LAMPIRAN

Lampiran 1 Desain manual

DESAIN MANUAL

PT PERUSAHAAN LISTRIK NEGARA (PERSERO)

GRATI COMBINED CYCLE POWER PLANT
1 X 500MW + 3 X 100MW

DESIGN MANUAL

CONTRACTOR : MITSUBISHI CORPORATION

MITSUBISHI HEAVY INDUSTRIES, LTD.
SIEMENS AKTIENGESELLSCHAFT.
COCKERILL MECHANICAL INDUSTRIES.

Conductor diameter — d = 0.018m

Construction of the grounding system — Mesh system

Depth of buried conductor — h=1.0 m

Average soil resistivity — ρ = 7.6 ohm-m

According to the graphic analysis (ρ − a curve) of the result of soil resistivity investigation report, which is to be submitted in separately, the summary table of those results of the averaged resistivity of the ground depth range of 1.0 meters are listed below TABLE-1.

—— TABLE-1 ——

Investigation Point No.	Location X	Location Y	Top level at measurement(m) (A)	Burried conductor level (m) (B)	Depth of conductor(m) (A)−(B)	Resistivity (ohm-m) N90° E
B−1	198.400	414.340	EL+11.26	EL+ 4.804	7.76	2.3
B−2	509.170	499.090	EL+ 7.50	*1EL− 2.196	11.00	7.6
B−3"	481.480	410.810	EL+ 9.28	EL+ 4.804	5.78	6.6
B−10'	549.610	199.830	EL+16.48	EL+15.304	2.48	5.9

(*1 : BELOW OF COOLING WATER PIPING)

Evaluating the above TABLE-1. the applied design value of soil resistivity is to be 7.6 (ohm-m) taking the maximum value from the area.

(9) Surface soil resistivity $\rho_s = 3.000 \text{ohm-m}$

Wet crushed rock and/or concrete foundation (ground surface) is considered. Normal trained operators and person's are used to walk on the paved road and gravel on crushed stone area. where operation access area is always designed and treated for the above.

(10) Grounding conductor length and area

Refer to FIG.-1 in this document.

		length of conductor	areas
Gnerator area	=	5.490 m	97.800 m²

These values are used for calculation

Extension area A (Substation)	=	980 m	15.450 m²
Extension area B (Tank Yard)	=	930 m	21.500 m²
Extension area C (Aux. is land & others)	=	2.420 m	18.050 m²

(11) Mesh conductor spacing $D = 40$ m

(12) Number of parallel conductor $n_A = 9$

$n_B = 11$

8. DETAIL OF CONDUCTOR SIZE

To maintain uniformity of earthing conductor size will be limited and standardized to the following :

Sheet 1

No.	APPLICATION	SIZE (mm^2) ($mm \times mm$)	CONNECTION POINT	REMARKS
1	Main embedded grounding conductor	240		
2	Exposed main earth cable in tray and trench	240		
3	Branch connection from the main to equipment	4 ~240		
4	AC system neutrals	95 ~240	neutral point	direct to the main in the concrete
5	Building structure	300		
6	Reinforcing bars	300	each layer	
7	Chimney foundation	300		
8	Jumper of flue duct for chimney	120 240		fiexible copper (if expansion joints)
9	Metal fence posts (substation) 〃 (property)	120 120	bottom of post 〃	20meter interval 30meter interval
10	Metal tanks (large capacity)	120	bottom of tank	20 points

