



Asia General
Transformer Co., Ltd.



POWER TRANSFORMER 66kV ~ 230 kV CLASS

ING Asia General Transformer Co., Ltd.



Certificate No: TH15/8962

ING Asia General Transformer Co., Ltd.



Certificate No: TH10/4921



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Rev 02

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ASIA GENERAL TRANSFORMER, **KEY TO SMART POWER** FOR THE RIGHT POWER AT THE RIGHT TIME

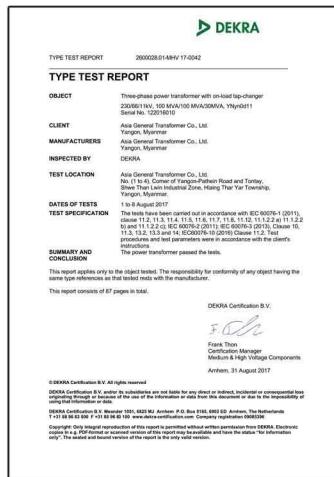
CONTENTS

- 01. Introduction
- 02. Technical Transferred Agreement
- 03. Production Range
- 04. Support & Services
- 05. Core Cutting and Lamination
- 06. Winding
- 07. Core & Assembly
- 08. Design
- 09. Research and Development
- 10. Tank
- 11. Testing
- 12. Cooling System

Introduction

AG is leading in technology for power transformer up to 230 kV voltage class. And also, the largest power transformer manufacturing plant in Myanmar.

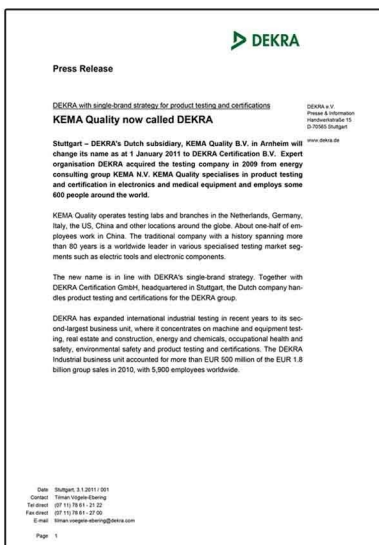
Type Test Achievement



- In Myanmar, Pioneer Test certified by International testing laboratory at DEKRA, Netherlands
- Fully local production with Japan's design, technology, training and supervision.

Introduction DEKRA

- AGT successfully passed Type Test accredited by DEKRA, Netherlands.



DEKRA is accredited by the Dutch Board of Accreditation (RvA) which is a member of the International Laboratory Accreditation Cooperation (ILAC) and the International Accreditation Forum (IAF).

In addition:

- (1) DEKRA is National Certification Body (NCB) within the IECEE CB scheme and operates CB Testing Laboratories (CBTL) globally
- (2) DEKRA is a Notified Body (NB) for various European Directives
- (3) DEKRA is listed as an approved Certification Body and Testing Laboratory by a wide range of government authorities, end users and consultants.

Technical Transferred Agreement Certificate

(Asia General Transformer & Mitsubishi Electric Corporation (MELCO))

Agreement Certificates and with Globalize Mitsubishi Electric Corporation, Japan as following technical transfer agreement on Jun.2015 & Dec 2016 successfully.



In accordance with the Technical Transfer agreement MELCO transfers their technology of 66kV and above upto 230kV voltage class Power Transformer to AGT such as Technical Documents, Technical Training, Technical Assistance, Consultation, Supervision during production and testing with reference to Power Transformer 100MVA 230/66/11kV Oil immersed transformer trademark and trade name agreement, AGT produces that transformer by using the term "Licensed By Mitsubishi Electric Corporation".

Production Range

- Rated power up to 150MVA and operating voltage up to 230kV, AG offers off-load or on - load tap changers to adapt them to various grid conditions. AG manufactures transformers under IEC and required national standards.

