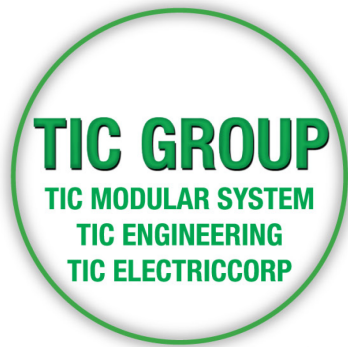


# TIC GROUP

## IEC61439-1&2

[www.ticcorp.net](http://www.ticcorp.net)  
[www.smartticgroup.com](http://www.smartticgroup.com)



TIC  
Design-verified  
switchboard for  
infrastructure up  
to 16,000A

TICCORP.NET



## TIC BEHIND YOUR ELECTRICAL POWER

TIC have passed Type Test from  
Germany and ASTA Type  
CERTIFICATE IEC61439-1:2020



Short Circuit withstand strength Test



Temperature Rise  
Limit Test



Impulse Withstand  
Voltage Test

## SMART SYSTEM



Smart Monitoring Via mobile  
phone and your computer



Smart QR code, provide  
MDB, DB data



CLOUD COMPUTING



Easy for Energy  
management

V	Current	Power	Temp
100 V	100 A	100 W	100 C
200 V	200 A	200 W	200 C
300 V	300 A	300 W	300 C

Address :

TIC MODULAR SYSTEM CO., Ltd.  
99/9 Moo. 12 T.Raiking A.Sampran  
Nakornpathom 73210 THAILAND

Tel : 02-105-4247 Fax : 02-482-1620

Please feel free Visit our website for more information [www.ticcorp.net](http://www.ticcorp.net)

# IEC61439-1:2020



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Factory 2



Factory 3,4



Factory 5

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## About Us

**TIC** was established Sine 1996 to manufacture switchboards and control panels for the local commercial , official and industrial sector.

LV Switchgear Manufacture to your Specific Project Requirements

The TIC range of Switchboards have been developed with exacting standards in both design and manufacture.

**TIC** is fully IEC 60439-1 certified through IPH Berlin Germany. Also fully IEC 61439 - 1 ASTA certified

### We are extremely proud of this achievement:

*First company in Thailand that has passed Type Test 5000A at form 4B by VDE Germany certified (IEC60439 - 1 ) : 2004 )1st edition*

*First company in Thailand that has passed Type Test 5000A at form 3B by ASTA certified (IEC61439 – 1 ) : 2020 ) 3rd edition*

*First company in South East Asia who made the highest current LV Switchboard ( 10000A , 16000A)*

### Address

99/9 Moo12 , Phuttamonthon 5 Road, Raiking, Sampran, Nakornprathom 73210.

Telephone Number : (662)-105-4247.,(662)-408-8620-39

TIC Modular Fax :(662)-482-1620

TIC Engineering Fax : (662)-482-1621-22

TIC Electric Corporation Fax : (662)-482-1982

## IEC61439-1:2020



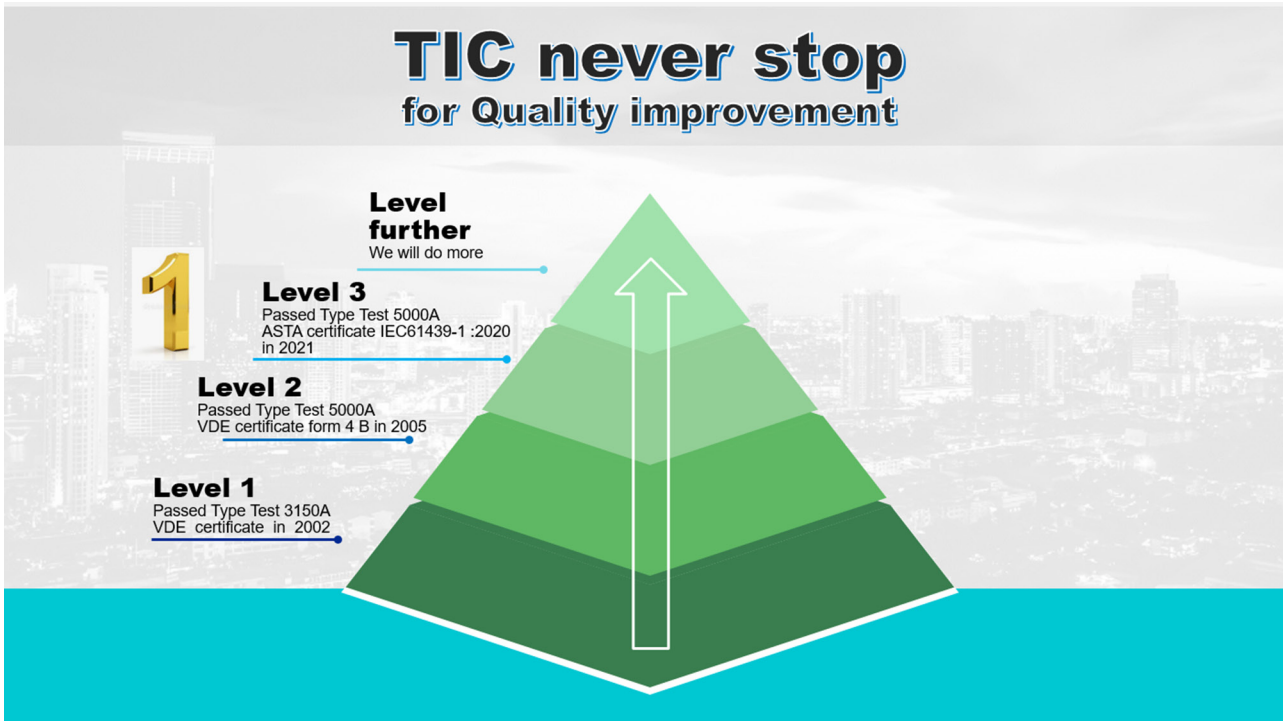
[www.ticcorp.net](http://www.ticcorp.net)  
[www.smartticgroup.com](http://www.smartticgroup.com)



Google Maps

About Us

About Us



1996	2004	2005	2008	2021
Establish TIC Modular System Company	Establish TIC Engineering Company	Passed Type Test 3150 A VDE certificate	Passed Type Test 5000 A VDE certificate	Passed Type Test 5000 A ASTA certificate IEC61439-1 : 2020

↓

**SUCCESS**

*We are the first company in Thailand and South East Asia*

Passed Type Test 5000 A ASTA certificate  
( With the newest IEC61439-1 : 2020 )

# TECHNICAL INFO

## IEC61439-1:2020

What change?  
Where is the test clause no.13?

NEWS

### What change?

IEC 61439-2 : 2020

Verifications with reference to the tests listed in Annex D of IEC 61439-1 : 2020

- |   |                                      |
|---|--------------------------------------|
| 1: Strength of material and parts   | 9: Dielectric properties             |
| 2: Degree of protection of enclosures                                     | 10: Temperature-rise limits          |
| 3: Clearances   | 11: Short-circuit withstand strength |
| 4: Creepage distances   | 12: Electromagnetic compatibility    |
| 5: Protection against electric shock and integrity of protective circuits |                                      |
| 6/7/8: No verification by testing required                                |                                      |

Test Clause No.13 Mechanical operation in IEC61439 edition 2: 2011 has moved to inside Test Clause No.1 (Strength of material and parts) in IEC61439 edition 3: 2020

### Design verification

Table D.1 provides a list of design verifications to be performed for various characteristics.

**Table D.1 - List of design verifications to be performed**

<b>MANUFACTURER:</b>	TIC MODULAR SYSTEM CO., LTD 99/9 Moo.12 Puttamonthon5 Road, Raiking, Sampran Nakornprathom 73210
<b>APPARATUS:</b>	5000 A, 415 V / 1000 V / 12 kV ( $U_{tr}$ - $U_b$ , / $U_i$ / $U_{imp}$ ), 50 Hz, IP43, Form 3b, Power Switchgear and Controlgear Assembly (PSC-Assembly) incorporating one three-phase and neutral non-extendable horizontal bare busbar system, one incoming 3 pole withdrawable air circuit-breaker unit, two outgoing ACB units and two outgoing MCCB units and a protective circuit.  The Assembly (PSC-Assembly) is suitable for indoor use and has a metallic enclosure.
<b>DESIGNATION:</b>	TIC MODEL 003_2
<b>TESTED BY:</b>	Intertek Testing Services (Guangzhou) Ltd. No. 3-1, Xinhai Xinyi Road, Huangge Town, Nansha District, Guangzhou City, China  Guangdong Testing Institute of Product Quality Supervision Dongguan (GQI - Dongguan) No. 68 Xihu East Road, Shilong Town, Dongguan City, Guangdong Province, China.
<b>DATES OF TESTS:</b>	-
The apparatus, constructed in accordance with the description and drawings incorporated in this letter has been subjected to the series of proving tests in accordance with	
<b>IEC 61439-2: 2020</b>	
Verifications with reference to the tests listed in Annex D of IEC 61439-1: 2020:	
1: Strength of material and parts	9: Dielectric properties
2: Degree of protection of enclosures	10: Temperature-rise limits
3: Clearances	11: Short circuit withstand strength
4: Creepage distances	12: Electromagnetic compatibility
5: Protection against electric shock and integrity of protective circuits	
6/7/8: No verification by testing required	
The results of the verification by testing of the PSC - Assembly design are detailed on the following pages.	
Intertek Testing Services Shenzhen Ltd Guangzhou Branch Block E, No 72 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China Tel: (8620) 8213 9988 Fax: (8620) 3205 7538 www.intertek.com	

