test voltage shall be 70% of the minimum rated control supply voltage	-	N/A
8.3.3.3.3	Operational performance capability without current.		
	Type designation or serial number	TS1600H 4P	
	Sample no:	S1-1	
	Rated current In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt releases: Uc (V)		
	Rated control supply voltage undervoltage releases: Uc (V)		
	Ambient temperature 10-40 °C :	25 °C	P
	Number of operating cycles per hour	20 Cycles per hour	P
	Number of cycles without current (total) (closing mechanism energized at the rated Uc)	-	N/A
	Number of cycles without current (without releases)	2500 Cycles	P
	Applied voltage: closing mechanism (V)	-	N/A
	10% of total cycles for circuit-breaker with fitted shunt release: (50% at the beginning- and 50% at the end of the test.) Energized at the rated Uc	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Applied voltage: shunt releases (V)	-	N/A
	10% of total cycles for circuit-breaker with undervoltage releases: (50% at the beginning- and 50% at the end of the test.) Energized at the minimum rated Uc	-	N/A
	10 cycles without applied voltage at the undervoltage releases. (Shall not possible to close the circuit-breaker.)	-	N/A
	Applied voltage: undervoltage releases (V)	-	N/A
	Electrical components do not exceed the value indicated in tab. 7.	Compliance	P
8.3.3.3.4	Operational performance capability with current.		
	Rated current: In (A)	1600 A	
	Maximum rated operational voltage: Ue (V)	690 V	
	Conductor cross-sectional area (mm²) :	500 mm² X 2	P
	Number of operating cycles per hour	20 Cycles per hour	P
	Number of cycles with current (total) (closing mechanism energized at the rated Uc)	500 Cycles	P
	Applied voltage: closing mechanism (V)		P
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload setting at maximum and short-circuit setting at minimum.	Compliance	P
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,0 (V) ..... L1: ..... L2: L3:	L1: 691,8 V L2: 700,8 V L3: 708,3 V	P
	- test current I/Ie = 1,0 (A)..... L1: ..... L2: L3:	L1: 1618 A L2: 1625 A L3: 1602 A	P
	- power factor/time constant:	0,73	P
	- frequency: (Hz)	60 Hz	P
	- on-time (ms):	1000 ms	P
	- off-time (s):	179 s	P
	Electrical components do not exceed the value indicated in tab. 7.	Compliance	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.3.3.5	Additional test of operational performance capability without current for withdrawable circuit-breaker.		
	Number of operations cycles : 100	-	N/A
	After test, the isolating contacts, withdrawable mechanism and interlocks shall be suitable for further service.	-	N/A
8.3.3.4	Overload performance		
	this test applies to circuit-breaker of rated current up to and including 630 A		
	Type designation or serial number		
	Sample no:		
	Rated current In (A)		
	Rated operational voltage: Ue (V)		
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt releases: Uc (V)		
	Rated control supply voltage undervoltage releases: Uc (V)		
	Ambient temperature 10-40 °C :	-	N/A
	Number of operating cycles per hour	-	N/A
	Maximum rated operational voltage: Ue (V)	-	N/A
	Number of operating cycles per hour	-	N/A
	Number of cycles with current (total) (closing mechanism energized at the rated Uc)	-	N/A
	Applied voltage: closing mechanism (V)	-	N/A
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload/short-circuit settings at maximum.	-	N/A
	Conditions, overload operations:		
	- test voltage U/Ue = 1,05 (V) .....L1: .....L2: L3:	-	N/A
	- test current AC/DC: I/Ie = 6,0/2.5 (A) .....L1: .....L2: L3:	-	N/A
	- power factor/time constant:	-	N/A

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- Number of cycles manually opened: 9	-	N/A
	- Number of cycles automatically opened by an overload release: 3	-	N/A
	- frequency: (Hz)	-	N/A
	- on-time max 2s:	-	N/A
8.3.3.5	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1380 V	P
	- no breakdown or flashover	No	P
	For circuit-breaker suitable for isolation, the leakage current shall be measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue, and shall not exceed 2 mA.	≤ 0,02 mA / 759 V	P
8.3.3.6	Verification of temperature-rise		
****	- the values of temperature-rise do not exceed those specified in tab. 7.	See table S1-1 (4P)	P
	Temperature rise of main circuit terminals ≤ 80 K (K) :	≤ 69,1 K	P
	conductor cross-sectional area (mm²) :	500 mm² x 2	P
	test current Ie (A) :	1600 A	P
8.3.3.7	Verification of overload releases		
	Test current: 1.45 times the value of their current setting at the reference temperature: (A)	2320 A	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	540 s	P
8.3.3.8	Verification of undervoltage and shunt releases		
	Circuit-breaker fitted with undervoltage releases. The release shall not operate at 70% of the minimum control supply voltage -	-	N/A
	and shall operate at 35% of the maximum control supply voltage.	-	N/A
	Circuit-breaker fitted with shunt releases. The release shall operate at 70% of the minimum rated control supply voltage. Test made at room temperature.	-	N/A
8.3.3.9	Verification of the main contact position for circuit-breakers for isolation		
	actuating force for opening (N) .....:	216 N	—
	test force with blocked main contacts for 10 s (N) .:	648 N	

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Dependent power operation	-	N/A
	Supply voltage of 110% of rated voltage (V).....:	-	N/A
	Three attempts of 5 s to operate the equipment at intervals of 5 min.	-	N/A
	Independent power operation	-	N/A
	Three attempts to operate the equipment by the stored energy.	-	N/A
	Lock ability of driving mechanism in OFF-position at test force and blocked main contacts .....:	-	N/A
	Position indicator does not show OFF-position after capture of test force at blocked main contacts	Compliance	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.4	TEST SEQUENCE II (Ics):		
8.3.4.1	Test of rated service short-circuit breaking capacity		
	Test sequence of operation: O – t – CO – t – CO		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S2-1 Rev	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	240 V	
	Rated service short-circuit breaking capacity: (kA)	57 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	<30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P

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ВЯРНО С ОРИГИНАЛ

МИТ 23 ЕООД LTD СОФИЯ

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm²) :	2CX50X10 mm²	P
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 253,6 V L2: 253,0 V L3: 254,1 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 57,7 kA L2: 57,6 kA L3: 57,5 kA	P
	power factor/time constant :	0,2	P
	- Factor "n"	2,27	P
	- peak test current (A) :	131,1 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 121,5 kA L2: 93,1 kA L3: 87,0 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 70,1 MA^2s L2: 43,0 MA^2s L3: 31,8 MA^2s	P
	Pause, t: (min)	3	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 67,5 kA L2: 105,0 kA L3: 116,7 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 28,6 MA^2s L2: 49,3 MA^2s L3: 57,0 MA^2s	P
	Pause, t: (min)	3	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 100,8 kA L2: 80,6 kA L3: 115,1 kA	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 51,9 MA^2s L2: 30,9 MA^2s L3: 64,1 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.4.2	Operational performance capability with current.		
	Rated current: In (A)	1600 A	
	Maximum rated operational voltage: Ue (V)	240 V	
	Conductor cross-sectional area (mm^2) :	500 mm^2 X 2	
	Number of operating cycles per hour	20 Cycles per hour	P
	Number (5% of the number given in column 4, tab. 8) of cycles with current (total) (closing mechanism energized at the rated Uc)	25 Cycles	P
	Applied voltage: closing mechanism (V)	-	N/A
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload setting at maximum and short-circuit setting at minimum.	Compliance	P
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,0 (V) ..... L1: ..... L2: L3:	L1: 243,5 V L2: 250,5 V L3: 251,5 V	P
	- test current I/Ie = 1,0 (A) ..... L1: ..... L2: L3:	L1: 1604 A L2: 1618 A L3: 1606 A	P
	- power factor/time constant:	0,71	P
	- frequency: (Hz)	60 Hz	P
	- on-time (ms):	1000 ms	P
	- off-time (s):	179 s	P
8.3.4.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V	1000 V	P
	- no breakdown or flashover	No	P
	- the leaking current for circuit-breaker suitable for isolation: (<2mA / 1.1 Ue)	≤ 1,14 mA / 264 V	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.4.4	Verification of temperature-rise		
	- the values of temperature-rise do not exceed those specified in tab. 7.	See table S2-1R (3P)	P
	Temperature rise of main circuit terminals. ≤ 80 K (K) :	≤ 75,3 K	P
	conductor cross-sectional area (mm²) :	500 mm² x 2	P
	test current Ie (A) :	1600 A	P
8.3.4.5	Verification of overload releases		
	Test current: 1.45 times the value of their current setting at the reference temperature: (A)	2320 A	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	535 s	P

8.3.4	TEST SEQUENCE II (Ics):		
8.3.4.1	Test of rated service short-circuit breaking capacity		
	Test sequence of operation: O – t – CO – t – CO		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S2-2	
	Rated current: In (A)	630 A	
	Rated operational voltage: Ue (V)	240 V	
	Rated service short-circuit breaking capacity: (kA)	57 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P

000740

ВЯРНО С ОРИГИНАЛА MWF 23 EOOD LTD. СОФИЯ

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm²) :	2CX40X5 mm²	P
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 253,7 V L2: 252,8 V L3: 254,0 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 57,7 kA L2: 57,6 kA L3: 57,5 kA	P
	power factor/time constant :	0,20	P
	- Factor "n"	2,27	P
	- peak test current (A) :	131,1 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 123,2 kA L2: 93,1 kA L3: 91,3 kA	P
	- Joule integral I²dt (A²s) ..... L1: ..... L2: L3:	L1: 73,9 MA^{2}s L2: 44,6 MA^{2}s L3: 36,2 MA^{2}s	P
	Pause, t: (min)	4	P

000741

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 75,1 kA L2: 110,2 kA L3: 111,4 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 32,8 MA^2s L2: 59,6 MA^2s L3: 65,0 MA^2s	P
	Pause, t: (min)	3	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 112,4 kA L2: 78,2 kA L3: 97,5 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 66,4 MA^2s L2: 38,0 MA^2s L3: 43,7 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.4.2	Operational performance capability with current.		
	Rated current: In (A)		
	Maximum rated operational voltage: Ue (V)		
	Conductor cross-sectional area (mm^2) :		
	Number of operating cycles per hour	-	N/A
	Number (5% of the number given in column 4, tab. 8) of cycles with current (total) (closing mechanism energized at the rated Uc)	-	N/A
	Applied voltage: closing mechanism (V)	-	N/A
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload setting at maximum and short-circuit setting at minimum.	-	N/A
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,0 (V) ..... L1: ..... L2: L3:	-	N/A
	- test current I/Ie = 1,0 (A) ..... L1: ..... L2: L3:	-	N/A

000742

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- power factor/time constant:	-	N/A
	- frequency: (Hz)	-	N/A
	- on-time (ms):	-	N/A
	- off-time (s):	-	N/A
8.3.4.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V	1000 V	P
	- no breakdown or flashover	No	P
	- the leaking current for circuit-breaker suitable for isolation: (<2mA / 1.1 Ue)	≤ 0,77 mA / 264 V	P
8.3.4.4	Verification of temperature-rise		
	- the values of temperature-rise do not exceed those specified in tab. 7.	-	N/A
	Temperature rise of main circuit terminals. ≤ 80 K (K) :	-	N/A
	conductor cross-sectional area (mm²) :	-	N/A
	test current Ie (A) :	-	N/A
8.3.4.5	Verification of overload releases		
	Test current: 1.45 times the value of their current setting at the reference temperature: (A)	913,5 A	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	517 s	P

8.3.4	TEST SEQUENCE II (Ics):		
8.3.4.1	Test of rated service short-circuit breaking capacity		
	Test sequence of operation: O – t – CO – t – CO		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S2-3	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	460 V	
	Rated service short-circuit breaking capacity: (kA)	50 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

