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Harmonic Assessment for Cement Kiln



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Power Quality Analysis Section PEA Area 1 (North) Chiangmai

MODERN QUALITY CARE SERVICE TEAM





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- General Information and Customer Process
- Customer Concern
- Harmonic Assessment Report
- Conclusion



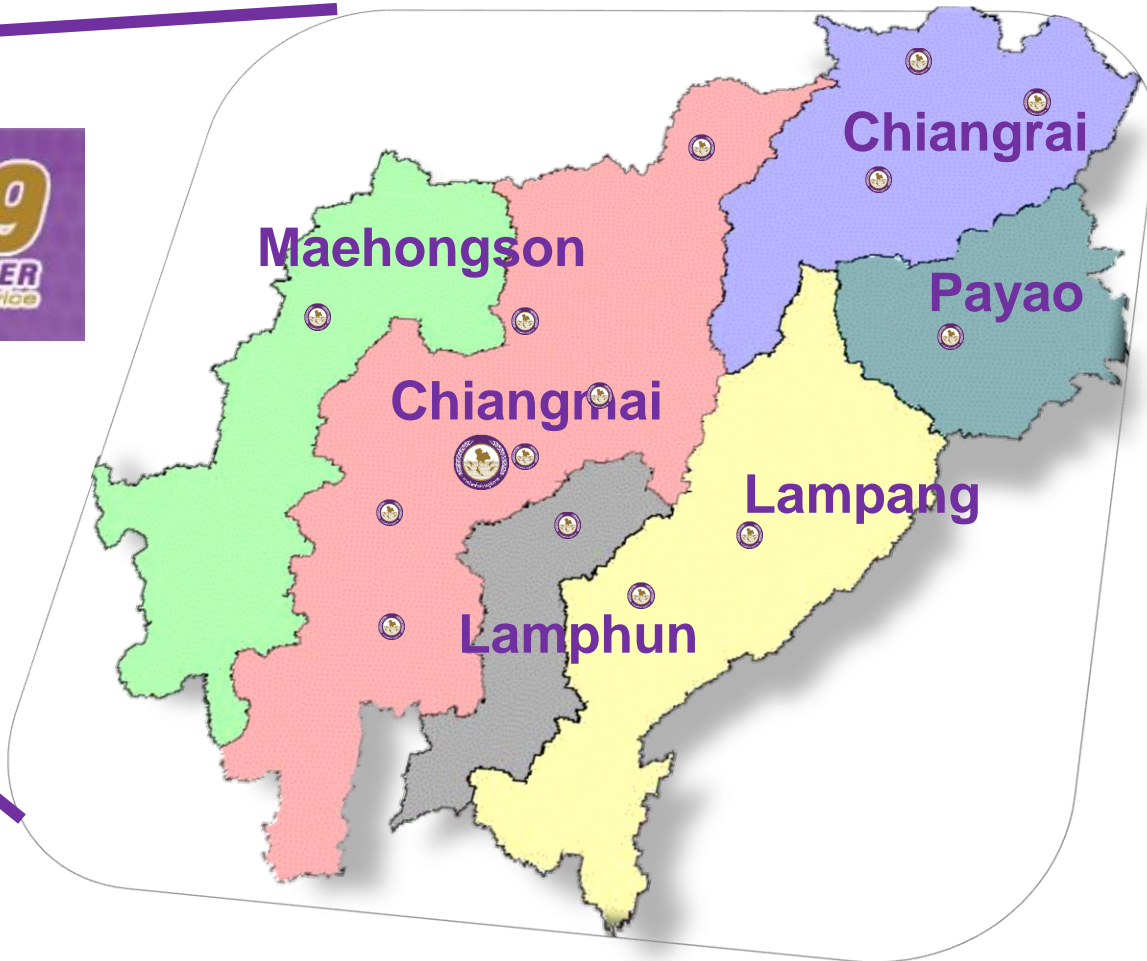


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PEA North (Area1) Chiangmai



1129
PEA CALL CENTER
Smart Service





High Value 115 kV Transmission Line Customer

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Cement Company

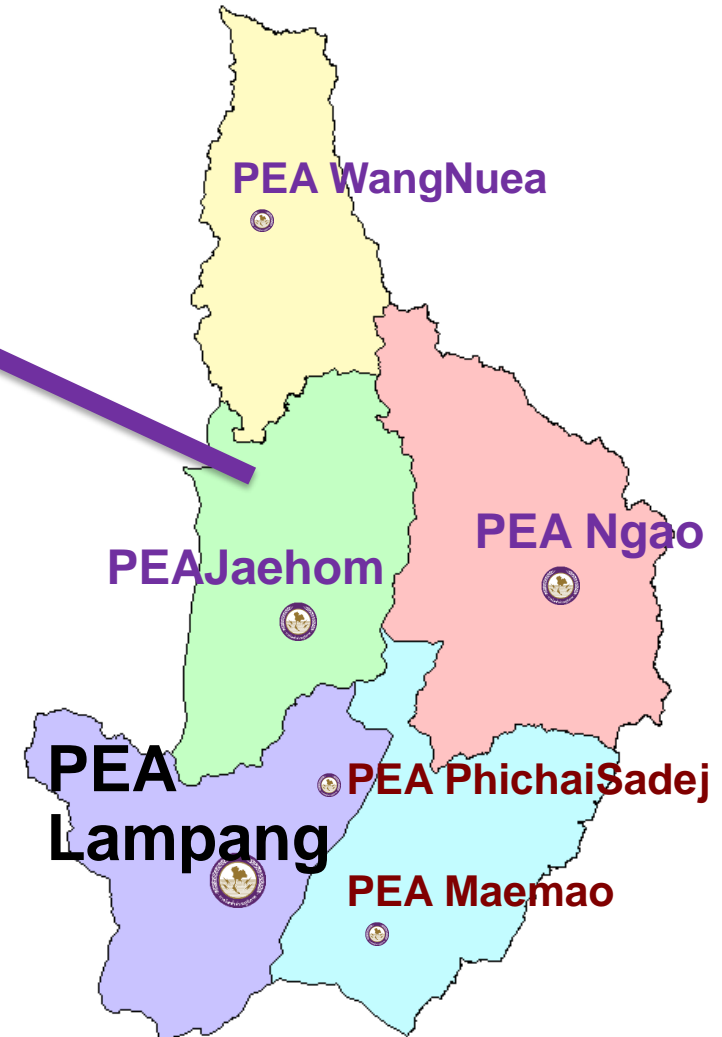
Address: 279 Moo 5 ,Jaehom District, Lampang

Capacity: 63,000 KVA

kW Peak: 39,920 kW

kWH/ month: 15 million kWh

TOU Rate via 115kV AMR





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Switching Diagram 2016 for 115 kV PEA Transmission Line to Cement Company

ระยะทาง 50 กม.
จาก ลำปาง 2

PEA (Jaehom)
115 / 22 kV
1 x 25 MVA



Cement Substation
115 / 6.6 kV
2 x 31.5 MVA



CS Circuit Switcher



PEA 115 kV
Transmission Line

EGAT
(Lampang2)