TECHNICAL INFO

PANEL SYSTEMS

- TIC we made to order under IEC Standard
- Unit Substation
- Low Volt Volt Switchboard
- Main Distribution board ( MDB )
- Emergency Distribution Board ( EDB )
- Motor Control Center Board ( MCC )
- Distribution Board ( DB ) or Pa nel Board



Technical Info



X-Energy License Switchboard

System Features

<b>Standards</b>	IEC/EN 61439-1/-2
<b>Internal partition</b>	Design-venfied
<b>Rated operational voltage <math>U_e</math></b>	Form 1 to Form 4 690V / 50-60 Hz
<b>Rated current <math>I_e</math></b>	up to 5000 A
<b>Rated short-time withstand current <math>I_{cw}</math></b>	up to 100 kA <sub>eff</sub>
<b>Ambient air temperature</b>	35 °C (24-h average value)
<b>Degree of protection</b>	IP 31 / IP 55
<b>Net configuration</b>	TN-C / TN-C-S / TN-S / IT
<b>Colour</b>	RAL 7035 (other colours on request)
<b>Dimensions</b>	H 2000 mm. basic height, without plinth W 425/600/800/850/1000/1100/1200/1350 mm. D 400/600/800/1000 mm. (800+200)



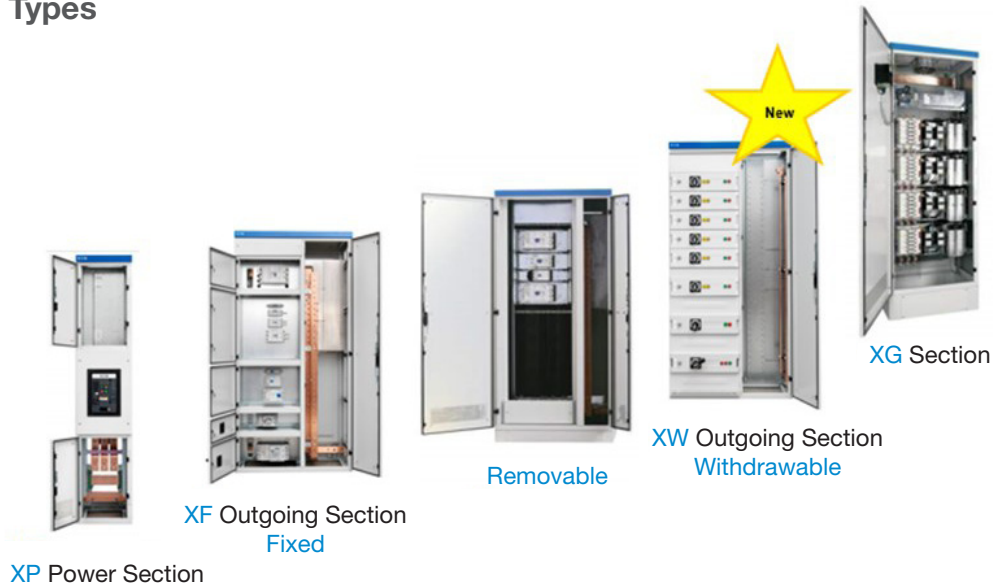
Double door cubicle

# TECHNICAL INFO

5 variants, with maximum benefits.

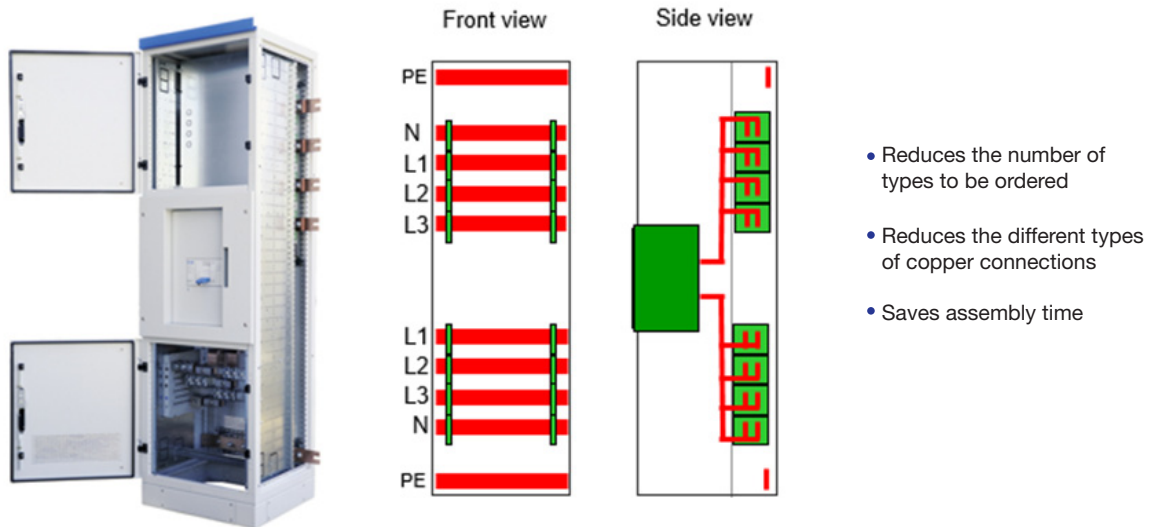
## An Intelligent System Platform

### 5 Basic Types



## Main Busbar Position at the Back BBB

### Symmetrical Section Arrangement





## TECHNICAL INFO

xEnergy – Licensee Manufacturer

TIC are a Thailand based specialist Switchboard Manufacturer.

Our Switchboard is designed and manufactured to exacting Type Test standards, ensuring a high quality, reliable product is supplied, whilst our internal switchboard manufacturing processes, resources and facilities ensures that we can manufacture our Switchboard cost effectively and quickly; meeting the tightest timescales and ensuring that your projects remain on schedule.



*Packaging for export*

### TIC Modular System

Offer a dedicated design service offering bespoke electrical Switchboard manufacture to fulfil client specifications.

Forms of separation which typically include 2, 3 & 4

In general Ratings from 250A to 6300A

But we has made electrical switchboard the highest current in South East Asia

At 16,000 Ampere

Bespoke design to meet client specification

Conventional or Intelligent Options

Option to integrate and extend existing LV switchboard

Customized layout configurations such as Straight, “L”, “T”, “U” and rectangular shaped configurations

Back to Back Construction

Front & Rear Access

Top & Bottom Cable Entry

Fully welded mild steel, or stainless steel

Ingress Protection up to IP55

Powder Coating in RAL and client color options



# TECHNICAL INFO

## POWDER COATING IN RAL AND CLIENT NEED COLOR OPTIONS

Technical Info

RAL 7026	RAL 7030	RAL 7031	RAL 7032
RAL 7035	RAL 7036	RAL 7037	RAL 7038



*RAL7032 & RAL7035 are the standard colors*

*Also, TIC-we can produce according to customers' requirements*



Structure Powder Coating The powder coating is electrostatically applied. This way ALL faces are covered inside and outside assuring high mechanical strength, very good corrosion protection and resistance to chemicals, temperature and weather variations. The powder coating can easily be re-painted and is free from heavy metals, chromate and silicon.