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ВЯРНО С ОРИГИНАЛА

МИЛ 23 ЕООД СОФИЯ MIL 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm²) :	2CX50X10 mm²	P
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 486,2 V L2: 488,7 V L3: 484,7 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 50,9 kA L2: 50,3 kA L3: 50,5 kA	P
	power factor/time constant :	0,23	P
	- Factor "n"	2,17	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- peak test current (A) :	110,9 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 108,9 kA L2: 82,4 kA L3: 86,2 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 62,0 MA^2s L2: 38,3 MA^2s L3: 35,3 MA^2s	P
	Pause, t: (min)	5	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 86,5 kA L2: 83,1 kA L3: 106,8 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 45,8 MA^2s L2: 37,9 MA^2s L3: 64,3 MA^2s	P
	Pause, t: (min)	3	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 73,8 kA L2: 102,3 kA L3: 98,6 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 31,5 MA^2s L2: 54,7 MA^2s L3: 54,1 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.4.2	Operational performance capability with current.		
	Rated current: In (A)	1600 A	
	Maximum rated operational voltage: Ue (V)	460 V	
	Conductor cross-sectional area (mm^2) :	500 mm^2 X 2	
	Number of operating cycles per hour	20 Cycles per hour	P
	Number (5% of the number given in column 4, tab. 8) of cycles with current (total) (closing mechanism energized at the rated Uc)	25 Cycles	P
	Applied voltage: closing mechanism (V)	-	N/A

000745

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД София MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload setting at maximum and short-circuit setting at minimum.	-	N/A
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,0 (V) ..... L1: ..... L2: L3:	L1: 472,0 V L2: 474,8 V L3: 476,8 V	P
	- test current I/Ie = 1,0 (A) ..... L1: ..... L2: L3:	L1: 1600 A L2: 1622 A L3: 1610 A	P
	- power factor/time constant:	0,70	P
	- frequency: (Hz)	60 Hz	P
	- on-time (ms):	1000 ms	P
	- off-time (s):	179 s	P
8.3.4.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V	1000 V	P
	- no breakdown or flashover	No	P
	- the leaking current for circuit-breaker suitable for isolation: (<2mA / 1.1 Ue)	≤ 0,58 mA / 506 V	P
8.3.4.4	Verification of temperature-rise		
	- the values of temperature-rise do not exceed those specified in tab. 7.	See table S2-3 (3P)	P
	Temperature rise of main circuit terminals. ≤ 80 K (K) :	≤ 78,4 K	P
	conductor cross-sectional area () :	500 mm² x 2	P
	test current Ie (A) :	1600 A	P
8.3.4.5	Verification of overload releases		
	Test current: 1.45 times the value of their current setting at the reference temperature: (A)	2320 A	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	532 s	P

000746

ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.4	TEST SEQUENCE II (Ics):		
8.3.4.1	Test of rated service short-circuit breaking capacity		
	Test sequence of operation: O – t – CO – t – CO		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S2-4 Rev	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V	
	Rated service short-circuit breaking capacity: (kA)	35 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P

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ВЯРНО С ОРИГИНАЛА

МИГ 2.3 ЕООД СОФИЯ MIG 2.3 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Conductor cross-sectional area (mm²) :	2CX50X10 mm²	P
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 734,9 V L2: 735,7 V L3: 733,0 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 35,1 kA L2: 35,0 kA L3: 35,1 kA	P
	power factor/time constant :	0,24	P
	- Factor "n"	2,17	P
	- peak test current (A) :	76,3 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 74,5 kA L2: 58,3 kA L3: 63,2 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 31,5 MA^2s L2: 21,6 MA^2s L3: 20,4 MA^2s	P
	Pause, t: (min)	5	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 56,9 kA L2: 74,7 kA L3: 65,9 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 17,9 MA^2s L2: 30,9 MA^2s L3: 24,7 MA^2s	P
	Pause, t: (min)	3	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 62,8 kA L2: 59,0 kA L3: 74,5 kA	P

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ВЯРНО С ОРИГИНАЛА

МИГ 2.3 ЕООД СОФИЯ MIG 2.3 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 25,2 MA^2s L2: 20,3 MA^2s L3: 32,0 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.4.2	Operational performance capability with current.		
	Rated current: In (A)	1600 A	
	Maximum rated operational voltage: Ue (V)	690 V	
	Conductor cross-sectional area (mm^2) :	500 mm^2 X 2	
	Number of operating cycles per hour	20 Cycles per hour	P
	Number (5% of the number given in column 4, tab. 8) of cycles with current (total) (closing mechanism energized at the rated Uc)	25 Cycles	P
	Applied voltage: closing mechanism (V)	-	N/A
	For circuit-breaker fitted with adjustable releases, test shall be made with the overload setting at maximum and short-circuit setting at minimum.	-	N/A
	Conditions, make/break operations:		
	- test voltage U/Ue = 1,0 (V) ..... L1: ..... L2: L3:	L1: 716,5 V L2: 719,8 V L3: 716,0 V	P
	- test current I/Ie = 1,0 (A) ..... L1: ..... L2: L3:	L1: 1622 A L2: 1622 A L3: 1624 A	P
	- power factor/time constant:	0,73	P
	- frequency: (Hz)	60 Hz	P
	- on-time (ms):	1000 ms	P
	- off-time (s):	179 s	P
8.3.4.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V	1380 V	P
	- no breakdown or flashover	No	P
	- the leaking current for circuit-breaker suitable for isolation: (<2mA / 1.1 Ue)	≤0,07 mA / 759 V	P

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ВЯРНО С ОРИГИНАЛА

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict

8.3.4.4	Verification of temperature-rise		
	- the values of temperature-rise do not exceed those specified in tab. 7.	See table S2-4R (3P)	
	Temperature rise of main circuit terminals. ≤ 80 K (K) :	≤ 78,9 K	P
	conductor cross-sectional area (mm²) :	500 mm² x 2	P
	test current Ie (A) :	1600 A	P
8.3.4.5	Verification of overload releases		
	Test current: 1.45 times the value of their current setting at the reference temperature: (A)	2320 A	P
	Conventional tripping time: <1h when In < 63A, <2h when In > 63 A	537 s	P

8.3.4	TEST SEQUENCE II/III (Ics=Icu):	N/A

8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S3-1	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	240 V	
	Rated ultimate short-circuit breaking capacity: (kA)	75 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Rated control supply voltage of shunt release: Uc (V)		
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	216 s 204 s 220 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Conductor cross-sectional area (mm²) :	2CX50X10 mm²	P
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 253,6 V L2: 253,6 V L3: 253,7 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 75,9 kA L2: 76,3 kA L3: 74,8 kA	P
	power factor/time constant :	0,20	P
	- Factor "n"	2,27	P
	- peak test current (Amax) :	172,9 kA	
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 126,1 kA L2: 122,8 kA L3: 109,8 kA	P
	- Joule integral I²dt (A²s) ..... L1: ..... L2: L3:	L1: 92,5 MA^2s L2: 71,7 MA^2s L3: 50,5 MA^2s	P
	Pause, t: (min)	4	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 126,1 kA L2: 110,1 kA L3: 111,4 kA	P
	- Joule integral I²dt (A²s) ..... L1: ..... L2: L3:	L1: 92,0 MA^2s L2: 64,0 MA^2s L3: 53,9 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1000 V	P
	- no breakdown or flashover	No	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 0,1 mA / 264 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	123 s 122 s 129 s	P

8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S3-2	
	Rated current: In (A)	630 A	
	Rated operational voltage: Ue (V)	240 V	
	Rated ultimate short-circuit breaking capacity: (kA)	75 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

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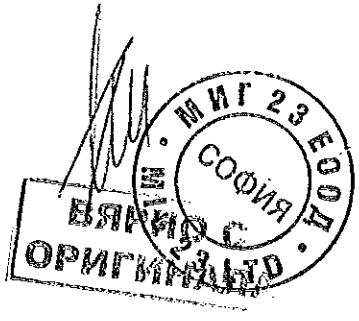

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	218 s 212 s 214 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm^2) :	2CX40X5 mm^2	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) .....L1: .....L2: L3:	L1: 253,8 V L2: 253,2 V L3: 254,1 V	P
	- r.m.s. test current AC/DC: (A).....L1: .....L2: L3:	L1: 75,9 kA L2: 76,3 kA L3: 74,8 kA	P
	power factor/time constant :	0,20	P
	- Factor "n"	2,28	
	- peak test current (Amax) :	172,9 kA	
	Test sequence "O"		
	- max. let-through current: (kApeak) .....L1: .....L2: L3:	L1: 142,5 kA L2: 120,7 kA L3: 108,0 kA	P
	- Joule integral I^2dt (A^2s) .....L1: .....L2: L3:	L1: 98,0 MA^2s L2: 68,4 MA^2s L3: 48,9 MA^2s	P
	Pause, t: (min)	6	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) .....L1: .....L2: L3:	L1: 133,3 kA L2: 89,6 kA L3: 127,9 kA	P
	- Joule integral I^2dt (A^2s) .....L1: .....L2: L3:	L1: 85,3 MA^2s L2: 46,1 MA^2s L3: 75,1 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1000 V	P
	- no breakdown or flashover	No	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 1,31 mA / 264 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	128 s 125 s 126 s	P

8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S3-3	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	460 V	
	Rated ultimate short-circuit breaking capacity: (kA)	65 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	211 s 215 s 209 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm^2) :	2CX50X10 mm^2	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 484,6 V L2: 485,5 V L3: 484,4 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 67,0 kA L2: 65,7 kA L3: 65,8 kA	P
	power factor/time constant :	0,20	P
	- Factor "n"	2,25	P
	- peak test current (Amax) :	149,3 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 140,3 kA L2: 111,6 kA L3: 105,7 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 98,9 MA^2s L2: 65,2 MA^2s L3: 50,2 MA^2s	P
	Pause, t: (min)	5	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 98,7 kA L2: 130,0 kA L3: 125,9 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 58,9 MA^2s L2: 93,2 MA^2s L3: 93,3 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1000 V	P
	- no breakdown or flashover	No	P

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ВЯРНО С ОРИГИНАЛА

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 3,0 mA / 506 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	127 s 128 s 127 s	P

8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S3-4Rev	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V	
	Rated ultimate short-circuit breaking capacity: (kA)	45 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	214 s 203 s 211 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm²) :	2CX50X10 mm²	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 734,8 V L2: 734,8 V L3: 733,0 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 45,3 kA L2: 45,0 kA L3: 45,3 kA	P
	power factor/time constant :	0,24	P
	- Factor "n"	2,13	P
	- peak test current (Amax) :	96,6 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 95,8 kA L2: 74,1 kA L3: 79,1 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 52,1 MA^2s L2: 33,8 MA^2s L3: 32,0 MA^2s	P
	Pause, t: (min)	10	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 94,3 kA L2: 86,4 kA L3: 69,1 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 48,9 MA^2s L2: 43,5 MA^2s L3: 28,0 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1 380 V	P
	- no breakdown or flashover	No	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 0,78 mA / 759 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	127 s 126 s 126 s	P
8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 4P	
	Sample no:	S3-1	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	240 V	
	Rated ultimate short-circuit breaking capacity: (kA)	75 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

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ВЯРНО С ОРИГИНАЛА

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict

	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	226 s 215 s 214 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm^2) :	2CX50X10 mm^2	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 253,4 V L2: 253,3 V L3: 253,5 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 75,9 kA L2: 76,3 kA L3: 74,8 kA	P
	power factor/time constant :	0,20	P
	- Factor "n"	2,28	P
	- peak test current (Amax) :	172,9 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 142,2 kA L2: 126,1 kA L3: 65,5 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 102,1 MA^2s L2: 80,0 MA^2s L3: 19,5 MA^2s	P
	Pause, t: (min)	4	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 111,1 kA L2: 77,6 kA L3: 80,5 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 64,0 MA^2s L2: 41,1 MA^2s L3: 33,6 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1000 V	P
	- no breakdown or flashover	No	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 0,1 mA / 264 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	123 s 128 s 121 s	P

