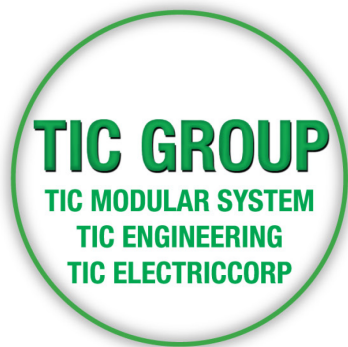


TIC GROUP

IEC61439-1&2

www.ticcorp.net



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



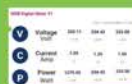
Smart Monitoring Via mobile
phone and your computer



Smart QR code, provide
MDB, DB data



CLOUD COMPUTING



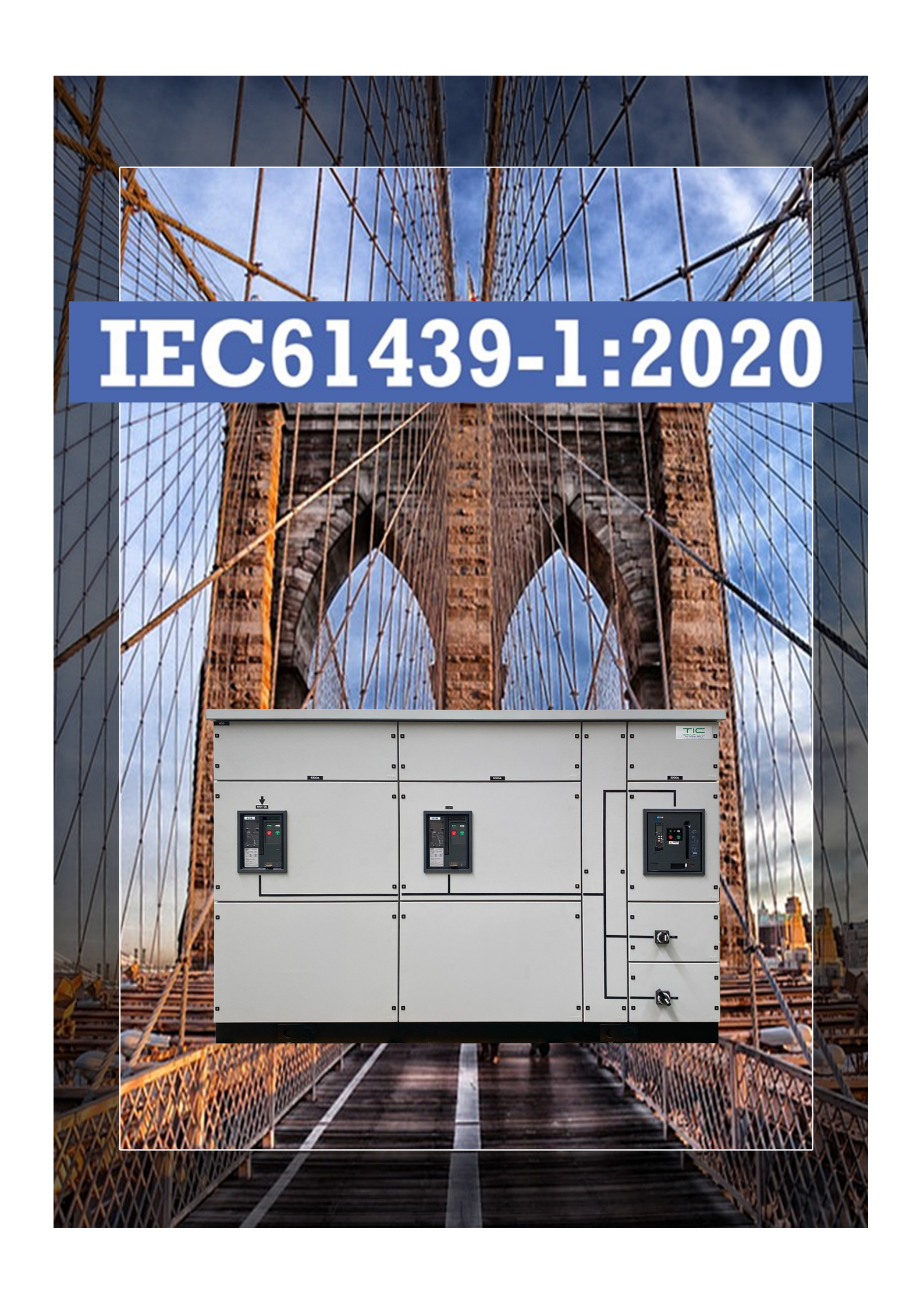
Easy for Energy
management

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



IEC61439-1:2020



Contents

Page

About Us

2-3

Technical Info

4-25

Routine Test

26-28

Technical Support

29-33

Certificate

34

Project Reference

35-36



Factory 1



Factory 2



Factory 3,4



Factory 5

Contents

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

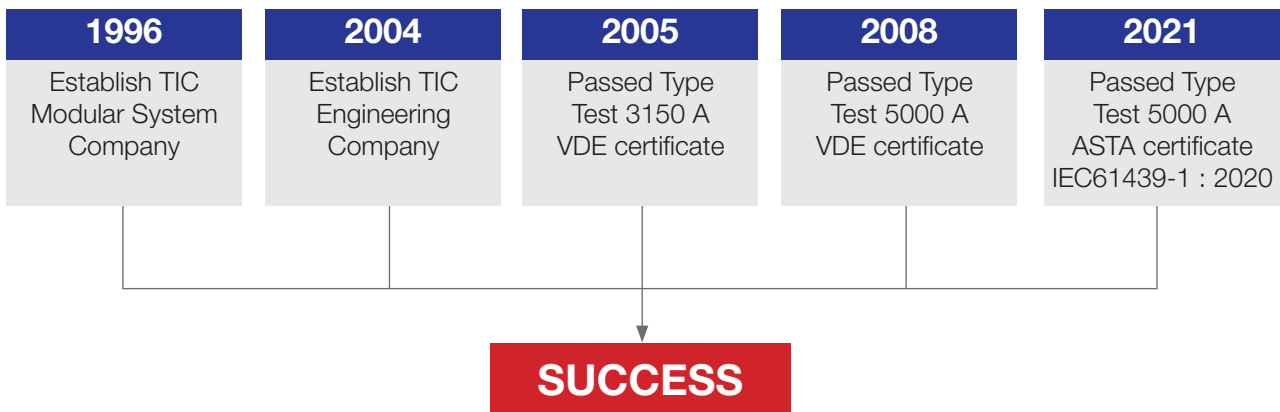
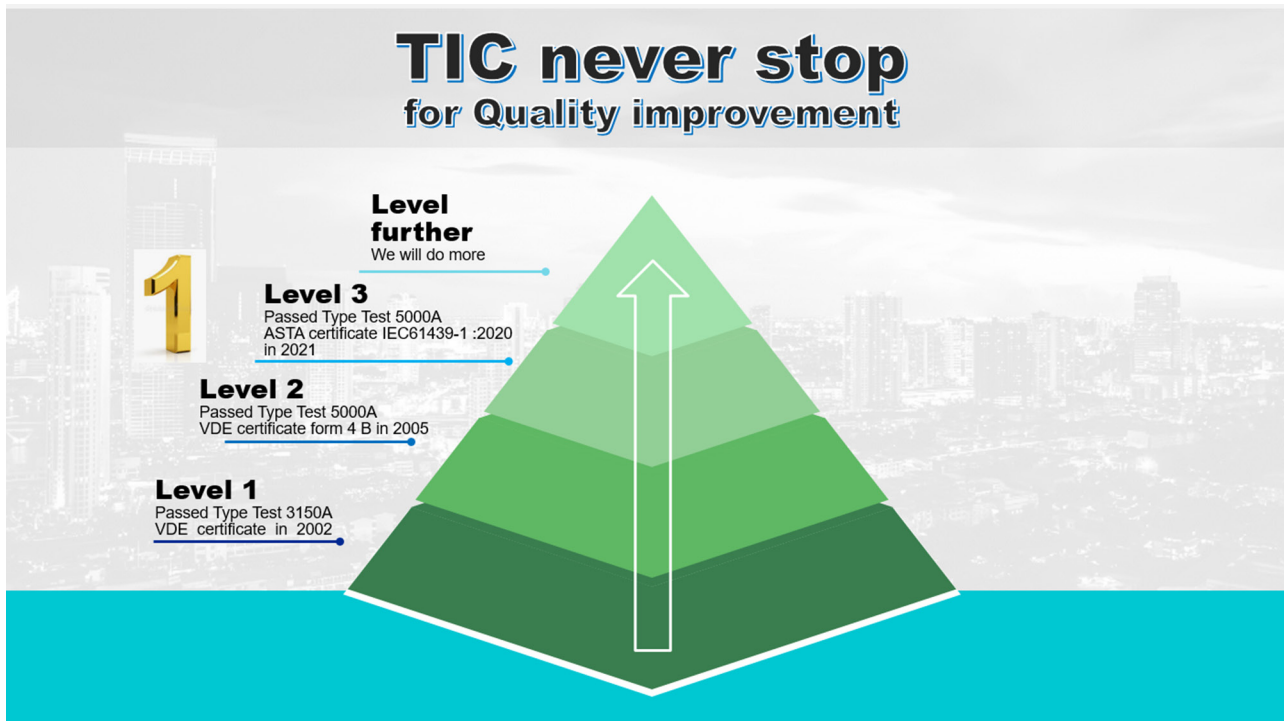


www.ticcorp.net



Google Maps

About Us



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

MANUFACTURER:	TIC MODULAR SYSTEM CO., LTD 99/9 Moo.12 Puttamonthon5 Road, Raiking, Sampran Nakornprathom 73210
APPARATUS:	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.
DESIGNATION:	TIC MODEL 003_2
TESTED BY:	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.
DATES OF TESTS:	-
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	
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	
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 7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China Tel: (8620) 6213 0088 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



X-Energy License Switchboard

System Features

Standards

IEC/EN 61439-1/-2

Internal partition

Design-venfied

Rated operational voltage U_e

Form 1 to Form 4

Rated current I_e

690V / 50-60 Hz

Rated short-time withstand current I_{cw}

up to 5000 A

Ambient air temperature

up to 100 kA_{eff}

Degree of protection

35 °C (24-h average value)

Net configuration

IP 31 / IP 55

Colour

TN-C / TN-C-S / TN-S / IT

Dimensions

RAL 7035 (other colours on request)

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)



