Short circuit tests technical file Wöhner bar systems mounted on ETA enclosure

This file was drafted on November 11, 2004, and includes:

1) Technical report on the calculation methods extrapolated from the systems tested at CESI and assembly drawing (2 pages plus cover)

2) Tables with chart of Icw (Icc) values and relative centerline distance between the supports, for the configuration of bar distribution system, 60 mm CL distance (11 pages plus cover)

3) CESI test report No. A4/519182 (9 pages plus cover)

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Part 1)
Technical report and assembly drawing
(2 pages)

The short circuit test is prescribed by standard EN 60439-1 Art. 8.2.3.
Such test is mandatory both for TTA and for PTTA assembly, whereby the difference is that, for ANS assembly, the standard only prescribes to refer to a tested type assembly, which is not necessarily stored and available at the assembly manufacturer.
From the test results, you can extrapolate the values for a bar system different from the tested one, adopting the procedure described in IEC publication 1117 (1992). " Method for the determination of short circuit resistance for non-standard switchgear and controlgear assemblies (PTTA)".
Standard EN 60439-1 in Note 1 to Art. 8.2.3.2.5 allows the extrapolation procedure according to the IEC publication 1117.
The actual calculation mode (formulas etc.) is given in the publication IEC 865, from which the harmonized standard EN 60865-1 has been extracted.

To allow an assembly manufacturer to develop a suitable and certifiable bar configuration, Wöhner has applied to CESI to carry out a type test for short-circuit withstand strenght on the following five bar distribution systems, mounted on the **ETA** enclosure model **ARETA** (two columns 800 x 2000 x 600, combined - see drawing):

Triple T copper bars- In 2500 A *
Double T copper bars- In 1600 A *
Double T copper bars- In 1250 A *
Copper bars 30 x 10 (mm) - In 630A/800 A *
Copper bars 20 x 5 (mm) - In 320 A *

From the test value, all other Icw (Icc) values were extrapolated according to the CL distance between supports.
For the following 6 systems - that complete the Wöhner range - all values were extrapolated from the two tested systems measuring 30 x 10 and 20 x 5, referring to the most suitable in terms of acceptable short circuit current, as prescribed by the standards.

Copper bars 20 x 10 (mm) - In 520 A *
Copper bars 12 x 10 (mm) - In 360 A *
Copper bars 30 x 5 (mm) - In 450 A *
Copper bars 25 x 5 (mm) - In 400 A *
Copper bars 15 x 5 (mm) - In 250 A *
Copper bars 12 x 5 (mm) - In 200 A *

*(* - Refer to the catalog for effective capacity in A)*

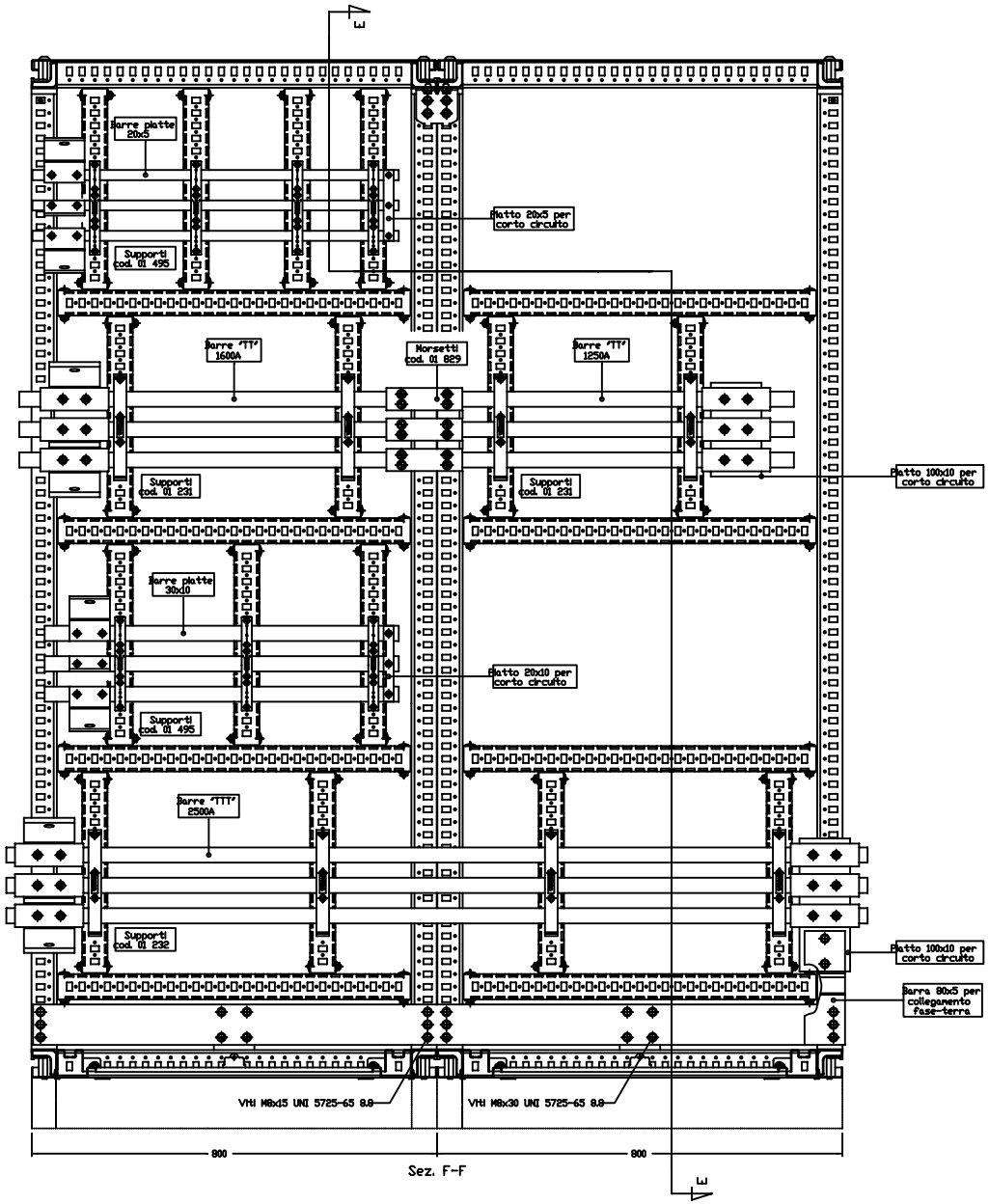
The 11 tables and related charts (see Section 2) indicate, for each system, the admitted values of short-lasting nominal current **Icw** (without protection devices), or conditioned short circuit nominal current **Icc** (conditioned by protection devices), the related peak current **Ipk** and the corresponding CL distance between supports. ***Carefully read the notes in the tables for correct dimensioning.***

It must be underlined that standard defines two basic conditions:

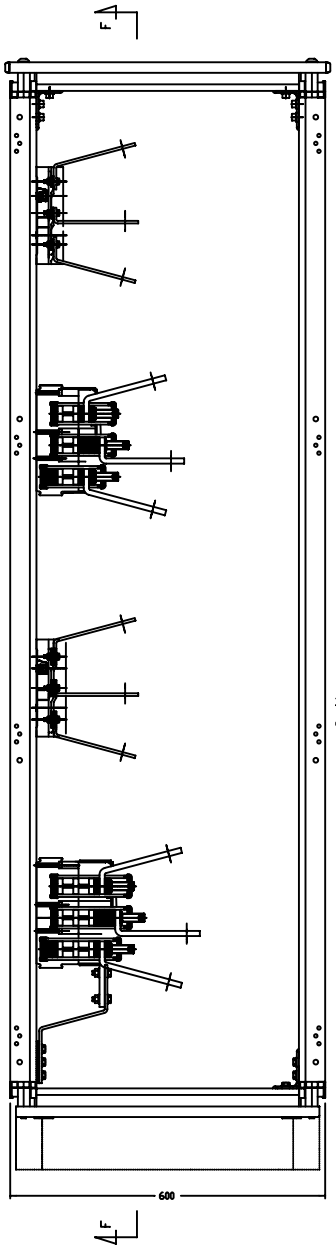
1. **Short circuit current can be changed only with lower values**
2. **It is not allowed to change the support material or shape (only for the bar system)**