Lampiran 2 Spesifikasi resistivitymeter

SPESIFIKASI RESISTIVITYMETER

SPESIFIKASI RESISTIVITYMETER

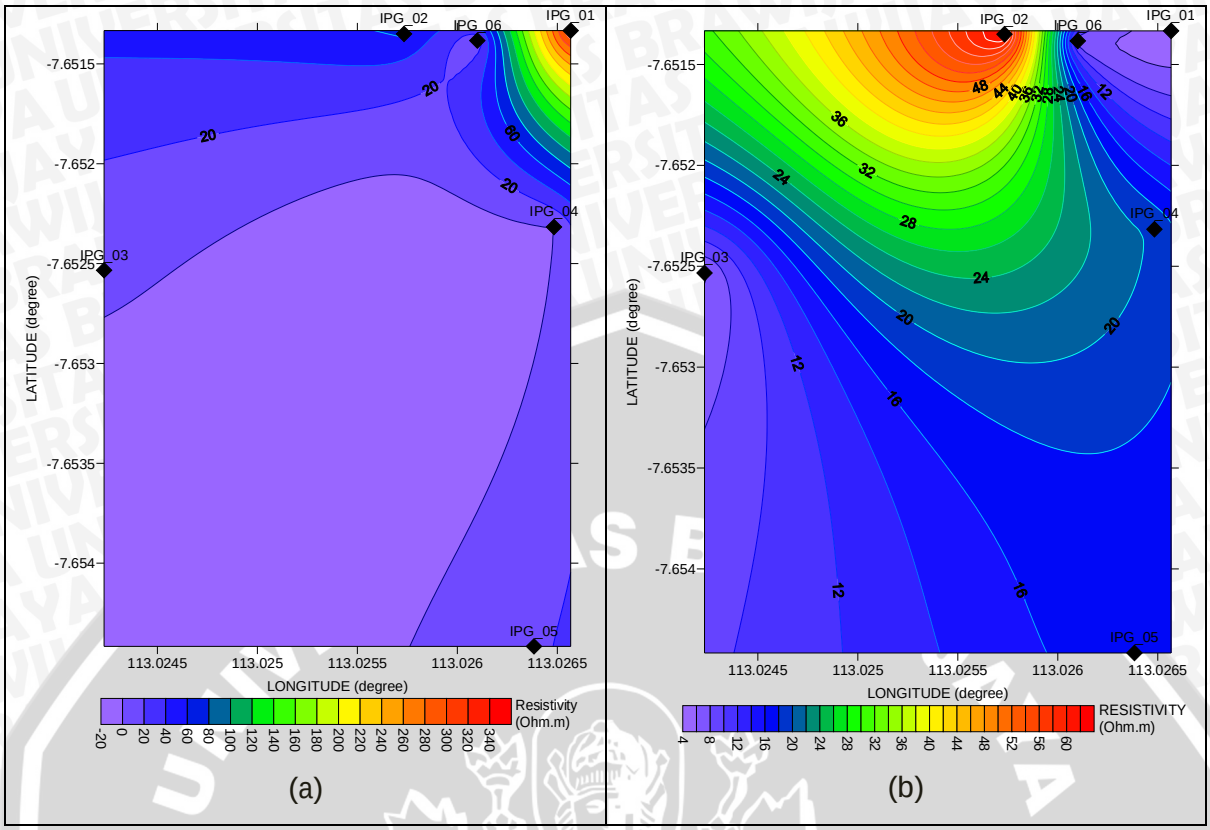
ABEM Terrameter SAS 300C

Transmitter:	Selectable currents: 0.2, 0.5, 1, 2, 5, 10, 20 mA Excitation voltage, max: 160V (320V p-p)