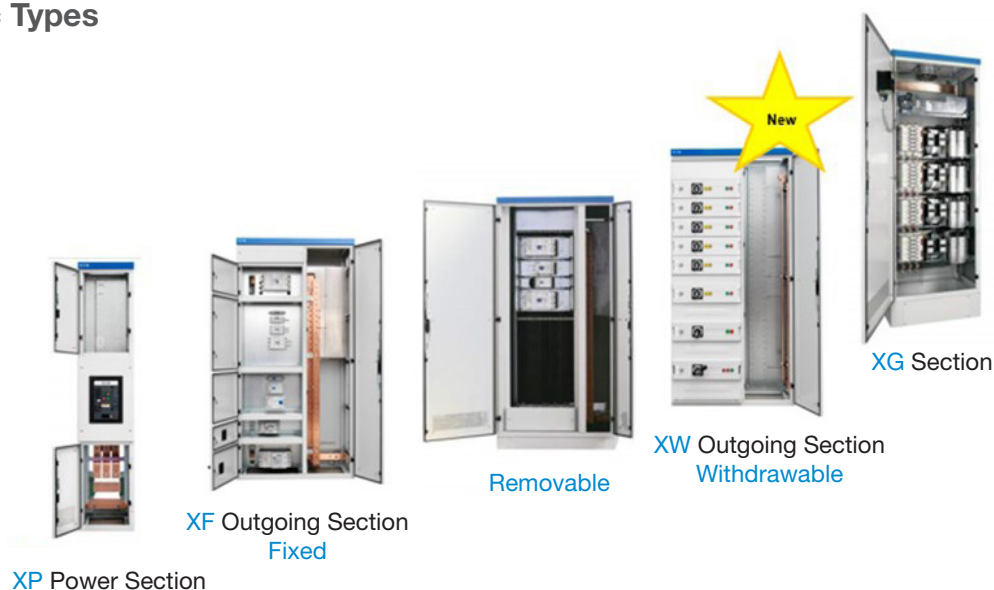
Double door cubicle

TECHNICAL INFO

5 variants, with maximum benefits.

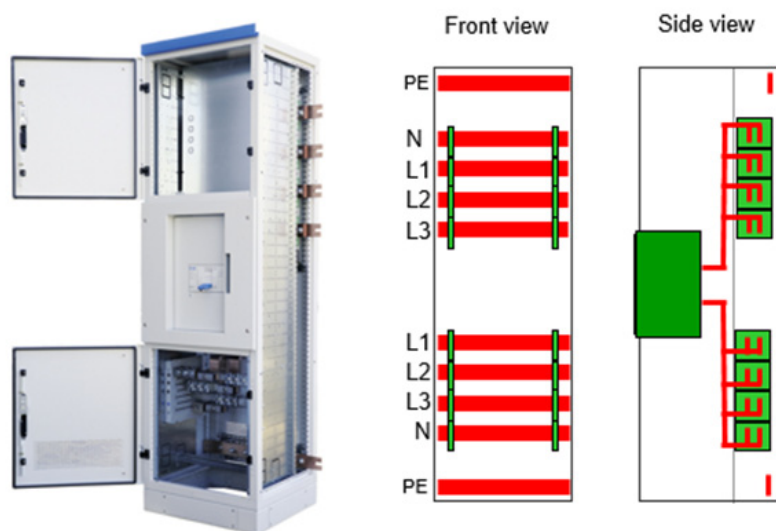
An Intelligent System Platform

5 Basic Types



Main Busbar Position at the Back BBB

Symmetrical Section Arrangement



- Reduces the number of types to be ordered
- Reduces the different types of copper connections
- Saves assembly time

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 have 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

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



RAL 5002

RAL 5003

RAL 5009

RAL 5010

RAL 5015

RAL 5017

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.

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:

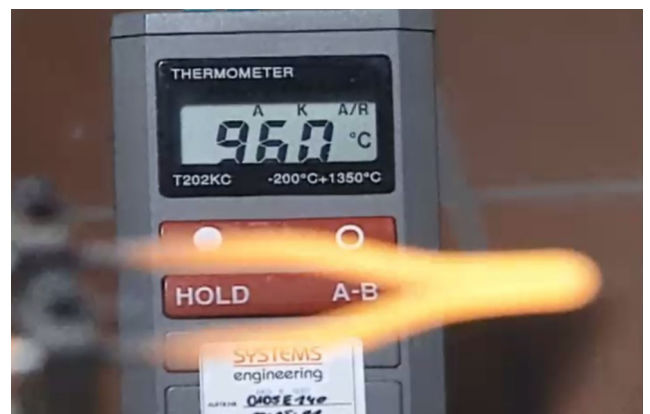
1. 6 cycles of 24hrs each to **damp heat test** at $40\pm 3^{\circ}\text{C}$ and **relative humidity** of 95% (IEC 60068-2-30)
2. 2 cycles of 24hrs each to **salt mist test** at $35\pm 2^{\circ}\text{C}$ (IEC 60068-2-11)

- **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°C dry heat test (IEC 60068-2-2)
- Verification of **resistance of insulating materials to abnormal heat and fire** (glow wire test)
- 960°C for parts necessary to retain current-carrying parts in position;
- 850°C for enclosures intended for mounting in hollow walls;
- 650°C for all other parts, including parts necessary to retain the protective conductor.