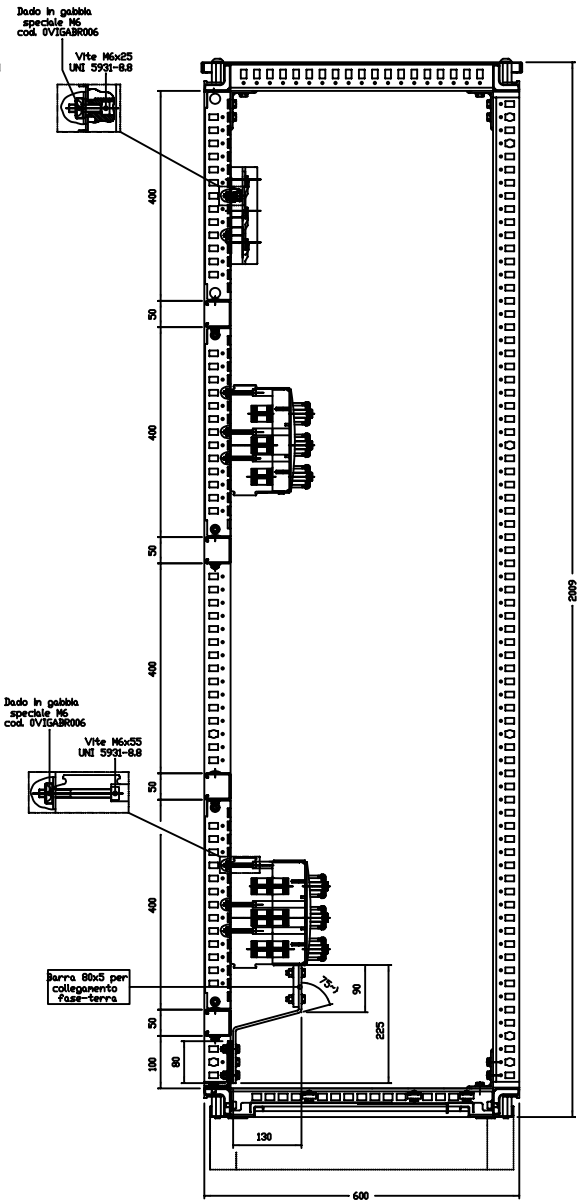
NOTE: The bar systems and the enclosure must be mounted in conformity with the manufacturers' prescriptions to ensure a mechanical resistance of components equivalent to the tested system, with particular reference to the screw locking torque and the fastening method for the bottom plate of the panel, which can be used as an alternative to crosspieces.

The ETA enclosure has withstood the short circuit dynamic stress with no problem, including short circuit between phase and earth, whereby current flows through the metal structure. The ARETA enclosures has already been tested with traditional bar systems up to 60 kA three-phase and 48 kA phase-earth, with no damage (see general catalog 2005/2006 and QuadroPlan manual), so they can be used up to these values with all the bar systems from the leading brands.



Sez. F-F





Sez. E-E

Revisione	Descrizione	Data	Controllato
A			

ETA-WÖHNER
Prove di corto circuito
Assieme

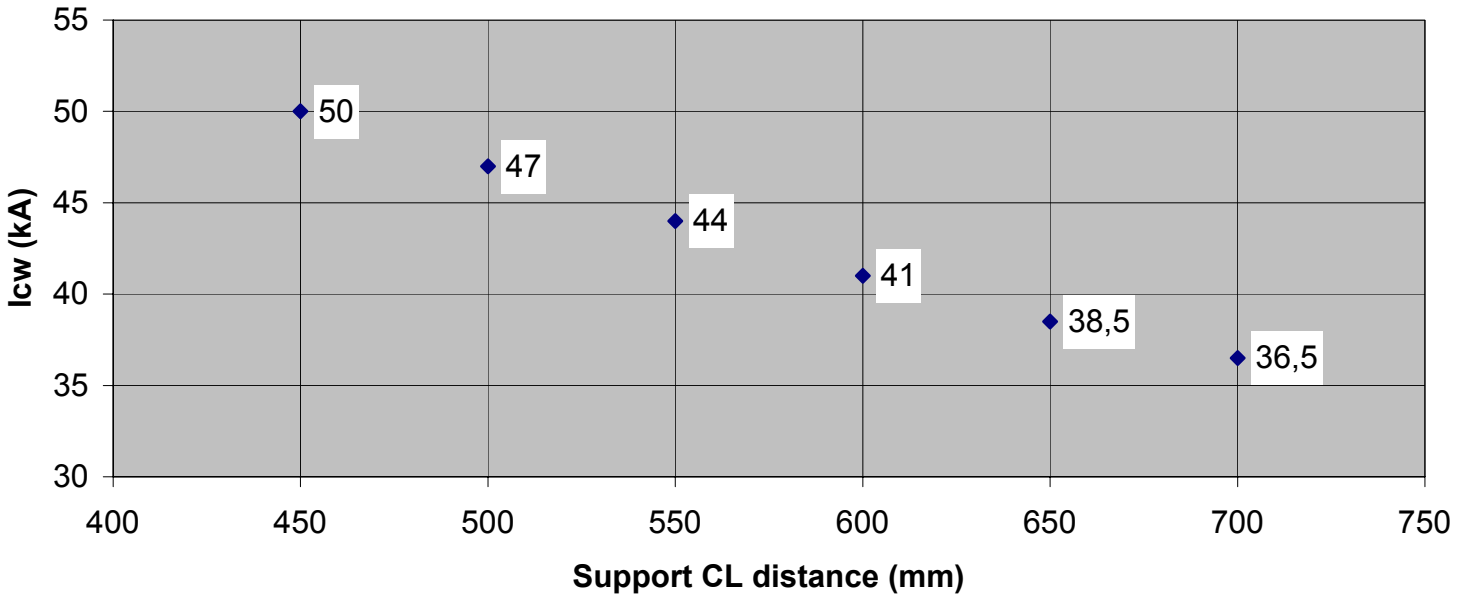
Scritto da: Data: Firma:
Controllato: Data: Firma:
Trattamento: N° varchiabili:
Per tolleranze generali vedere: TELLERfatec | Codice di protezione: WWW | Verificato: | Materiale: | Massa Kg:
Scala: 1/5 | Data: 04.08.2004 | Disegnatore: G.Nava | Controllo: AZartenega | Quantità: | Num°: EW01 01 02 | Foglio: 1 di 1

Part 2)
Tables with chart of lcw (lcc) values and relative centerline distance between the supports, for the configuration of bar distribution system, 60 mm CL distance
(11 pages)