8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 4P	
	Sample no:	S3-2	
	Rated current: In (A)	630 A	
	Rated operational voltage: Ue (V)	240 V	
	Rated ultimate short-circuit breaking capacity: (kA)	75 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	222 s 224 s 220 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	<30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm^2) :	2CX40X5 mm^2	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 253,4 V L2: 253,3 V L3: 253,5 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 75,9 kA L2: 76,3 kA L3: 74,8 kA	P
	power factor/time constant :	0,20	P
	- Factor "n"	2,28	P
	- peak test current (Amax) :	172,9 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 99,3 kA L2: 100,6 kA L3: 65,4 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 71,2 MA^2s L2: 66,2 MA^2s L3: 19,7 MA^2s	P
	Pause, t: (min)	6	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 121,8 kA L2: 148,7 kA L3: 58,4 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 69,5 MA^2s L2: 106,2 MA^2s L3: 18,4 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1000 V	P
	- no breakdown or flashover	No	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 0,45 mA / 264 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	130 s 127 s 125 s	P
8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utillization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 4P	
	Sample no:	S3-3	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	460 V	
	Rated ultimate short-circuit breaking capacity: (kA)	65 kA	
	Rated control supply voltage of closing mechanism: Uc (V)	-	
	Rated control supply voltage of shunt release: Uc (V)	-	

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	217 s 226 s 221 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm²) :	2CX50X10 mm²	P

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ВЯРНО С ОРИГИНАЛ

МИГ 23 ЕООД СОФИЯ МИГ 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO		
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 484,8 V L2: 485,4 V L3: 484,8 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 67,0 kA L2: 65,7 kA L3: 65,8 kA	P
	power factor/time constant :	0,2	
	- Factor "n"	2.23	
	- peak test current (Amax) :	149,3 kA	
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 99,3 kA L2: 100,7 kA L3: 100,4 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 68,1 MA^2s L2: 59,8 MA^2s L3: 48,1 MA^2s	P
	Pause, t: (min)	2	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 127,7 kA L2: 134,2 kA L3: 80,0 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 77,3 MA^2s L2: 91,8 MA^2s L3: 40,0 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1000 V	P
	- no breakdown or flashover	No	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 0,78 mA / 506 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	124 s 120 s 121 s	P

8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 4P	
	Sample no:	S3-4Rev	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V	
	Rated ultimate short-circuit breaking capacity: (kA)	45 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	218 s 218 s 224 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm^2) :	2CX50X10 mm^2	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) .....L1: .....L2: L3:	L1: 735,6 V L2: 732,7 V L3: 732,8 V	P
	- r.m.s. test current AC/DC: (A).....L1: .....L2: L3:	L1: 45,3 kA L2: 45,0 kA L3: 45,3 kA	P
	power factor/time constant :	0,24	P
	- Factor "n"	2,14	P
	- peak test current (Amax) :	96,8 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) .....L1: .....L2: L3:	L1: 95,5 kA L2: 73,9 kA L3: 79,3 kA	P
	- Joule integral I^2dt (A^2s) .....L1: .....L2: L3:	L1: 52,1 MA^2s L2: 38,1 MA^2s L3: 36,8 MA^2s	P
	Pause, t: (min)	3	P
	Test sequence "CO"		
	- max. let-through current: (kApeak) .....L1: .....L2: L3:	L1: 79,1 kA L2: 75,3 kA L3: 95,3 kA	P
	- Joule integral I^2dt (A^2s) .....L1: .....L2: L3:	L1: 43,3 MA^2s L2: 37,9 MA^2s L3: 57,8 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1380 V	P
	- no breakdown or flashover	No	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD.

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 1,0 mA / 759 V	P
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	127 s 127 s 127 s	P

8.3.5	TEST SEQUENCE III (Icu)		
	Rated ultimate short-circuit breaking		
	Except where the combined test sequence applies, this test sequence applies to circuit-breaker of utilization category A and to circuit-breaker of utilization B having a rated ultimate short-circuit breaking capacity higher than the rated short-time withstand current.		
	For circuit-breakers of utilization B having a rated short-time withstand current equal to their rated ultimate short-circuit breaking capacity, this test sequence need not be made, since, in this case, the ultimate short-circuit breaking capacity, is verified when carrying out test sequence IV.		
	For integrally fused circuit-breakers, test sequence V applies in place of this sequence.		
	Type designation or serial number	TS1600H 4P	
	Sample no:	S3-5	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	240 V/√ 3	
	Rated ultimate short-circuit breaking capacity: (kA)	75 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		

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ВЯРНО С ОРИГИНАЛА

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	This test sequence need not be made when Icu = Ics		
8.3.5.1	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	230 s - - 230 s	P
8.3.5.2	Test of rated ultimate short-circuit breaking capacity		
	The test sequence of operations is O – t – CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	< 30mm^2	P
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm²) :	2CX50X10 mm²	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening, torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 145,8 V	P
	- r.m.s. test current AC/DC: (A)..... L1: ..... L2: L3:	L1: 77,7 kA	P
	power factor/time constant :	0,20	P
	- Factor "n"	2,15	P
	- peak test current (Amax) :	167,5 kA	P
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 122,9 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 67,9 MA^2s	P
	Pause, t: (min)	4	
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 110,2 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 56,4 MA^2s	P
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
8.3.5.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V for 5 seconds	1000 V	P
	- no breakdown or flashover	No	P
	- the leaking current for circuit-breaker suitable for isolation: (<6mA / 1,1 Ue)	≤ 0,77 mA / 264 V	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.5.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	122 s - - 129 s	P
8.3.6	TEST SEQUENCE IV		
	Rated short-time withstand current		
	Except where the combined test sequence applies, this test sequence applies to circuit-breakers of utilization category B and to those circuit-breaker of category A covered by note 3 of table 4, and comprises the following tests:		
	Where integrally fused circuit-breaker are of utilization category B, they shall meet the requirements of this sequence.		
	Type designation or serial number	TS1600H 3P	
	Sample no:	S4-1	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V	
	Rated short-time withstand current: (kA/s)	25 kA 1s	
	Rated frequency: (Hz)	60 Hz	
8.3.6.1	Verification of overload releases		
	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	223 s 229 s 211 s	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.6.2	Test of rated short-time withstand current.		
	For this test, any over-current release, including the instantaneous override, if any, likely to operate during the test, shall be rendered inoperative.		
	- test frequency: (Hz)	60 Hz	P
	- duration of the test: (s)	1 s	P
	- test frequency: (Hz)	60 Hz	P
	- power factor / time constant (ms):	0,25	P
	- factor "n"	2,09	P
	- test voltage: (V) ..... L1: ..... L2: L3:	L1: 724,9 V L2: 724,6 V L3: 724,9 V	P
	- r.m.s. test current: (kA) ..... L1: ..... L2: L3:	L1: 25,5 kA L2: 25,6 kA L3: 25,4 kA	P
	- highest peak current: (kA)	53,5 kA	P
8.3.6.3	Verification of temperature-rise		
	- the values of temperature-rise do not exceed those specified in tab. 7.	See table S4-1 (3P)	P
	Temperature rise of main circuit terminals. ≤ 80 K (K) :	≤ 67,0 K	P
	conductor cross-sectional area (mm²) :	500 mm² X 2	P
	test current Ie (A) :	1600 A	P
8.3.6.4	Test of short-circuit breaking capacity at the max. short-time withstand current.		
	Rated short-time withstand current: (kA/s)		
	Test sequence: O – t – CO		
	max. available time setting of the short–time delay short-circuit release. (s)	0,4 s	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 724,9 V L2: 724,6 V L3: 724,9 V	P
	- r.m.s. test current AC/DC: (A) ..... L1: ..... L2: L3:	L1: 25,5 kA L2: 25,6 kA L3: 25,4 kA	P
	- test frequency: (Hz)	60 Hz	P
	- power factor / time constant (ms):	0,25	P
	- factor "n"	2,09	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Test sequence "O"		
	- max. let-through current: (kApeak) .....L1: .....L2: L3:	L1: 51,1 kA L2: 40,7 kA L3: 44,8 kA	P
	- Joule integral I^2dt (A^2s) .....L1: .....L2: L3:	L1: 266,6 MA^2s L2: 260,4 MA^2s L3: 257,8 MA^2s	P
	Pause, t: (min)	5	P
	- the circuit-breaker shall remain closed for the short-time corresponding to the max. available time setting of the short–time delay short-circuit release and -		P
	- the instantaneous override, if any, shall not operate.		P
	-pause: t (s)		
	Test sequence "CO"		
	- max. let-through current: (kApeak) .....L1: .....L2: L3:	L1: 49,8 kA L2: 38,4 kA L3: 46,3 kA	P
	- Joule integral I^2dt (A^2s) .....L1: .....L2: L3:	L1: 7,8 MA^2s L2: 8,3 MA^2s L3: 1,2 MA^2s	P
	Pause, t: (min)		
	- the circuit-breaker shall remain closed for the short-time corresponding to the max. available time setting of the short–time delay short-circuit release and -		P
	- the instantaneous override, if any, shall not operate.		P
	- if the circuit-breaker has a making current release, this requirement does not apply to the CO operation, if the prospective current exceeds the pre-determined value, since it will then operate.		P
8.3.6.5	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V	1380 V	P
	- no breakdown or flashover	No	P
	- For circuit-breaker suitable for isolation, the leakage current shall be measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue, and shall not exceed 2 mA.	≤ 0,03 mA / 759 V	P
8.3.6.6	Verification of overload releases		

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД София 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the maximum value stated by the manufacturer for twice the value of the current setting, at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	132 s 130 s 129 s	P
8.3.6	TEST SEQUENCE IV		
	Rated short-time withstand current		
	Except where the combined test sequence applies, this test sequence applies to circuit-breakers of utilization category B and to those circuit-breaker of category A covered by note 3 of table 4, and comprises the following tests:		
	Where integrally fused circuit-breaker are of utilization category B, they shall meet the requirements of this sequence.		
	Type designation or serial number	TS1600H 4P	
	Sample no:	S4-1	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V/√ 3	
	Rated short-time withstand current: (kA/s)	25 kA 1s	
	Rated frequency: (Hz)	60 Hz	
8.3.6.1	Verification of overload releases		
	The operation of overload releases shall be verified at twice the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	152~317 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	222 s 221 s 230 s 227 s	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
8.3.6.2	Test of rated short-time withstand current.		
	For this test, any over-current release, including the instantaneous override, if any, likely to operate during the test, shall be rendered inoperative.		
	- test frequency: (Hz)	60 Hz	P
	- duration of the test: (s)	1 s	P
	- test frequency: (Hz)	60 Hz	P
	- power factor / time constant (ms):	0,25	P
	- factor "n"	2,09	P
	- test voltage: (V) .....L1: .....L2: L3:	L1: 420,8 V	P
	- r.m.s. test current: (kA).....L1: .....L2: L3:	L1: 25,5 kA	P
	- highest peak current: (kA)	53,3 kA	P
8.3.6.3	Verification of temperature-rise		
	- the values of temperature-rise do not exceed those specified in tab. 7.	-	N/A
	Temperature rise of main circuit terminals. ≤ 80 K (K) :	-	N/A
	conductor cross-sectional area (mm²) :	-	N/A
	test current Ie (A) :	-	N/A
8.3.6.4	Test of short-circuit breaking capacity at the max. short-time withstand current.		
	Rated short-time withstand current: (kA/s)		
	Test sequence: O – t – CO		
	max. available time setting of the short–time delay short-circuit release. (s)	0,4 s	P
	- test voltage U/Ue = 1,05 (V) .....L1: .....L2: L3:	L1: 420,8 V	P
	- r.m.s. test current AC/DC: (A).....L1: .....L2: L3:	L1: 25,0 kA	P
	- test frequency: (Hz)	60 Hz	P
	- power factor / time constant (ms):	0,25	P
	- factor "n"	2,12	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Test sequence "O"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 52,2 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 255,9 MA^2s	P
	Pause, t: (min)	3	P
	- the circuit-breaker shall remain closed for the short-time corresponding to the max. available time setting of the short–time delay short-circuit release and -		P
	- the instantaneous override, if any, shall not operate.		P
	-pause: t (s)		P
	Test sequence "CO"		
	- max. let-through current: (kApeak) ..... L1: ..... L2: L3:	L1: 38,7 kA	P
	- Joule integral I^2dt (A^2s) ..... L1: ..... L2: L3:	L1: 249,8 MA^2s	P
	Pause, t: (min)		
	- the circuit-breaker shall remain closed for the short-time corresponding to the max. available time setting of the short–time delay short-circuit release and -		P
	- the instantaneous override, if any, shall not operate.		P
	- if the circuit-breaker has a making current release, this requirement does not apply to the CO operation, if the prospective current exceeds the pre-determined value, since it will then operate.		P
8.3.6.5	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V	1380 V	P
	- no breakdown or flashover	No	P
	- For circuit-breaker suitable for isolation, the leakage current shall be measured through each pole with the contacts in the open position, at a test voltage of 1,1 Ue, and shall not exceed 2 mA.	≤ 0,03 mA / 759 V	P
8.3.6.6	Verification of overload releases		