Application Standard

- Confirm to IEC 60076

Scope of Production & Services

Plant

Production

- Distribution Transformer (Corrugated Hermetically Sealed Type)
- Up to 230 kV Voltage Class Power Transformer (Conventional type with Conservator)
- Cast Resin Transformer (Conform to IEC 60076-11)
- On Load Tap Changing Transformer
- Pad Mounted Transformer (American Style)
- Pole Mounted Transformer
- Unit Substation Transformer (Package or Compact Substation)



Power Transformer with
(100MVA, 230/66/11 kV)



Power Transformer with
On Load Tap Changer



Power Transformer
No Load Tap Changer
(30MVA, 66kV)

Support and Services

Service Support

- Erection & Recondition Testing
- Repair & Refurbishment of Power Transformers
- Oil Passivation and filling under vacuum at site
- Oil Filtration and Testing: DGA, BSV and Moisture content
- Refurbishment of Tap-changers
- Spare parts
- Annual Maintenance Contracts
- Upgrading of Transformers
- Back up installation for OLTC

Erection and Commissioning

- Transformers are delivered as complete sets or partially assembled with regard to their dimensions and installed conditions
- AGT is able to deliver , erect and commission at tt remote locations of Extra High Power Transformers through careful transport planning , efficient erection and testing and commissioning works with the qualified engineers and high quality equipment.

Value Add to our customers

-Competitive

Our lean manufacturing processes, advance technology and large distribution channels enable us to offer competitive prices

-Reliable Supply

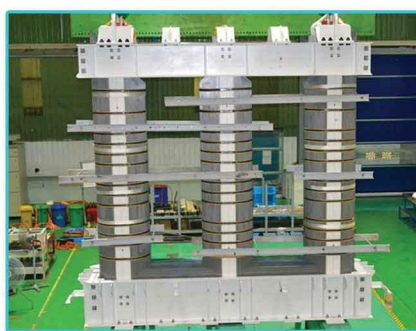
With our mass production methodology supported by world class machinery, we have continuous supply to meet your needs

-Dedicated Support

Our in house 24 hour after sales service team provides local technical support and dedicated support to stand ready for your continuity of business

Core cutting and Lamination

Using high-quality cold-rolled grain-oriented silicon steel laminations, which increase the inter lamination resistance and decrease eddy current losses. The cores are fully-mitered and utilize the step lap joints, the flux distribution is improved. The temperature rise of core is designed to be low, if necessary, by placement of vertical oil ducts.



Core Stacking Process

Winding

The windings are made by OFHC(Oxygen Free High Conductivity) copper which provides maximum strength, short-circuit withstand capability, increased predictability and lower hot spot temperatures for loading and overloading. Cooling ducts are formed in the windings by radial spacers made of special high density pressboard insulation. All windings are manufactured in a Clean Winding Environment. The winding machines are separated into horizontal and vertical types.

The horizontal winding method is used for a low-electromotive force, high-current type with a large number of conductors.

The vertical winding method is used for high electromotive force, low-current conditions with a small number of conductors and implements a complex winding method.

Continuously Transposed Conductors are arranged from several insulated rectangular wires, in two side by side laying stacks. CTC used in Power Transformers give several advantages in the design and in the construction compared to conventional conductor. It brings great advantage in reduction of eddy current losses, particularly at the end of winding. In addition, it is possible to increase in the space factor of the winding, due to small thickness of the insulation of single conductors and getting a more uniform distribution of the temperature throughout the whole winding.

By Sam Dong (Continuously Transposed Conductor)

The advantage of using transposed conductor is to short winding time during the production of power transformers, decrease size and cost of transformer because of increased space factor in the winding, improve short-circuit and mechanical strength of the winding.

After completion of the windings, all coils are dried in an oven and pressed to size to obtain short-circuit resistance. The windings are then ready to combine with the core and other internal accessories



Vertical Winding Machine



Horizontal Winding Machine



Vertical Winding Machine

Core & Coil Assembly

The individual windings are assembled one over the other to form the entire phase assembly. All corrections from the windings to the tap changer and bushings, are made by insulated cables and bus bars.