wöhner

60 mm system

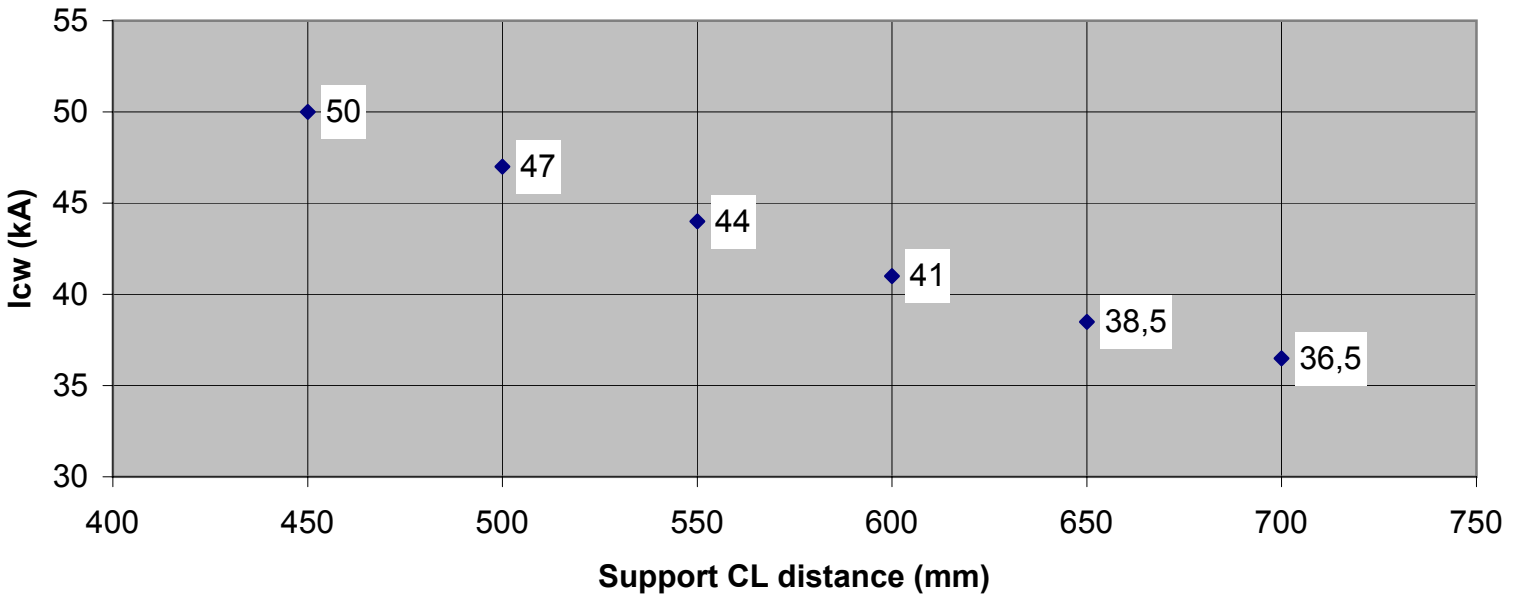
Triple T copper bars - In 2500 A (tested system)			
Bar part number: 01 187; 01 227			
Support part number: 01 232			
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)	
450	50	105	Test values
500	47	99	Values extrapolated by calculation. NB All values in the table, also test values, are valid for 2 or 4 and more supports mounted at equal distances. For 3 supports at equal distances, decrease the CL value by 15% approx. or the Icw value by 10% approx. (calculations according to EN 60865-1)
550	44	92	
600	41	86	
650	38,5	81	
700	36,5	77	



wöhner

60 mm system

Double T copper bars - In 1600 A (tested system)			
Bar part number: 01 608; 01 190; 01 249; 01 229			
Support part number: 01 231			
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)	
450	50	105	Test values
500	47	99	Values extrapolated by calculation. NB All values in the table, also test values, are valid for 2 or 4 and more supports mounted at equal distances. For 3 supports at equal distances, decrease the CL value by 15% approx. or the Icw value by 10% approx. (calculations according to EN 60865-1)
550	44	92	
600	41	86	
650	38,5	81	
700	36,5	77	

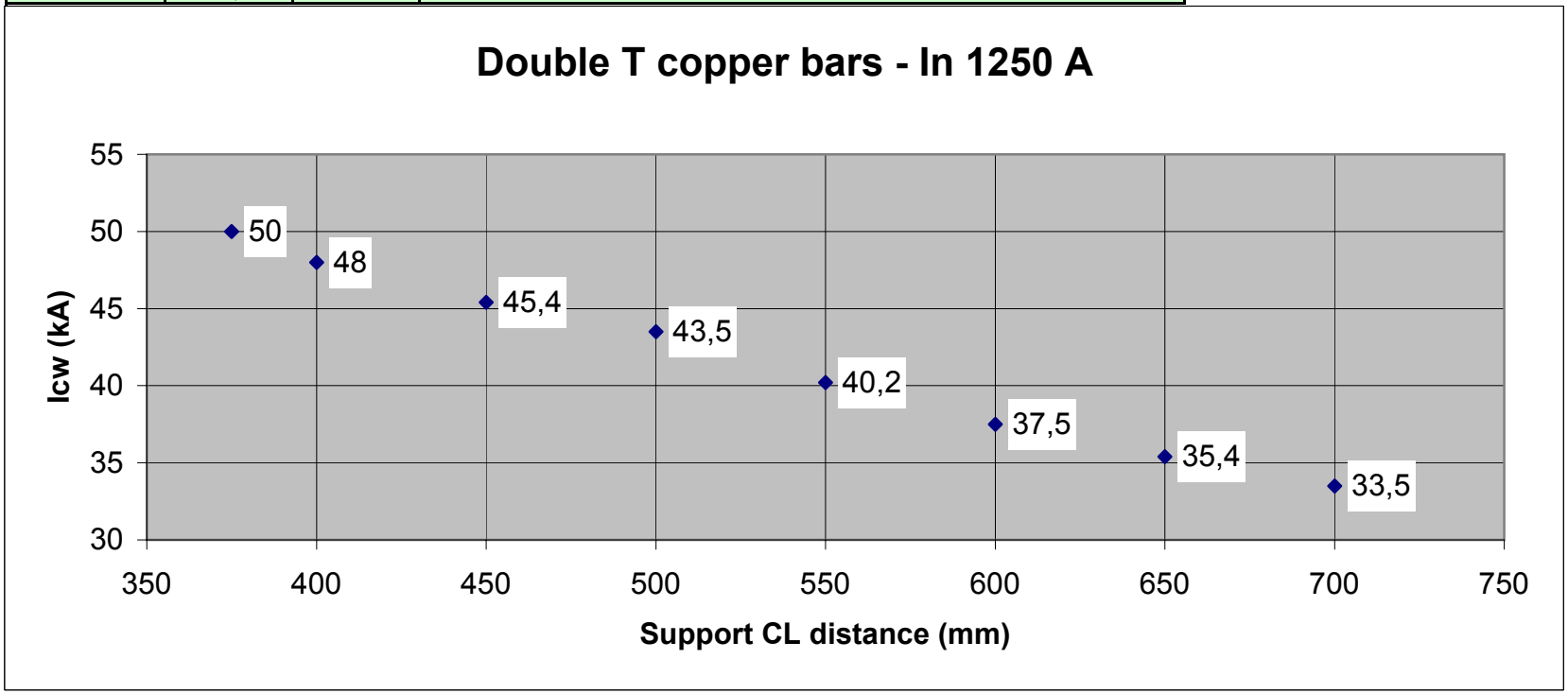


wöhner

beta

60 mm system

Double T copper bars - In 1250 A (tested system)			
Bar part number: 01 609; 01 224; 01 250; 01 223			
Support part number: 01 231			
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)	
375	50	105	Test values
400	48	101	Values extrapolated by calculation. NB All values in the table, also test values, are valid for 2 or 4 and more supports mounted at equal distances. For 3 supports at equal distances, decrease the CL value by 15% approx. or the Icw value by 10% approx. (calculations according to EN 60865-1)
450	45,4	95	
500	43,5	91	
550	40,2	84	
600	37,5	79	
650	35,4	74	
700	33,5	70	