RAL 5002	RAL 5003
RAL 5009	RAL 5010
RAL 5015	RAL 5017

*TIC Switchboard made to order under standard*

# TECHNICAL INFO

## Standards on low voltage assemblies and applicability

The basic Standard establishes the requirements for the construction, safety and maintenance of the assemblies by identifying ratings, service conditions, mechanical and electrical requirements and prescriptions relevant to performances

No.	Characteristic to be verified	Clauses or subclauses	Verification options available		
			Testing	Comparison with a reference design	Assessment
1	Strength of material and parts	10.2			
	Resistance to corrosion	10.2.2	Yes	No	No
	Properties of insulating materials:	10.2.3			
	Thermal stability	10.2.3.1	Yes	No	No
	Resistance to abnormal heat and fire due to internal electric effects	10.2.3.2	Yes	No	Yes
	Resistance to ultra-violet (UV) radiation	10.2.4	Yes	No	Yes
	Lifting	10.2.5	Yes	No	No
	Mechanical impact	10.2.6	Yes	No	No
	Marking	10.2.7	Yes	No	No
	Mechanical operation	10.2.8	Yes	No	No
2	Degree of protection of enclosures	10.3	Yes	No	Yes
3	Clearances	10.4	Yes	No	No
4	Creepage distances	10.4	Yes	No	No
5	Protection against electric shock and integrity of protective circuits	10.5			
	Effective continuity between the exposed conductive parts of the ASSEMBLY and the protective circuit	10.5.2	Yes	No	No
	Short-circuit withstand strength of the protective circuit	10.5.3	Yes	Yes	No
6	Incorporation of switching devices and components	10.6	No	No	Yes
7	Internal electrical circuits and connections	10.7	No	No	Yes
8	Terminals for external conductors	10.8	No	No	Yes
9	Dielectric properties	10.9			
	Power-Frequency withstand voltage	10.9.2	Yes	No	No
	Impulse withstand voltage	10.9.3	Yes	No	Yes
10	Temperature-rise limits	10.10	Yes	Yes	Yes
11	Short-circuit withstand strength	10.11	Yes	Yes	No
12	Electromagnetic compatibility (EMC)	10.12	Yes	No	Yes

NOTE: In the IEC61439-1 : 2011 Test No.13 Mechanical operation (Subclause 10.13 has moved in to Strength of material Subclause 10.2.8) In the IEC61439-1 : 2020

## TECHNICAL INFO

### Strength of materials and parts

10.2.2. Resistance to corrosion:

- **Severity A** for Indoor application is requiring 2 tests:

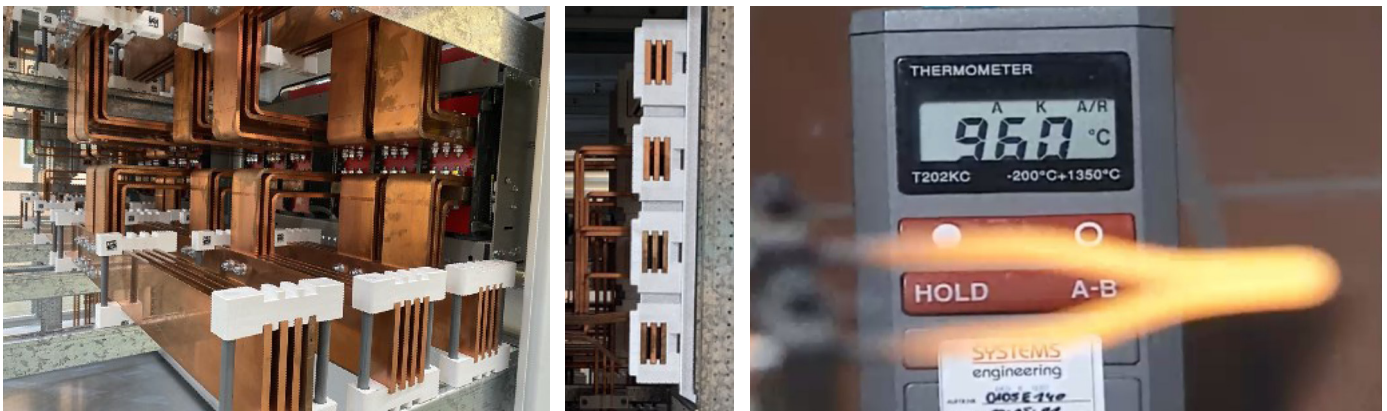
1. 6 cycles of 24hrs each to **damp heat test** at  $40\pm 3^{\circ}\text{C}$  and **relative humidity** of 95% (IEC 60068-2-30)
2. 2 cycles of 24hrs each to **salt mist test** at  $35\pm 2^{\circ}\text{C}$  (IEC 60068-2-11)

- **Severity B** for metallic outdoor enclosures

TIC model 003 has passed both case for indoor and outdoor use

10.2.3 Properties of insulating materials:

- Verification of **thermal stability of enclosures at normal heat**,  $70^{\circ}\text{C}$  dry heat test (IEC 60068-2-2)
- Verification of **resistance of insulating materials to abnormal heat and fire** (glow wire test)
- $960^{\circ}\text{C}$  for parts necessary to retain current-carrying parts in position;
- $850^{\circ}\text{C}$  for enclosures intended for mounting in hollow walls;
- $650^{\circ}\text{C}$  for all other parts, including parts necessary to retain the protective conductor.



TIC Busbar support has passed Glow wire test  $960^{\circ}\text{C}$  30 sec

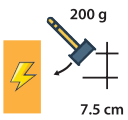
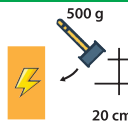
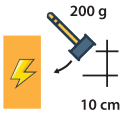
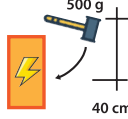
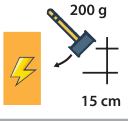
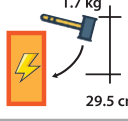
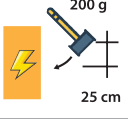
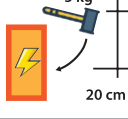
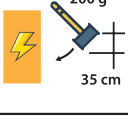
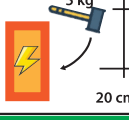
# TECHNICAL INFO

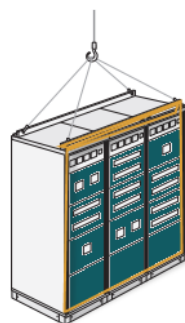
## Strength of materials and parts

- 10.2.4. Resistance to ultra-violet (UV) radiation → (outdoor)
- 10.2.5. Lifting → max. 3000kg (up to 3 Sections, max. 2,4m)
- 10.2.6. Mechanical Impact (IEC 62262) → IK10
- 10.2.7. Marking (type label strength)

The IK rating scale identifies the ability of an enclosure to resist impact energy levels measured in joules (J) i.e. how much mechanical im-pact an enclosure can resist. This scale is often used for electrical equipment like vid-eo cameras or luminaires.

It's an international numeric classification, denoted as IKXX, where "XX" is a number from 00 to 10 that indicates the degrees of protection provided by electrical enclo-sures against external me-chanical impacts.

IK Test			IK Test		
01		Energy 0.15 J	06		Energy 1 J
02		Energy 0.2 J	07		Energy 2 J
03		Energy 0.35 J	08		Energy 5 J
04		Energy 0.5 J	09		Energy 10 J
05		Energy 0.7 J	10		Energy 20 J



Lifting



### Relationship between the degree of protection IK and the impact energy

IK code	IK00	IK01	IK02	IK03	IK04	IK05	IK06	IK07	IK08	IK09	IK10
Impact Energy in joule	(*)	0.14	0.2	0.35	0.5	0.7	1	2	5	10	20

**TIC Switchboard has passed Mechanical impact test at maximum IK10**

## TECHNICAL INFO

### Degree of protection IP of an assembly








#### Ingress Protection (IP) Rating

Protection specification code (International Protection)

IEC 62208: 2011, Clause 9.8

IEC 60529: 2013

#### “First Digit” Protection against solid object

Code	Level of protection
0	 No protection
1	 Ingress of solid object diameter 50 mm is protected
2	 Ingress of solid object diameter 12.5 mm is protected
3	 Ingress of solid object diameter 2.5 mm is protected
4	 Ingress of solid object diameter 1.0 mm is protected
5	 Protected against harmful dust
6	 Totally protected against dust


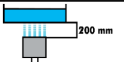

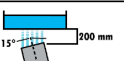

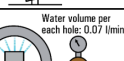

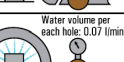

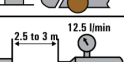

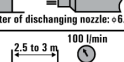




#### The IEC protection code (International Protection IP)

The IP codes are used to define protection against the ingress of solid foreign objects and water with harmful effects. Since the IP code is used for all equipment annex B of the IEC standard gives instructions to technical committees for applying IP codes. The protection against the ingress of solid foreign objects is also used as a means of specifying protection against accidental contact with live parts and therefore serves two different but related purposes.