TIC Busbar support has passed Glow wire test 960°C 30 sec

TECHNICAL INFO

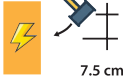
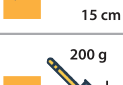
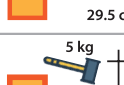
Strength of materials and parts

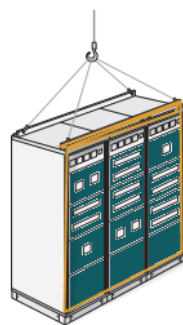
10.2.4. Resistance to ultra-violet (UV) radiation → (outdoor)

- 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	No protection	No test
1	Protection against water drop 	No harmful effect of vertical water drip By using water drip tool vertically dropping water for 10 min 
2	Protection against water drop 	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 m²/min, at least for 3 min in total. Water volume per each hole: 0.07 l/min Diameter of discharging nozzle: ≤6.3 
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 m²/min, at least for 3 min in total. Water volume per each hole: 12.5 l/min Diameter of discharging nozzle: ≤12.5 
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

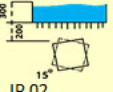
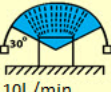
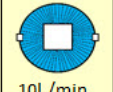
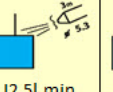
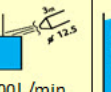
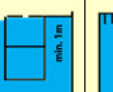
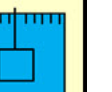
Ingress Protection (IP) Rating

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 $\approx 15^\circ$ angle	Protected against dripping water of $\approx 60^\circ$ 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

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:

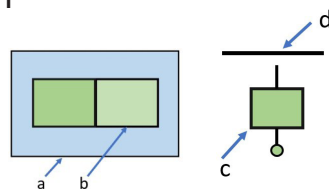
by means of barriers of partitions (metallic or non metallic materials) is aimed at:

- 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

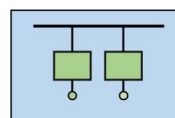
These barriers protects the operator from direct contacts and from the effects of the arc of the breakers in the normal access direction and also easily to visual inspection.



Caption

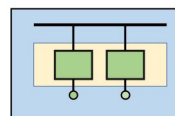
- a** Housing
- b** Internal segregation
- c** Functional units including the terminals for the associated external conductors
- d** Busbars, including the distribution bus-bars

Form 1
(no internal segregation)



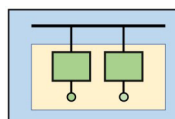
Form1

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



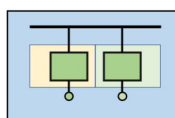
Form 2a

Form 2b Terminals separated from the busbars



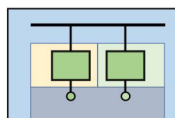
Form 2b

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



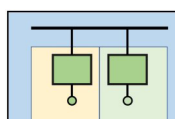
Form 3a

Form 3b
Terminals separated from the busbars



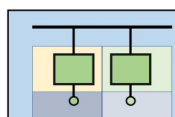
Form 3b

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 4a

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

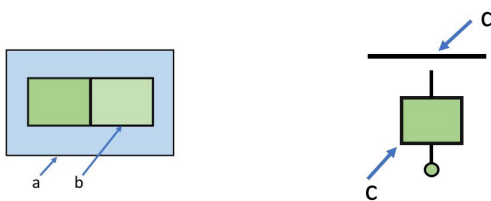


Form 4b

TECHNICAL INFO

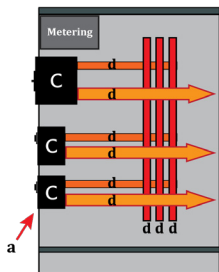
Form of internal separations

specifications of the different types of form



Caption

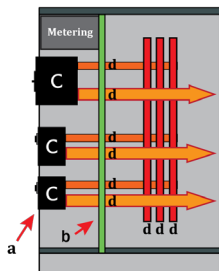
- a Housing
- b Internal segregation
- c Functional units including the terminals for the associated external conductors
- d Busbars, including the distribution bus-bars



Form 1
(no internal segregation)

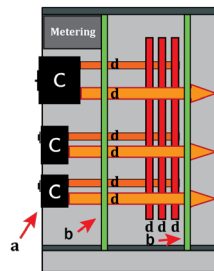


Form 1
(no internal segregation)



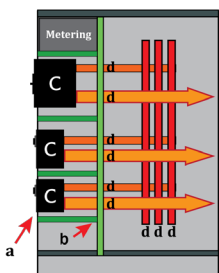
Form 2
(segregation of the busbars from the functional units)

Form 2a
Terminals not separated from the busbars



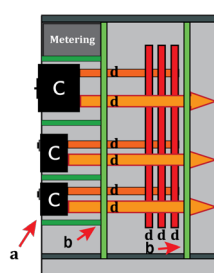
Form 2
(segregation of the busbars from the functional units)

Form 2b
Terminals separated from the busbars



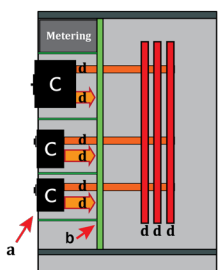
Form 3
(separation of the busbars from the functional units + separation of the functional units from each other)

Form 3a
Terminals not separated from the busbars



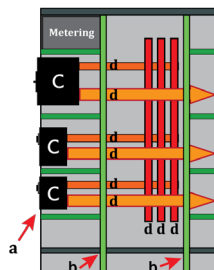
Form 3
(separation of the busbars from the functional units + separation of the functional units from each other)

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 4a
Terminals in the same compartment as the associated functional unit



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 used 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): • mechanical strength of conducting material (g); • possible effect on adjacent equipment; • permissible temperature limit of the insulating materials in contact with the conductor; • effect of the temperature of the conductor on apparatus connected to it • for plug-in contacts, nature and surface treatment of the contact material
Manual operating means: • of metal • of insulating material	15 (c) , (h) 25 (c) , (h)
Accessible external enclosures and covers • Metal surfaces • Insulating surfaces	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 under service conditions (see 7 . 1) . During verification a different ambient air temperature is permissible (see 10 . 10 . 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 60076-1. 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 60076-1, 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.