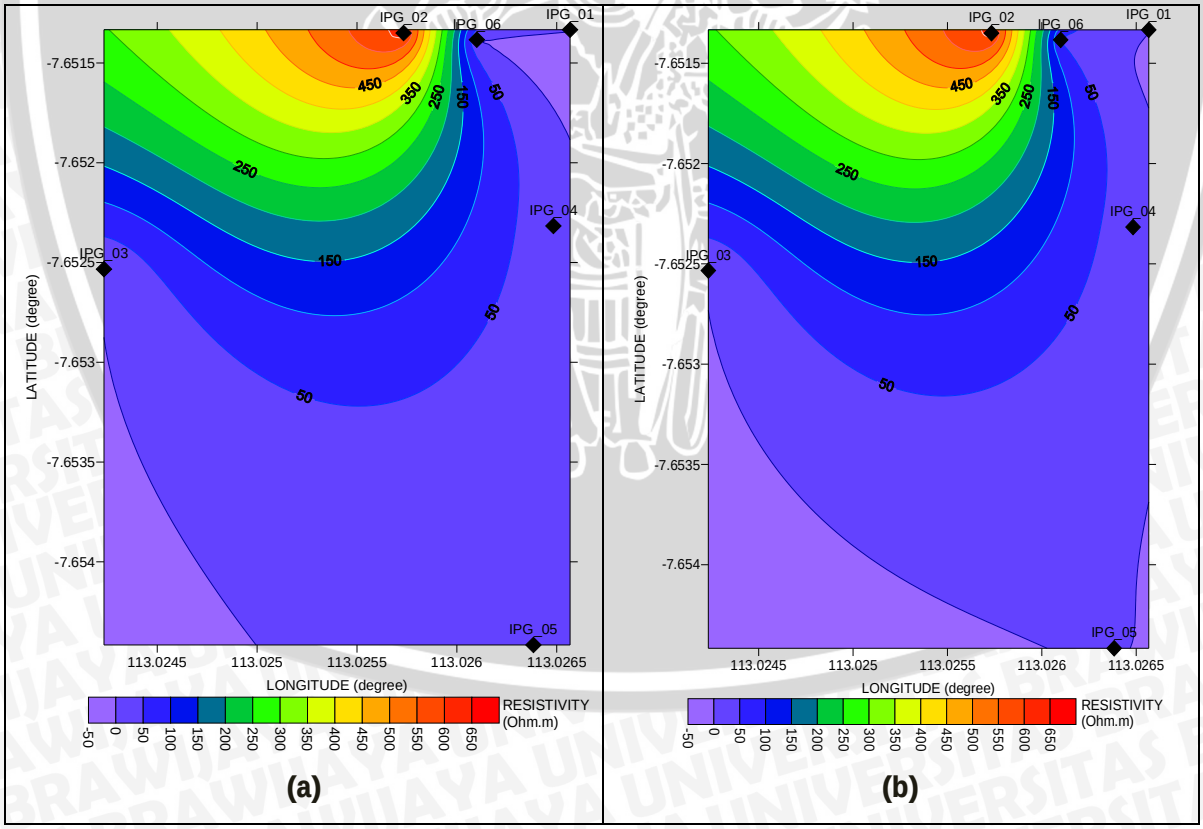
Receiver:	Input impedance: 10MΩ, min Input range: 0-500V Resolution (precision): ±1μV Accuracy: 1% ±50μV Noise rejection: 95dB at 50-60Hz 85dB at 16-20Hz
System data:	ΔV/I range: 0-1.9 MΩ ΔV/I precision: 0.05mΩ (at 20mA, one reading) ΔV/I accuracy: 2%±precision (at 1 MΩ) Selectable cycle times: 3.6, 7.2, 14.4 sec. Selectable total averaging period: 3.6-920sec (1-64 readings)
Temperatur Range:	Within specification: 0 deg...+60 deg. C Operating: -10 deg...+70 deg. C
Power Supply:	Rechargeble 12V NiCd battery, 4Ah.
Fuse:	10A Fast blow 5x2mm.
Battery capacity:	3500 - 5000 single cycle measurement per charge.
Weight:	5.6 kg include battery.
Dimensions:	WxLxH (105x325x300 mm)

Lampiran 3 Tahanan jenis tanah hasil pengukuran geolistrik

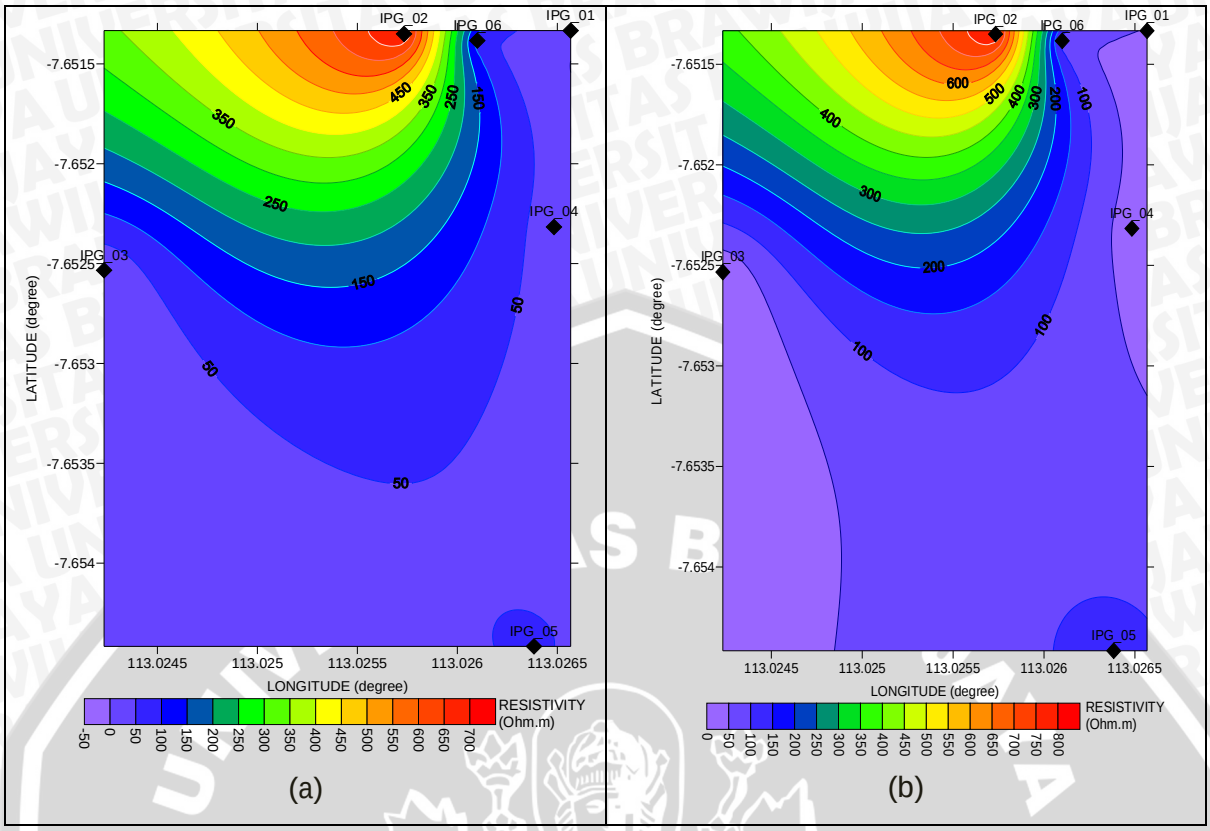
TAHANAN JENIS TANAH HASIL PENGUKURAN GEOLISTRIK