30 km. from
Lampang2



ระยะทาง 5 กม.
จาก ลำปาง 2

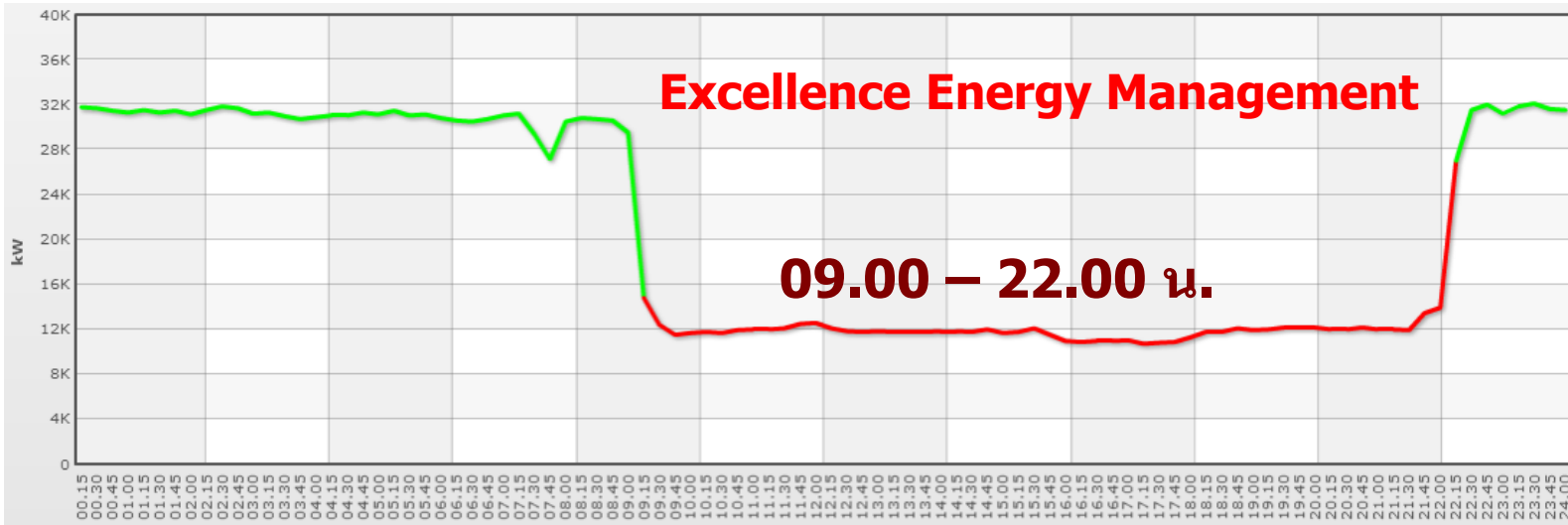
PEA (Lampang3)
115 / 22 kV
1 x 25 MVA



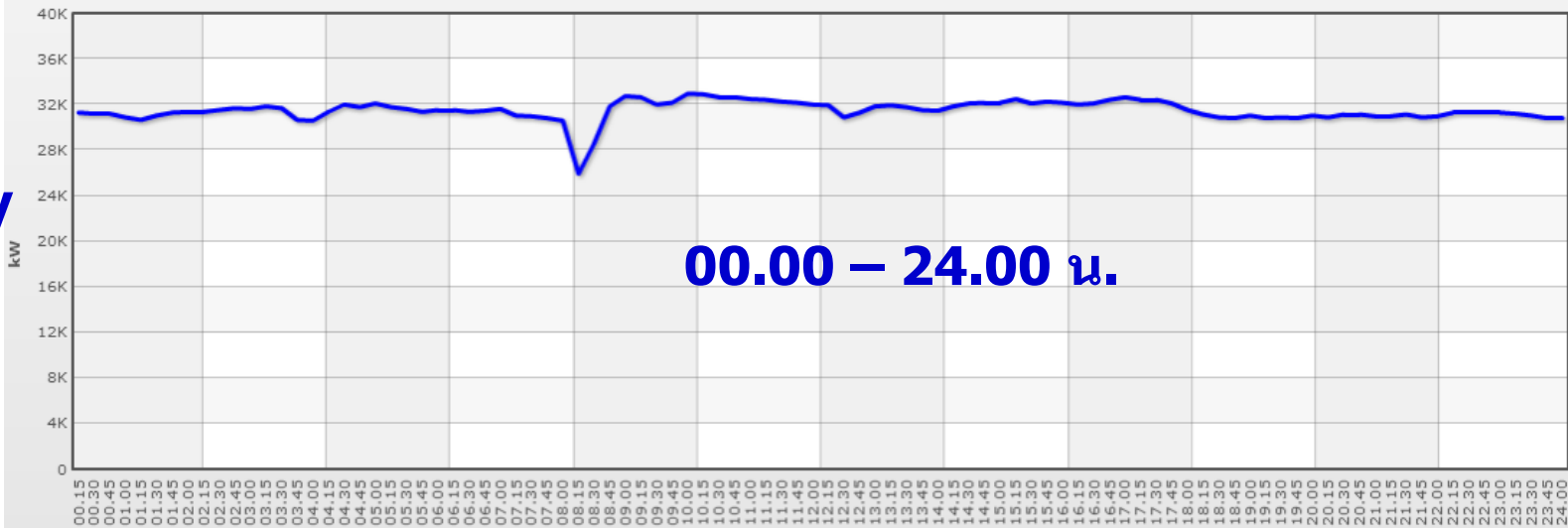
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Cement Company Load Profile