Winding Inserting

All windings are inserted into a core.



Core & Coil Assembly

Connection of off load tap changer or on load tap changer is either integral part of the core-coil assembly.



Vapor phase drying

Core and coil assembly is dried using a vapour phase cycle method.



In-tanking Process

The core and coil assembly is inserted in the tank.

Design

MELCO Training

AGT design team was trained at Mitsubishi Electric Corporation in Ako City Japan for the production of 100MVA, 230kV Power Transformer. The team attended 3 months on job training, accumulating invaluable technical and manufacturing experience. We are now capable of producing Extra High Power Transformers in Myanmar.

Type of Training	Technical Professional
Electrical	Ms.Naw Thaw Thi Paw Htoo, Mr.Aung Thu Ya, Mr.Tay Zar Win
Mechanical complete with (Winding, Insulation, Core, Internal Assembly)	Ms.Naw Thaw Thi Paw Htoo, Mr.Aung Thu Ya, Mr.Ye Kyaw Phyo
Production Process /Learning Facilities	Mr.Aung Kyaw Swar Soe Mr.Kyaw Thu Ya

The above Technical Professionals are certified by MELCO



Tank

Tanks for power transformer are made of hot rolled steel. The transformer tank enclosure is manufactured with the necessary strength to protect all inner structures, to contain and ventilate insulating oil and to withstand build up of interior pressure during faults.



Tank Welding

All the welding are tested with a penetrant liquid and with the x-rays when necessary.

Surface Treatment and Painting



Cleaning of tanks

The outer surfaces of the tank are shot blasted to obtain a very fine and smooth finish.



Painting

After cleaning the tanks, polyurethane primer coat or inside and outside of the tank. The outside surface is painted with polyurethane top coat.

Cooling System

The main source of heat generation in transformer is copper loss. In power transformer, we use external **transformer cooling system** to accelerate the dissipation rate of heat of transformer. For accelerating cooling different **transformer cooling methods** are used depending upon their size and ratings.

AGT can design and manufacture transformer with two types of cooling system They are:

- ONAF (Oil Natural Air Forced)
- ONAN (Oil Natural Air Natural)



ONAN (Oil Natural Air Natural)

This is the simplest transformer cooling system. The full form of ONAN is “Oil Nature Air Natural”. Here natural convectional flow of hot oil is utilized for cooling. In convectional circulation of oil, the hot oil flows to the upper portion of the transformer tank and the vacant place is occupied by cold oil. This hot oil which comes to upper side, will dissipate heat in the atmosphere by natural conduction, convection & radiation in air and will become cold. In this way the oil in the transformer tank continually circulate when the transformer put into load. As the rate of dissipation of heat in air depends upon dissipating surface of the oil tank, it is essential to increase the effective surface area of the tank. So additional dissipating surface in the form of tubes or radiators connected to the transformer tank. This is known as radiator of transformer or radiator bank of transformer.

ONAF (Oil Natural Air Forced)

Heat dissipation can obviously be increased, if dissipating surface is increased but it can be make faster by applying forced air flow on that dissipating surface. Fans blowing air on cooling surface is employed. Forced air takes away the heat from the surface of radiator and provides better cooling than natural air. The full form of ONAF is “Oil Natural Air Forced”. As the heat dissipation rate is faster and more in ONAF transformer cooling method than ONAN cooling system, electrical power transformer can be put into more load without crossing the permissible temperature limits.

Testing

AGT is using accurate state of the art testing equipment, conducting testing on EHV power transformer in accordance with the latest IEC Standard. Qualified and experienced Engineers are leading with perfection the Factory Acceptance Test (FAT) while keeping the high standards of quality assurance. Our Testing Technologies are established by all complete routine tests, type tests and special tests up to 200MVA, 230kV system except from short circuit withstand test as per international standards. Type Test Accredited by DEKRA Netherlands.