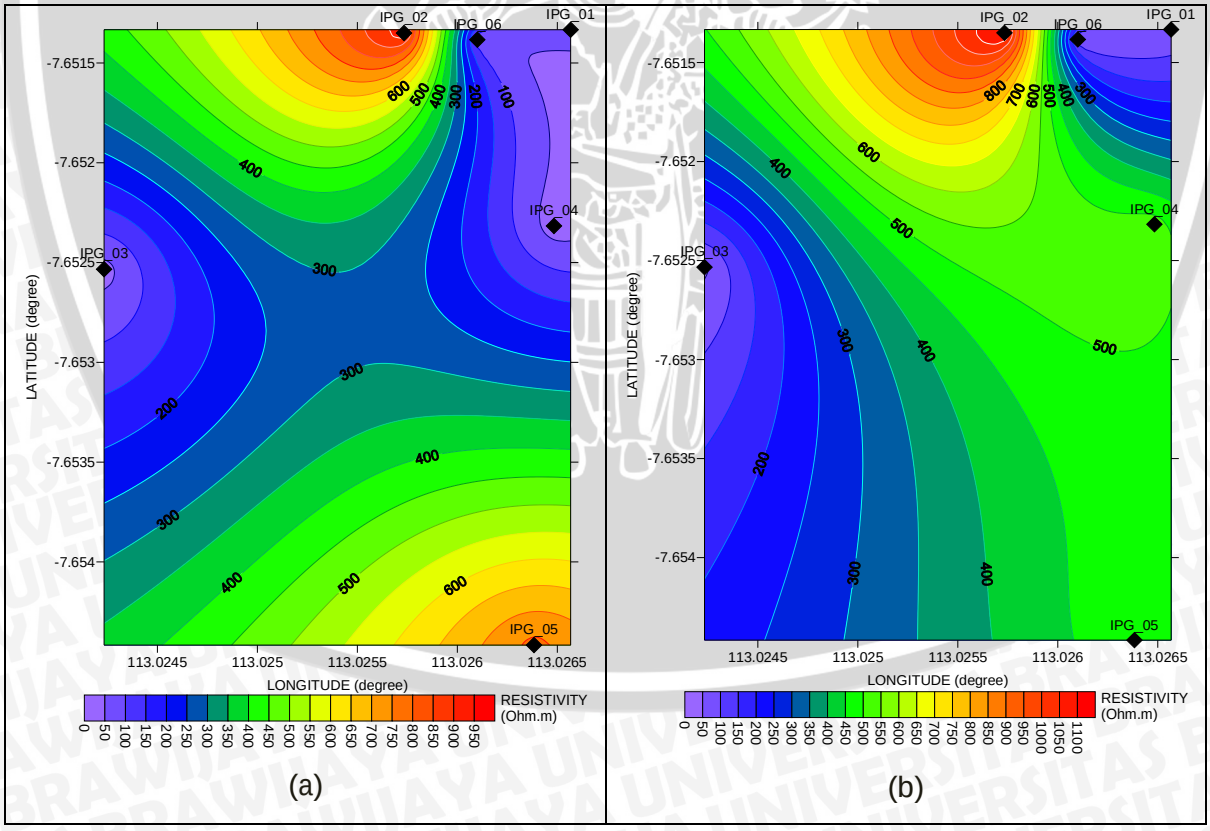
Gambar 1. Contour lamina pada kedalaman (a) 0 meter (b) 5 meter