**Monday
-
Friday**



**Saturday
-
Sunday**

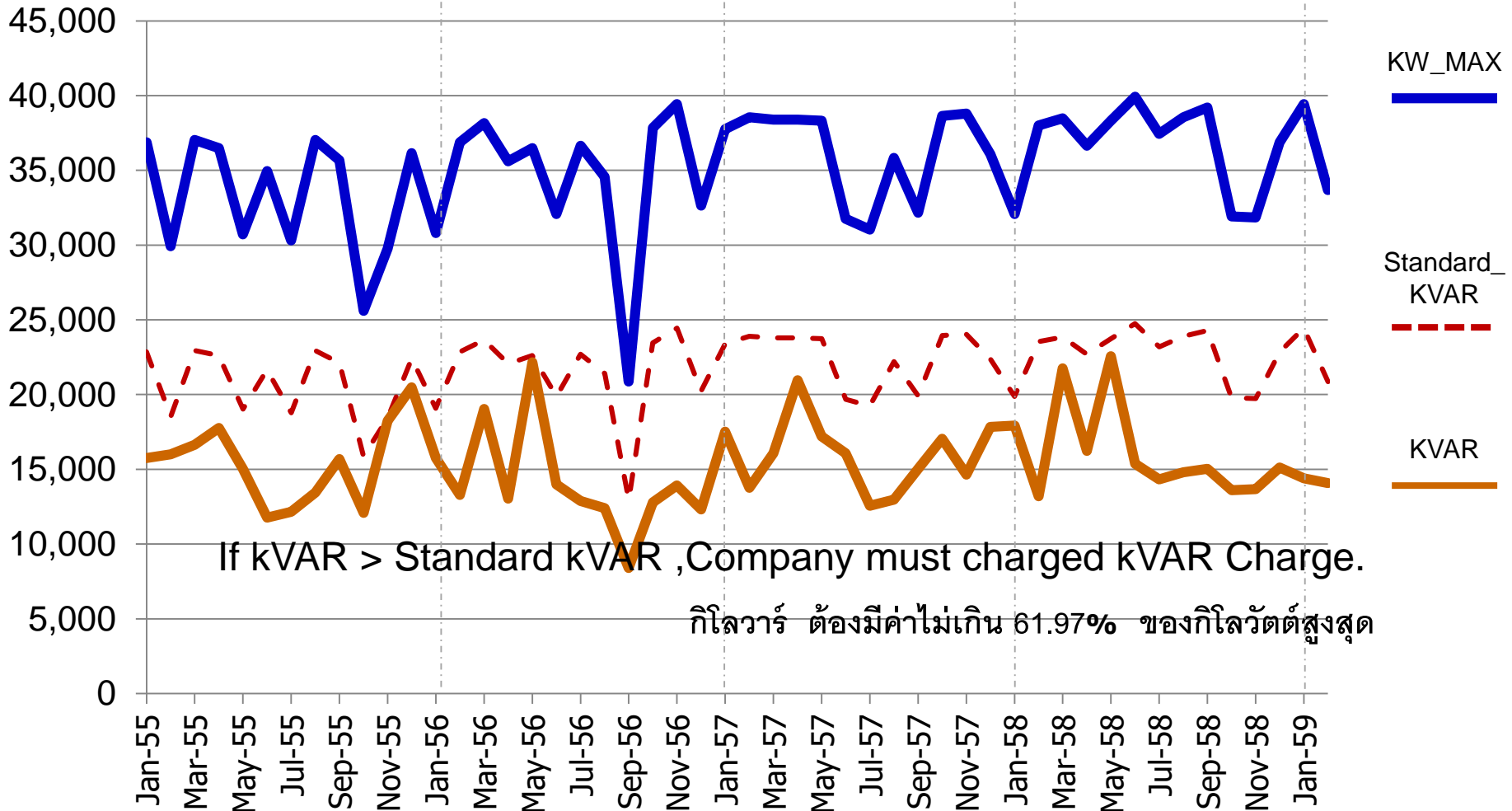




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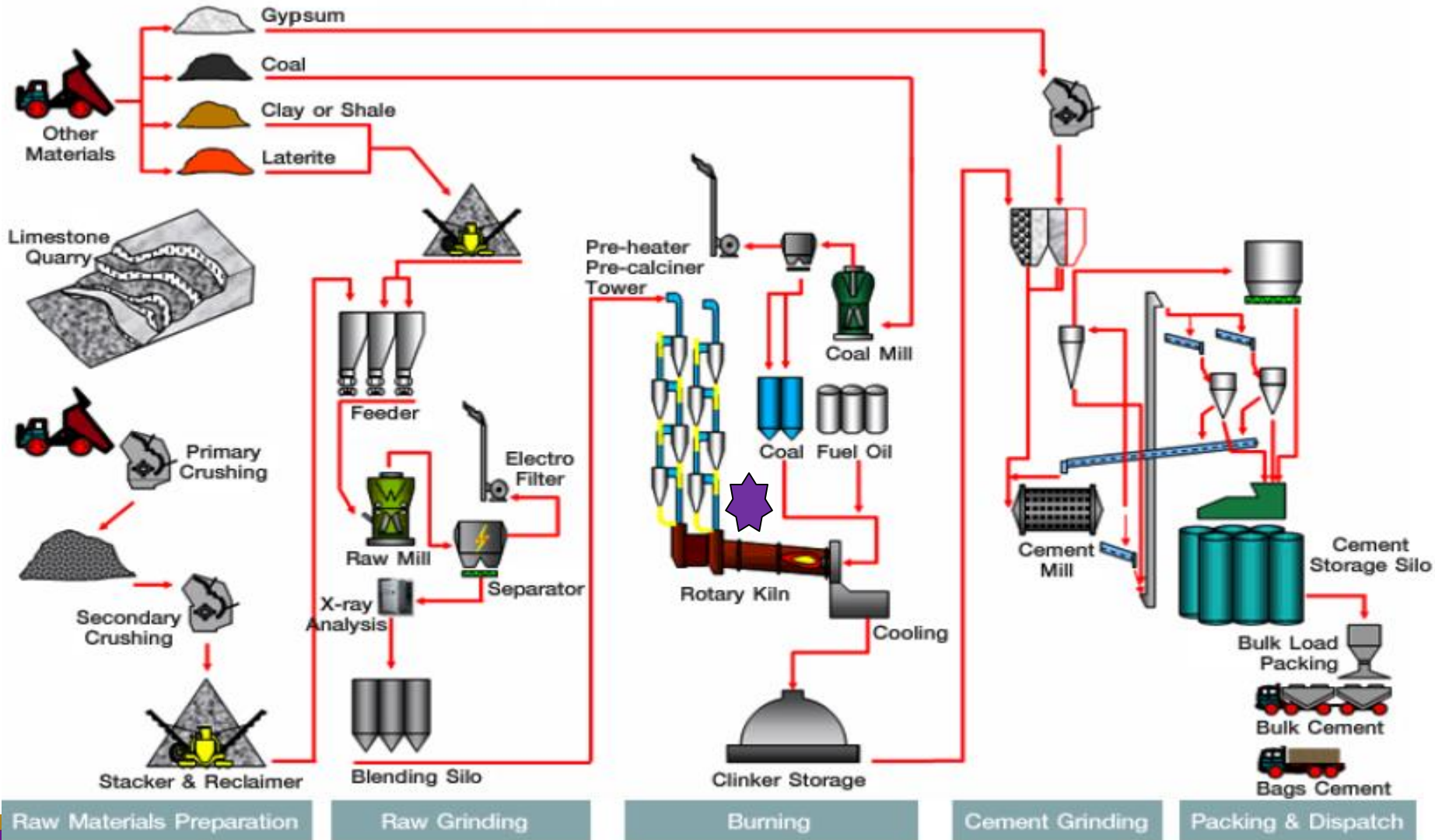
kW Max and kVAR