Control Room of Extra-High Voltage Test Laboratory



Extra-High Voltage Test Laboratory

Routine Tests

- Measurement of Winding Resistance
- Measurement of Voltage ratio and check of phase displacement
- Measurement of short circuit impedance and load loss
- Measurement of no-load loss and current
- Dielectric routine test
- Test on On-load Tap Changer, where appropriate
- Check of the ratio and polarity of built-in current transformer
- Check of core and frame insulation for liquid immersed transformers with core or frame insulation

Additional Routine Test for Transformer with $U_m > 72.5\text{kV}$ (Optional)

- Determination of capacitance, winding to earth and between windings
- Measurement of dc insulation resistance between each winding to earth and between windings
- Measurement of dissipation factor($\tan\delta$) of the insulation system capacitances
- Measurement of dissolved gasses
- Measurement of no-load loss and current at 90% and 110% of rated voltage

Type Tests

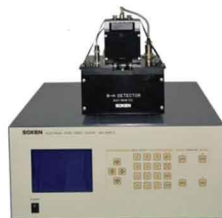
- Temperature-rise type test (IEC 60076-2)
- Dielectric type test (IEC 60076-3)
- Determination of sound level (IEC 60076-10)
- Measurement of no-load loss and current at 90% and 110% rated voltage

Special Tests (Optional)

- Dielectric Special Test (IEC 60076-3)
- Winding hot-spot temperature -rise measurement
- Determination of capacitance winding to earth and between windings
- Measurement of dissipation factor($\tan\delta$) of the insulation system capacitance
- Measurement of zero sequence impedance on three phase transformer
- Measurement of dc insulation resistance each winding to earth and between windings
- Measurement of frequency response (Frequency Response Analysis or FRA)
- Measurement of dissolved gasses in dielectric liquid
- Measurement of the harmonic of the no-load current
- Measurement of moisture content in transformer insulation
- Vacuum deflection test on liquid immersed transformers
- Pressure deflection test on liquid immersed transformers
- Vacuum tightness test on site on liquid immersed transformers
- Check of external coating
- Determination of weight with transformer arranged for transport

Laboratory Test

- Quality of all incoming material are checked by our QA Section and tested in AGT's Laboratory room by our QC Section.



Research & Development

Whilst continuously working to reinforce the basic technology, AG Group is committed to the research and development of cutting-edge products, designs and systems to meet the needs of the society and our customers.

These includes;

Type Test: We are one of the first Myanmar companies to begin undertaking type testing of 1MVA, 33/0.4kV Transformer. By rising to this challenge, we have furthered enhanced our design principles and manufacturing processes.

Cost efficiency: Leaner product designs to enhance the use of enclosure space and to streamline the product installation to save cost and convenience.

International Collaboration: Incorporating the cutting edge technologies and process to keep up with the current and future trends by consulting and collaborating with our international partners.

Design : As one of our strength point, we have own design calculation and verification program in order to improve and further development.



Quality Assurance

Asia General Transformer believe that within the scope of our services, the Quality Management System complies with the requirements of ISO 9001: 2008 and as such, this enables us to offer our Clients a proven level of Quality Assurance.

Environmental Management

Asia General Transformer committed to provide a quality service in a manner that ensures a safe and healthy workplace for our employees and minimizes our potential impact on the environment. We will operate in compliance with all relevant environmental legislation and we will strive to use pollution prevention and environmental best practices in all we do.

We will, therefore, manage our processes, our materials, and our people in order to reduce the environmental impacts associated with our work.

World Class Materials

All the incoming materials are procured from AG approved sources and are subjected to quality checks as per IEC and ISO standards and consequently selected suppliers from world class companies including Germany, Italy, Japan and Korea.