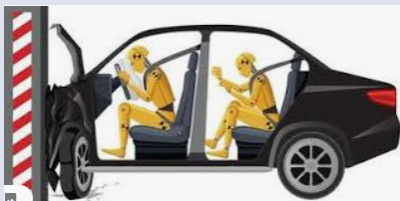


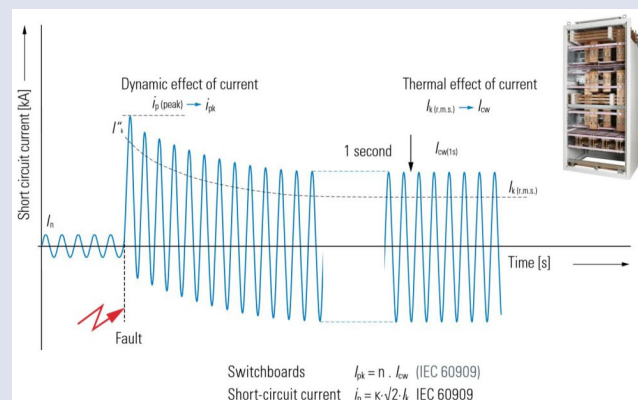
Photo 5: Bolted short-circuit connection for MCCB + N

Photo 6: Connection points with one central hole

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

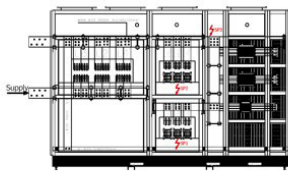


TIC Model 003—Short circuit withstand Test May 2021
ASTA certified

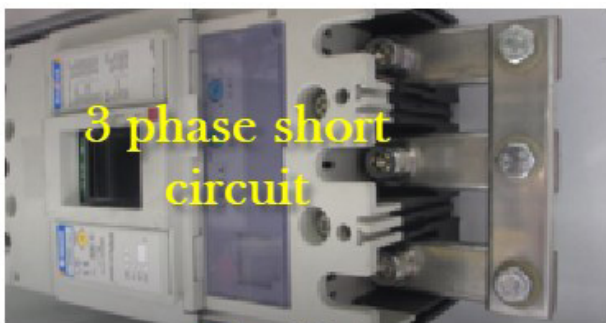
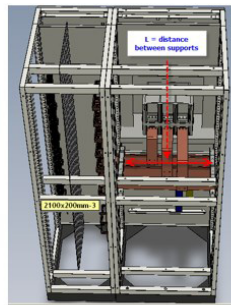
TECHNICAL INFO

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 (56 x 2.2 x 65 kA)
Symmetrical short-circuit current: 39 kA (56 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 trans-mission 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

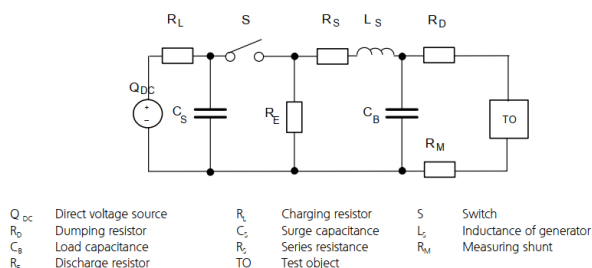
Verification of the dielectric properties

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 μ 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

^a 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

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

Dauerstrom in A							
blank				gestrichen			
Teilleiterzahl				Teilleiterzahl			
1	2	3	4 50 mm ¹⁾	1	2	3	4 50 mm ¹⁾
I	II	III	II II	I	II	III	II II
108 A	182 A	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	1180 A		497 A	924 A	1320 A	
245 A	412 A	498 A		287 A	470 A	525 A	
327 A	586 A	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	600 A	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	2580 A
583 A	994 A	1260 A	1920 A	697 A	1140 A	1330 A	2010 A
852 A	1510 A	2040 A	2600 A	1020 A	1720 A	2320 A	2950 A
688 A	1150 A	1440 A	2210 A	826 A	1330 A	1510 A	2310 A
985 A	1720 A	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	5130 A
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

¹⁾ Mindestmaß für lichten Schienenabstand

TECHNICAL INFO

Table busbar for rated current (Temp Rise 60k) IEC61439-1 ambient 35C max 40C

No	Size (m.m)		Continuous current (A)			
	WIDTH	THICK	1	2	3	4
1	12	5	257	452	577	-
2	15	3	235	409	523	-
3	20	5	397	725	1001	-
4	20	10	619	1196	1711	-
5	30	5	550	909	1299	-
6	30	10	831	1537	2146	-
7	40	10	1037	1871	2567	3306
8	50	5	845	1441	1972	2784
9	50	10	1235	2190	2958	3770
10	60	5	998	1668	2088	3205
11	60	10	1434	2494	3335	4205
12	80	5	1283	2103	2538	3944
13	80	10	1798	3060	4046	5003
14	100	10	2161	3596	4727	5771
15	120	10	2523	4147	5423	6525
16	160	10	3219	5206	6786	8019
17	200	10	3901	6250	8135	9483

At Temp Rise 60k , Average Ambient 35 c (Max 40C)
k2 = 1.45

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

Technical Info

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 ^b
Busbar and conductor	Limited byⁱ: - mechanical strength of conducting material^g; - possible effect on adjacent equipment; - permissible temperature limit of the insulating materials in contact with the conductor; - effect of the temperature of the conductor on the apparatus connected to it; - for plug-in contacts, nature and surface treatment of the contact material