2012 2013 2014 2015





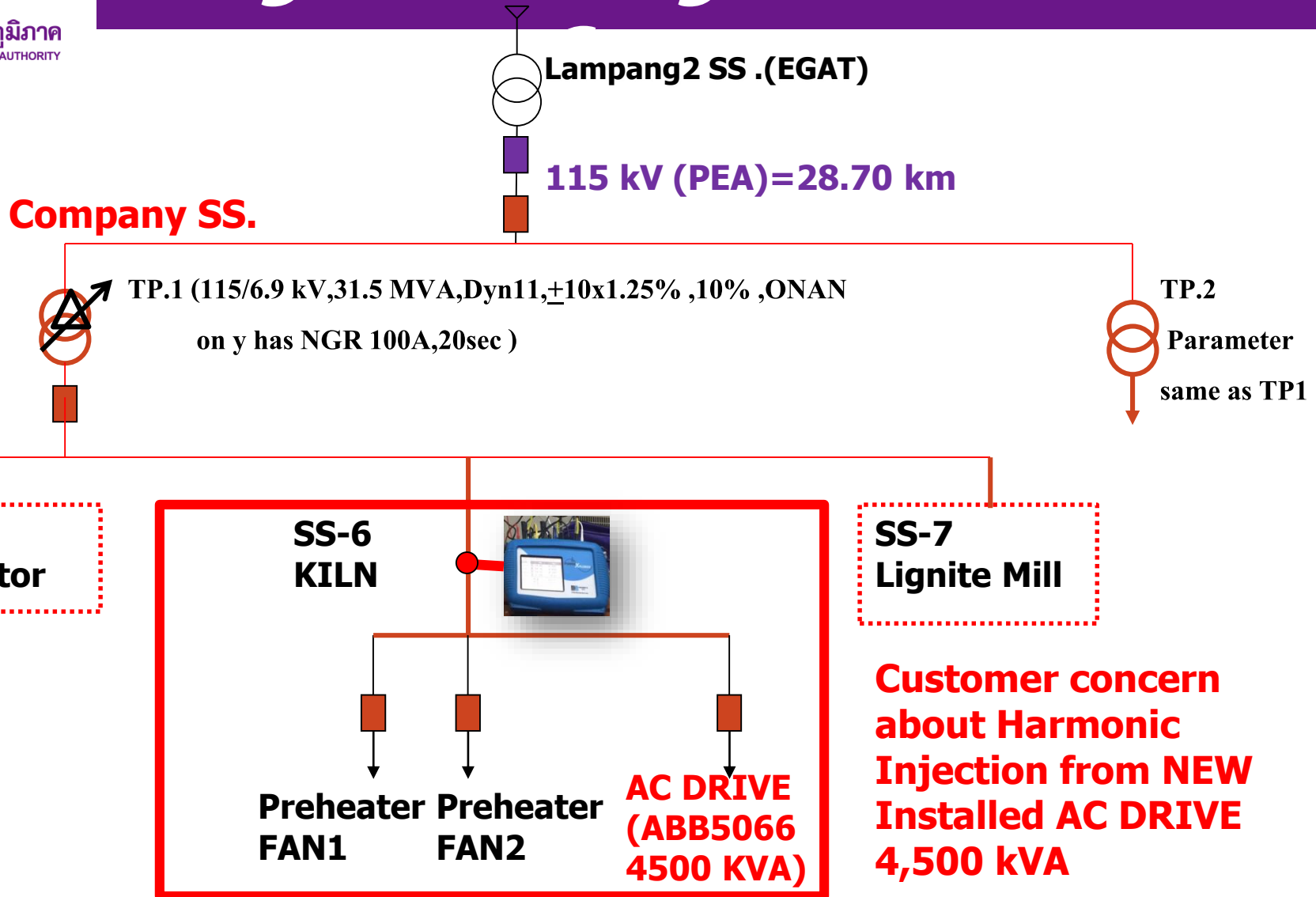
The Cement Manufacturing



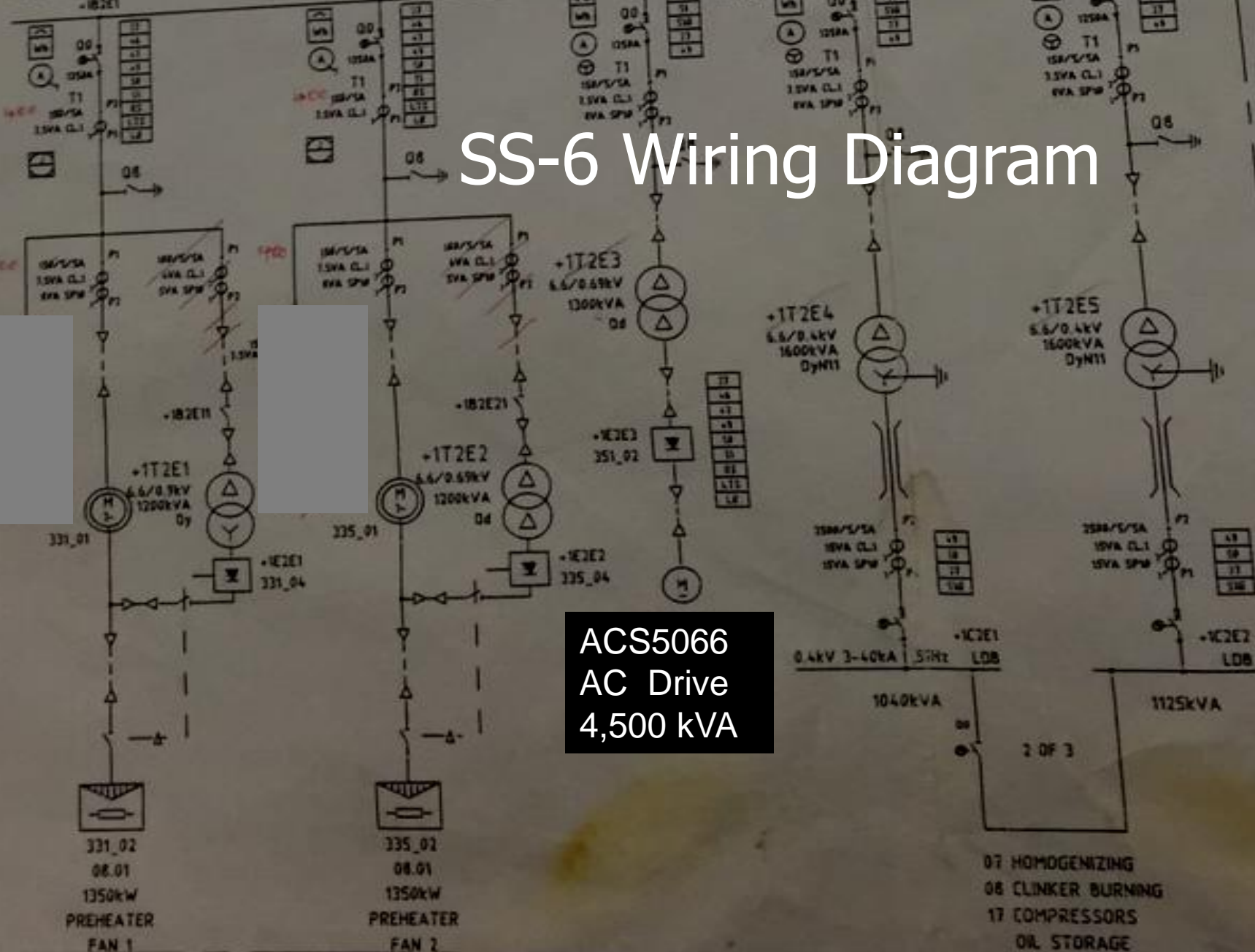


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Single Line Diagram of Cement



6.6kV 3-50Hz 40kA 1250A



SS-6 Wiring Diagram

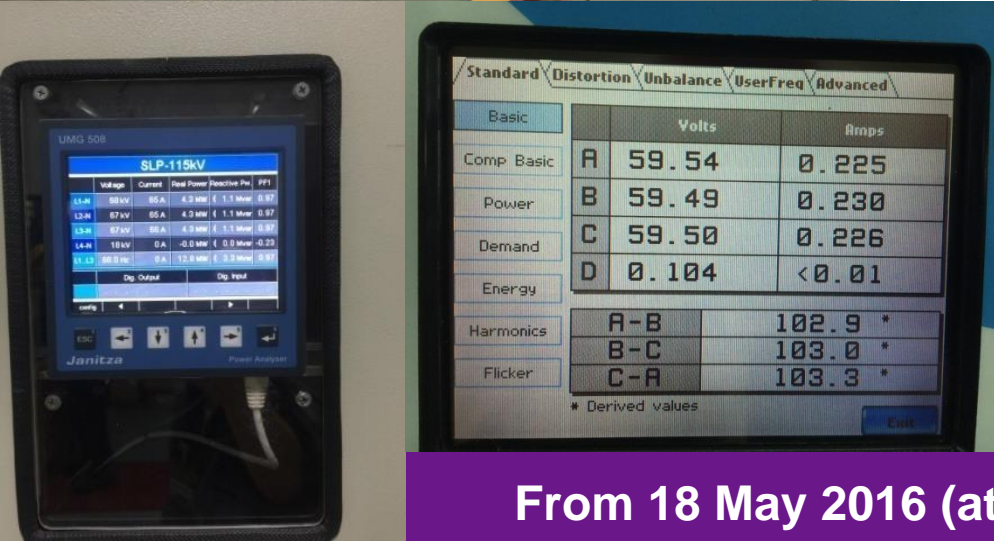
ACS5066
AC Drive
4,500 kVA

- 07 HOMOGENIZING
- 08 CLINKER BURNING
- 17 COMPRESSORS OIL STORAGE



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Monitoring Harmonic Assessment at SS-6 Bus(6.6 kV)