Radiator
Brand : SW Industry
Country : Korea



Rectangular Wire
Brand : Samdong
Country : Korea



HV/LV Bushing
Brand : ABB
Country : Sweden



OLTC Tap Changer VRF-Type
Brand : MR
Country : Germany



Cooling Fan
Brand : Korea Power Tech
Country : Korea



Rapid Pressure Rise Relay
Brand : Qualitrol
Country : USA

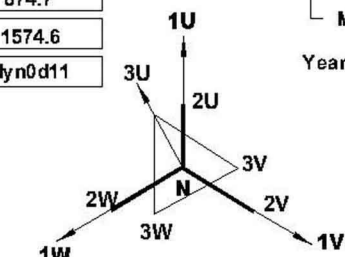
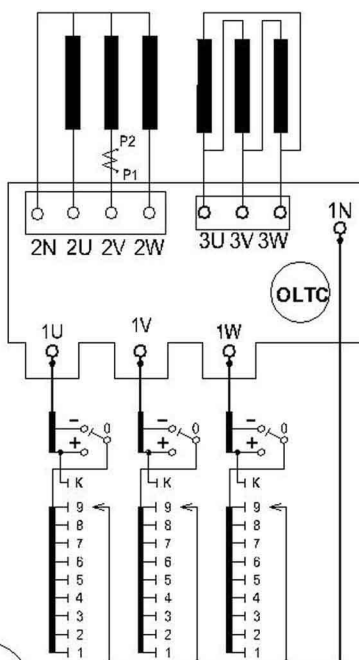


Pressure Relief Device
Brand : Qualitrol
Country : USA



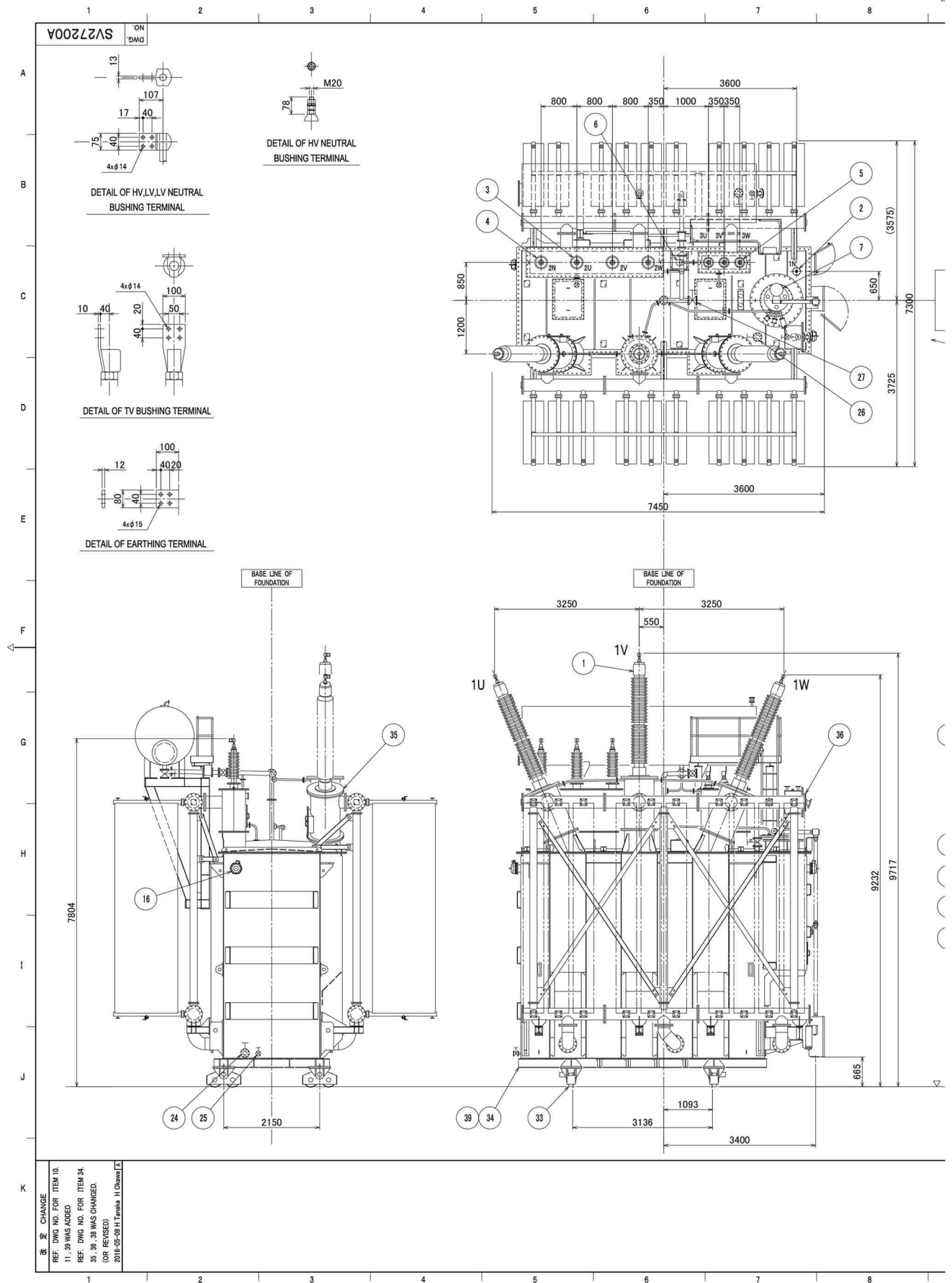
ASIA GENERAL TRANSFORMER CO.LTD, YANGON,MYANMAR
OIL IMMERSED ON-LOAD TAP CHANGING TRANSFORMER