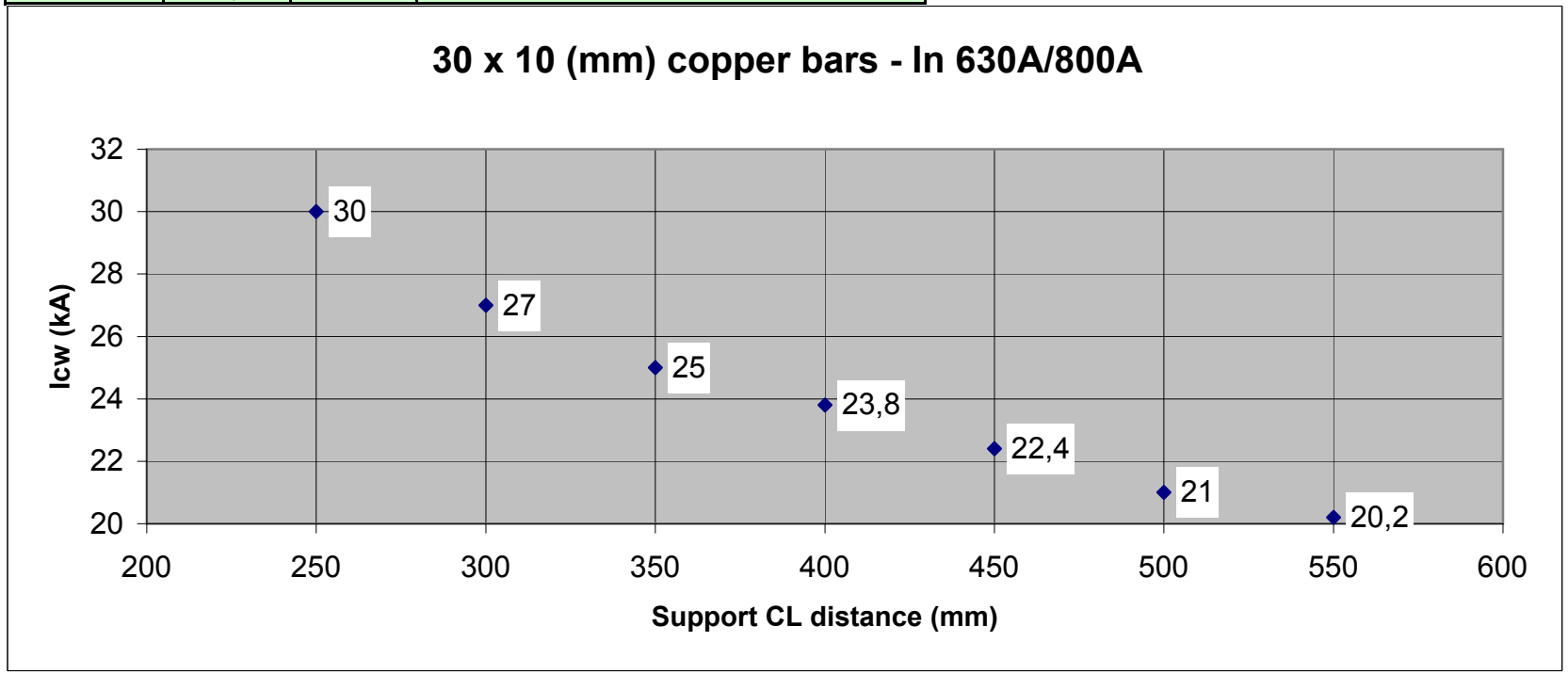


wöhner

eta

60 mm system

30 x 10 (mm) copper bars - In 630A/800A (tested system)			
Bar part number: 01 625; 01 204			
Support part number: 01 495			
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)	
250	30	63	Test values
300	27	57	Values extrapolated by calculation. NB All values in the table, also test values, are valid for any number of supports (calculations according to standard EN 60865-1).
350	25	53	
400	23,8	50	
450	22,4	47	
500	21	44	
550	20,2	40	



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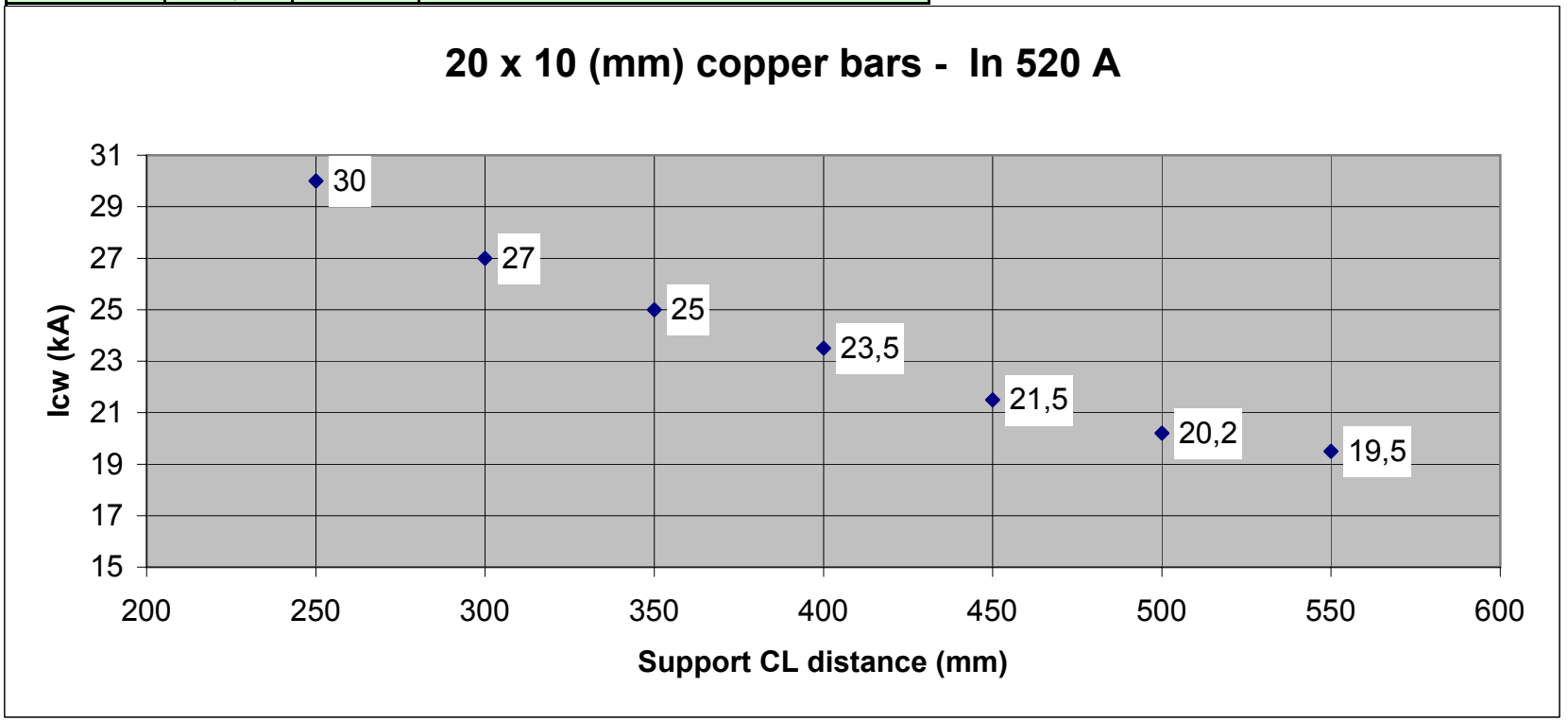
60 mm system

20 x 10 (mm) copper bars - In 520 A		
Bar part number: 01 624		
Support part number: 01 495		
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)
250	30	63
300	27	57
350	25	53
400	23,5	50
450	21,5	45
500	20,2	42
550	19,5	39

All values were extrapolated through calculation from the values of the 30x10 tested system and are valid for any number of supports (calculations according to standard EN 60865-1).