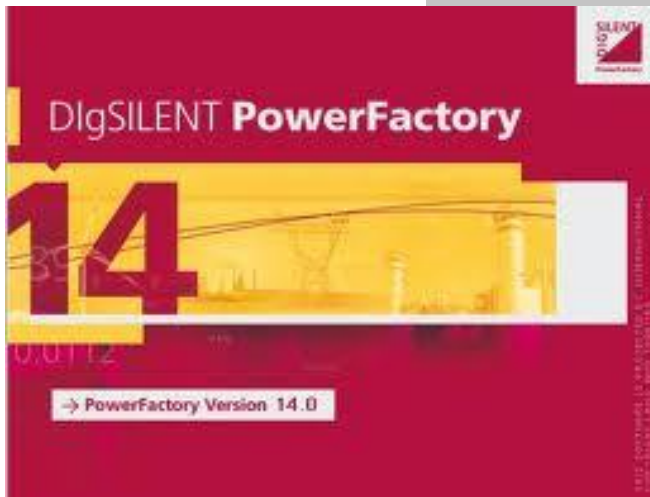
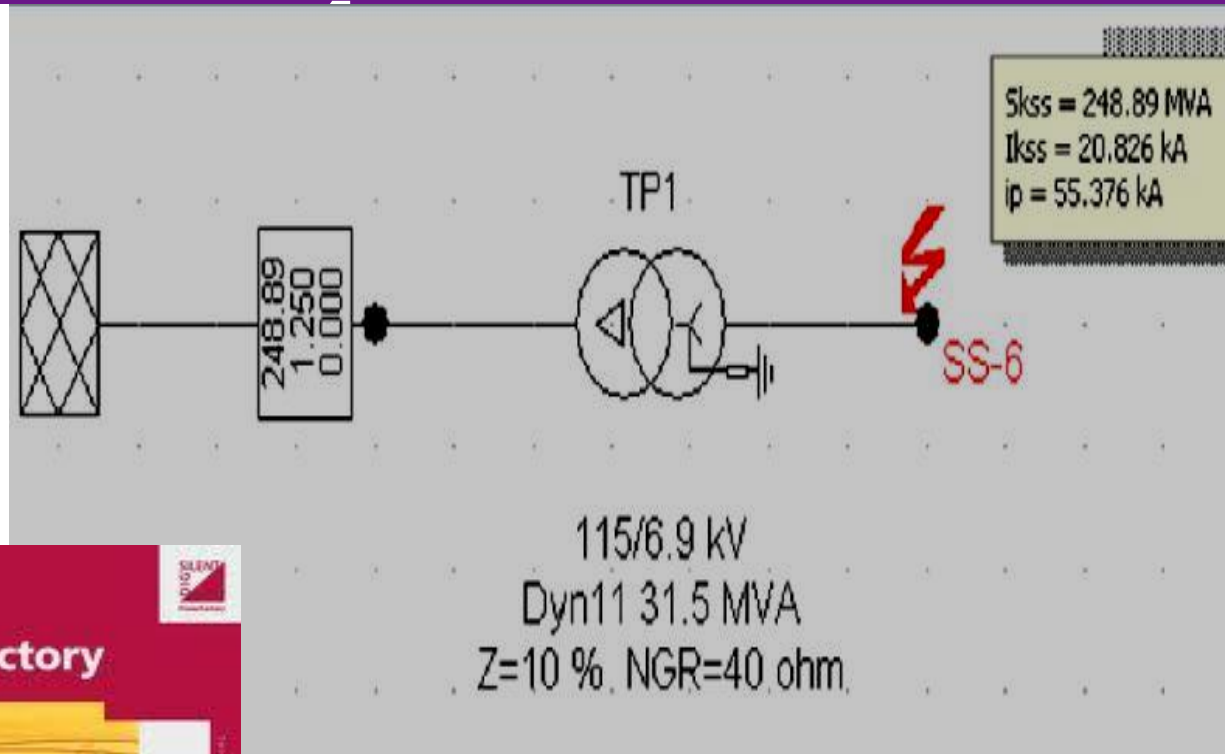


From 18 May 2016 (at noon) – 24 May 2016 11am.



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SS-6 Simulator for Harmonic





The harmonic assessment according to regulation for the commercial and industrial

(PRC-PQG-02/1998)

Voltage at PCC. (kV)	Total harmonic distortion (%)	Total harmonic distortion in each order.(THD _v %)	
		% Odd	% Even
11,12,22 and 24	4	3	1.75
Assessment	0.79%	0.72%	0.12096%
Results	PASS	PASS	PASS



The harmonic regulation for the commercial and industrial (PRC-PQG-02/1998)

Current distortion limits in each order (A_{rms})

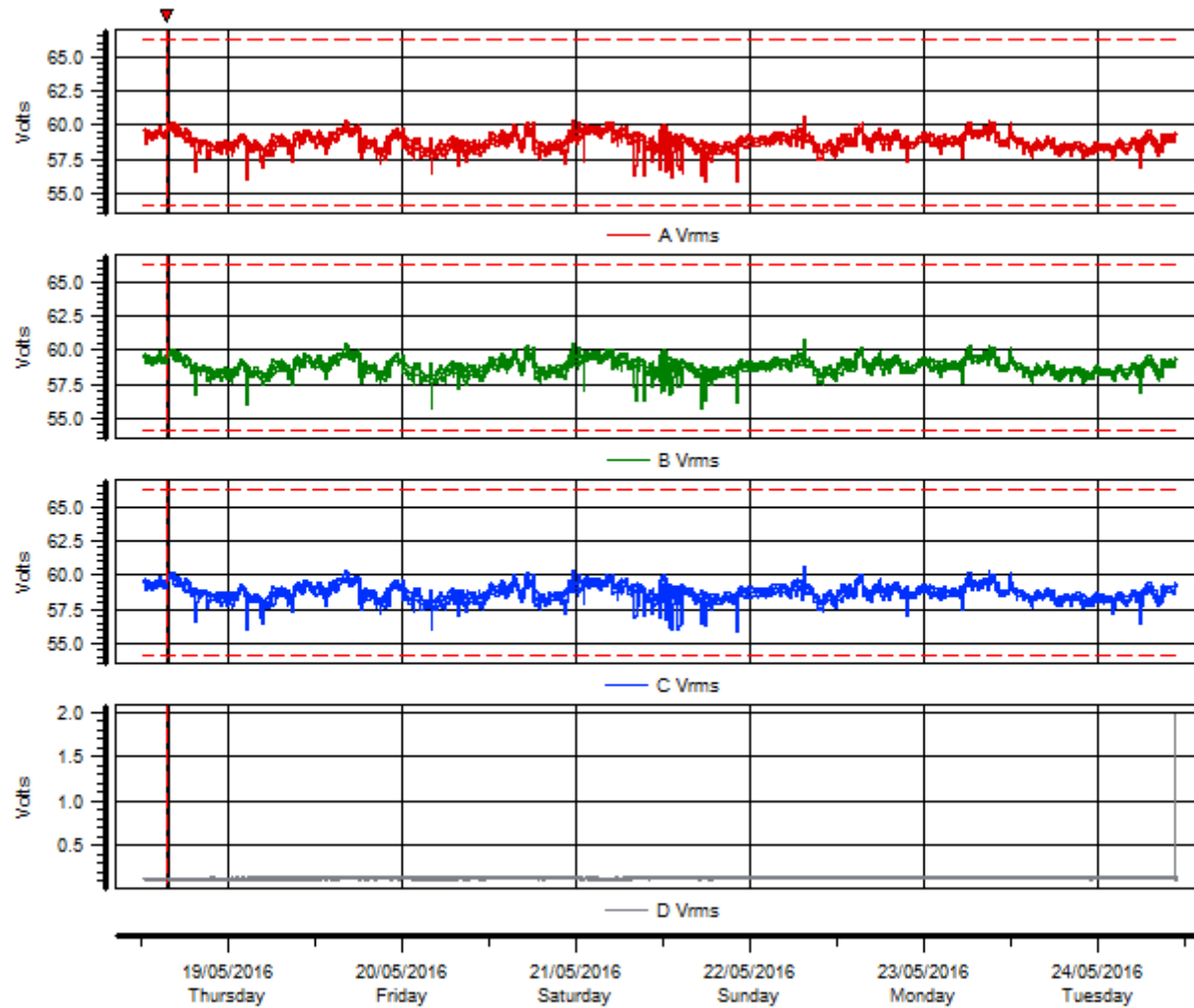
Voltage at PCC. (kV)/MVA SC	Current distortion limits in each order (A_{rms})											
	2	3	4	5	6	7	8	9	10	11	12	13
11,12,22 and 24 (100 MVA _{sc})	13	8	6	10	4	8	3	3	3	7	2	6
248.89 MVA	32.36	19.91	14.93	24.89	9.96	19.91	7.4 7	7.47	7.47	17.42	4.98	14.93
Assessment	2.109	4.123	0.656	23.4375	0.40	4.153	0.3 685	0.584	0.685	6.238	0.584	3.1775
Result	PASS	PASS	PASS	PASS	PA SS	PASS	PA SS	PASS	PASS	PASS	PASS	PASS