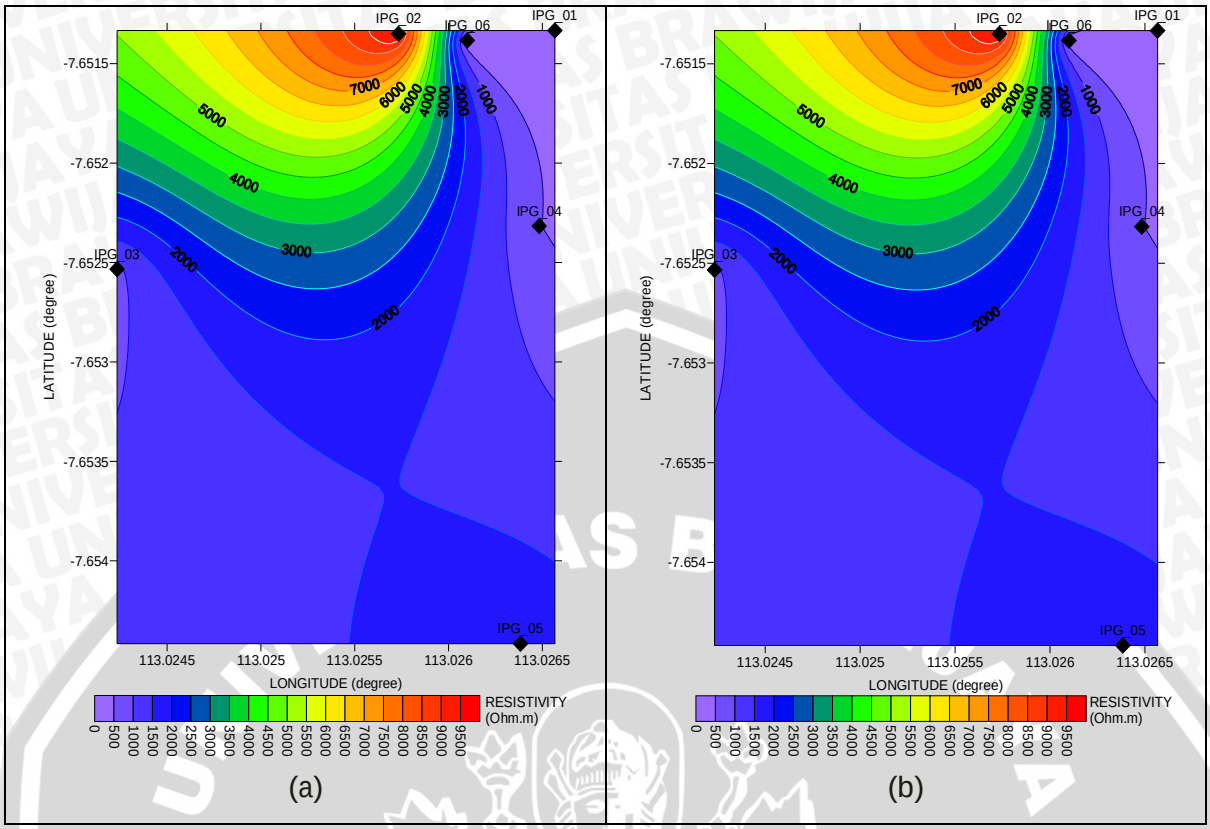
Gambar 2. Contour lamina pada kedalaman (a) 10 meter (b) 15 meter