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The operation of overload releases shall be verified at 2,5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the maximum value stated by the manufacturer for twice the value of the current setting, at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	123 s 127 s 122 s 124 s	P
8.3.7	TEST SEQUENCE V		N/A
8.3.8	TEST SEQUENCE VI: Combined test sequence		N/A
Annex B	Circuit-breakers incorporating residual current protection		N/A
Annex C	Individual pole short-circuit test sequence		N/A
Annex F	Additional tests for circuit-breakers with electronic over-current protection		P
F4 and F5	Verification of electromagnetic compatibility (EMC)		P
	See report:	**R410-1375 (A-Type)**	P
F6	Suitability for multiple frequencies		N/A
	The tests shall be performed at each rated frequency or, when a range of rated frequencies is declared, at the lowest and the highest rated frequencies.		N/A
F.6.2	Tests shall be performed on any pair of phase-poles chosen at random at any convenient voltage. Under-voltage releases, if any, shall either be energized or disabled. All other auxiliaries shall be disconnected during the test.		N/A
	The short-time and instantaneous trip current settings shall each, if relevant, be adjusted to 2,5 times the current setting. If this setting is not available, the next closest higher setting shall be used.	-	N/A
	A current of 0,95 times the conventional non-tripping current (see Table 6) is applied for a time equal to 10 times the tripping time which corresponds to 2,0 times the current setting.	-	N/A
	Immediately following the test of a), a current of 1,05 times the conventional tripping current (see Table 6) is applied.	-	N/A

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ МИГ 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	A further test starting from the cold state is made at 2,0 times the current setting.	-	N/A
	For each test frequency, the overload tripping characteristics shall comply with the following requirements: – for test a) no tripping shall occur; – for test b) tripping shall occur within the conventional time (see Table 6); – for test c) tripping shall occur within 1,1 times the maximum and 0,9 times the minimum values of the manufacturer's stated time-current characteristic.	-	N/A
F.7.	Dry heat test		P
F.7.1	The test shall be performed on the circuit-breaker in accordance with 7.2.2 at the maximum rated current for a given frame size, on all phase poles, at an ambient temperature of 40 °C	In= _____ A	N/A
	The duration of the test, once temperature equilibrium is reached, shall be 168 h		N/A
	Tightening torques applied to the terminals shall be in accordance with the manufacturers' instructions. In absence of such instructions, table 4 of IEC 60947-1 shall apply	Torque= _____ Nm	N/A
	As an alternative, the test may be performed as follows:	compliance	P
	- measure and record the highest temperature rise of the air surrounding the electronic components, during the temperature rise verification of test sequence 1	Ambient temperature during temperature rise test: 36.1 °C	P
	- install the electronic controls in the chamber	compliance	P
	- supply the electronic controls which there input energizing value	compliance	P
	- adjust the temperature of the test chamber to a value of 40 K above the temperature rise recorded for the surrounding the electronic components and maintain this temperature for 168 h	Chamber temperature: 76.1 °C	P
	Test carried out.....:	☐ normal ☒ alternative	P
F.7.2	Test results		P
	The circuit-breaker and the electronic controls shall meet the following requirements:	compliance	P
	- no tripping of the circuit-breaker shall occur	compliance	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- no operating of the electronic controls which would cause the circuit-breaker to trip shall occur	compliance	P
F.7.3	Verification of the overload releases		P
	Following the test F.7.1, the operation of the overload releases of the circuit-breaker shall be verified in accordance with 7.2.1.2.4, item b).	I test: 1680 A(1, 0 In x 1,05) I test: 2080 A(1, 0 In x 1,30) Ambient temperature: 20 °C	P
7.2.1.2.4	Opening by over-current releases	compliance	P
b)	Opening under overload conditions		N/A
1)	Instantaneous or definite time-delay operation	-	N/A
	The release shall cause tripping of the circuit-breaker with an accuracy of + 10% of the tripping current value of the current setting for all values of current setting of the overload release	-	N/A
2)	Inverse timer-delay operation		P
	At the reference temperature and at 1,05 times the current setting with the conventional non-tripping current, the opening release being energized on all poles, tripping shall not occur in less than the conventional time from the cold state, i.e. with the circuit-breaker at the reference temperature	No tripping	P
	Moreover, when at the end of the conventional time the value of current is immediately raised to 1,30 times the current setting, i.e. with the conventional tripping current, tripping shall then occur in less than the conventional time later	792 s	P
	If a release is declared by the manufacturer as substantially independent of ambient temperature, the current values of table 6 shall apply within the temperature band declared by the manufacturer, within a tolerance of 0,3%/K	-	N/A
	The width of the temperature band shall be at least 10 K on either side of the reference temperature	compliance	P
F.8.	Damp heat test		P
F.8.1	Test procedure	compliance	P
	The test shall be performed according to IEC 60068-2-30 (12 +12 hours cycle)	compliance	P
	Test Db temperature cycle between 25°C and upper temperature	compliance	P
	The upper temperature shall be 55°C ± 2 °C (variant 1) and number of cycles shall be six.	compliance	P

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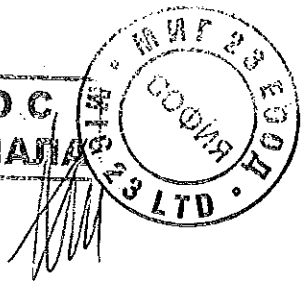
ВЯРНО С ОРИГИНАЛА



IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The relative humidity is maintained at a high level at the upper temperature	compliance	P
	The test may be performed with only the electronic controls in the test chamber	compliance	P
	Test result.....:	compliance	P
F.8.2	Verification of the overload releases		P
	Following the test F.8.1, the operation of the overload releases of the circuit-breaker shall be verified in accordance with 7.2.1.2.4, item b).	I test: 1680 A(1, 0 In x 1,05) I test: 2080 A(1, 0 In x 1,30) Ambient temperature: 20 °C	P
7.2.1.2.4	Opening by over-current releases	compliance	P
b)	Opening under overload conditions		N/A
1)	Instantaneous or definite time-delay operation	-	N/A
	The release shall cause tripping of the circuit-breaker with an accuracy of + 10% of the tripping current value of the current setting for all values of current setting of the overload release	-	N/A
2)	Inverse timer-delay operation		P
	At the reference temperature and at 1,05 times the current setting with the conventional non-tripping current, the opening release being energized on all poles, tripping shall not occur in less than the conventional time from the cold state, i.e. with the circuit-breaker at the reference temperature	No tripping	P
	Moreover, when at the end of the conventional time the value of current is immediately raised to 1,30 times the current setting, i.e. with the conventional tripping current, tripping shall then occur in less than the conventional time later	786 s	P
	If a release is declared by the manufacturer as substantially independent of ambient temperature, the current values of table 6 shall apply within the temperature band declared by the manufacturer, within a tolerance of 0,3%/K	-	N/A
	The width of the temperature band shall be at least 10 K on either side of the reference temperature	compliance	P
F.9.	Temperature variation cycles at a specified rate of change		P
F.9.1	Test conditions		P
	Each design of electronic controls shall be submitted to temperature variation cycles in according with figure F.15	Compliance	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The rise and fall of temperature during the rate of variation shall be 1 K/min ± 0,2 K/min.	Compliance	P
	Their temperature, once reached, shall be maintained for at least 2 h.	Compliance	P
	The number of cycles shall be 28.	compliance	P
F.9.2	Test procedure		P
	The test shall be carried out according IEC 60068-2-14.	compliance	P
	For the these test, the electronic controls may be mounted inside the circuit-breaker or separately.	compliance	P
	The electronic controls shall be energized to simulate service conditions.	Compliance	P
	Where the electronics controls are mounted inside the circuit-breaker, the main circuit shall not be energized.	compliance	P
F.9.3	Test results		P
	The electronic controls shall meet the following requirement.	compliance	P
	No operation of the electronic controls which would cause the circuit-breaker to trip during the 28 cycles shall occur.	Compliance	P
F.9.4	Verification of overload releases	compliance	P
	Following the test F.9.1, the operation of the overload releases of the circuit-breaker shall be verified in accordance with 7.2.1.2.4, item b).	I test: 1680 A(1, 0 In x 1,05) I test: 2080 A(1, 0 In x 1,30) Ambient temperature: 20 °C	P
7.2.1.2.4	Opening by over-current releases	Compliance	P
b)	Opening under overload conditions	Compliance	P
1)	Instantaneous or definite time-delay operation	-	N/A
	The release shall cause tripping of the circuit-breaker with an accuracy of + 10% of the tripping current value of the current setting for all values of current setting of the overload release	-	N/A
2)	Inverse timer-delay operation	Compliance	P
	At the reference temperature and at 1,05 times the current setting with the conventional non-tripping current, the opening release being energized on all poles, tripping shall not occur in less than the conventional time from the cold state, i.e. with the circuit-breaker at the reference temperature	No tripping	P

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ВЯРНО С ОРИГИНАЛА

МИГ 2,3 ЕООД София МИГ 2,3 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Moreover, when at the end of the conventional time the value of current is immediately raised to 1,30 times the current setting, i.e. with the conventional tripping current, tripping shall then occur in less than the conventional time later	754 s	P
	If a release is declared by the manufacturer as substantially independent of ambient temperature, the current values of table 6 shall apply within the temperature band declared by the manufacturer, within a tolerance of 0,3%/K	-	N/A
	The width of the temperature band shall be at least 10 K on either side of the reference temperature	compliance	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
Annex F	Additional tests for circuit-breakers with electronic over-current protection		P
F4 and F5	Verification of electromagnetic compatibility (EMC)		P
	See report:	**R410-1376 (S-Type)**	P
F6	Suitability for multiple frequencies		N/A
	The tests shall be performed at each rated frequency or, when a range of rated frequencies is declared, at the lowest and the highest rated frequencies.		N/A
F.6.2	Tests shall be performed on any pair of phase-poles chosen at random at any convenient voltage. Under-voltage releases, if any, shall either be energized or disabled. All other auxiliaries shall be disconnected during the test.		N/A
	The short-time and instantaneous trip current settings shall each, if relevant, be adjusted to 2,5 times the current setting. If this setting is not available, the next closest higher setting shall be used.	-	N/A
	A current of 0,95 times the conventional non-tripping current (see Table 6) is applied for a time equal to 10 times the tripping time which corresponds to 2,0 times the current setting.	-	N/A
	Immediately following the test of a), a current of 1,05 times the conventional tripping current (see Table 6) is applied.	-	N/A
	A further test starting from the cold state is made at 2,0 times the current setting.	-	N/A
	For each test frequency, the overload tripping characteristics shall comply with the following requirements: – for test a) no tripping shall occur; – for test b) tripping shall occur within the conventional time (see Table 6); – for test c) tripping shall occur within 1,1 times the maximum and 0,9 times the minimum values of the manufacturer's stated time-current characteristic.	-	N/A
F.7.	Dry heat test		P
F.7.1	The test shall be performed on the circuit-breaker in accordance with 7.2.2 at the maximum rated current for a given frame size, on all phase poles, at an ambient temperature of 40 °C	In= _____ A	N/A
	The duration of the test, once temperature equilibrium is reached, shall be 168 h		N/A
	Tightening torques applied to the terminals shall be in accordance with the manufacturers' instructions. In absence of such instructions, table 4 of IEC 60947-1 shall apply	Torque= _____ Nm	N/A
	As an alternative, the test may be performed as	compliance	P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД СОФИЯ MIG 23 LTD