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SS-6 Voltage Waveform

Timeplot

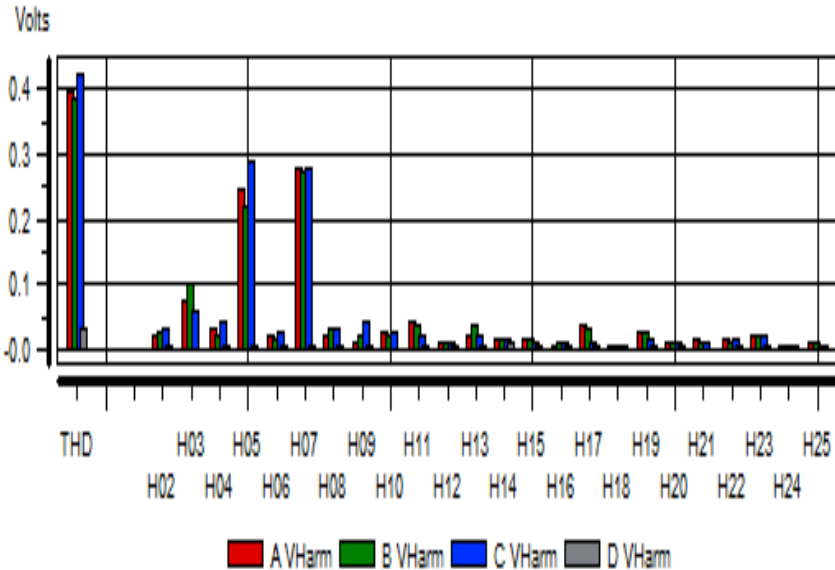


Event #237 at 18/05/2016 15:29:59.799
Timed



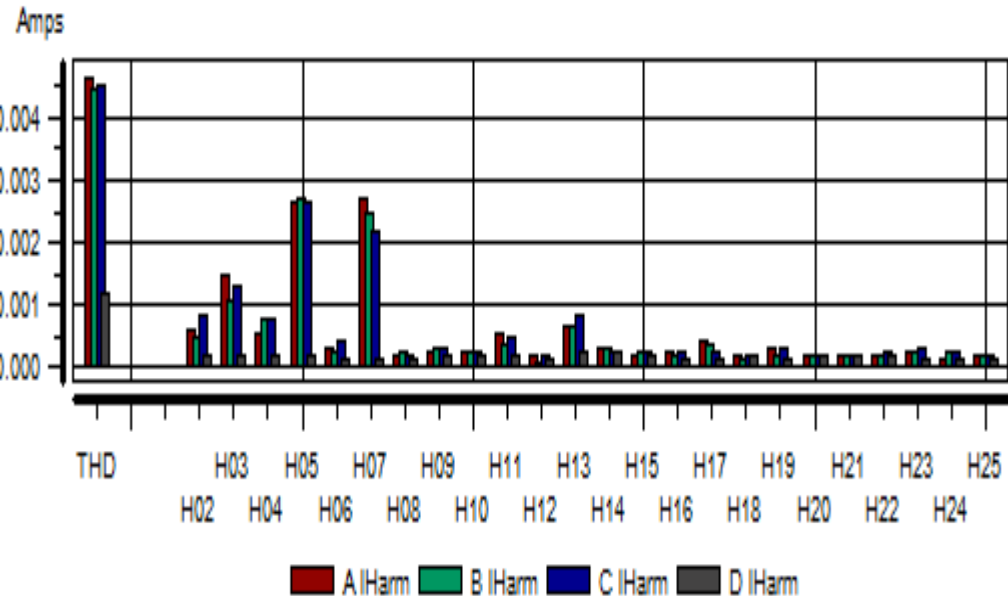
Harmonic Waveform for the first AC Drive Injection

Waveform harmonics



	AV	BV	CV	DV	A-BV	B-CV	C-AV	AI	BI	CI	DI
RMS	59.65	59.59	59.66	0.12	103.07	103.24	103.57	0.25	0.25	0.26	0.00
FND	59.65	59.59	59.66	0.06	103.06	103.23	103.57	0.25	0.25	0.26	0.00
DC	0.02	-0.02	-0.01	0.02	0.04	-0.01	-0.03	0.00	0.00	0.00	-0.00
THD	0.40	0.39	0.42	0.03	0.67	0.69	0.72	0.00	0.00	0.00	0.00

Waveform harmonics



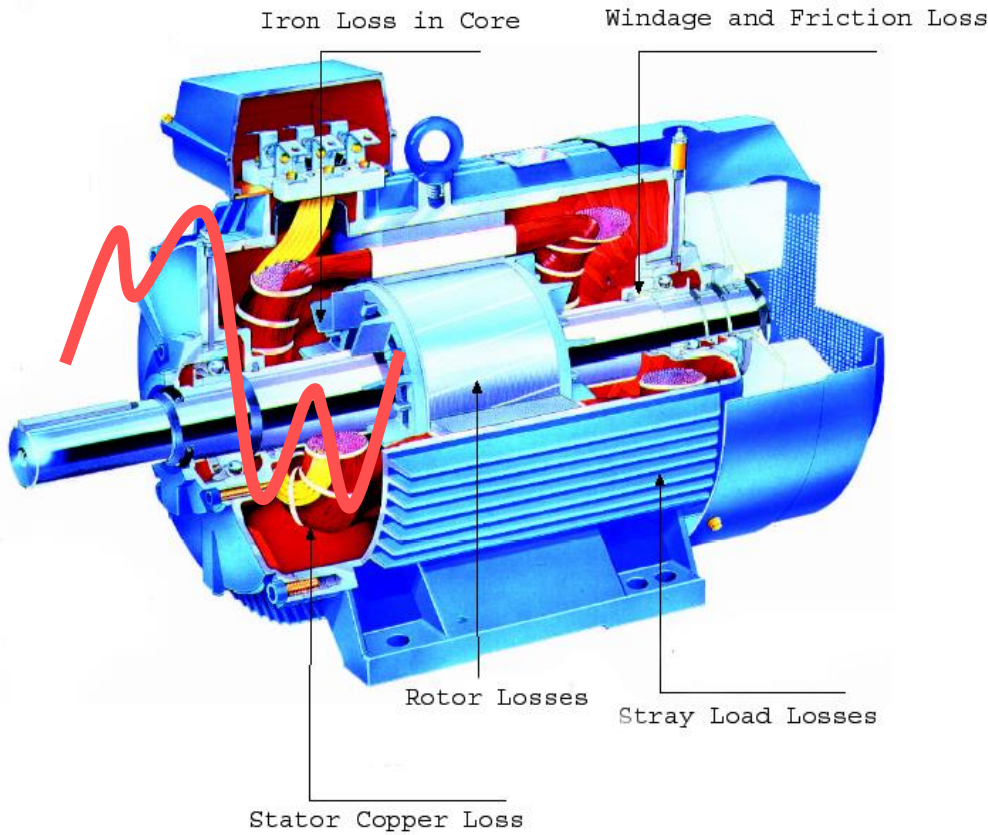
	AV	BV	CV	DV	A-BV	B-CV	C-AV	AI	BI	CI	DI
RMS	59.65	59.59	59.66	0.12	103.07	103.24	103.57	0.25	0.25	0.26	0.00
FND	59.65	59.59	59.66	0.06	103.06	103.23	103.57	0.25	0.25	0.26	0.00
DC	0.02	-0.02	-0.01	0.02	0.04	-0.01	-0.03	0.00	0.00	0.00	-0.00
THD	0.40	0.39	0.42	0.03	0.67	0.69	0.72	0.00	0.00	0.00	0.00

First AC Drive Injection On 18 May 2016 , 3.30 pm.