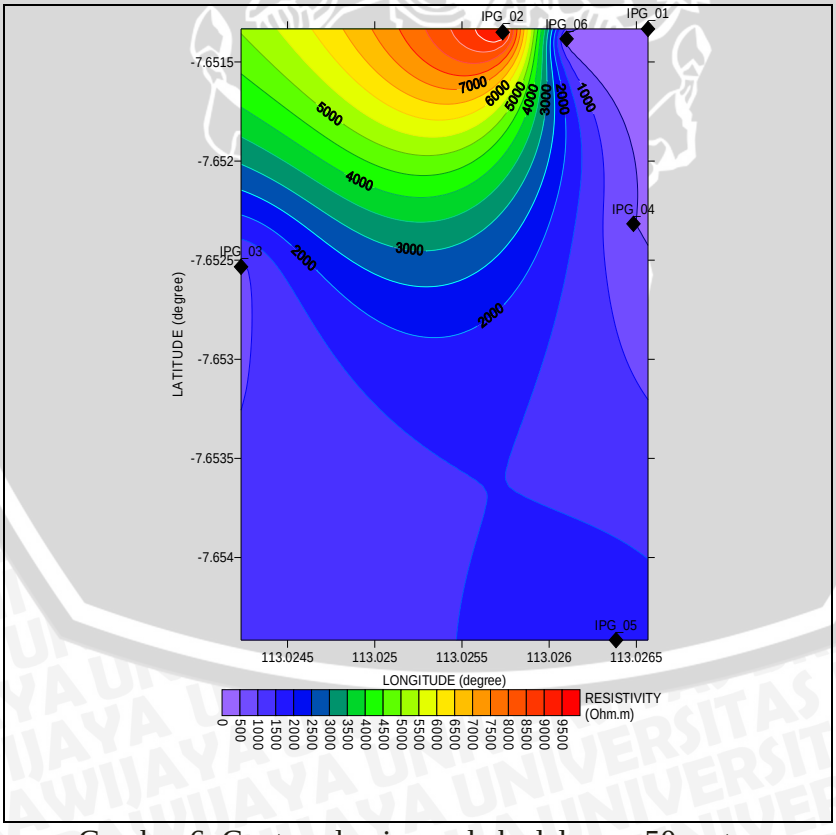
Gambar 3. Contour lamina pada kedalaman (a) 20 meter (b) 25 meter



Gambar 4. Contour lamina pada kedalaman (a) 30 meter (b) 35 meter



Gambar 5. Contour lamina pada kedalaman (a) 40 meter (b) 45 meter



Gambar 6. Contour lamina pada kedalaman 50 meter

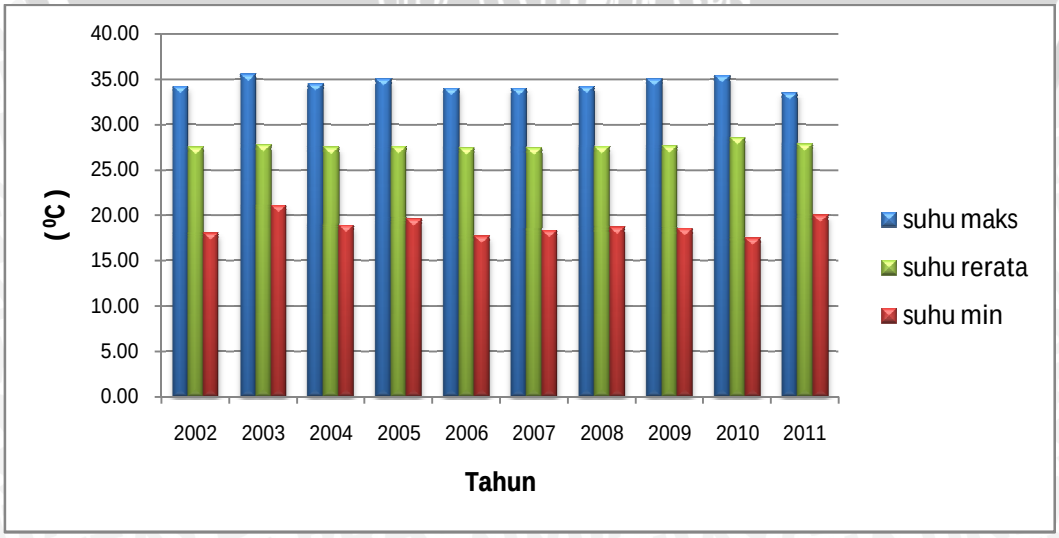
Lampiran 4 Temperatur tahunan di wilayah grati (2002-2011)

TEMPERATUR TAHUNAN DI WILAYAH GRATI (2002-2011)

Data temperatur udara diperoleh dari BMKG Karangploso yaitu di Pos Pengukuran P3GI yang terletak di Desa Pekuncen kabupaten Pasuruan. Berdasarkan data tahun 2002 sampai 2011.