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



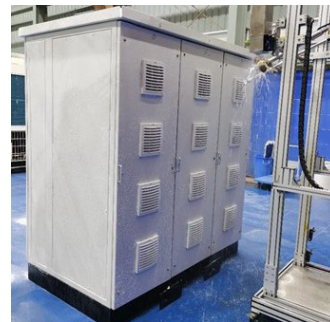
Routine Test

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 compo-nents of electric clearance min 14 mm	
	15	Creepage distance check		Bus bar, main circuit connector and grounding metal compo-nents 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

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

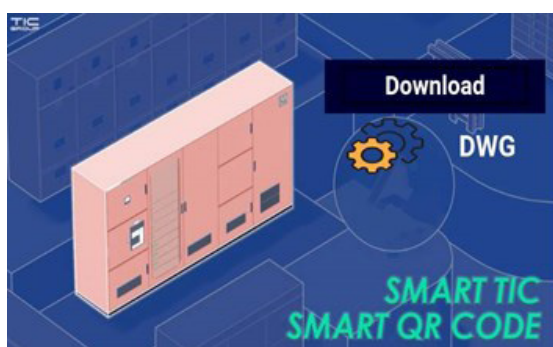
TIC's smart systems : More safety for your switchboard.

Real Time Monitoring System

For reliable operation

For the protection of people and systems

Power management for the future



Energy Monitoring platform

Real-time Energy Monitoring

Insight analytics

Potential cost-saving identification

Real-time notifications

Energy report

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

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

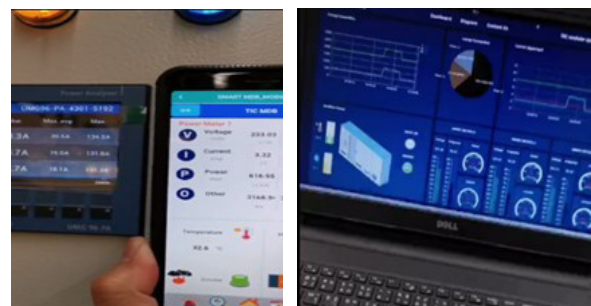
Power management



Easily Check Drawing and information of MDB Via QR Code



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



	VDE Prüf- und Zertifizierungsinstitut VDE Testing and Certification Institute Mittelstraße 28 · D-63089 Offenbach · Tel: +49 (0)69 6569-8306 · Fax: +49 (0)69 6569-8330 · 555	
Testprotokoll Protokoll Nr.	Low-voltage switchgear and controlgear assemblies Niederspannungsschaltanlagenkontrollen	
VDE Prüf- und Zertifizierungsinstitut Prüfstelle für Schalt- und Schutzgeräte Laboratory for Switchgear and Protection Devices Accredited Laboratory		
File reference: Aktenzeichen	5000570-1494-0002/54369 - 1999.1219A.008	
Client: Auftraggeber	TTC Modular System Co., Ltd. 99/9 Moo 12 Pattumommai 5 Rd, Raking, Samran, Nakornpathom 73210, Thailand	
License holder: Genehmigungsinhaber	-	
Manufacturer: Hersteller	TTC Modular System Co., Ltd. 99/9 Moo 12 Pattumommai 5 Rd, Raking, Samran, Nakornpathom 73210, Thailand	
Place of manufacture: Fertigungsstätte ist	TTC Modular System Co., Ltd. 99/9 Moo 12 Pattumommai 5 Rd, Raking, Samran, Nakornpathom 73210, Thailand	
Type designation: Typenbezeichnung	Type Test Model 002	
Date of test: Tag der Prüfung	31 January to 4 February 2005	
Testing place: Prüfst.	Institut „IPH“ für elektrische Hochleistungstechnik“ Linsenhofweg 14a 716 0-12851 Bietigheim Tel: +49 (0) 7143 9495-200, Fax: +49 (0) 7143 9495-222	
Additional enclosures: Zusätzliche Anlagen	Photographs, CAD drawings, Drawings	
Applied standards: Angelegene Normen	DIN EN 60439-1 VDE 0550 Teil 509: 2005-01 IEC 60439-1: 2004	
Test report: Prüfprotokoll	The rated characteristics related to the range of tests performed have been verified. The tests have been PASSED.	
Tested by: Geprüft von	Name / Name Signature / Unterschrift	Name / Name Signature / Unterschrift
Checked by: Überprüft von	Name / Name Signature / Unterschrift	Name / Name Signature / Unterschrift
Date: Geprüft am	Date: Überprüft am	Date: Geprüft am
Test report contains the results of an investigation carried out on the submitted products. This test report may only be passed to a third party in its complete wording and the date of issue. Das Testprotokoll enthält die Ergebnisse einer Untersuchung an den zur Prüfung vorgelegten Gegenständen. Dieser Prüfbericht darf Dritten nur im vollen Wortlaut und unter Angabe des Ausstellungsdatums zur Kenntnis gegeben werden.		