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	follows:		
	- measure and record the highest temperature rise of the air surrounding the electronic components, during the temperature rise verification of test sequence 1	Ambient temperature during temperature rise test: 36.1 °C	P
	- install the electronic controls in the chamber	compliance	P
	- supply the electronic controls which there input energizing value	compliance	P
	- adjust the temperature of the test chamber to a value of 40 K above the temperature rise recorded for the surrounding the electronic components and maintain this temperature for 168 h	Chamber temperature: 76.1 °C	P
	Test carried out.....:	☐ normal ☒ alternative	P
F.7.2	Test results		P
	The circuit-breaker and the electronic controls shall meet the following requirements:	compliance	P
	- no tripping of the circuit-breaker shall occur	compliance	P
	- no operating of the electronic controls which would cause the circuit-breaker to trip shall occur	compliance	P
F.7.3	Verification of the overload releases		P
	Following the test F.7.1, the operation of the overload releases of the circuit-breaker shall be verified in accordance with 7.2.1.2.4, item b).	I test: 1680 A(1, 0 In x 1,05) I test: 2080 A(1, 0 In x 1,30) Ambient temperature: 20 °C	P
7.2.1.2.4	Opening by over-current releases	compliance	P
b)	Opening under overload conditions		N/A
1)	Instantaneous or definite time-delay operation	-	N/A
	The release shall cause tripping of the circuit-breaker with an accuracy of + 10% of the tripping current value of the current setting for all values of current setting of the overload release	-	N/A
2)	Inverse timer-delay operation		P
	At the reference temperature and at 1,05 times the current setting with the conventional non-tripping current, the opening release being energized on all poles, tripping shall not occur in less than the conventional time from the cold state, i.e. with the circuit-breaker at the reference temperature	No tripping	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Moreover, when at the end of the conventional time the value of current is immediately raised to 1,30 times the current setting, i.e. with the conventional tripping current, tripping shall then occur in less than the conventional time later	768 s	P
	If a release is declared by the manufacturer as substantially independent of ambient temperature, the current values of table 6 shall apply within the temperature band declared by the manufacturer, within a tolerance of 0,3%/K	-	N/A
	The width of the temperature band shall be at least 10 K on either side of the reference temperature	compliance	P
F.8.	Damp heat test		P
F.8.1	Test procedure	compliance	P
	The test shall be performed according to IEC 60068-2-30 (12 +12 hours cycle)	compliance	P
	Test Db temperature cycle between 25°C and upper temperature	compliance	P
	The upper temperature shall be 55°C ± 2 °C (variant 1) and number of cycles shall be six.	compliance	P
	The relative humidity is maintained at a high level at the upper temperature	compliance	P
	The test may be performed with only the electronic controls in the test chamber	compliance	P
	Test result.....:	compliance	P
F.8.2	Verification of the overload releases		P
	Following the test F.8.1, the operation of the overload releases of the circuit-breaker shall be verified in accordance with 7.2.1.2.4, item b).	I test: 1680 A(1, 0 In x 1,05) I test: 2080 A(1, 0 In x 1,30) Ambient temperature: 20 °C	P
7.2.1.2.4	Opening by over-current releases	compliance	P
b)	Opening under overload conditions		N/A
1)	Instantaneous or definite time-delay operation	-	N/A
	The release shall cause tripping of the circuit-breaker with an accuracy of + 10% of the tripping current value of the current setting for all values of current setting of the overload release	-	N/A
2)	Inverse timer-delay operation		P

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ВЯРНО С ОРИГИНАЛА

МИГ 23 ЕООД · MIG 23 LTD · София

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	At the reference temperature and at 1,05 times the current setting with the conventional non-tripping current, the opening release being energized on all poles, tripping shall not occur in less than the conventional time from the cold state, i.e. with the circuit-breaker at the reference temperature	No tripping	P
	Moreover, when at the end of the conventional time the value of current is immediately raised to 1,30 times the current setting, i.e. with the conventional tripping current, tripping shall then occur in less than the conventional time later	779 s	P
	If a release is declared by the manufacturer as substantially independent of ambient temperature, the current values of table 6 shall apply within the temperature band declared by the manufacturer, within a tolerance of 0,3%/K	-	N/A
	The width of the temperature band shall be at least 10 K on either side of the reference temperature	compliance	P
F.9.	Temperature variation cycles at a specified rate of change		P
F.9.1	Test conditions		P
	Each design of electronic controls shall be submitted to temperature variation cycles in according with figure F.15	Compliance	P
	The rise and fall of temperature during the rate of variation shall be 1 K/min ± 0,2 K/min.	Compliance	P
	Their temperature, once reached, shall be maintained for at least 2 h.	Compliance	P
	The number of cycles shall be 28.	compliance	P
F.9.2	Test procedure		P
	The test shall be carried out according IEC 60068-2-14.	compliance	P
	For the these test, the electronic controls may be mounted inside the circuit-breaker or separately.	compliance	P
	The electronic controls shall be energized to simulate service conditions.	Compliance	P
	Where the electronics controls are mounted inside the circuit-breaker, the main circuit shall not be energized.	compliance	P
F.9.3	Test results		P
	The electronic controls shall meet the following requirement.	compliance	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	No operation of the electronic controls which would cause the circuit-breaker to trip during the 28 cycles shall occur.	Compliance	P
F.9.4	Verification of overload releases	compliance	P
	Following the test F.9.1, the operation of the overload releases of the circuit-breaker shall be verified in accordance with 7.2.1.2.4, item b).	I test: 1680 A(1, 0 In x 1,05) I test: 2080 A(1, 0 In x 1,30) Ambient temperature: 20 °C	P
7.2.1.2.4	Opening by over-current releases	Compliance	P
b)	Opening under overload conditions	Compliance	P
1)	Instantaneous or definite time-delay operation	-	N/A
	The release shall cause tripping of the circuit-breaker with an accuracy of + 10% of the tripping current value of the current setting for all values of current setting of the overload release	-	N/A
2)	Inverse timer-delay operation	Compliance	P
	At the reference temperature and at 1,05 times the current setting with the conventional non-tripping current, the opening release being energized on all poles, tripping shall not occur in less than the conventional time from the cold state, i.e. with the circuit-breaker at the reference temperature	No tripping	P
	Moreover, when at the end of the conventional time the value of current is immediately raised to 1,30 times the current setting, i.e. with the conventional tripping current, tripping shall then occur in less than the conventional time later	782 s	P
	If a release is declared by the manufacturer as substantially independent of ambient temperature, the current values of table 6 shall apply within the temperature band declared by the manufacturer, within a tolerance of 0,3%/K	-	N/A
	The width of the temperature band shall be at least 10 K on either side of the reference temperature	compliance	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict

Annex H	Individual pole short-circuit test sequence		
	Circuit-breaker for use in IT systems		
H.2	Test of individual pole short-circuit breaking capacity		
	A short-circuit test is made on the individual poles of a multipole circuit-breaker at a value of prospective current (I_{IT}) equal to 1,2 times the maximum setting of the short-time delay release tripping current or, in the absence of such a release, 1,2 time the max. setting of the tripping current of the instantaneous release, or, where relevant 1,2 times the maximum setting of the definite time delay release tripping current, but not less than 500 A nor exceeding 50kA.		
	Type designation or serial number	TS1600H 3P	
	Sample no:	H-1	
	Rated current: In (A)	1600 A	
	Rated operational voltage: Ue (V)	690 V	
	Rated ultimate short-circuit breaking capacity: (kA)	45 kA	
	Rated control supply voltage of closing mechanism: Uc (V)		
	Rated control supply voltage of shunt release: Uc (V)		
	The test sequence of operations is O – t - CO		
	For circuit-breaker fitted with adjustable releases, test shall be made with the current and time settings at maximum.	Compliance	P
	closing mechanism energized with 85% at the rated Uc: (V)	-	N/A
	The circuit-breaker is mounted complete on its own support or an equivalent support.	Compliance	P
	Test made in free air:	Compliance	P
	Distances of the metallic screen's: (all sides)	Side : 73.5 mm, Front : 0 mm Top bottom : no screen	P
	The characteristics of the metallic screen:		
	- woven wire mesh	-	N/A
	- perforated metal	Compliance	P
	- expanded metal	-	N/A
	- ratio hole area/total area: 0,45-0,65	0,5	P
	- size of hole: <30mm^2	<30mm^2	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- finish: bare or conductive plating	Compliance	P
	Test made in specified individual enclosure: Details of these tests, including the dimensions of the enclosure:	-	N/A
	Fuse "F": copper wire: diameter 0,8 mm, 50 mm long	Compliance	P
	Circuit is earthed at: (load-star- or supply-star point)	Load-star point	P
	Conductor cross-sectional area (mm^2):	2CX50X10 mm^2	P
	If terminals unmarked: line connected at: (underside/upside)	-	N/A
	Tightening torques: (Nm)	50 Nm	P
	Test sequence of operation: O – t – CO	Compliance	P
	Test circuit according figure: 9	Compliance	P
	- test voltage U/Ue = 1,05 (V) ..... L1: ..... L2: L3:	L1: 735,3 V	P
	Short-circuit test current (I_{IT}): equal to 1,2 times the max. setting of the short-time delay release tripping current,	19,2 kA	P
	or, in the absence of such a release, 1,2 time the max. setting of the tripping current of the instantaneous release,	Compliance	P
	or, where relevant 1,2 times the max. setting of the definite time delay release tripping current, but not exceeding 50kA.	-	N.A.
	- r.m.s. test current AC/DC: (A)	19,2 kA	P
	power factor/time constant:	0,30	P
	- Factor "n"	2,01	P
	- peak test current (Amax) :	38,6 kA	P
	Test sequence "O" L1		
	- max. let-through current: (kApeak) L1:	37,7 kA	P
	- Joule integral I^2dt (A^2s) L1:	154,7 MA^2s	P
	Pause, t: (min)	3	P
	Test sequence "CO" L1		
	- max. let-through current: (kApeak) L1:	32,7 kA	P
	- Joule integral I^2dt (A^2s) L1:	150,9 MA^2s	P

IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Test sequence "O" L2		
	- max. let-through current: (kApeak) L2:	37,4 kA	P
	- Joule integral I^2dt (A^2s) L2:	154,3 MA^2s	P
	Pause, t: (min)	4	P
	Test sequence "CO" L2		
	- max. let-through current: (kApeak) L2:	31,1 kA	P
	- Joule integral I^2dt (A^2s) L2:	150,6 MA^2s	P
	Test sequence "O" L3		
	- max. let-through current: (kApeak) L3:	37,6 kA	P
	- Joule integral I^2dt (A^2s) L3:	154,2 MA^2s	P
	Pause, t: (min)	5	P
	Test sequence "CO" L3		
	- max. let-through current: (kApeak) L3:	33,9 kA	P
	- Joule integral I^2dt (A^2s) L3:	150,8 MA^2s	P
	For 4-pole circuit-breakers with a protected neutral pole, the test voltage for that pole shall be phase-to-phase voltage divided by $\sqrt{3}$. This test is applicable only where the construction of the protected neutral pole differs from that of the phase poles.	-	N.A.
	Test sequence "O" N		
	- max. let-through current: (kApeak) ..... N:	-	N.A.
	- Joule integral I^2dt (A^2s) ..... N:	-	N.A.
	Pause, t: (min)	-	N.A.
	Test sequence "CO" N		
	- max. let-through current: (kApeak) ..... N:	-	N.A.
	- Joule integral I^2dt (A^2s) ..... N:	-	N.A.
	Melting of the fusible element	Compliance	P
	Holes in the PE-sheet for test sequence "O"	-	N/A
	Cracks observed	Compliance	P
H.3	Verification of dielectric withstand		
	- equal to twice the rated operational voltage with a minimum of 1000 V	1380 V	P
	- no breakdown or flashover	No	P

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IEC 60947-2			
Clause	Requirement + Test	Result - Remark	Verdict
H.4	Verification of overload releases		
	The operation of overload releases shall be verified at 2.5 times the value of their current setting on each pole separately.		
	The operating time shall not exceed the max. value stated by the manufacturer for twice the current setting at the reference temperature, on a pole singly.		
	Time specified by the manufacturer:	92~182 s	P
	- Operation time: (s) ..... L1: ..... L2: ..... L3: ..... N :	133 s 129 s 129 s	P
H.5	Marking		
	Circuit-breaker for which all values of rated voltage have not been tested according to this annex or are not covered by such testing, shall be identified by the symbol ⊗ which shall be market on the circuit-breaker immediately following these values of rated voltage	Compliance	P

Annex J	Electromagnetic compatibility (EMC) – Requirements and test methods for circuit-breakers: see report no. EMC-PW-6538	P