*TIC has passed the IP test IP 31, IP43, IP54, IEC60529 : 2013*



#### “Second Digit” Protection against liquid

Code	Level of protection	Test method outline (test performed using pure water)
0	<b>No protection</b>	<b>no protection against liquid object</b> <b>No test</b>
1	Protection against water drip 	No harmful effect of vertical water drip By using water drip tool vertically dropping water for 10 min 
2	Protection against water drip 	No harmful effect of water drip from vertical direction when the enclosure is tilted at 15° from its normal position By using water drip tool, move it in angle of 15°, dripping water for 10 min (2.5 min per direction) 
3	Protection against water spray 	No harmful effect of water spray at any angle up to 60° from the vertical direction By using tool as described in right picture, spraying water vertically in angle up to 60° for 10 min 
4	Protection from water splash 	No harmful effect of water spray from all direction By using tool as described in right picture, splashing water from all direction for 10 min 
5	Protection from water jets 	No harmful effect of water spray from all direction By using tool as described in right picture, Jet the water from all direction to the object surface for 1 m <sup>2</sup> /min, at least for 3 min in total. Water volume per each hole: 0.07 l/min Diameter of discharging nozzle: <math>\leq 6.3</math> 
6	Protection from strong water jets 	No harmful effect of strong water spray from all direction By using tool as described in right picture, Jet the water from all direction to the object surface for 1 m <sup>2</sup> /min, at least for 3 min in total. Water volume per each hole: 12.5 l/min Diameter of discharging nozzle: <math>\leq 12.5</math> 
7	Protection from water dip 	No harmful effect of water dip in certain level of pressure and length of time Dip into 1 m depth water for 30 min 
8	Protection from water sink 	No harmful effect against water sink which the condition is decided between customer & manufacturer (in severer condition comparing to no.7) Should be decided between customer and manufacturer 



IP5X Testing



IPX3 Testing

**TIC Switchboard has passed Degree of Protection Test IP 31, 43, 54, 55**

# TECHNICAL INFO

## Degree of protection IP of an assembly

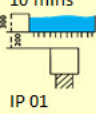
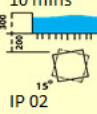
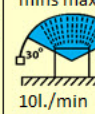
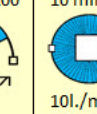
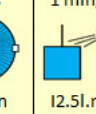
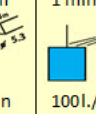
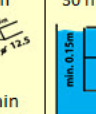
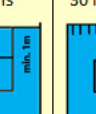
### Ingress Protection (IP) Rating

Protection specification code (International Protection)

IEC 62208: 2011, Clause 9.8

IEC 60529: 2013

### “First Digit” Protection against solid object

THE IP SCALE										
1ST NUMERAL: DEGREE OF PROTECTION WITH RESPECT TO PERSONS AND SOLID OBJECTS.		2ND NUMERAL: DEGREE OF PROTECTION WITH RESPECT TO HARMFUL INGRESS OF WATER								
		0	1	2	3	4	5	6	7	8
		Non protected	Protected against dripping water	Protected against dripping water of =15° angle	Protected against dripping water of =60° angle	Protected against splashing water	Protected against water jets	Protected against heavy seas	Protected against immersion	Protected against submersion
0	Non Protected	IP 00	Test time 10 mins  IP 01	Test time 10 mins  IP 02 80kN/m	Test time 10 mins max 200  10l./min 80kN/m	Test time 10 mins  10l./min 30kN/m	Test time 1 min/m  12.5l./min 100kN/m	Test time 1 min/m  100l./min	Test time 30 mins  min. 0.15m	Test time 30 mins  min. 1m
1	Protected against solid objects greater than Dia. 50 mm	IP 10	IP 11	IP 12	IP 13					
2	Protected against solid objects greater than Dia. 12 mm	IP 20	IP 21	IP 22	IP 23					
3	Protected against solid objects greater than Dia. 2.5 mm	IP 30	IP 31	IP 32	IP 33	IP 34				
4	Protected against solid objects greater than Dia. 1.0 mm	IP 40	IP 41	IP 42	IP 43	IP 44	IP 45	IP 46		
5	Dust protected					IP 54	IP 55	IP 56		
6	Dust tight						IP 65	IP 66	IP 67	IP 68

Technical Info

TIC Switchboard has passed Degree of Protection Test IP 31, 43, 54, 55

# TECHNICAL INFO

## Forms of internal separations

specifications of the different types of form

Standard IEC 61439-2 defines the separations inside an assembly according to 4 types of form, ( Form 1 to form 4B )

### SEPARATION PROVIDES:

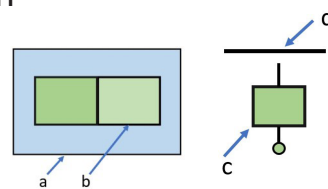
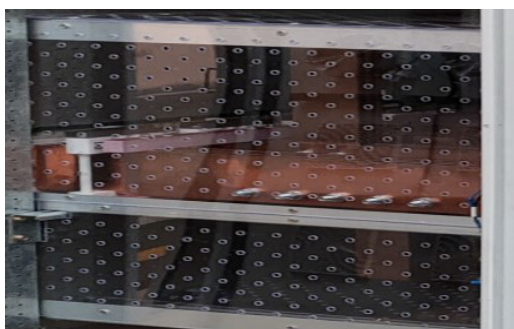
by means of barriers of partitions ( metallic or non metallic materials ) is aimed at:

- Protection against contact with live parts belonging to the adjacent functional units the degree of protection must be at least IP xxb.
- Protection against the passage of solid foreign bodies from one unit of an assembly to an adjacent unit the degree of protection must be at least IP 2x (which covers IP xxb).

The main purpose is to maintain the availability of the power supply in the event of a fault or if work is being carried out on the panel.

TIC , we can provide our customer, who need to visual check by using polycarbonate barriers

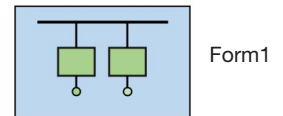
These barriers protects the operator from direct contacts and from the effects of the arc of the breakers in the normal access direction and also easily to visual inspection.



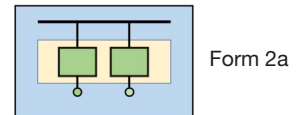
**Caption**

- a** Housing
- b** Internal segregation
- c** Functional units including the terminals for the associated external conductors
- d** Busbars, including the distribution bus-bars

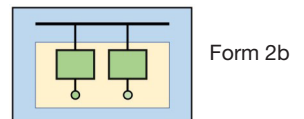
**Form 1**  
(no internal segregation)



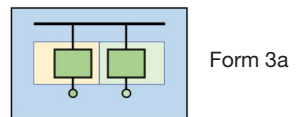
**Form 2** (segregation of the busbars from the functional units)  
Form 2a  
Terminals not separated from the busbars



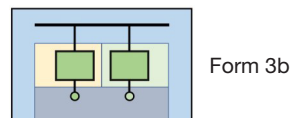
Form 2b Terminals separated from the busbars



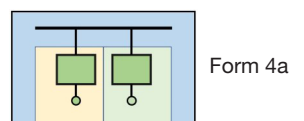
**Form 3**  
(separation of the busbars from the functional units + separation of the functional units from each other)  
Form 3a  
Terminals not separated from the busbars



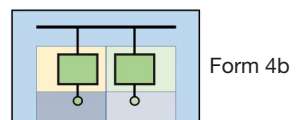
Form 3b  
Terminals separated from the busbars



**Form 4**  
(separation of the busbars from the functional units + separation of the functional units from each other + separation of the terminals from each other)  
Form 4a  
Terminals in the same compartment as the associated functional unit



Form 4b  
Terminals not in the same compartment as the associated functional unit



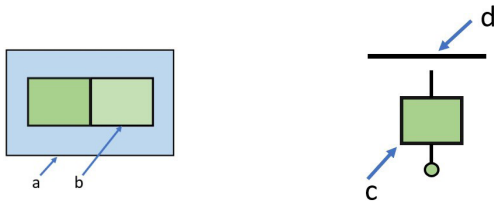
Technical Info



# TECHNICAL INFO

## Form of internal separations

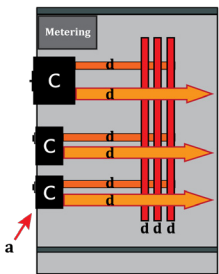
specifications of the different types of form



**Caption**

- a** Housing
- b** Internal segregation
- c** Functional units including the terminals for the associated external conductors
- d** Busbars, including the distribution bus-bars

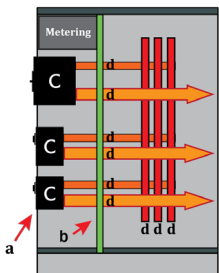
Technical Info



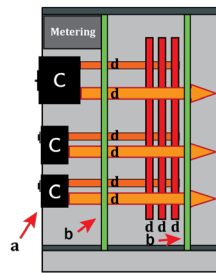
**Form 1**  
(no internal segregation)



**Form 1**  
(no internal segregation)

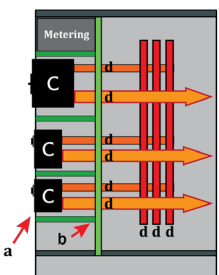


**Form 2**  
(segregation of the busbars from the functional units)

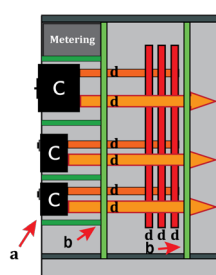


**Form 2**  
(segregation of the busbars from the functional units)

**Form 2b**  
Terminals separated from the busbars

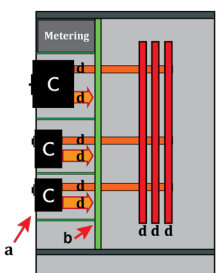


**Form 3**  
(separation of the busbars from the functional units + separation of the functional units from each other)

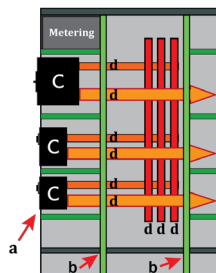


**Form 3**  
(separation of the busbars from the functional units + separation of the functional units from each other)

**Form 3b**  
Terminals separated from the busbars



**Form 4**  
(separation of the busbars from the functional units + separation of the functional units from each other + separation of the terminals from each other)



**Form 4**  
(separation of the busbars from the functional units + separation of the functional units from each other + separation of the terminals from each other)

**Form 4b**  
Terminals not in the same compartment as the associated functional unit

# TECHNICAL INFO

## Temperature-rise limits

Performance requirements: Subclause 9.2

Design Verification: Subclause 10.10

*Temperature rise tests are use to make sure that a product does not get overheated during operation*

**Temperature rise limits** is one of the most critical in determining the reliability and long service capability of a PSC-assembly and must not be overlooked.