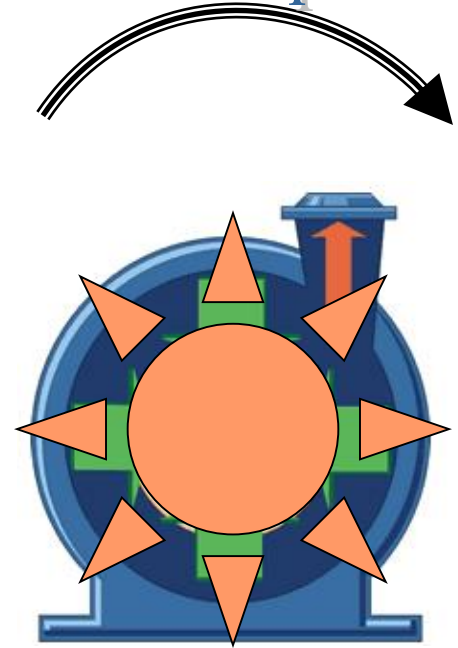


Effect of 5 th Harmonic

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Positive Sequence



Negative Sequence

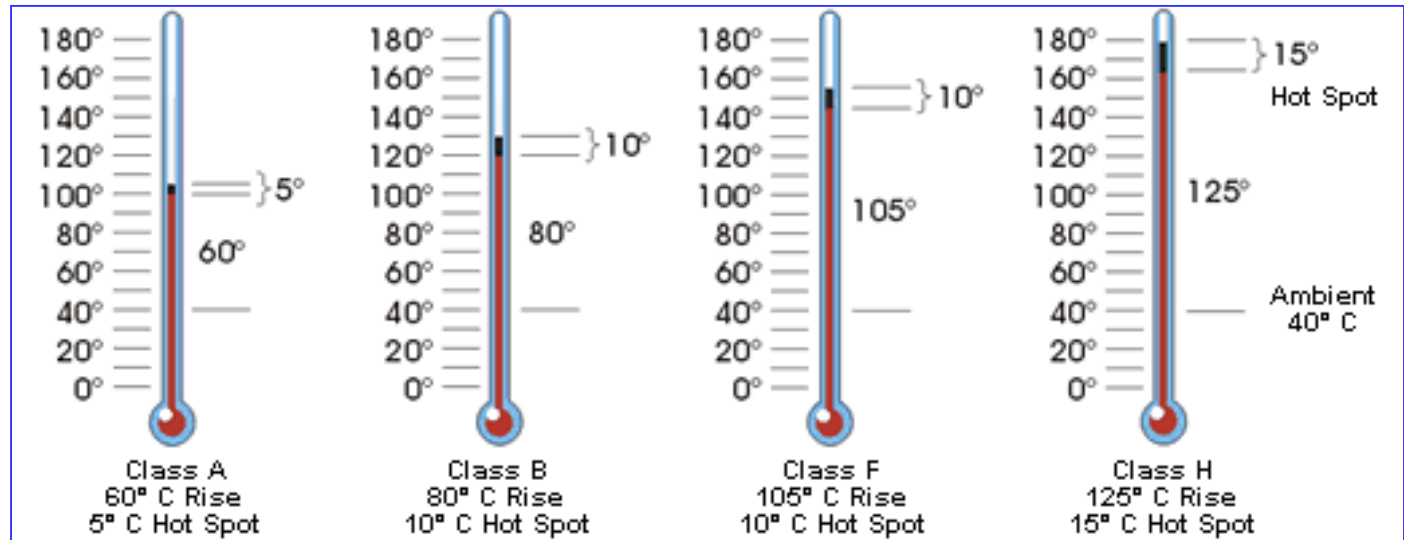




Effect of Harmonic on Motor

Ambient Temperature 40 °C

Insulation Class



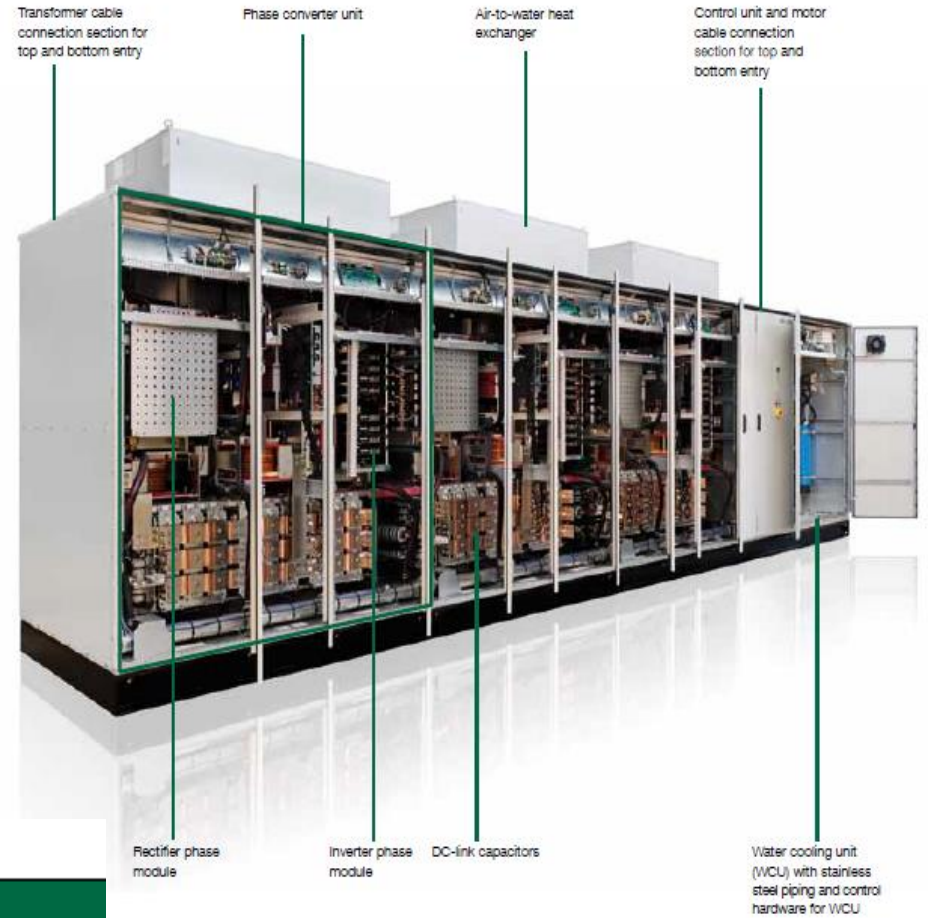
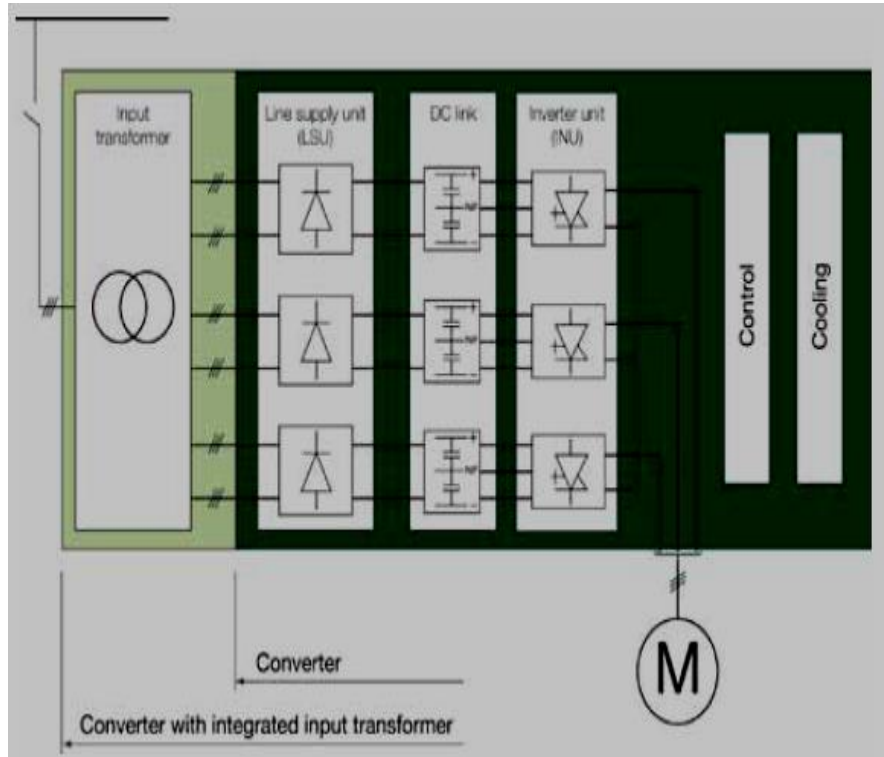
Life Time of Motor decrease more than 50% when Operating Temperature increase 10c for each class