Annex N	Electromagnetic compatibility (EMC) – Additional requirements and test methods for devices not covered by Annexes B, F and M	N/A

Annex O	Instantaneous trip circuit-breakers (ICB)	N/A

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IEC 60947-2

	TABLE: Heating Test		S1-1 (3P)
	Test voltage (V):		—
	Ambient (°C):	24,1 °C	—

Thermocouple Locations	max. temperature measured, (°C)	max. temperature limit, (°C)
LINE L1	63,2	80
LINE L2	67,2	80
LINE L3	69,8	80
LOAD L1	63,5	80
LOAD L2	68,1	80
LOAD L3	73,3	80
Manual operating means: non-metallic	19,7	35
Parts intended to be touched but not hand-held: non-metallic	19,3	50
Parts which need not be touched during no rmal operation	40,9	60
OCR (Over current relay)	32,9	N/A

8.3.4.4	TABLE: Heating Test		S2-1R (3P)
	Test voltage (V):		
	Ambient (°C):	27,2 °C	

Thermocouple Locations	max. temperature measured, (°C)	max. temperature limit, (°C)
LINE L1	63,9	80
LINE L2	74,8	80
LINE L3	63,9	80
LOAD L1	67,6	80
LOAD L2	75,3	80
LOAD L3	66,1	80

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IEC 60947-2

8.3.4.4	**TABLE: Heating Test**		S2-3 (3P)
	Test voltage (V):		
	Ambient (°C):	27,9 °C	

Thermocouple Locations	max. temperature measured, (°C)	max. temperature limit, (°C)
LINE L1	67,0	80
LINE L2	72,5	80
LINE L3	66,9	80
LOAD L1	69,7	80
LOAD L2	78,4	80
LOAD L3	74,9	80

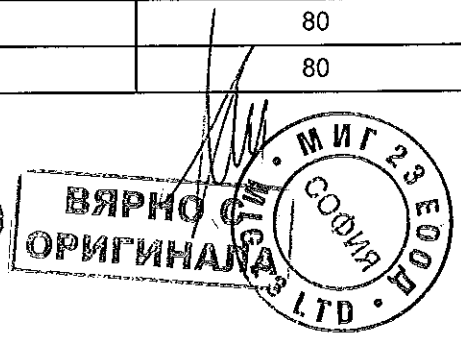
8.3.4.4	**TABLE: Heating Test**		S2-4R (3P)
	Test voltage (V):		
	Ambient (°C):	25,9 °C	

Thermocouple Locations	max. temperature measured, (°C)	max. temperature limit, (°C)
LINE L1	63,7	80
LINE L2	70,7	80
LINE L3	62,9	80
LOAD L1	67,0	80
LOAD L2	78,9	80
LOAD L3	69,0	80

	TABLE: Heating Test		S4-1 (3P)
	Test voltage (V):		—
	Ambient (°C):	23,2 °C	—

Thermocouple Locations	max. temperature measured, (°C)	max. temperature limit, (°C)
LINE L1	60,0	80
LINE L2	66,8	80
LINE L3	61,4	80
LOAD L1	58,1	80
LOAD L2	67,0	80
LOAD L3	63,3	80

000793



IEC 60947-2

	TABLE: clearance and creepage distance measurements					3P
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
P-P		690	8	40,3	16	49
L-A		690	8	32,9	16	32,9
C-O		690	8	31,3	16	65,79

supplementary information:

P-P : Pole to Pole, L-A : Live part to accessible part, C-O : across open contacts.

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IEC 60947-2

	TABLE: Heating Test		S1-1 (4P)
	Test voltage (V):		—
	Ambient (°C):	25,5 °C	—

Thermocouple Locations	max. temperature measured, (°C)	max. temperature limit, (°C)
LINE L1	67,9	80
LINE L2	66,2	80
LINE L3	64,6	80
LOAD L1	68,0	80
LOAD L2	69,1	80
LOAD L3	65,4	80
Manual operating means: non-metallic	18,0	35
Parts intended to be touched but not hand-held: non-metallic	17,1	50
Parts which need not be touched during no rmal operation	36,7	60
OCR (Over current relay)	36,1	N/A

	TABLE: clearance and creepage distance measurements					4P
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
P-P		690	8	40,3	16	49
L-A		690	8	32,9	16	32,9
C-O		690	8	31,3	16	65,79

supplementary information:

P-P : Pole to Pole, L-A : Live part to accessible part, C-O : across open contacts.

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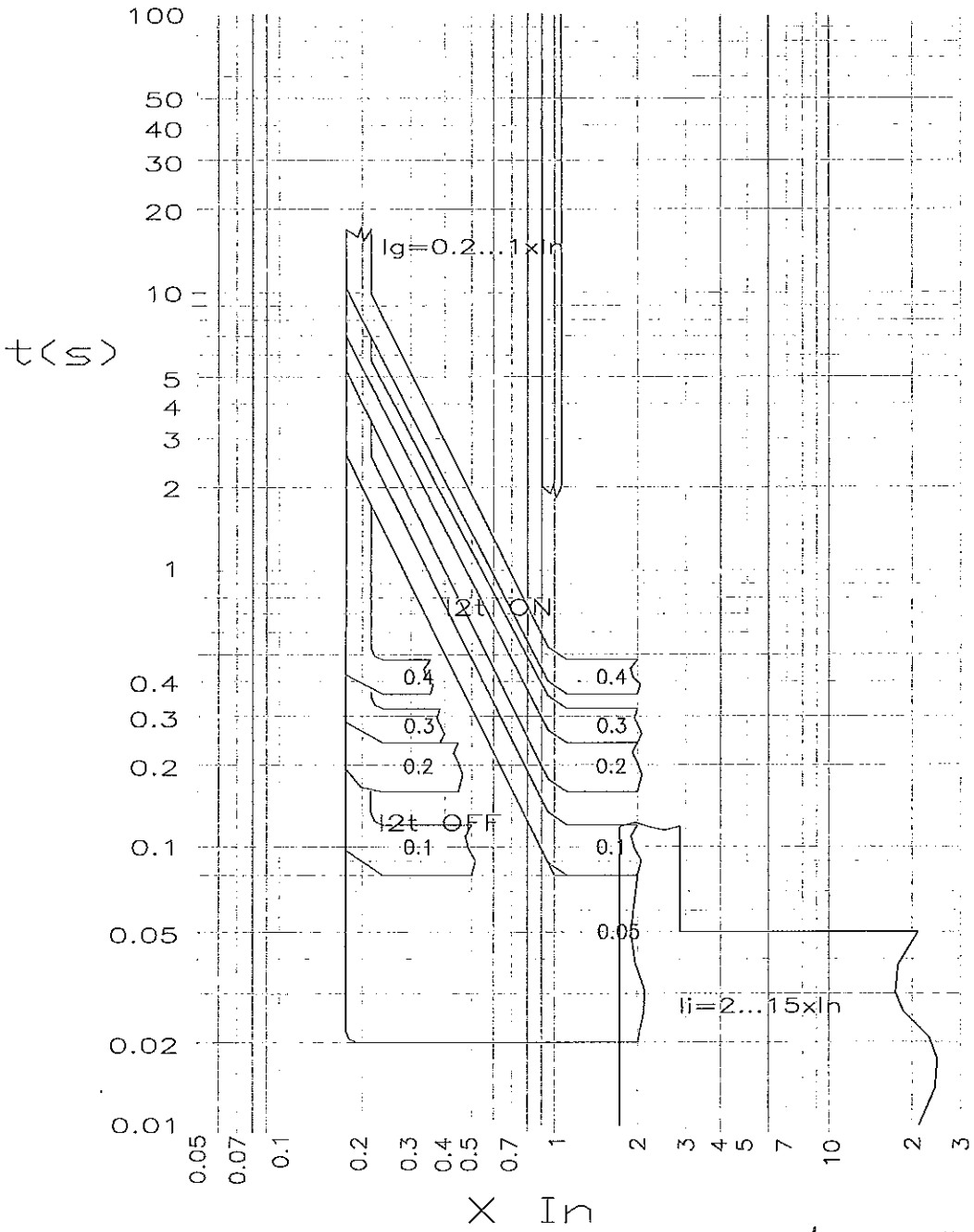
IEC 60947-2

Time current characteristics

1. Instantaneous/Ground fault



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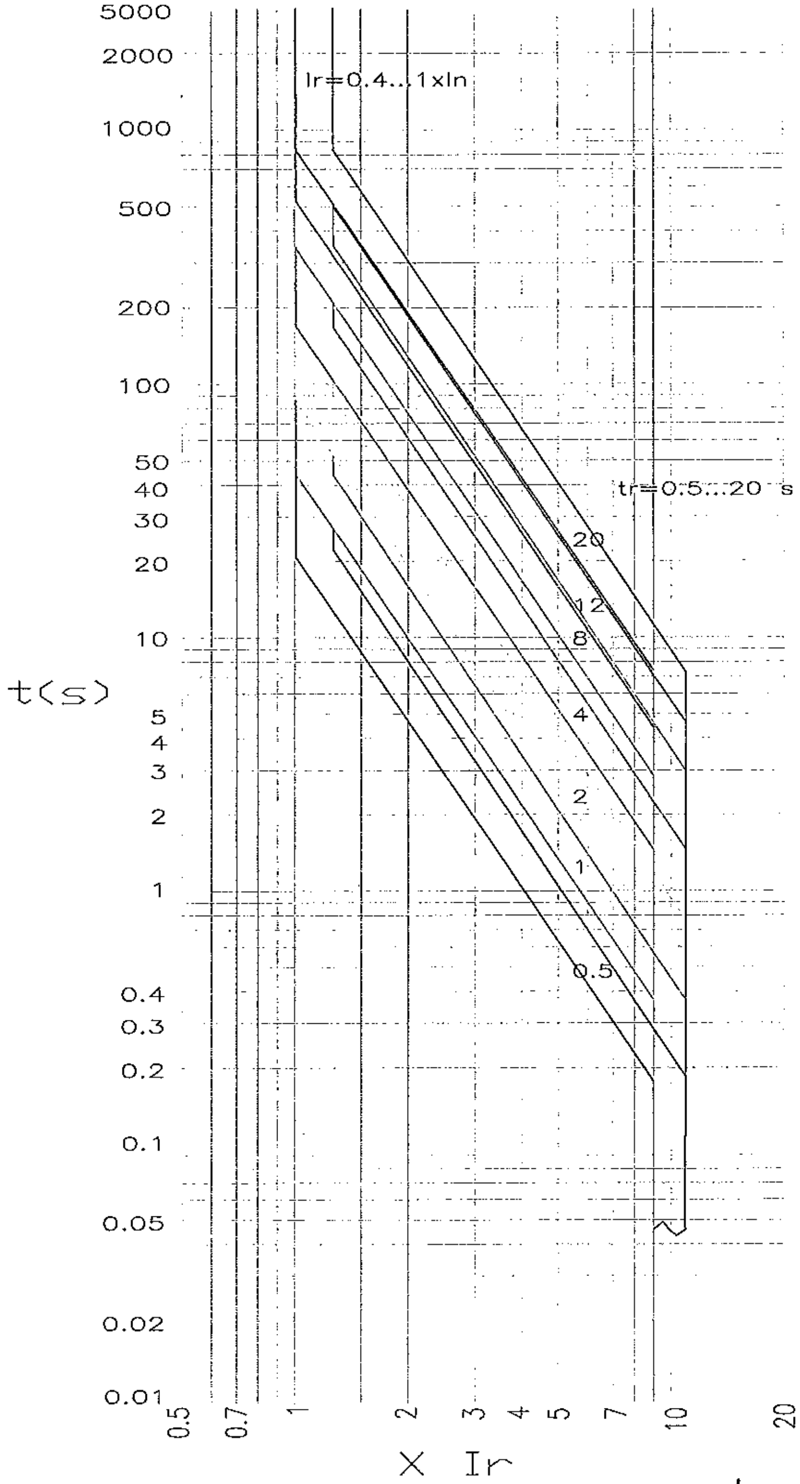
2. Long time delay