wöhner

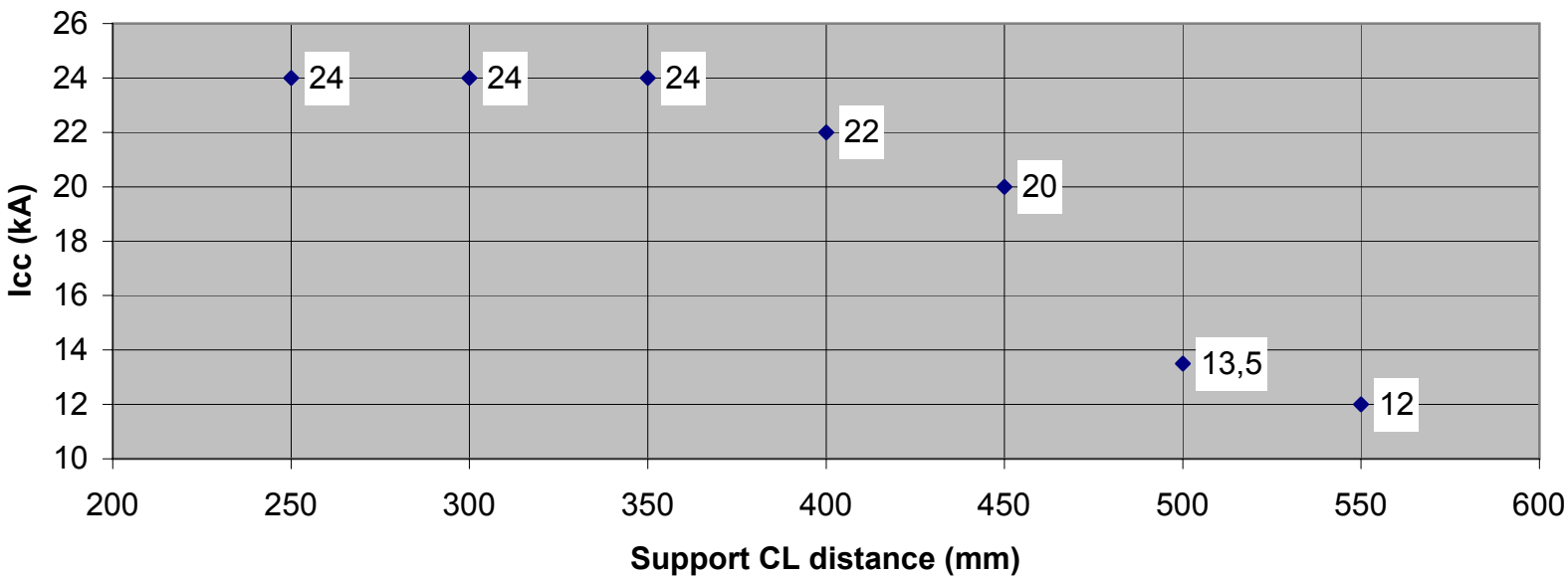
eta

60 mm system

12 x 10 (mm) copper bars - In 360 A		
Bar part number: 01 623		
Support part number: 01 495		
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)
250	24	50
300	24	50
350	24	50
400	22	46
450	20	40
500	13,5	27
550	12	24

All values were extrapolated through calculation from the values of the 30x10 tested system and are valid for any number of supports (calculations according to standard EN 60865-1).

NOTE: The Icw value of 24 kA is the limit value calculated for the thermal effects of a failure lasting 1s and not for the mechanical resistance of copper. The calculation proves that such value can be maintained up to a 350 mm CL distance between the supports.



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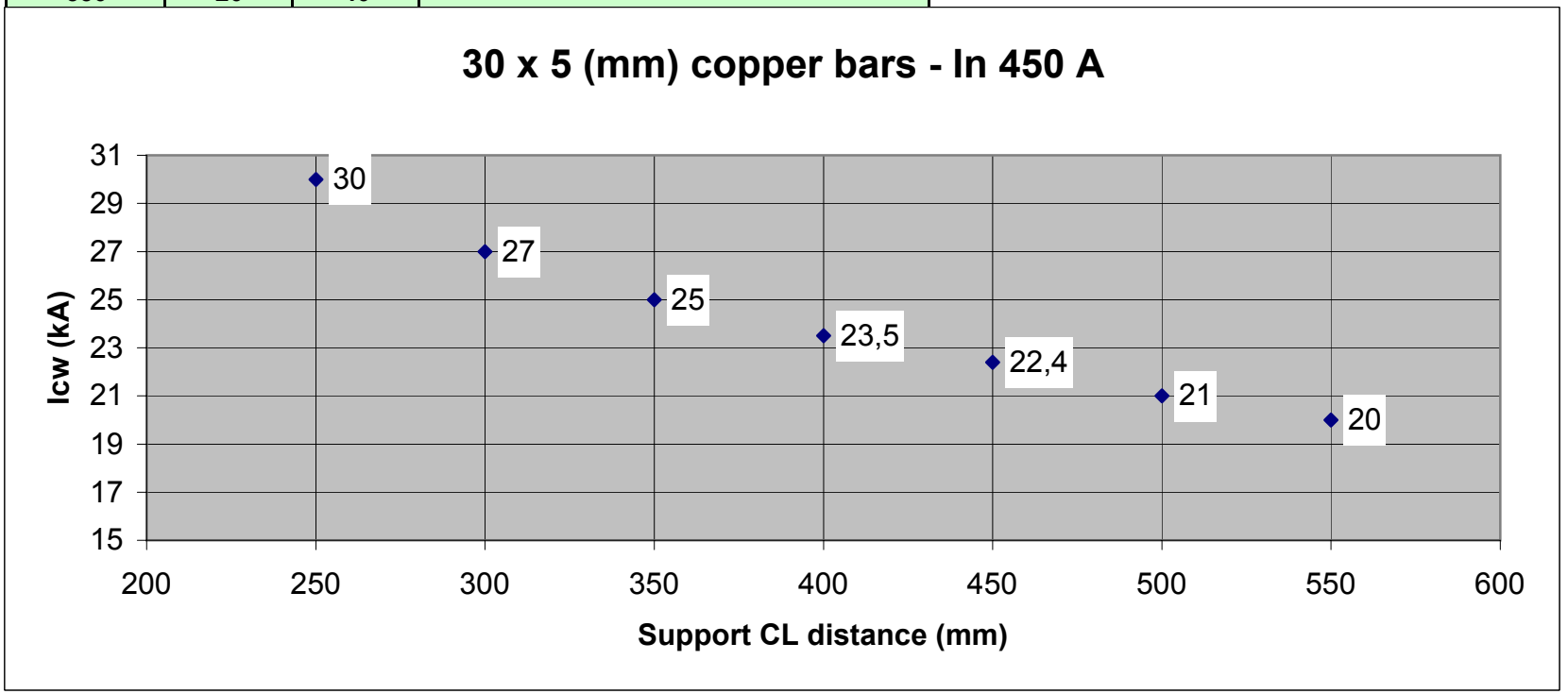
beta

60 mm system

30 x 5 (mm) copper bars - In 450 A		
Bar part number: 01 622		
Support part number: 01 495		
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)
250	30	63
300	27	57
350	25	53
400	23,5	49
450	22,4	47
500	21	44
550	20	40

All values were extrapolated through calculation from the values of the 30x10 tested system and are valid for any number of supports (calculations according to standard EN 60865-1).