The design of an assembly should take into account a number of factors which will affect the assembly's ability to meet the temperature rise limits set by the standard. The limits for the various parts of an assembly are summarized in Table 6 ( Temperature rise limit ) page 99 of IEC61439-1:2020

Part of assemblies	Temperature rise (K)
Built-in components (a)	In accordance with the relevant product standard requirements for the individual components or, in accordance with the component manufacturer's instructions (f), taking into consideration the temperature in the assembly.
Terminals for external insulated conductors	70 (b)
Busbars and conductors,	Limited by (f): <ul style="list-style-type: none"> <li>• mechanical strength of conducting material (g);</li> <li>• possible effect on adjacent equipment;</li> <li>• permissible temperature limit of the insulating materials in contact with the conductor;</li> <li>• effect of the temperature of the conductor on apparatus connected to it</li> <li>• for plug-in contacts, nature and surface treatment of the contact material</li> </ul>
Manual operating means: <ul style="list-style-type: none"> <li>• of metal</li> <li>• of insulating material</li> </ul>	15 (c) , ( h ) 25 (c) , ( h )
Accessible external enclosures and covers <ul style="list-style-type: none"> <li>• Metal surfaces</li> <li>• Insulating surfaces</li> </ul>	30 (d) , ( h ) 40 (d) , ( h )
Discrete arrangements of plug and socket-type connections	Determined by the limit for those components of the related equipment of which they form a part (e)

*The temperature - rise limits given in this table apply for a daily average ambient air temperature up to 35 ° C u n d e r service conditions ( see 7 . 1 ) . During verification a different ambient air temperature is permissible ( see 1 0 . 1 0 . 2 . 3 . 4 ) .*

## TECHNICAL INFO

### Temperature-rise limits

The term “built-in components” means:

- conventional switchgear and control gear;
- electronic sub-assemblies (e.g. rectifier bridge, printed circuit);
- parts of the equipment (e.g. regular, stabilized power supply unit, operational amplifier).

The temperature-rise limit of 70 K is a value based on the conventional test of IEC 60071-1. An assembly used or tested under installation conditions may have connections, the type, nature and disposition of which will not be the same as those adopted for the test, and a different temperature-rise of terminals may result and may be required or accepted. Where the terminals of the built-in component are also the terminals for external insulated conductors, the lower of the corresponding temperature-rise limits shall be applied. The temperature-rise limit is the lower of the maximum temperature-rise specified by the component manufacturer and 70 K. In the absence of manufacturer's instructions, it is the limit specified by the built-in component product standard but not exceeding 70 K. For terminals of the built-in component that are terminals for external insulated conductors, the thermocouple for the temperature-rise test shall not be placed on the test conductor insulation.

Manual operating means with assemblies which are only accessible after the assembly has been opened, for example draw-out handles which are not operated while the assembly is in normal service, are permitted to sustain a 25 K increase on these temperature-rise limits

Unless otherwise specified, in the case of covers and enclosures, which are accessible but need not be touched during normal operation, a 10 K increase on these temperature-rise limits is permissible. External surfaces and parts over 2 m from the base of the assembly are considered inaccessible.

This allows a degree of flexibility in respect of equipment (e.g. electronic devices) which is subject to temperature-rise limits different from those normally associated with switchgear and control gear.

For temperature-rise tests according to IEC 60071-1, the temperature-rise limits have to be specified by the original manufacturer. It is the responsibility of the original manufacturer to take into account any additional measuring points and limits imposed by the

component manufacturer.

Assuming all other criteria listed are met, a maximum temperature-rise of 105 K for copper busbars and conductors shall not be exceeded. The 105 K relates to the temperature above which annealing of copper is likely to occur. In the absence of a declaration from the original manufacturer, regarding the reliability and stability of the ageing behavior of the electrical contact or joint, a maximum temperature-rise of 55 K for bare (uncoated) aluminum busbars and conductors is applicable.



TIC Model 002—Temperature Rise limit Test Feb 2005  
VDE certificated



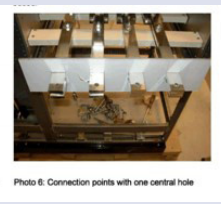
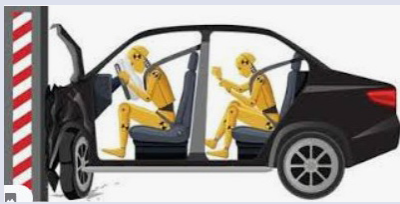
TIC Model 003—Temperature Rise limit Test May 2021  
ASTA certificated

## TECHNICAL INFO

### Short circuit withstand strength

Short circuit withstand strength : look like a crash test of a car

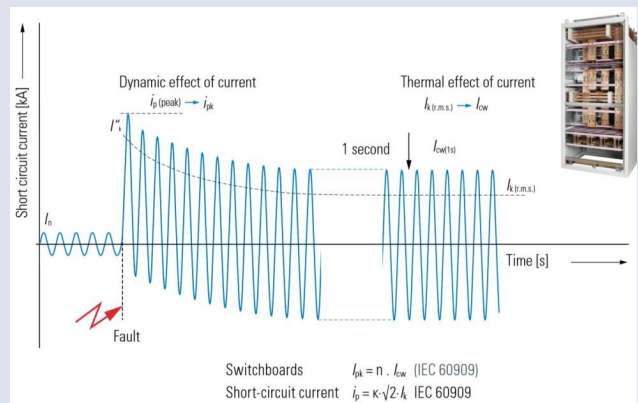
A **crash test** is a form of destructive testing usually performed in order to ensure safe design standards in crashworthiness and crash compatibility for various modes of transportation (see automobile safety) or related systems and components.



For the real life if some accident such as short circuit occur at MDB , The important part , structure not destroy and harmful to the operator , Circuit breaker ,main conductors ( busbar and busbar supports ) still safe and available for working again soon.

The verification of the short-circuit withstand strength of switchboard is based on two values stated by the manufacturer of switchboard:

- $I_{cw}$  **rated short-time current** (usually for 1 second)
- $I_{pk}$  **rated dynamic short-circuit current of switchboard**



TIC Model 002— Short circuit withstand Test Feb 2005  
VDE certified

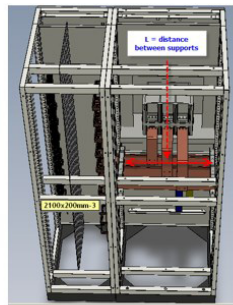
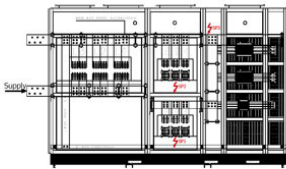


TIC Model 003—Short circuit withstand Test May 2021  
ASTA certified

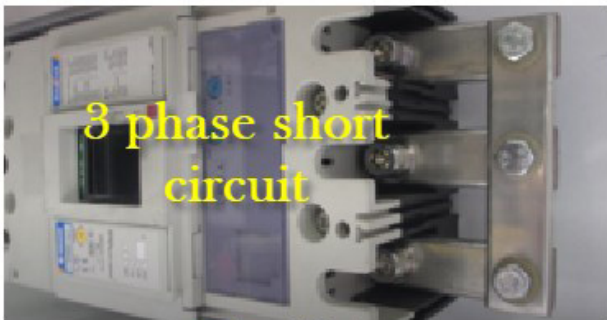
# TECHNICAL INFO

## Short circuit withstand strength

### STL MEMBER



- Verification of short-circuit withstand strength of the main busbar  
Peak short-circuit current: 165 kA  
Symmetrical short-circuit current: 75 kA  
Duration of short-circuit: 1 s
- Verification of short-circuit withstand strength of the outgoing circuits  
Peak short-circuit current: 143 kA  
Symmetrical short-circuit current: 65 kA  
Duration of short-circuit: 1 s
- Verification of short-circuit withstand strength of the neutral bar  
Peak short-circuit current: 86 kA (66 x 2.2 x 65 kA)  
Symmetrical short-circuit current: 39 kA (36 x 65 kA)  
Duration of short-circuit: 1 s



On completion of any short-circuit tests, at least the following must be maintained:

- minimum IP protection
- creepage and clearance distances
- insulation integrity and mechanical integrity Slight deformation of enclosures and busbars is acceptable.