Tabel 1. Karakteristik Temperatur Udara Tahunan

Tahun	Suhu Rata-rata (^{0}C)	Suhu Maximum (^{0}C)	Suhu Minimum (^{0}C)
2002	27.50	34.20	18.00
2003	27.80	35.50	21.10
2004	27.52	34.50	18.90
2005	27.57	35.00	19.60
2006	27.44	34.00	17.70
2007	27.39	34.00	18.30
2008	27.58	34.20	18.70
2009	27.64	35.00	18.50
2010	28.53	35.40	17.50
2011	27.85	33.50	20.00
Rerata	**27.68**	**34.53**	**18.83**
Maks	**28.53**	**35.50**	**21.10**
Min	**27.39**	**33.50**	**17.50**



Gambar 1. Karaktersitik Temperatur Udara

Lampiran 5 Katalog ukuran kabel di pasaran

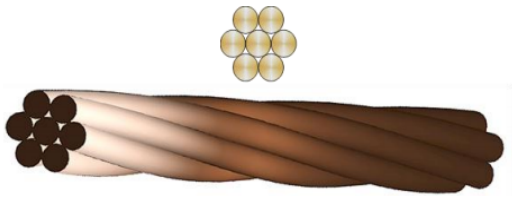
KATALOG UKURAN KABEL DI PASARAN

General Cable

ENERGY CABLES

Bare Copper Conductors

PHC



APPLICATION		
These conductors are a combination of imperial and metric sizes. Their main use is bare aerial conductors because of lower elongation and increased tensile rating compared to annealed copper conductors. They can also be used in earth mats, and as earthing conductors between earth rods. ▪ PHC = Plain Hard Drawn Copper	STANDARD	Various
	VOLTAGE	N/A
	CONDUCTOR	Hard Drawn Copper
	MAX. OPERATING TEMP.	75°C (Aerial suspended)

TECHNICAL SPECIFICATIONS

ITEM NUMBER	CONDUCTOR				OVERALL DIAMETER	APPROX. MASS
	mm^2	$Inch^2$	(No./mm)	(No./inch)	NOMINAL mm	kg/km
21940000	14.6	0.023	7/1.63	7/0.064	4.9	130
21975000	16	0.025	7/1.70	7/0.067	5.1	140
21985000	23	0.036	7/2.03	7/0.080	6.1	200
22000000	24.5	0.038	7/2.11	7/0.083	6.3	220
22015000	25	0.039	7/2.14	7/0.084	6.4	225
10290000	35	0.054	19/1.53	19/0.060	7.7	320
22040000	40	0.062	19/1.63	19/0.064	8.2	360
22045000	43	0.067	19/1.70	19/0.067	8.5	390
22070000	61	0.095	19/2.03	19/0.080	10.2	550
22080000	66	0.102	19/2.11	19/0.083	10.6	600
22090000	92	0.143	37/1.78	37/0.070	12.5	830
22140000	400	0.620	61/2.85	61/0.112	25.7	3530

CONDUCTOR			
NOMINAL AREA mm^2	MAXIMUM DC RESISTANCE @20°C Ω/km	NOMINAL AREA mm^2	MAXIMUM DC RESISTANCE @20°C Ω/km
14.6	1.27	40	0.466
16	1.16	43	0.429
23	0.816	61	0.301
24.5	0.755	66	0.278
25	0.734	92	0.201
35	0.529	400	0.048

General Cable
GENERAL CABLE AUSTRALIA PTY LTD
Level 1, 591-595 Blackburn Road
Notting Hill VIC 3168
Locked Bag 220, Clayton VIC 3168, Australia
Phone: 1300 363 282
FAX: 1300 363 382
EMAIL: sales@generalcable.com.au

LUAS PENAMPANG KONDUKTOR YANG DIPILIH

Lampiran 6 Surat izin pengambilan data

SURAT IZIN PENGAMBILAN DATA

INDONESIA POWER

UNIT BISNIS PEMBANGKITAN PERAK - GRATI
Jl. Raya Surabaya - Probolinggo Km.73 PO. Box 11, Grati 67184
Desa Wates, Kecamatan Lekok Kabupaten Pasuruan
Telepon : (0343) 413582, 413583
Facsimile : (0343) 413693, 413524, 425588
B a n k : Bank Negara Indonesia 1946(Persero) Tanjung Perak