Rated Power	HV&MV LV	MVA	100	INSULATION LEVEL	HV HVN MV MVN LV	kV	LI 950 ,AC 395
Phase		3					AC 38
Frequency	Hz	50					LI 325,AC 140
Type of Cooling		ONAN					AC 140
Temp Class		A					LI 75,AC 28
Temp. Rise (Oil / Wdg)	°C	60 / 65		Total Oil Quantity		kg	60200
Conform to		IEC 60076		Oil Quantity in OLTC			222
Rated Voltage	HV MV LV	kV	230 66 11	Core & Winding Weight			81500
Rated Line Current	HV MV LV	A	251 874.7 1574.6	Total Weight (with Oil)			203500
Vector Group		YNyn0d11		Transportation Weight (with Oil)			166000
				Transportation Weight (without Oil)			115000
				Impedance	HV - MV HV - LV MV - LV	%	11.74 4.91 1.06
				Year of Manufacture			2017
				Serial No.			122016010



HV			CONNECTION		CT	WTI 2V Phase
VOLTAGE V	CURRENT A	POSITION	TAP SELECTOR	CHANGE-OVER SELECTOR		
260360	221.8	1	1	+	Burden (VA)	40
256565	225.0	2	2		Ratio	875/2
252770	228.4	3	3		Class	5P10
248975	231.9	4	4			
245180	235.5	5	5			
241385	239.2	6	6			
237590	243.0	7	7			
233795	246.9	8	8			
230000	251.0	9a	9	-		
		9b	K			
		9c	1			
226205	255.2	10	2			
222410	259.6	11	3			
218615	264.1	12	4			
214820	268.8	13	5			
211025	273.6	14	6			
207230	278.6	15	7			
203435	283.8	16	8			
199640	289.2	17	9			

Power Transformers





ASIA GENERAL HOLDING

SALES AND HEAD OFFICE

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09 790551896, 09 790551897

Fax : 01 2304274

Email : sales.ageh@ageholding.com

FACTORY AGT (Transformers)

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Corner of Yangon-Pathein Road and Tontay,
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Hlaing Tharyar Township, Yangon,
11401, Myanmar

Tel: 09-73020453, 0973020452,
09-456437337

Fax: 01-685981

E-mail: commercial.ageh@ageholding.com

FACTORY AGE (Switchgear and Panels)

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E-mail: commercial.ageh@ageholding.com