### STL

The Short-Circuit Testing Liaison (STL) provides a forum for voluntary international collaboration between testing organizations. The basic aim is the harmonized application of IEC and Regional Standards for the type testing of electrical power equipment. Note: STL is concerned with high voltage electrical transmission and distribution power equipment (i.e. above 1000V a.c. and 1200V d.c.) for which the type tests specified in Standards include short-circuit and dielectric verification tests

Six basic Type Test Certificates may be issued by STL Members. STL Procedure No. 1 identifies the specific Certificate title for each type of product. They are as follows:

#### Type Test Certificate of Complete Type Test

This Certificate provides the verification of all the rated characteristics of the equipment as assigned by the manufacturer, by means of the performance of all type tests specified by the Standards.

#### Type Test Certificate of Dielectric Performance

This Certificate provides the verification of all dielectric ratings by means of the performance of the appropriate type tests specified by the Standards.

Type Test Certificate of Temperature Rise Performance This Certificate provides the verification of the temperature-rise limits together with measurement of the main circuit resistance, by means of the performance of the appropriate type tests specified by the Standards.

#### Type Test Certificate of Short-Circuit / Making and Breaking Performance

This Certificate provides the verification of the rated characteristics with respect to short-circuit and/or making and breaking performance, by means of the performance of the appropriate type tests specified by the Standards.

#### Type Test Certificate of Switching Performance

This Certificate provides the verification of the switching ratings (e.g. capacitive current) by means of the performance of the appropriate type tests specified by the Standards.

#### Type Test Certificate of Internal Arc Performance

This Certificate provides the verification of the behavior under internal arc conditions of switchgear and controlgear by means of the appropriate tests specified as type tests by the Standards.

## TECHNICAL INFO

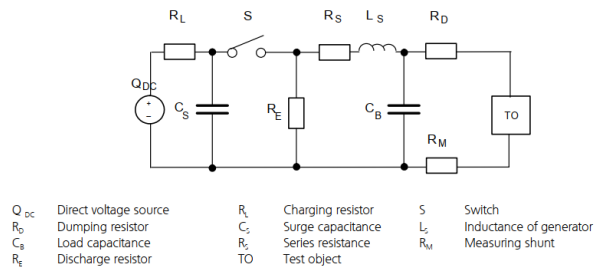
### Verification of the dielectric properties

IEC 61439-1 : 2020 © IEC 2020

The Dielectric tests check the insulation performance levels for the maximum operating voltage. They are carried out at the industrial frequency of 50 Hz and in the form of voltage waves simulating a lightning strike.



Technical data of test circuit



### Impulse withstand Voltage Test

For this test, all the electrical equipment of the assembly shall be connected, except those items of apparatus which, according to the relevant specifications, are designed for a lower test voltage; current-consuming apparatus (e.g. windings, measuring instruments, voltage surge suppression devices) in which the application of the test voltage would cause the flow of a current, shall be disconnected. Such apparatus shall be disconnected at one of their terminals unless they are not designed to withstand the full test voltage, in which case all terminals may be disconnected.

### Evaluation of test

The test object was tested at 14.8 kV lightning impulse voltage (1.2/50  $\mu$ s).

No disruptive discharges occurred. The requirements specified by DIN EN and IEC 60439-1, Sub-clause 8.2.2, have been met.

The test object has PASSED the type test-verification of dielectric properties.

### Power frequency withstand Voltage Test

Table 8 - Power-frequency withstand voltage for main circuits (10.9.2)

Rated insulation voltage, $U_i$ (line to line AC or DC) V	Dielectric test voltage AC RMS V	Dielectric test voltage DC V
$U_i \leq 60$	1000	1415
$60 < U_i \leq 300$	1500	2120
$300 < U_i \leq 690$	1890	2670
$690 < U_i \leq 800$	2000	2830
$800 < U_i \leq 1000$	2200	3110
$1000 < U_i \leq 1500^a$	2700	3820

<sup>a</sup> For DC only.

The test voltage at the moment of application shall not exceed 50% of the full test value. It shall then be increased progressively to this full value and maintained for 60 + 02 second

**TIC Switchboard has passed Dielectric property Test by VDE in 2005 and by ASTA in 2021  
Ui 1000 V Impulse withstand maximum 12 kV**



# TECHNICAL INFO

## Copper busbar

Technical Info

Abmessung je Teilleiter	Querschnitt je Teilleiter	Gewicht je Teilleiter
B x D		
12 x 2 mm	23,5 mm <sup>2</sup>	0,209 kg/m
15 x 2 mm	29,5 mm <sup>2</sup>	0,262 kg/m
15 x 3 mm	44,5 mm <sup>2</sup>	0,396 kg/m
20 x 2 mm	39,5 mm <sup>2</sup>	0,351 kg/m
20 x 3 mm	59,5 mm <sup>2</sup>	0,529 kg/m
20 x 5 mm	99,1 mm <sup>2</sup>	0,882 kg/m
20 x 10 mm	199 mm <sup>2</sup>	1,77 kg/m
25 x 3 mm	74,5 mm <sup>2</sup>	0,663 kg/m
25 x 5 mm	124 mm <sup>2</sup>	1,11 kg/m
30 x 3 mm	89,5 mm <sup>2</sup>	0,796 kg/m
30 x 5 mm	149 mm <sup>2</sup>	1,33 kg/m
30 x 10 mm	299 mm <sup>2</sup>	2,66 kg/m
40 x 3 mm	119 mm <sup>2</sup>	1,06 kg/m
40 x 5 mm	199 mm <sup>2</sup>	1,77 kg/m
40 x 10 mm	399 mm <sup>2</sup>	3,55 kg/m
50 x 5 mm	249 mm <sup>2</sup>	2,22 kg/m
50 x 10 mm	499 mm <sup>2</sup>	4,44 kg/m
60 x 5 mm	299 mm <sup>2</sup>	2,66 kg/m
60 x 10 mm	599 mm <sup>2</sup>	5,33 kg/m
80 x 5 mm	399 mm <sup>2</sup>	3,55 kg/m
80 x 10 mm	799 mm <sup>2</sup>	7,11 kg/m
100 x 5 mm	499 mm <sup>2</sup>	4,44 kg/m
100 x 10 mm	999 mm <sup>2</sup>	8,89 kg/m
120 x 10 mm	1200 mm <sup>2</sup>	10,7 kg/m
160 x 10 mm	1600 mm <sup>2</sup>	14,2 kg/m
200 x 10 mm	2000 mm <sup>2</sup>	17,8 kg/m

Dauerstrom in A							
blank				gestrichen			
Teilleiterzahl				Teilleiterzahl			
1	2	3	4	1	2	3	4
I	II	III	II II	I	II	III	II II
108 A	182A	216 A		123 A	202 A	228 A	
128 A	212 A	247 A		148 A	240 A	261 A	
162 A	282 A	361 A		187 A	316 A	381 A	
162 A	264 A	298 A		189 A	302 A	313 A	
204 A	348 A	431 A		237 A	394 A	454 A	
274 A	500 A	690 A		319 A	560 A	728 A	
427 A	825 A	1180A		497 A	924 A	1320 A	
245 A	412 A	498 A		287 A	470 A	525 A	
327 A	586A	795 A		384 A	662 A	839 A	
285 A	476 A	564 A		337 A	544 A	593 A	
379 A	672 A	896 A		447 A	760 A	944 A	
573 A	1060 A	1480 A		676 A	1200 A	1670 A	
366 A	600A	690 A		435 A	692 A	725 A	
482 A	836 A	1090 A		573 A	952 A	1140 A	
715 A	1290 A	1770 A	2280 A	850 A	1470 A	2000 A	2580A
583 A	994 A	1260 A	1920 A	697 A	1140 A	1330 A	2010A
852 A	1510A	2040 A	2600 A	1020 A	1720 A	2320 A	2950 A
688 A	1150A	1440 A	2210 A	826 A	1330 A	1510 A	2310 A
985 A	1720A	2300 A	2900 A	1180 A	1960 A	2610 A	3290 A
885 A	1450 A	1750 A	2720 A	1070 A	1680 A	1830 A	2830 A
1240 A	2110 A	2790 A	3450 A	1500 A	2410 A	3170 A	3930 A
1080 A	1730 A	2050 A	3190 A	1300 A	2010 A	2150 A	3300 A
1490 A	2480 A	3260 A	3980 A	1810 A	2850 A	3720 A	4530 A
1740 A	2860 A	3740 A	4500 A	2110 A	3280 A	4270 A	5130A
2220 A	3590 A	4680 A	5530 A	2700 A	4130 A	5360 A	6320 A
2690 A	4310 A	5610 A	6540 A	3290 A	4970 A	6430 A	7490 A

<sup>1)</sup> Mindestmaß für lichten Schienenabstand

DIN standard temperature rise 30C average ambient 35C (Max 40C)



## TECHNICAL INFO

### Copper busbar



TIC busbar table has using CDA standard formula for find out the current carrying in the busbar.