Nomor : ~~Dp~~ / 32 / UBPPGT / 2013
Lampiran : -
Perihal : Pengambilan data Kuisioner PT Indonesia Power UBP Perak & Grati

Pasuruan, 02 September 2013

Kepada Yth :

Dekan
Fakultas Teknik Elektro
Universitas Brawijaya
Jl. Mayjen Haryono no.167 Malang 65145

Menindaklanjuti surat Saudara,
Nomor : 1781 / UN10.6/AK/2013
Perihal : Pengambilan data Sistem Pembangkit untuk penyusunan skripsi

Dengan ini disampaikan bahwa pada prinsipnya kami menyetujui permohonan saudara untuk melaksanakan pengambilan data sistem pembangkit untuk penyusunan skripsi, dengan nama mahasiswa sbb :

REG		NAMA	JURUSAN	Lokasi Praktek
1		Ignatius Agung Pratama	Teknik Elektro	Pemeliharaan Listrik
2		Galuh Indra Permadi	Teknik Elektro	Pemeliharaan Listrik

Dengan ketentuan sebagai berikut ;
- Jadwal praktek kerja tanggal : **10 & 17 September 2013**
- Perusahaan tidak memberikan fasilitas antar jemput / bantuan uang transport, penginapan, uang makan, uang saku maupun asuransi kecelakaan.
- Siswa datang langsung ke Bidang Humas Unit Bisnis Pembangkitan Perak & Grati dengan membawa copy surat ini yang telah dicap kampus / sekolah.

Siswa diwajibkan:
1 Melaksanakan praktek kerja sesuai dengan jadwal yang telah ditetapkan dan mentaati peraturan yang berlaku di perusahaan.
2 Membawa pakaian kerja lapangan, safety shoes, helm dan pakaian olah raga.
3 Menyerahkan foto berwarna ukuran 4x 6 sebanyak 2 (dua) lembar.
4 Membuat laporan praktek kerja lapangan.

Demikian disampaikan, atas perhatiannya kami ucapkan terima kasih.

GENERAL MANAGER

UNIT BISNIS PEMBANGKITAN INDONESIA POWER PERAK & GRATI

Ir. MUHAMMAD MURSID

INDONESIA POWER
UNIT BISNIS PEMBANGKITAN PERAK DAN GRATI

Pasuruan, 05 September 2013

Kepada :

Dekan Fakultas Teknik Elektro
Universitas Brawijaya
Jl. Mayjen Haryono No. 167
di
Malang 65145

DAFTAR PENGANTAR
No. : 475.DP/082/UBPPGT/2013

Bersama ini kami sampaikan surat - surat / dokumen sebagai berikut :

NO.	TANGGAL	NOMOR SURAT	PERIHAL	KET.
1	02/09/2013	56/32/UBPPGT/2013	Up. Dekan - Pengambilan Data Kuisioner PT Indonesia Power UBP Perak & Grati	

Diterima Tanggal : 06/9/13

Nama terang / cap dinas

Harap lembar *SALINAN* dikirim kembali / di-fax ke nomor : (0343) 413693 / 413524

Pelaksana Kesekretariatan

Erfika Ardhianti

ASLI

Lampiran 7 Dokumentasi lokasi yang akan digunakan untuk unit Pembangkit baru

DOKUMENTASI LOKASI YANG AKAN DIGUNAKAN UNTUK UNIT PEMBANGKIT BARU

Gambar 1. Lokasi yang akan digunakan untuk unit Pembangkit baru

Gambar 2. Lokasi yang akan digunakan untuk unit Pembangkit baru

Gambar 3. Lokasi yang akan digunakan untuk unit Pembangkit baru

Lampiran 8 Diagram garis tunggal sistem 500 KV di PT. Indonesia Power Grati

DIAGRAM GARIS TUNGGAL SISTEM 500 KV

DI PT. INDONESIA POWER GRATI

Lampiran 9 Diagram garis tunggal sistem 150 KV di PT. Indonesia Power Grati

DIAGRAM GARIS TUNGGAL SISTEM 150 KV DI PT. INDONESIA POWER GRATI

Lampiran 10 Desain *layout* sistem pengetanahan peralatan yang sudah terpasang

DESAIN *LAYOUT* SISTEM PENGETANAHAN PERALATAN YANG SUDAH TERPASANG