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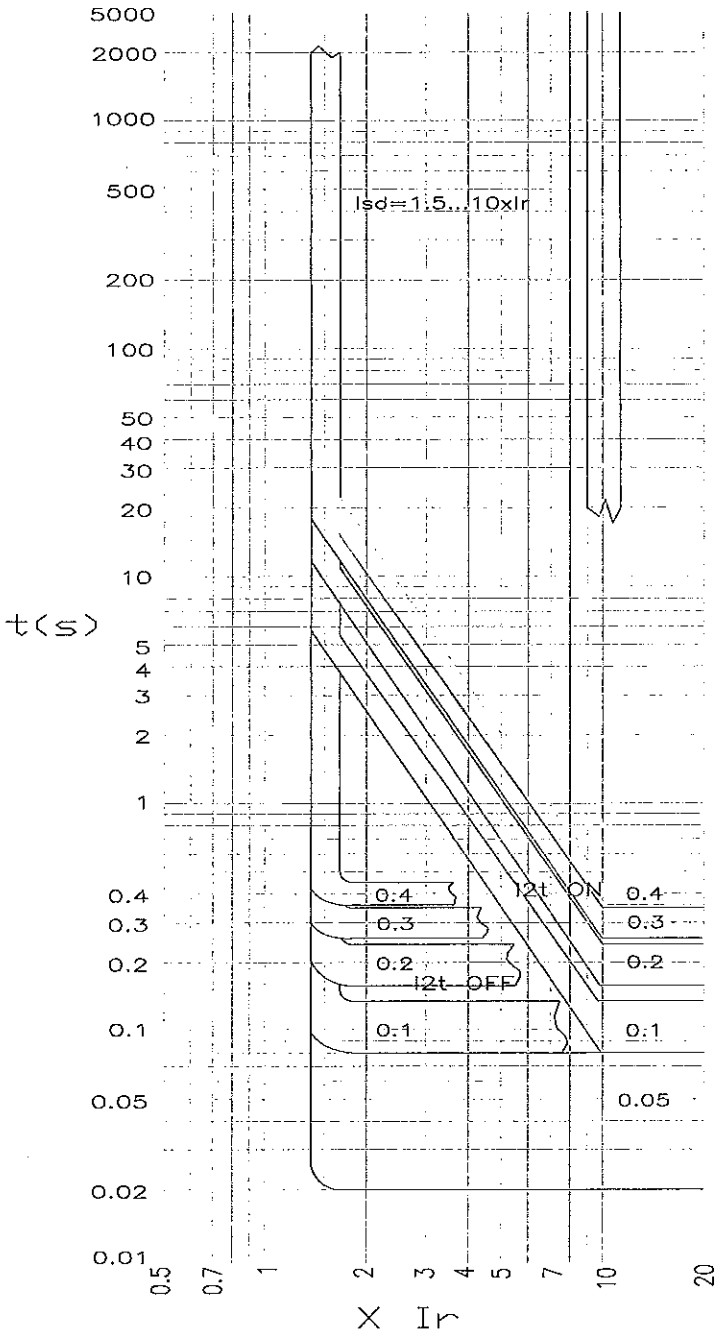
3. Short time delay



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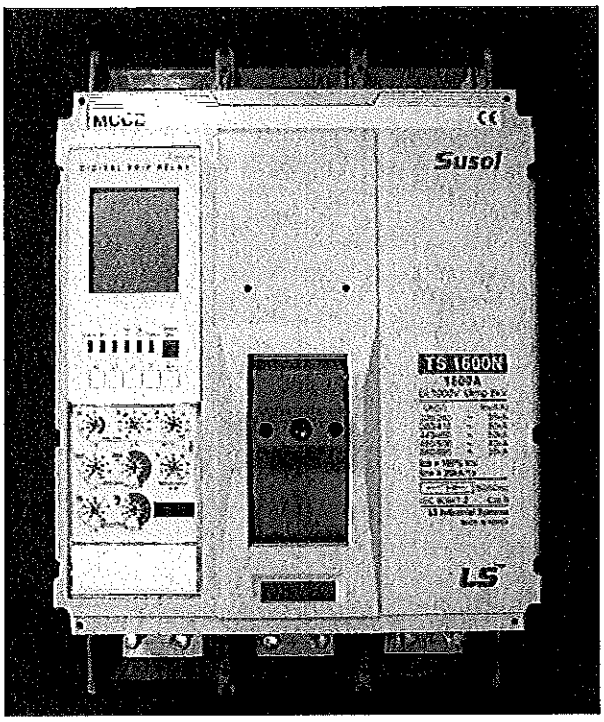
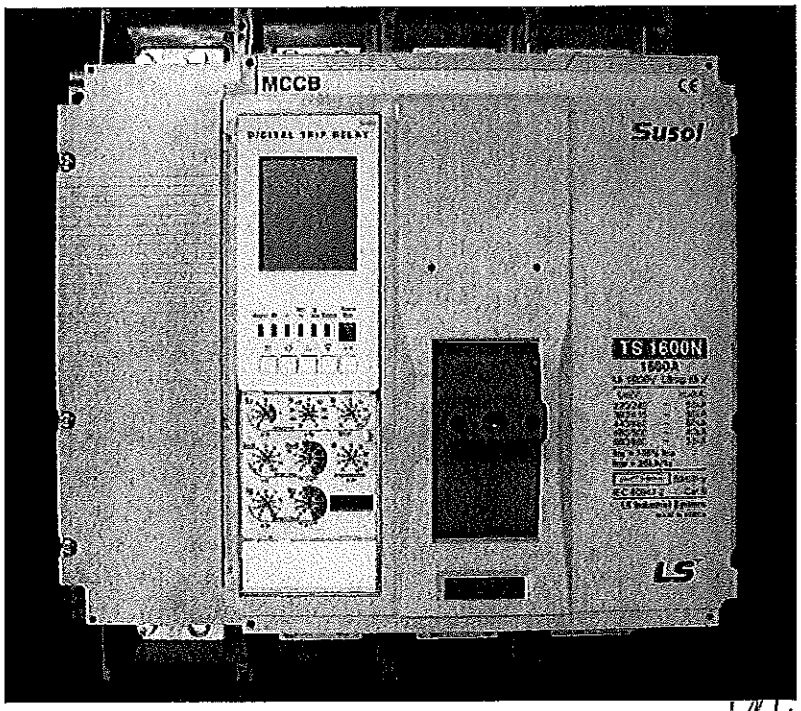
Photographs

TS1600N 3P



TS1600N 4P



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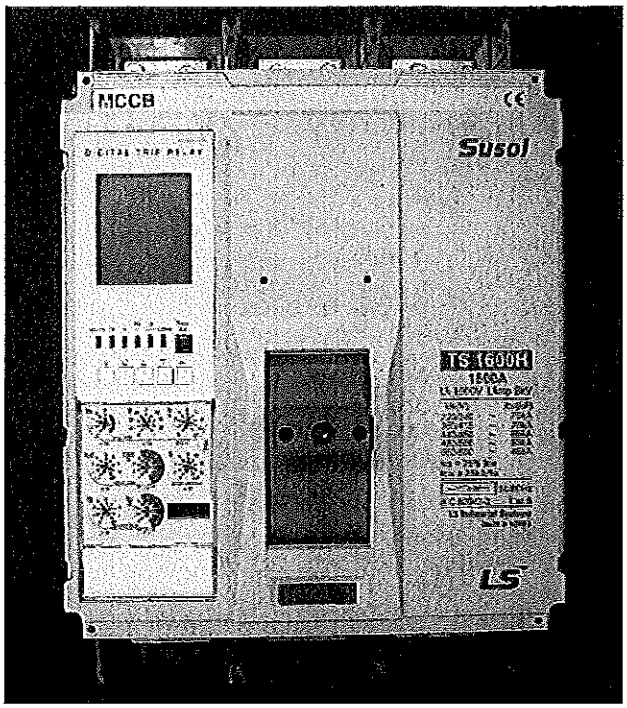
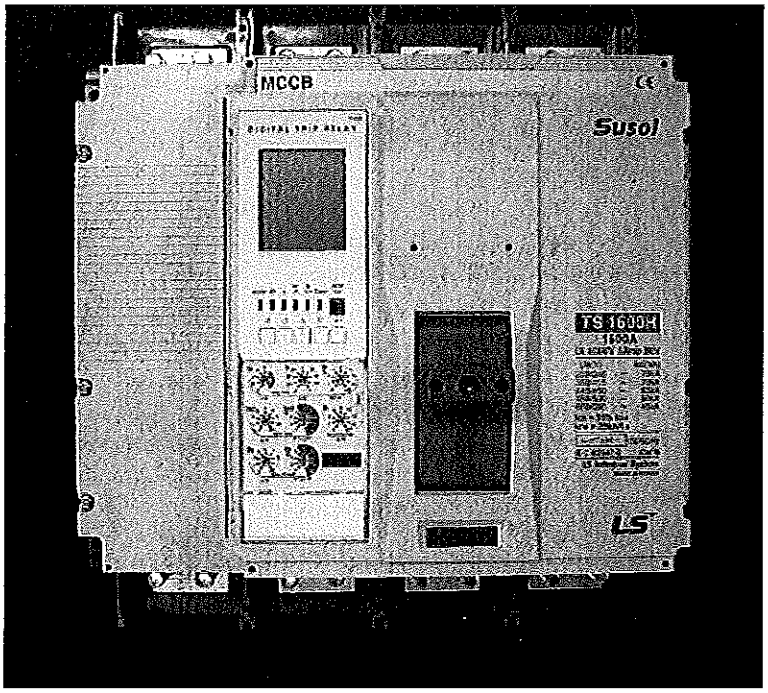
TS1600H 3P



TS1600H 4P



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СПИСЪК

на типовите изпитвания, проведени от независима изпитвателна лаборатория,
за предлаганите триполюсни автоматични прекъсвачи, както следва:

Марка: LS Industrial Systems Co., Ltd
Продукт: триполюсен автоматичен прекъсвач
Серия: TS

5.2 Маркировка
7.1 Конструкция
8.3.3 Основни характеристики
8.3.3.1 Изключващи граници и характеристики
8.3.3.2 Диелектрични свойства
8.3.3.3 Механични характеристики
8.3.3.4 Характеристики при претоварване
8.3.3.5 Проверка на диелектрична издръжливост
8.3.3.6 Проверка при повишаване на температурата
8.3.3.7 Проверка на сработване при претоварване
8.3.4 Характеристики при късо съединение
8.3.4.1 Работна изключвателна възможност при късо съединение
8.3.4.2 Работни характеристики
8.3.4.3 Проверка на диелектрична издръжливост
8.3.4.4 Проверка при повишаване на температурата
8.3.4.5 Проверка на сработване при претоварване
8.3.5 Характеристики при късо съединение
8.3.5.1 Издържан импулсен ток
8.3.5.2 Изключвателна възможност при късо съединение
8.3.5.3 Проверка на диелектричните свойства
8.3.5.4 Проверка сработване при претоварване
8.3.6 Условен ток на късо съединение
8.3.6.1 Проверка сработване при претоварване
8.3.6.2 Издържан ток на късо съединение
8.3.6.3 Проверка при повишаване на температурата
8.3.6.4 ПРоверка на изключвателната възможност при максимален ток на късо съединение
8.3.6.5 Проверка на диелектричните свойства
8.3.6.6 Проверка на сработване при претоварване

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Annex to ISO/IEC 17025 declaration of accreditation
for registration number: **K 006**

of **KEMA Nederland B.V.**
Calibration & Metering
Arnhem

This annex is valid from: **30-03-2010** to **01-03-2014** Replaces annex dated: **30-06-2009**

Premises: **n.a.**

HCS code	Measured quantity, Range	Frequency	Best measurement capabilities (k=2)	Remarks
LF 0 0	DC/LF Quantities			
LF 1 0	DC Voltage			
	Standard cells		3 μV	
	Up to 1 mV		0,4 μV	
	1 mV to 10 mV		$3 \cdot 10^{-4} \cdot U$	
	10 mV to 100 mV		$3 \cdot 10^{-5} \cdot U$	
	100 mV to 10 V		$5 \cdot 10^{-6} \cdot U$	
	10 V to 100 V		$1 \cdot 10^{-5} \cdot U$	
	100 V to 1100 V		$2 \cdot 10^{-5} \cdot U$	
	Zener Reference Standards			
	1 V and 1,018 V		3 μV	
	10 V		20 μV	
	High Voltage			Measuring
	1 kV to 6 kV		$2 \cdot 10^{-3} \cdot U$	
LF 2 0	DC Current			
	10 μA to 3 A		$2 \cdot 10^{-5} \cdot I$	
	3 A to 10 A		$2{,}5 \cdot 10^{-5} \cdot I$	
	10 A to 20 A		$6 \cdot 10^{-5} \cdot I$	