BS 159:1992 stipu-lates a maximum tem-perature rise of 50°C above a 24 hour mean ambient temperature of up to 35°C, and a peak ambient temper-ature of 40°C. Alterna-tively, ANSI C37.20 permits a temperature rise of 65°C above a maximum ambient of 40°C, provided that silver-plated (or ac-ceptable alternative) bolted terminations

**TABLE BUSBARS FOR RATED CURRENTS (Working Temp 85°C(IEC61439-1))**

No.	Size		Continuous Current (A)			
	Width mm.	Thick mm.	Bare bus bar (No. of bus bar)			
			1	2	3	4
1	12	5	237	452	666	
2	15	3	209	397	583	768
3	20	5	357	673	983	1288
4	20	10	541	1018	1515	1928
5	30	5	499	929	1346	1785
6	30	10	741	1397	1962	2499
7	40	10	930	1706	2388	3037
8	50	5	768	1432	2025	2595
9	50	10	1140	1996	2793	3550
10	60	5	898	1639	2316	2968
11	60	10	1308	2273	3168	4016
12	80	5	1169	2057	2896	3704
13	80	10	1628	2811	3908	4949
14	100	10	1939	3323	4602	5814
15	120	10	2234	3818	5284	6674
16	160	10	2819	4779	6589	8303
17	200	10	3367	5652	7754	9739



**Temperature Rise 50C max ambient 40 C for save operation**

**Similar to ABB busbar table ( Ref: 1SDC103G0202 Table 8 : operating current and power losses of bare conductor**

**TIC busbar temperature rise 50C has passed Type Test IEC61439-1:2020**

# TECHNICAL INFO

## Copper busbar

### Why TIC using copper busbar at temperature rise 50C?

Concern about temperature rise, Here is some limitation

Parts of ASSEMBLIES	Temperature rise K
Unplated busbars	50
Plated busbars	65
Terminals except as covered below	50
Terminals for devices marked for use with 90°C conductors, based upon 75 °C ampacity	60
Terminals for devices rated 110A and less, if marked for use with 75 °C conductors	65

The IEC60947 standard series defines the test regime for all low voltage electrical apparatus.

Table 2 in IEC60947-1 states that 70° K temperature rise is permissible on Silver or Nickel plated terminals of low voltage apparatus within an ambient 35°C, thereby achieving the maximum permissible conductor temperature of 105°C. Once the ambient temperature within an enclosure is identified, the designer can select the conductor size from table B3 from AS4388:1996 with confidence, knowing that the apparatus will perform as tested.



Terminals for external insulated conductor	70 <sup>b</sup>
Busbar and conductor	Limited by <sup>i</sup> : <ul style="list-style-type: none"> <li>- mechanical strength of conducting material<sup>g</sup>;</li> <li>- possible effect on adjacent equipment;</li> <li>- permissible temperature limit of the insulating materials in contact with the conductor;</li> <li>- effect of the temperature of the conductor on the apparatus connected to it;</li> <li>- for plug-in contacts, nature and surface treatment of the contact material</li> </ul>

**TIC busbar temperature rise 50C has passed Type Test IEC61439-1:2020**

## TECHNICAL INFO

### Routine Test

#### Inspection & Test Procedure

##### 1. General

Inspection and test procedure or routine verification in the latest standard IEC-61439 is intended to detect faults in the material and workmanship and ascertain proper functioning of the manufactured assembly. It is made on each assembly, whether it is necessary during assembly or/and after assembly.

Verification shall comprise the following categories:

##### a) Construction

1. Degree of protection of enclosure
2. Clearance & creepage distance
3. Protection against electrical shock and integrity of protection circuits
4. Incorporation of built-in components

##### 5. Internal electrical circuit & connection

##### 6. Terminal for external conductors

##### 7. Mechanical operation

##### b) Performance

1. Dielectric properties
2. Wiring, operational performance and function



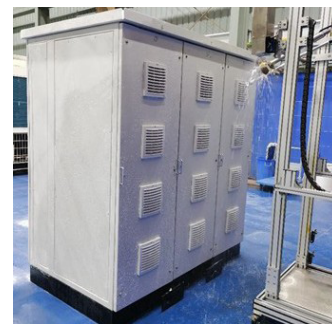
# Routine Test

## Routine Test

### 2. Procedures

#### 2.1 Degree of protection of enclosure.

A visual inspection to be done to confirm that the prescribed measures to achieve the designated degree of protection are maintained.



#### 2.2 Clearance & creepage distance.

Busbar, main circuit connector and grounding metal components of electric clearance minimum is 14 mm. Busbar, main circuit connector and grounding metal components of creepage distance minimum is 16 mm.

#### 2.3 Protection against electrical shock and integrity of protection circuits

Visual inspection to be done to ensure that panel is safe for operator comprise of:

- Degree of protection must follow design requirement
- Continuity of grounding of each metal component not over than 100 milliohm (with driving current at least 10A (AC or DC). Usually, It is taken for 5 points.
- Barrier against live part are firmly secured.
- Barrier or shutter (if applicable) for removal part.
- Continuity of earth busbar protection against external fault.

#### 2.4 Incorporation of built-in components

The installation & identification of built-in components shall be accordance with the panel build-er standard instruction.

# Routine Test

## Routine Test

### 2. Procedures (cont.)

#### 2.5 Internal electrical circuit & connection

The connections, especially screwed and bolted connection shall be checked for the correct tightness on a random basis. Tightness of bolt for conductor & busbar shall follow with panel assembling drawing or panel builder standard instruction.

#### 2.6 Terminal for external conductors

The number, type and identification shall be checked in accordance with project specification of panel builder standard.

#### 2.7 Mechanical operation

The effectiveness of mechanical actuating elements, interlocks and locks including those associated with removable parts shall be checked. They shall be checked with 5 times operations and shall work properly.

#### 2.8 Dielectric properties

A power frequency withstand test shall be performed on all circuit (between phases, phase to ground and aux circuit to ground) for 1890 VAC for duration 1s for main circuit . This test need not be made on auxiliary circuit which are protected by a short circuit protective device with a rating not exceed 16A or if an electrical function test has been made previously at the rated operational voltage for which the auxiliary circuits are designed.

#### 2.9 Wiring, operational performance and function

Following items to be checked on the assembly panels:

Providing of the name plate with one or more labels on each assembling.

Check that wiring is done properly including correct labeling & functional circuits.

Documentation of the panel including handling, installation, operation & maintenance manual

Check of the component identification.

## Routine Test

Project	NO	Content	Technical requirements	measure	Result	
inspection	1	Nameplate check	Project is complete beautiful, neat, good looking and correct			
	2	Lacquer layer coating quality	No bubble, peel- off, hemp points, etc.			
	3	Door structure check assembly	The opening angle more than 90 degrees, 5 times turn, should not crash with the components. Door should be spread evenly			
	4	Panel component installation	Clean, beautiful			
Installation check	5	com- ponent	Test bench installation	Smooth regular, firm, without shake a phenomenon		
	6		Components installed placement	Comply with the standards or drawings requirements, not influence each other, decorate reasonable		
	7		Operation device installation	Convenient operation		
	8	A loop wire	Conductors carrying current	Should comply with the design requirements		
	9		Insulation of wires rated voltage	Should comply with the standard		
	10		Wire color	Should comply with the standard		
	11		Looping wire laying	Enough length, placed properly		
	12		Insulation wire laying	Not in conducting elements through metal components have protection use line clip fixed or insulation line slot		
	13	Conductors and components (including heater) connection	Should comply with the requirement of process			
	14	Electric clearance check	Bus bar, main circuit connector and grounding metal components of electric clearance min 14 mm			
	15	Creepage distance check	Bus bar, main circuit connector and grounding metal components of creepage distance min 16 mm			
Mechanical, electrical operation test	16	ACB operation inspection	Five times close-open, normal and reliable			
	17	Manual operator inspection	Five times operation, normal and reliable			
Dielectric strength test	18	Pressure test before insulation resistance (megger 500 V should be measured: 20 M Ω)	AB _____ MΩ, BC _____ MΩ, CA _____ MΩ A0 _____ MΩ, B0 _____ MΩ, C0 _____ MΩ			
	19	After the pressure test insulation resistance (megger 500 V should be measured: 20 M Ω)	AB _____ MΩ, BC _____ MΩ, CA _____ MΩ A0 _____ MΩ, B0 _____ MΩ, C0 _____ MΩ			
	20	A loop alternate test (phase to phase)	AC 1890 V / 1 s, no breakdown, flash collaterals			
	21	A loop of test (phase to ground)	AC 1890 V / 1 s, no breakdown, flash collaterals			
	22	The secondary circuit of test	AC 1890 V / 1 s, no breakdown, flash collaterals			
Get an electric shock protection test	23	Shell protection grade examination	IP31 or IP55			
	24	Protection circuit connection	Continuity, less than 100 mΩ good con-tacts			

### Module Unit or Equipment Mounted on the section

No/Name	Switch Type/Serial No.	CT type/Ratio	DPM Type/Serial No	Other Devices	

# Technical Support

TIC's technical support is both competent and reliable. New customers are offered optional training on how to build a design-verified switchgear assembly. The advantage of realizing the first switchgear assembly directly with the panel builder is an opportunity to communicate the optimal workflow.