VDE Prüf- und Zertifizierungsinstitut VDE VERBAND DER ELEKTROTECHNIK ELEKTRONIK INFORMATIONSTECHNIK ZERTIFIKAT CERTIFICATE	
Auftraggeber / Hersteller Client / Manufacturer	TIC Modular System Co., LTD. 50102 M. 12, Phumamonthon 5 Rd., Baling, Nakhonpham 73219, Thailand
Ereignis Product	Niederspannung-Schaltgerätekombination Low-voltage switchgear and controlgear assembly
Typebezeichnung Type designation	5-feldrige Mittelspannung Nr. 001 (siehe Prüfbericht) 5-unit sample assembly No. 001 (see test report)
Technische Merkmale Technical characteristics	Bemessungsableitungsbegrenzung 415 V Rated operational voltage 415 V Bemessungsableitstrom 3150 A Rated current 2100 A Schutzart IP 2 X D Degree of protection IP 2 X D
Prüfbericht Nr. / Test Report Ref. Ausstellungsdatum / Date of issue	5000576-1994-000114191 - 1999.0275.2.178 08.09.2002
Angewandte Normen Applied standards	IEC 60438-1: 1999 / EN 60438-1: 1999 IEC 60438-2: 1999 (VDE 0480 Teil 500): 2000-08
Geprüfte Abnahme Tested clauses	8.2.1; 8.2.2; 8.2.3; 8.2.4; 8.2.5; 8.2.6; 8.2.7
Ein Muster dieses Ereignisses wurde geprüft und die Übereinstimmung mit den angewandten Normen festgestellt. Der oben genannte Prüfbericht ist Grundlage dieses Zertifikats. A sample of the product has been tested and found to be in conformity with the applied standards. The above mentioned Test Report is part of this certificate. Dieses Zertifikat darf Dritten nur in Verbindung mit dem oben genannten Prüfbericht im vollen Wortlaut und unter Angaben des Ausstellungsdatums zur Kenntnis gegeben werden. This certificate may only be passed on to third party in connection with the above mentioned Test Report in its complete wording and the date of issue.	
VDE Prüf- und Zertifizierungsinstitut VDE Testing and Certification Institut Abteilung P1 Dezernent P1: Für den Binnenmarkt der Europäischen Union (EU) ist das VDE-Zertifikat erforderlich. Nur Kern-NEC 2000 zertifiziert worden. The E.U. Trading and Certification Institute has been notified with the Identification Number 0206 for the Internal Market of the European Union (EU). D-83069 Offenbach am Main, 30. August 2002 Ministratsize 28	

intertek
Total Quality Account

ASTA TYPE CERTIFICATE VERIFICATION OF TEST

Project No: SHA0940714 **Certificate No:** ASTA-TYPE-

Applicant: TICI MODULAR SYSTEM CO., LTD.
99/90 Mile 12 Puttamonthon sai 5 Rd., Soi Ranking 42 Trailking, A Samran,
Nakornpathom, THAILAND

Apparatus: 5000 K, 4 ISV / 1000 V / 12 kV ($\text{U}_{\text{LIM}}/\text{I}_{\text{LIM}}$) 30 Hz, IP65, form BII
Power Switchgear and Controlling Apparatus (PSC Assembly) incorporating one three-phase and neutral extraneous deadlocking horizontal timber busbar system, one incoming & 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 outdoor use and has a metallic enclosure.

Manufactured by: TICI MODULAR SYSTEM CO., LTD.
99/90 Mile 12 Puttamonthon sai 5 Rd., Soi Ranking 42 Trailking, A Samran,
Nakornpathom, THAILAND

Test Report No: 21020800GZA and YD71/M00503

Designation: TICI Model Q00-2

The apparatus which is representative of the designation, supplied drawings and photographs has been evaluated in accordance with:

IEC 61439-1 : 2020

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

1. Strength of material and parts	4/7/8	No verification by testing required
2. Degree of protection of enclosures	9	Detective properties
3. Clearances	10	Temperature-rise limits
4. Creepage Distances	11	Short circuit withstand strength
5. Protection against electric shock and integrity of protective conductors	12	Electromagnetic compatibility (EMC)

The results are shown in the report of test attached hereto. The value obtained and the general performance is considered to comply with the above Standard(EN) and to justify the rating assigned by the Manufacturer as stated on the ratings applied to this Certificate applies solely to the apparatus tested. Responsibility for conformity of any apparatus having the same or other designations rests with the Manufacturer.

IEC61439-1 : 2020

0919

This certificate was issued under conditions of accreditation in accordance with ISO/IEC 17025:2017. It is subject to periodic surveillance audits by Intertek. This certification does not constitute a recommendation or endorsement of products or services by Intertek. The responsibility for compliance with applicable standards lies with the client. Intertek's role is limited to providing independent technical information and advice based on its expertise and experience. Intertek is not responsible for any consequences arising from the use of this certificate.

[illegible]