wöhner

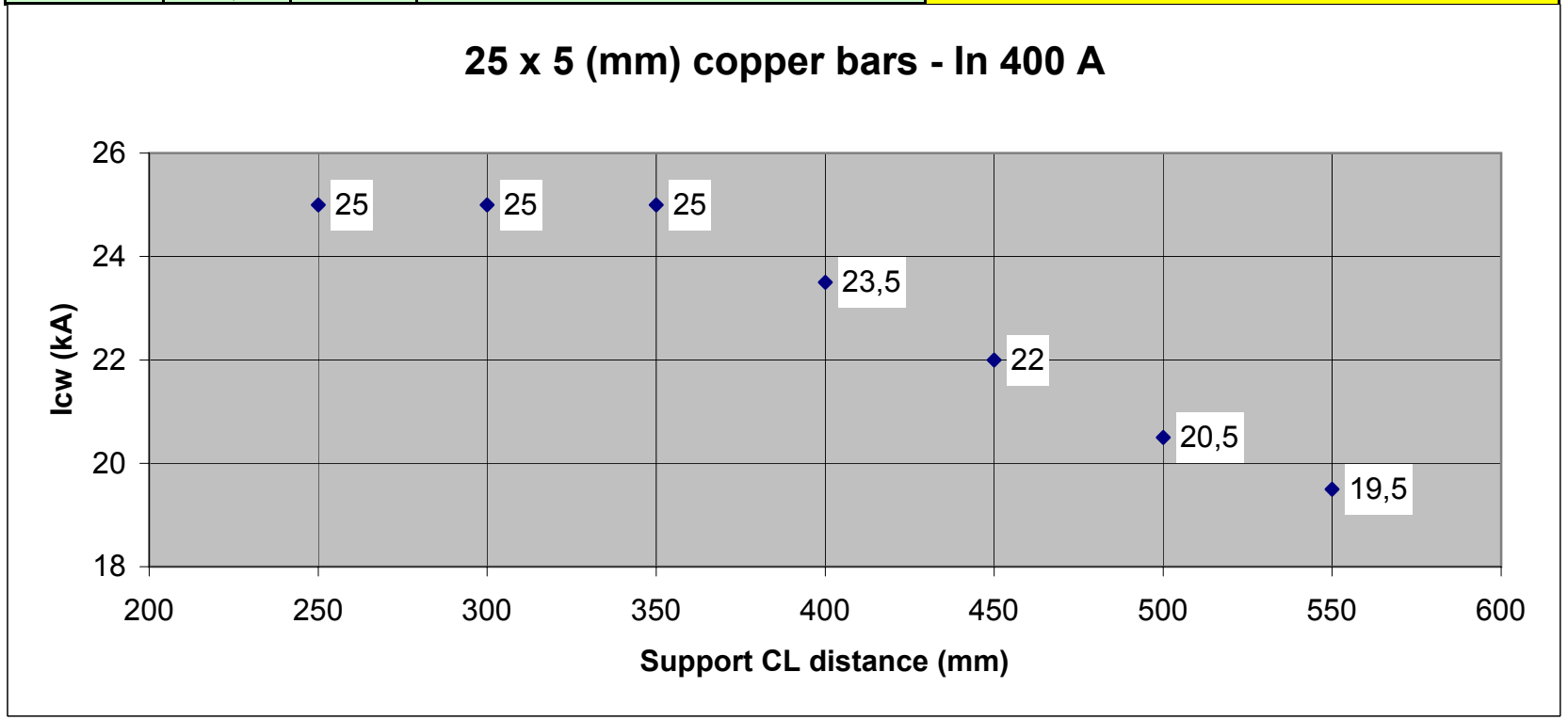
beta

60 mm system

25 x 5 (mm) copper bars - In 400 A		
Bar part number: 01 621		
Support part number: 01 495		
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)
250	25	53
300	25	53
350	25	53
400	23,5	49
450	22	46
500	20,5	43
550	19,5	39

All values were extrapolated through calculation from the values of the 30x10 tested system and are valid for any number of supports (calculations according to standard EN 60865-1).

NOTE: The Icw value of 25 kA is the limit value calculated for the thermal effects of a failure lasting 1s and not for the mechanical resistance of copper. The calculation proves that such value can be maintained up to a 350 mm CL distance between the supports.



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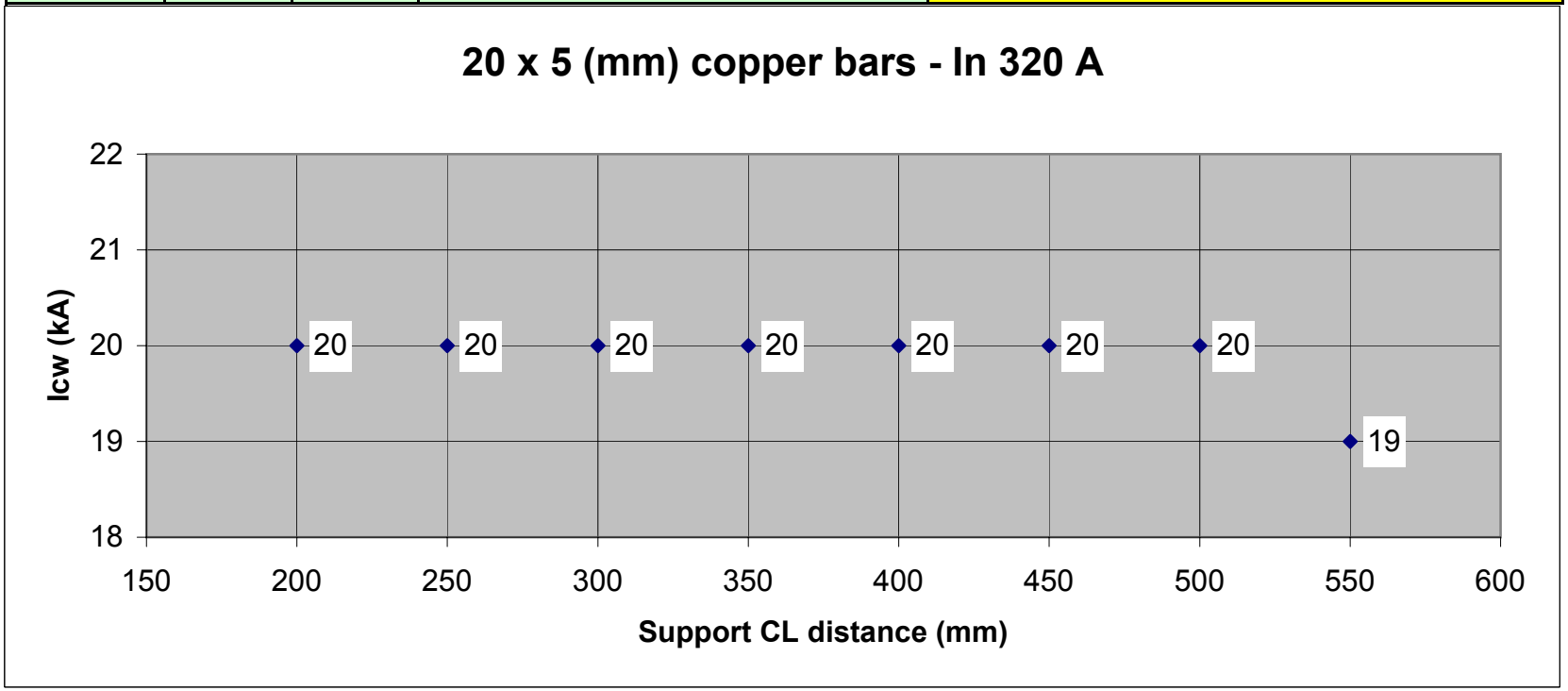
60 mm system

20 x 5 (mm) copper bars - In 320 A (tested system)				
Bar part number: 01 620				
Support part number: 01 495				
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)		
200	20	40	Test values	NOTE: The Icw value of 20 kA is the limit value calculated for the thermal effects of a failure lasting 1s and not for the mechanical resistance of copper. The calculation proves that such value can be maintained up to a 500 mm CL distance between the supports.
250	20	40	Values extrapolated by calculation. NB All values in the table, also test values, are valid for any number of supports (calculations according to standard EN 60865-1).	
300	20	40		
350	20	40		
400	20	40		
450	20	40		
500	20	40		
550	19	38		