This annex has been approved by:

000803

I.J.C. van der Pool
Chief Executive

Annex to ISO/IEC 17025 declaration of accreditation
for registration number: **K 006**

of **KEMA Nederland B.V.**
Calibration & Metering
Arnhem

This annex is valid from: **30-03-2010** to **01-03-2014** Replaces annex dated: **30-06-2009**

HCS code	Measured quantity, Range	Frequency	Best measurement capabilities (k=2)	Remarks
	20 A to 100 A		$1 \cdot 10^{-4} \cdot I$	
LF 3 1	AC Voltage			
	60 mV to 1000 V	40 Hz to 20 kHz	$2 \cdot 10^{-4} \cdot U$	
	60 mV to 1000 V	20 kHz to 50 kHz	$3 \cdot 10^{-4} \cdot U$	
	60 mV to 220 V	20 kHz to 50 kHz 50 kHz to 100 kHz	$4 \cdot 10^{-4} \cdot U$	
	220 V to 1000 V	50 kHz to 100 kHz	$4 \cdot 10^{-4} \cdot U$	
	220 V to 1000 V	50 kHz to 100 kHz	$2 \cdot 10^{-3} \cdot U$	
	High Voltage			Measuring
	1 kV tot 6 kV	50 Hz	$2 \cdot 10^{-3} \cdot U$	
LF 3 2	AC Voltage Ratio			
	(instrument transformers)			
	Primary: (10-600)V Secondary: (0,1-240)V	50 Hz and 60 Hz	$3 \cdot 10^{-5} \cdot U_{uit}/U_{in}$ and 90 µrad	
LF 3 3	AC Current			
	0,1 mA to 300 mA	40 Hz to 5 kHz	$3 \cdot 10^{-4} \cdot I$	
	300 mA to 20 A	40 Hz to 1 kHz	$3 \cdot 10^{-4} \cdot I$	
	20 A to 50 A	40 Hz to 1 kHz	$6 \cdot 10^{-4} \cdot I$	
LF 4 2	AC Current Ratio			ambient temp. (23 ± 2) °C
	(instrument transformers)	50 Hz and 60 Hz	$3 \cdot 10^{-5} \cdot I_{uit}/I_{in}$ and 90 µrad	Measuring

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Annex to ISO/IEC 17025 declaration of accreditation
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This annex is valid from: **30-03-2010** to **01-03-2014** Replaces annex dated: **30-06-2009**

HCS code	Measured quantity, Range	Frequency	Best measurement capabilities (k=2)	Remarks
	Primary: 5 A to 6000 A Secondary: 1A or 5A			
LF 4 3	High Current			
	10 A to 6000 A	50 Hz, 60 Hz	$3 \cdot 10^{-4} \cdot I$	
LF 5 0	Power and Energy			10 mV to 1100 V,
	Power			10 µA to 100 A
	0,1 µW to 1 µW		$1 \cdot 10^{-4} \cdot P$	
	1 µW to 1 kW		$5 \cdot 10^{-5} \cdot P$	
	1 kW tot 10 kW		$1 \cdot 10^{-4} \cdot P$	
	10 kW tot 110 kW		$2 \cdot 10^{-4} \cdot P$	
	3 W to 57,6 kW	50 Hz and 60 Hz	$\frac{3 \cdot 10^{-4}}{\cos\varphi} \cdot P$	on site to be performed at ambient temperature; voltage and current as mentioned above
	3 W to 2,9 MW	50 Hz and 60 Hz	$\frac{2 \cdot 10^{-4}}{\cos\varphi} \cdot P$	measuring 20 V to 1100 V 100 mA to 6000A cos φ = 0 to 1
	Reactive Power (P_r) 6 var to 1,8 Mvar	50 Hz and 60 Hz	$\frac{5 \cdot 10^{-4}}{\sin\varphi} \cdot P_r$	60 V to 300 V 100 mA to 6000 A
	Electrical (reactive-) energy			see (reactive-) power and time
LF 5 1	Power Factor cos φ : 0 to 1	40 Hz to 100 Hz	$\frac{2 \cdot 10^{-3}}{\cos\varphi} \cdot \mathrm{PF}$	

Annex to ISO/IEC 17025 declaration of accreditation
for registration number: **K 006**

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Arnhem

This annex is valid from: **30-03-2010** to **01-03-2014** Replaces annex dated: **30-06-2009**

HCS code	Measured quantity, Range	Frequency	Best measurement capabilities (k=2)	Remarks
LF 6	Impedance (DC/LF)			
LF 6 2	DC Resistance			Non-decadic values
	20 μΩ to 50 μΩ		$3 \cdot 10^{-4} . R$	
	50 μΩ to 100 μΩ		$1 \cdot 10^{-4} . R$	
	100 μΩ to 20 kΩ		$1{,}2 \cdot 10^{-5} . R$	
	1 mΩ to 10 mΩ		$6\ 5 \cdot 10^{-6} \cdot R$	
	10 mΩ to 1000 mΩ		$7 . 10^{-6} . R$	
	1 Ω to 10 kΩ		$5 \cdot 10^{-6} \cdot R$	
	10 kΩ to 1 MΩ		$1 \cdot 10^{-5} \cdot R$	
	1 MΩ to 10 MΩ		$1{,}2 \cdot 10^{-5} \cdot R$	
	10 MΩ to 100 MΩ		$3 . 10^{-5} . R$	
	100 μΩ to 10 kΩ		$6 . 10^{-6} . R$	Decadic Values
LF 6 4	Capacitance			
	LF Capacitance			accuracy depends on dissipation factor at 1 kHz
	10 pF to 100 pF	100 Hz, 1 kHz, 10 kHz	$1 \cdot 10^{-3} \cdot C$	
	1 μF	50 Hz, 200 Hz, 1 kHz	$1 \cdot 10^{-3} \cdot C$	
LF 6 7	Inductance			
	1 mH to 10 mH	1 kHz, (400-1692)Hz	$1 \cdot 10^{-3} \cdot L$	
	100 mH	100 Hz, 1 kHz 1,592 kHz	$1 \cdot 10^{-3} \cdot L$	
	1 H	100 Hz, 200 Hz, 400 Hz and 1 kHz	$1 \cdot 10^{-3} \cdot L$	
RF 0 0	RF Quantities			
RF 3 0	RF Power			
	- 9 dBm to +30 dBm	0,1 MHz to 4200 MHz	0,5 dB	Measuring:
	+30 dBm to +57 dBm	0,1 MHz to 500 MHz	0,6 dB	50 ohm coaxial VSWR
	-60 dBm to –10 dBm	10 MHz to 10000 MHz	0,5 dB	

Annex to ISO/IEC 17025 declaration of accreditation
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of **KEMA Nederland B.V.**
Calibration & Metering
Arnhem

This annex is valid from: **30-03-2010** to **01-03-2014** Replaces annex dated: **30-06-2009**

HCS code	Measured quantity, Range	Frequency	Best measurement capabilities (k=2)	Remarks
	-80 dBm to –10 dBm	0,1 MHz to 2700 MHz	1,1 dB	source < 2 Generating: (0,09 - 3200) MHz
RF 5 0	Rise time (10% to 90%) 1 ns to 1 ms		$2 \cdot 10^{-2} \cdot \tau$ +200 ps	10 mV/div to 1 kV/div
TF 0 0	TIME and FREQUENCY			
TF2 1	Frequency	1 Hz to 1,2 GHz	$5 \cdot 10^{-10} \cdot f$	
TF 2 2	Time interval	1 µs to ∞	$5 \cdot 10^{-10} \cdot t$ + 100 ns	
TF 3 2	Harmonic Distortion			(1)
	< 0,1 %	20 Hz to 2,5 kHz	$3 \cdot 10^{-4}$	
	0,1 % to 1 %	20 Hz to 2,5 kHz	$1 \cdot 10^{-3}$	
	1 % to 10 %	20 Hz to 2,5 kHz	$3 \cdot 10^{-3}$	
	10 % to 30 %	20 Hz to 2,5 kHz	$1 \cdot 10^{-2}$	
	30 % to 100 %	20 Hz to 2,5 kHz	$3 \cdot 10^{-2}$	

Part II, Mechanical quantities and Temperature

Measured quantity, Instrument, Gauge		Range	Best measurement capabilities (k=2)	Remarks
PV 1 0	Pressure			(2)
	Relative Pressure	(-10 to 10) kPa	$3 \cdot 10^{-4} \cdot p_e$ + 4 Pa	medium: air
		(-98 to 100) kPa	$3 \cdot 10^{-4} \cdot p_e$ + 5 Pa	medium: nitrogen
		100 kPa to 10 MPa	$3 \cdot 10^{-4} \cdot p_e$	medium: nitrogen
		(10 to 70) MPa	$3 \cdot 10^{-4} \cdot p_e$	medium: oil

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HCS code	Measured quantity, Range	Frequency	Best measurement capabilities (k=2)	Remarks
	Absolute Pressure	(80 to 110) kPa	$3 \cdot 10^{-4} \cdot p$	medium: air
		(2 to 200) kPa	$3 \cdot 10^{-4} \cdot p$ + 5 Pa	medium: nitrogen
		200 kPa to 10 MPa	$3 \cdot 10^{-4} \cdot p$	medium: nitrogen
		(10 to 70) MPa	$3 \cdot 10^{-4} \cdot p$	medium: oil
TE 0 0	TEMPERATURE, HUMIDITY AND THERMOPHYSICAL PROPERTIES			
TE 1 0	Resistance thermometers	-50 °C to 20 °C	0,02 K	
		20 °C to 50 °C	0,05 K	
		50 °C to 300 °C	0,05 K	
		300 °C to 550 °C	0,16 K	
		550 °C to 650 °C	0,50 K	
TE 3 0	Thermocouples	-50 °C to 20 °C	0,16 K	Including C.J. references
		20 °C to 50 °C	0,16 K	
		50 °C to 300 °C	0,16 K	
		300 °C to 550 °C	0,21 K	
		550 °C to 650 °C	0,6 K	
		650 °C to 1000 °C	1,6 K	
TE 4 0	Liquid-in-glass thermometers	-50 °C to 50 °C	0,02 K	
		20 °C to 50 °C	0,04 K	
		50 °C to 300 °C	0,02 K	
	Differential Temperature	-50 °C to 200 °C	0,05 K	t_{min} = -50 °C t_{max} = 200 °C
TE 4 1	Self indicating thermometers			

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HCS code	Measured quantity, Range	Frequency	Best measurement capabilities (k=2)	Remarks
	Dry Block Calibrators	-20 °C to 650 °C	$(8 \cdot 10^{-4} \cdot t_{90} + 0{,}06)$ K	
	Writing thermometers	15 °C to 50 °C	0,5 K	
	Digital thermometers	-50 °C to 20 °C	0,02 K	including C.J. references
		20 °C to 50 °C	0,05 K	resolution 1 digit
		50 °C to 300 °C	0,05 K	
		300 °C to 550 °C	0,16 K	
		550 °C to 630 °C	0,50 K	
		630 °C to 1000 °C	1,5 K	

Remarks:

The ambient temperature during calibration is, unless specified otherwise, for:
LF measurements @ (23 ± 1)°C
TF measurements @ (23 ± 1)°C
Pressure measurements @ (23 ± 2)°C
Temperature measurements @ (23 ± 2)°C

(1) The stated best measurement capabilities are based on the fundamental frequency of the input signal. If desired the distortion can be specified as a rang number of the harmonics.

(2) $p_e = p - p_{amb}$; p_e is the relative pressure, p_{amb} is the local air pressure, p is the absolute pressure.

The best measurement capability is the highest achievable accuracy for a given measuring value or measuring range, expressed as the total positive and negative measurement uncertainty.

The uncertainty is calculated according to EA-4/02 "Expression of the Uncertainty of Measurement in Calibration".

Calibrations are performed inside the laboratory, unless specified otherwise.