VDE Prüf- und Zertifizierungsinstitut VDE VERBAND DER ELEKTROTECHNIK ELEKTRONIK · INFORMATIONSTECHNIK · GAS ZERTIFIKAT CERTIFICATE																	
Auftraggeber / Hersteller Client / Manufacturer Ereignis Product Typenbezeichnung Type designation Technische Merkmale Technical characteristics	TIC Modular System Co., LTD. 989 Moo 12, Phuttamonthon 5 Rd., Raking, Sampran, Nakornpham 73210, Thailand Niederspannung-Schaltgerätekombination Low-voltage switchgear and controlgear assembly Type Test Model 002 (see testreport) <table border="0"> <tr> <td>Bemessungsbetriebsspannung</td> <td>415 V</td> </tr> <tr> <td>Rated operational voltage</td> <td>415 V</td> </tr> <tr> <td>Bemessungsbeitriebsstrom</td> <td>5000 A</td> </tr> <tr> <td>Rated current</td> <td>5000 A</td> </tr> <tr> <td>Bemessungskurzschlussstrom</td> <td>6575 KA, 1s</td> </tr> <tr> <td>Rated short-time current</td> <td>6575 KA, 1s</td> </tr> <tr> <td>Schutzart</td> <td>IP 4 X</td> </tr> <tr> <td>Degree of protection</td> <td>IP 4 X</td> </tr> </table>	Bemessungsbetriebsspannung	415 V	Rated operational voltage	415 V	Bemessungsbeitriebsstrom	5000 A	Rated current	5000 A	Bemessungskurzschlussstrom	6575 KA, 1s	Rated short-time current	6575 KA, 1s	Schutzart	IP 4 X	Degree of protection	IP 4 X
Bemessungsbetriebsspannung	415 V																
Rated operational voltage	415 V																
Bemessungsbeitriebsstrom	5000 A																
Rated current	5000 A																
Bemessungskurzschlussstrom	6575 KA, 1s																
Rated short-time current	6575 KA, 1s																
Schutzart	IP 4 X																
Degree of protection	IP 4 X																
Prüfbericht Nr. / Test Report No. Ausstellungsdatum / Date of issue Angewandte Normen Applied standards Geprüfte Abschnitte Tested clauses	5005576-1494-0002/ 54369 - 1999.1219.4.008 2005-03-31 DIN EN 60439-1 (VDE 0660 Teil 500) : 2000-08 EN 60439-1: 1999 / IEC 60439-1: 2004 8.2.1; 8.2.2; 8.2.3; 8.2.4; 8.2.5; 8.2.6; 8.2.7																
Ein Muster dieses Ereignisses wurde geprüft und die Übereinstimmung mit den angewandten Normen festgestellt. Der oben genannte Prüfbericht ist Grundlage dieses Zertifikates. <i>A sample of this product has been tested and found to be in conformity with the applied standards. The above mentioned Test Report is the basis of this certificate.</i> Dieses Zertifikat darf Dritten nur in Verbindung mit dem oben genannten Prüfbericht im vollen Wortlaut und unter Angabe des Ausstellungsdates zur Kenntnis gegeben werden. <i>This certificate may only be passed to a third party in combination with the above mentioned Test Report in its complete wording and the date of issue.</i>																	
VDE Prüf- und Zertifizierungsinstitut VDE Testing and Certification Institute Abteilung F1 Department F1  D-63099 Offenbach am Main, 12. Mai 2005 Musterseite 26																	
Für den Binnenmarkt der Europäischen Union (EU) ist das VDE-Prüfzertifikat unter der Kenn-Nr. 0360 notifiziert worden. For the Internal Market of the European Union (EU), the VDE Testing and Certification Institute has been notified with the Identification Number 0360 for the Internal Market of the European Union (EU).																	



Certificate of Registration

This certificate has been awarded to

TIC ENGINEERING CO., LTD.

99/9 Moo 12, Phutamonthon 5 Road, Tambon Raking, Amphur Samran,
Nakhonpathom, 73210, Thailand

In recognition of the organization's Environmental Management System which complies with

ISO 14001:2015

The scope of activities covered by this certificate is defined below

**Manufacture of Cable Tray, Cable Wireway,
Cable Ladder and Cable Trunking System**

Certificate Number 220872/EN/001/14/15			
This certificate is issued to the organization named above, which has been found to conform to the requirements of the standard named below, and which has been found to be in conformity with the standard named below, and which has been found to be in conformity with the standard named below.			
Date of Issue of Certificate	Issue Number	Certificate Expiry Date	Certification Cycle
14 February 2022	1	13 February 2025	1
Revision Date	Revision Number	Original Certificate Issue Date	Scheme Number
14 February 2022	0	14 February 2022	446

For detailed explanation for the data fields above, refer to <http://www.urs-holdings.com/pages-and-regulations>

Issued by








On behalf of the Schemes Manager

Project Reference



โรงงานล้างขวด สิงห์ เบอเวอเรจ บางเลน



ศูนย์ฝึกปฏิบัติการไฟฟ้าแรงสูง จังหวัดนครปฐม



KCE Electronics



CNC International



Baxter



Thai Beverage New Can Line #3



Suvarnabhumi Airport



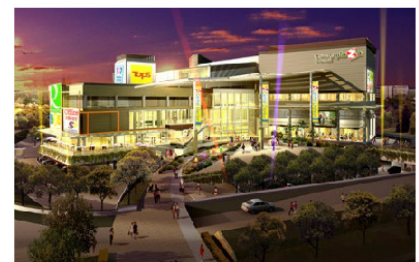
Airport Rail Link



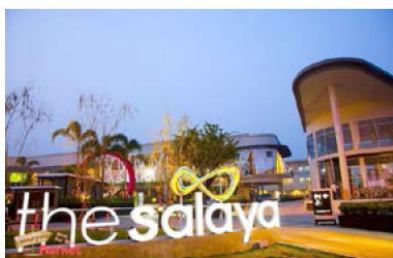
Siam Paragon



Central Rama 2



Central Chonburi



The Salaya



The Mall Bangkai



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



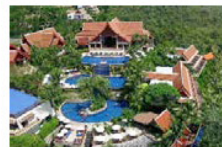
The Origin
Ratchada Ladprao



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



โรงพยาบาลสุรินทร์



โรงพยาบาลเอกชัย



โรงพยาบาลพรหมเชิด เอลฟ์-นคร



โรงพยาบาลสุราษฎร์



โรงพยาบาลวิชัยเวช



โรงพยาบาลศรีชัยยา



โรงพยาบาลพร - งาม



โรงพยาบาลพัทลุง



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



ticgroupmail@gmail.com