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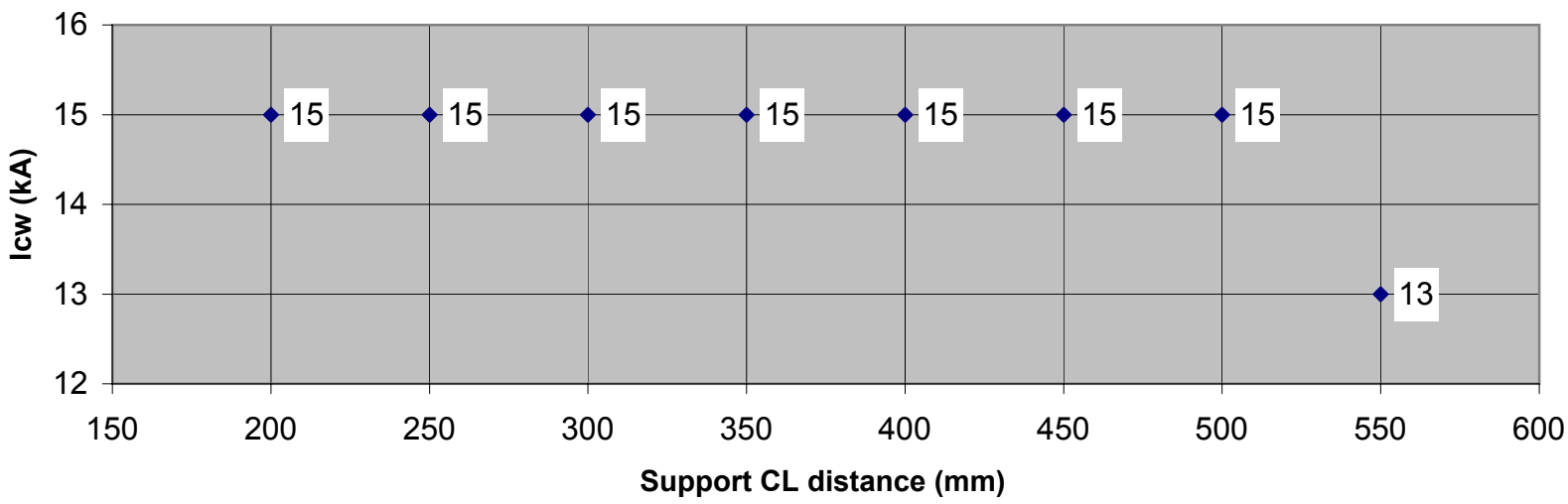
60 mm system

15 x 5 (mm) copper bars - In 250 A		
Bar part number: 01 619		
Support part number: 01 495		
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)
200	15	30
250	15	30
300	15	30
350	15	30
400	15	30
450	15	30
500	15	30
550	13	26

All values were extrapolated through calculation from the values of the 20x5 tested system and are valid for any number of supports (calculations according to standard EN 60865-1).

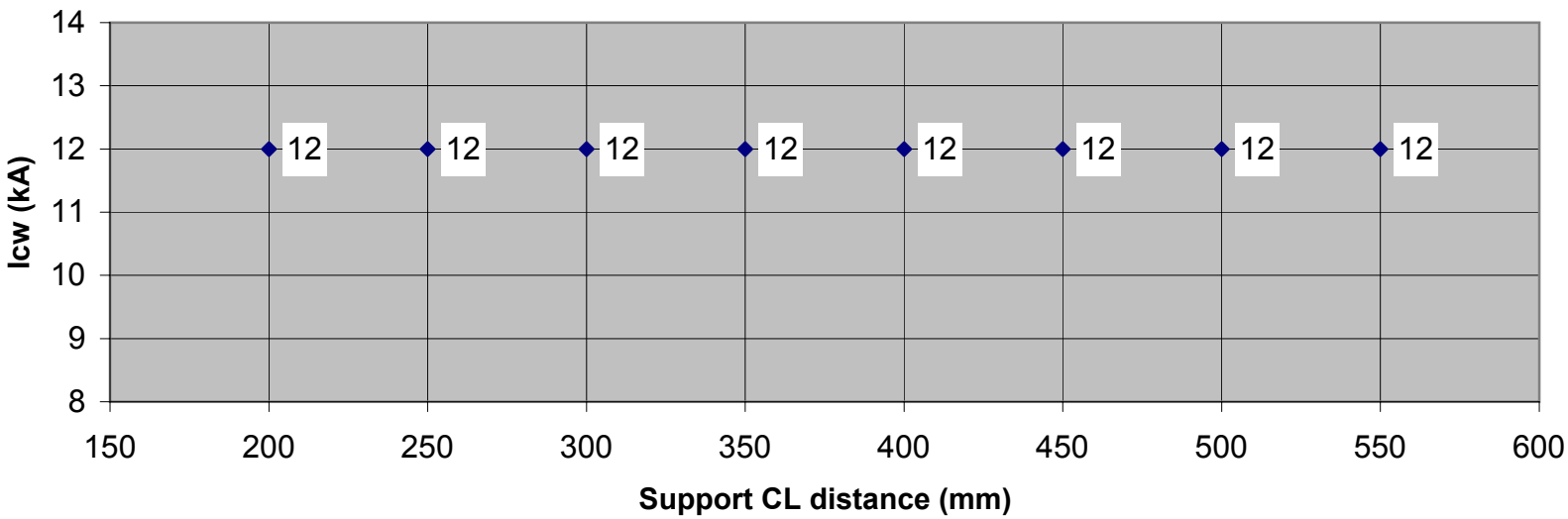
NOTE: The Icw value of 15 kA is the limit value calculated for the thermal effects of a failure lasting 1s and not for the mechanical resistance of copper. The calculation proves that such value can be maintained up to a 500 mm CL distance between the supports.



wöhner

60 mm system

12 x 5 (mm) copper bars - In 200 A				
Bar part number: 01 618				
Support part number: 01 495				
Support CL distance (mm)	Icw (kA for 1s)	Ipk (kA)		
200	12	24	All values were extrapolated through calculation from the values of the 20x5 tested system and are valid for any number of supports (calculations according to standard EN 60865-1).	NOTE: The Icw value of 12 kA is the limit value calculated for the thermal effects of a failure lasting 1s and not for the mechanical resistance of copper. The calculation proves that such value can be maintained up to a 550 mm CL distance between the supports
250	12	24		
300	12	24		
350	12	24		
400	12	24		
450	12	24		
500	12	24		
550	12	24		



Part 3)
CESI test report No A4/519182
(9 pages)

Test Report

CESI

Client	**Wohner Italia S.r.l. – Milano (Italy)**
Tested equipment	Bar system for low-voltage switchgear and controlgear assemby
Tests carried out	Verification of the short-circuit withstand strength of the main circuits Verification of the effectiveness of the protective circuit: - verification of the short-circuit withstand strength of the protective circuit
Standards/Specifications	Client's requests based on CEI EN 60439-1 (2000-11) Standard
Test date	**from** August 2, 2004 **to** August 2, 2004

No. of pages	14	**No. of pages annexed**	5
Issue date	November 11, 2004		

Prepared	BU PeC/TEST - C. Del Giorgio
Verified	BU PeC/TEST - A. Elli
Approved	BU PeC/TEST p. M. de Nigris

CESI
CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO
Business Unit
Prove e Componenti
Il Responsabile del Laboratorio

Tests witnessed by

Mr. C. Cortese	Wohner Italia
Mr. G. Nava	ETA
Mr. D. Masciardi	ETA
Mr. F. Salni	Brianza Progetti

Identification of the object effected

The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings.
CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.
These drawings, identified by CESI and numbered **A4/510743 No. 1 to 10**, have been returned to the Client.

Only for laboratory requirement, in order to reproduce the test conditions, all the laboratory data are contained in the document marked: MP-A4/509340

The measurement uncertainties of the test results reported in this document comply with the following limits:

voltage : ± 5 % ; current : ± 5 % ; time : ± 5 %

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level of about 95 %) and have to be considered as maximum estimated values referred to that type of measurement.