## Service/Support



### Preventive maintenance program

THERMOGRAPHY

POWER MEASURING & HARMONICS

COPPER BUSBAR CONDITION NUT, BOLT, SCREW

SWITCHBOARD CLEANING

CIRCUIT BREAKER INSPECTION

CAPACITOR INSPECTION

INSULATOR INSPECTION

BUSBAR SUPPORT

BREAKER CLEANING

Contact Resistance measurement

Technical Support

### SERVICE & MAINTENANCE

#### SERVICE TEAM

K.CHAINARONG TIYACHANANON

TEL: 081-836-5911

#### PM TEAM

TEL: 087-529-1222

OFFICE TEL: 02-408-8620- 29/222



# Technical Support

## Inspection & Preventive maintenance



### GUIDE TO SWITCHBOARD MAINTENANCE MAINTENANCE BENEFITS AND FACILITIES

#### A. Maintenance Program

A well-executed maintenance program can provide the following benefits:

1. Longer life of switchboard and fewer replacements;
2. Reduced time on repairs and overhauls, and the option of scheduling them at an Opportune time;
3. Fewer failures with unexpected outages;
4. Timely detection of any undesirable operating conditions which require correction;
5. Improved plant performance and increased operating economies.

#### B. Maintenance Records

A maintenance file should be established which should include the following:

1. A record of all installed switchboards and their maintenance schedule;
2. Nameplate data of all the equipment and its major components, instruction books, Renewal parts lists, bulletins and drawings;
3. A list of all items which have to be inspected and what adjustments are to be checked;
4. A record of past inspections and test results.



# Technical Support

## Inspection & Preventive maintenance



### GUIDE TO SWITCHBOARD MAINTENANCE

#### MAINTENANCE BENEFITS AND FACILITIES (continue)

##### C. Maintenance Tests

Maintenance tests are applicable as indicated:

1. Insulation resistance tests of the switchboards' breakers and bus can be useful in determining the condition of the insulation if they are performed regularly.

Since definite limits cannot be given for satisfactory insulation resistance, a record must be kept of the readings and comparisons made. Deterioration of insulation and the need for corrective action can be recognized if the readings are progressively lower after each test.

2. High potential tests are not required and are not recommended except in special circumstances, such as after repairs or modifications to the equipment that included the primary circuit (bus assemblies). When such tests are necessary, they may be conducted using 75% of the standard 50-cycle test voltage for new equipment.

3. After the switchboard has been serviced and adjusted, its operation should be checked before it is returned to service. This can best be done by putting the breaker in the test position (if drawout) and operating it with its associated control and protective devices from a separate source or supply.

# Technical Support

TIC's smart systems : More safety for your switchboard.

## Real Time Monitoring System

- For reliable operation
- For the protection of people and systems
- Power management for the future



## Energy Monitoring platform



## Building Energy Performance



## Home Dashboard



## QR CODE

Data base of TIC switchboard . Easily to check the switch-board information such as drawing , service history etc.

Technical Support

# Technical Support

## TIC's smart systems : More safety for your switchboard.

### Real Time Monitoring System, Smart management system



### Why Real-Time Monitoring is So Important

#### Immediate Results

Real-time monitoring helps the customer **identify the actual times** an incident occurs, the reporting time, and the resolution time accurately. By identifying these times, organizations can get more proactive with their response methods and deal with recurring problems efficiently.

#### Real-Time Visibility On Performance

The customer can easily identify trends and actions that contribute to the lowered performance of your systems and **take the necessary corrective measures with realtime monitoring.** It helps speed up the problem resolution process.

#### Automatic Alerts and Notifications

Real-time monitoring can be calibrated to produce **prioritized alerts** and trigger events to help manage infrastructure and carry out a smoother workflow for your IT teams. Real-time monitoring also enables the customer to communicate issues and alerts to users before it could heavily affect their operations and quickly seek the right course of action.

Temperature monitoring ( Hot Spot)  
Energy monitoring ( Current ,Volt , Kw etc.)

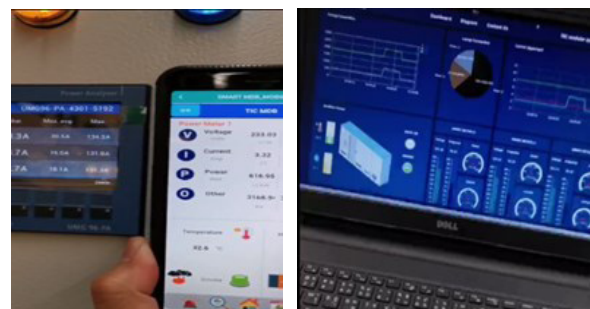
Real-time Alert & alarm  
Power management



Easily Check Drawing and information of MDB Via QR Code



Real time Security Alert & Safety alarm Via mobile phone & Line application





**Project Reference**



โรงงานล้างขวด สิงห์ เมอเวอเรจ บางเลน



ศูนย์ฝึกปฏิบัติการไฟฟ้าแรงสูง จังหวัดนครปฐม



KCE Electronics



CNC International



Baxter



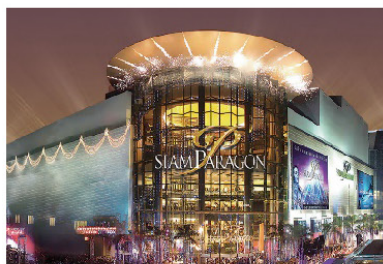
Thai Beverage New Can Line #3



Suvarnabhumi Airport



Airport Rail Link



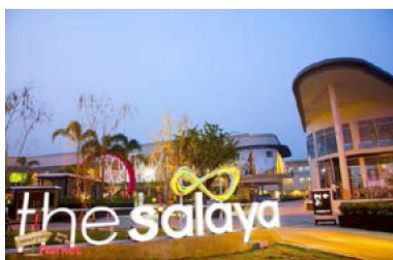
Siam Paragon



Central Rama 2



Central Chonburi



The Salaya



The Mall Bangkae



Esplanade

# Project Reference



AVANI RESORT  
KHAOLAK



IDEO RATCHADA  
SUTTHISAN



NOBLE  
CHAENGWATTANA



ATMOZ RATCHADA  
HUAYKWANG



IDEO RAMA 9  
ASOKE



MERCURE  
RAYONG  
LOMTALAY



THE PRIVACY  
TAOPOON  
INTERCHANGE



THE ADDRESS  
RATCHATHAWI



อาคารวิชาการและแพทย์  
มหาวิทยาลัยแม่ฟ้าหลวง



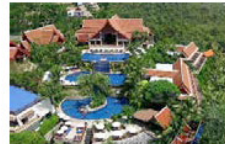
The Origin  
Ratchada Ladprao



Le Raffine  
Sukhumvit



THE PANO



Novotel Phuket



Red Mountain Golf  
Club



Plua Athenee Hotel  
Club



The Politan Aqua  
Phase 4



PRIMIO QUINTO



Phyl Pahol 34



THE TREE



CHAMBER



Koral Sport Complex



Siam Ocean World



Siam Niramit



โรงพยาบาลราชภัฏ



โรงพยาบาลเอกชัย



โรงพยาบาลพรนฉิเชิล เซลท์-เน็ต



โรงพยาบาลภูมิพล



โรงพยาบาลราชบุรี



โรงพยาบาลศรีอยุธยา



โรงพยาบาลพระราม



โรงพยาบาลพัทลุง



**TIC MODULAR SYSTEM CO.,LTD**  
**TIC ENGINEERING CO.,LTD**  
**TIC ELECTRIC CORPORATION CO.,LTD**