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ACS 5066 AC DRIVE for Motor

4500 KVA, 6.6 kV



Fields of application

Industries	Applications
Cement, mining and minerals	Grinding mills, conveyors, fans and pumps

ACS 5000 Voltage Source Inverter Multilevel-Fuseless (VSI-MF) topology



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Inverter type

Voltage Source Inverter Multilevel-Fuseless (VSI-MF),
9 levels line-to-line, with fast-switching power semiconductors
– Integrated Gate Commutated Thyristors (IGCTs), without
parallel or series connected devices

Nameplate of AC Drive

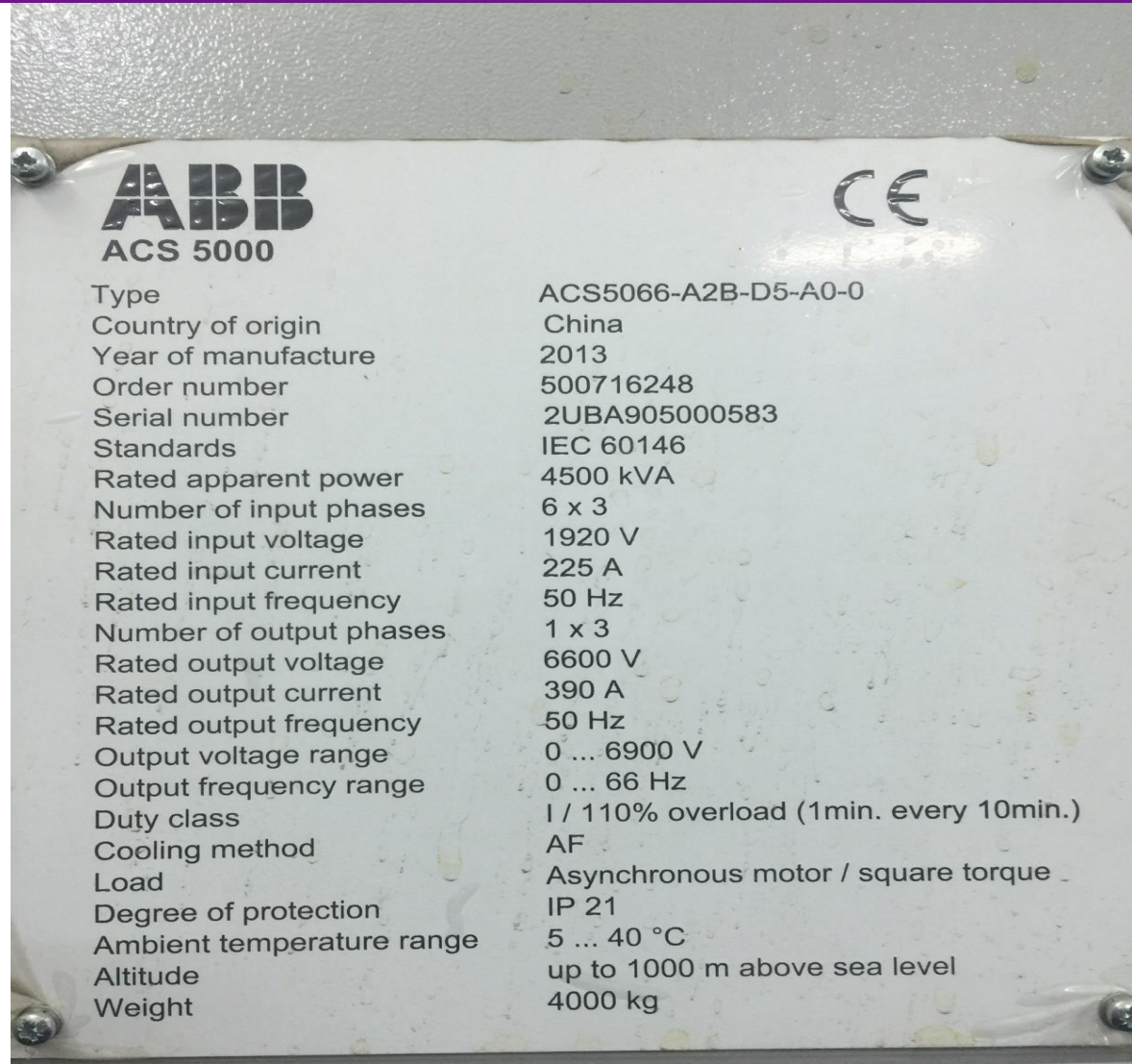


ABB
ACS 5000



Type	ACS5066-A2B-D5-A0-0
Country of origin	China
Year of manufacture	2013
Order number	500716248
Serial number	2UBA905000583
Standards	IEC 60146
Rated apparent power	4500 kVA
Number of input phases	6 x 3
Rated input voltage	1920 V
Rated input current	225 A
Rated input frequency	50 Hz
Number of output phases	1 x 3
Rated output voltage	6600 V
Rated output current	390 A
Rated output frequency	50 Hz
Output voltage range	0 ... 6900 V
Output frequency range	0 ... 66 Hz
Duty class	I / 110% overload (1min. every 10min.)
Cooling method	AF
Load	Asynchronous motor / square torque
Degree of protection	IP 21
Ambient temperature range	5 ... 40 °C
Altitude	up to 1000 m above sea level
Weight	4000 kg

ACS 5000



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CONCLUSION

- ❑ Harmonic Assessments for Cement Kiln are following PEA Standard but the 5th Harmonic must highly Consideration for the next step.
- ❑ The 5th Harmonic will act against the direction of rotation resulting in torque pulsations as High Heat for Motor.



THANK YOU

www.PEA.co.th