Laboratory information

Receipt date of the sample	July 21, 2004
Test location	CESI – Via Rubattino 54 – Milan
Activity code	44299J

Rated characteristics of the tested object assigned by the Client

Manufacturer of the bar system	**Wohner Italia**
Manufacturer of the carpentery	**ETA**
Operational voltage (Ue)	690 V
Insulation voltage (Ui)	690 V
Frequency	50 Hz

Designation	60 mm system; 320 A
Section of bars	(20x5) mm^2
Rated current	320 A
Short-time withstand current (Icw) and peak withstand current (Ipk)	20 kA for 1 s – 41 kA

Designation	60 mm system; 630 A
Section of bars	(30x10) mm^2
Rated current	630 A
Short-time withstand current (Icw) and peak withstand current (Ipk)	30 kA for 1 s – 63 kA

Designation	60 mm system; 1600/1250 A
Section of double T bars	(720)/(485) mm^2
Rated current	1600/1250 A
Short-time withstand current (Icw) and peak withstand current (Ipk)	50 kA for 1 s – 105 kA

Designation	60 mm system; 2500 A
Section of triple T bars	(1140) mm^2
Rated current	2500 A
Short-time withstand current (Icw) and peak withstand current (Ipk)	50 kA for 1 s – 105 kA
Short-time withstand current (Icw) and peak withstand current (Ipk) of the protective circuit	40 kA for 1 s – 84 kA
Section of the earthing bar	(80x5) mm^2

Verification of the short-circuit withstand strength of the main circuits

Test arrangements and test procedure

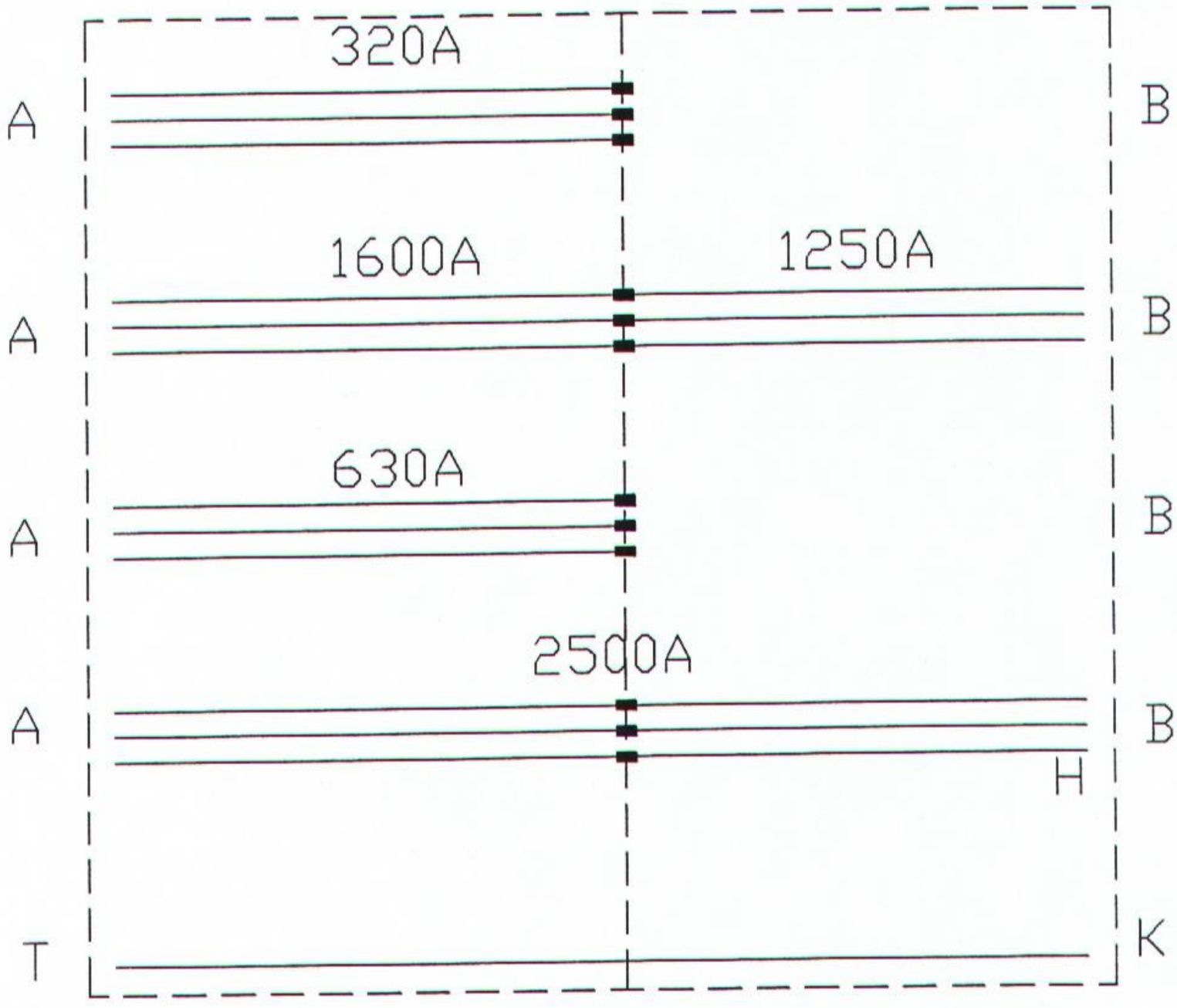
The equipment under test was blocked to the floor of the test room as in normal use and appropriately insulated from earth.

All parts of the equipment intended to be connected to the protective conductor in service, including the enclosure, were connected to the neutral point of supply through a fault current detection device consisting of a fuse of copper wire (of 0,8 mm diameter and about 50 mm in length) connected in series with a resistor, in order to limit the prospective fault current to about 1500 A.

The three-phase tests were performed supplying the terminals of the incoming circuit (point "A" of the test configuration M8000) by one copper tube per-phase having a cross-sectional area of 700 mm^2; these conductors were firmly blocked together at a distance of about 30 cm from the incoming terminals of the equipment under test.

Connection points for short-circuit tests

Test configuration M8000



Short-circuit tests results with three-phase current

Test circuit: M0007
Test configuration: M8000
Reference number of the oscillograms: A4/509340

Date: August 2, 2004

Test	Test configuration M8000		Bar system under test	Type of test	Oscillogram	Test current			I^2t	Duration	Frequency			Notes
	supply	short-circuit				Peak value	r.m.s. value	Average value						
No.	point	point	-	-	No./sheets	A	A	A	MA^2s	s	Hz			(*)
1	A	B	630	dynamic/-thermal	4/1	66070	30520 30780 30650	30650	-	1,0	50			a b c
2	A	B	1600/1250A	dynamic/-thermal	7/1	105520	49990 51810 50560	50790	-	1,0	50			a b c
3	A	B	2500A	dynamic/-thermal	10/1	105530	49520 50560 49920	50000	-	1,0	50			a b c
5	A	B	320A	dynamic/-thermal	13/1	42840	19880 20200 19980	20020	-	1,0	50			a b c

Conditions of the assembly after the tests: see notes

(*) Notes:
a = the fault current detection device did not melt
b = the bars and the enclosure did not show any deformation
c = the insulation of the conductors and the supporting insulating parts did not show any significant sign of deterioration

Verification of the effectiveness of the protective circuit

Verification of the short-circuit strength of the protective circuit

- **Test arrangements and test procedure**

The equipment under test was blocked to the floor of the test room as in normal use and appropriately insulated from earth.

The tests were performed connecting a single-phase test supply between the incoming terminal of one phase and the terminal for the incoming protective conductor (points "A" and "T" of the test configuration M8000).

The short-circuit connection between one phase of the main circuits and the protective circuit was made by a copper bar bolted between the lower end of the distribution busbar and the end of the protective conductor (points "H" and "K").

Short-circuit tests results with single-phase current

Test circuit: M0008
Test configuration: M8000
Reference number of the oscillograms: A4/509340

Date: August 2, 2004

Test	Test configuration M8000		Circuit	Type	Oscillogram	Test current		I^2t	Duration	Frequency			Notes
	supply	short-circuit	under test	of test		Peak value	r.m.s. value						
No.	point	point	-	-	No./sheets	A	A	MA^2s	s	Hz			(*)
4	A T	H K	protective	dyn./therm.	12/1	84270	40150	-	1,0	50			a b c

Conditions of the assembly after the tests: see notes

(*) Notes:
a = the bars and the enclosure did not show any deformation
b = the insulation of the conductors and the supporting insulating parts did not show any significant sign of deterioration
c = the electrical continuity of the protective circuit was not impaired by the tests