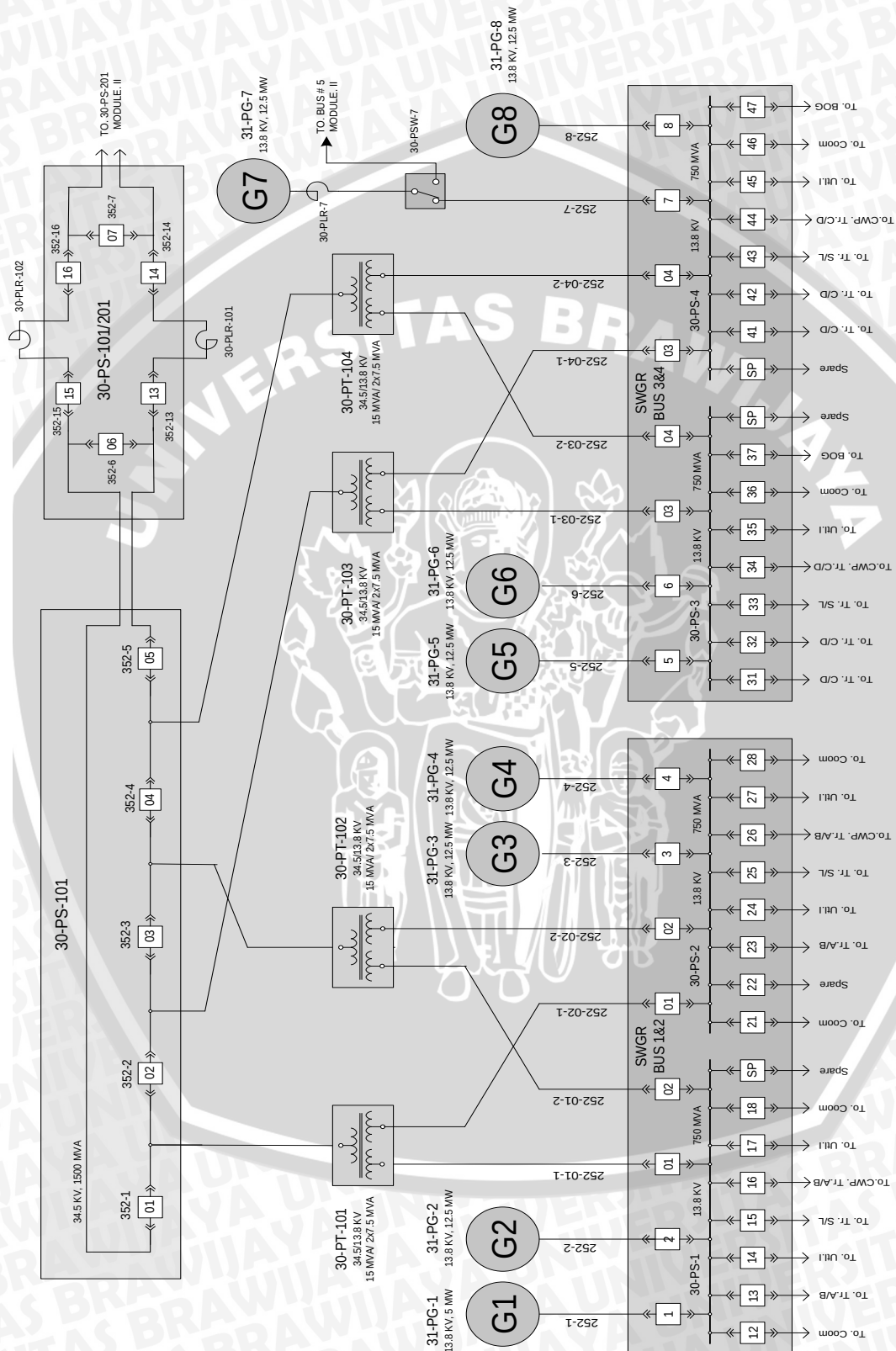




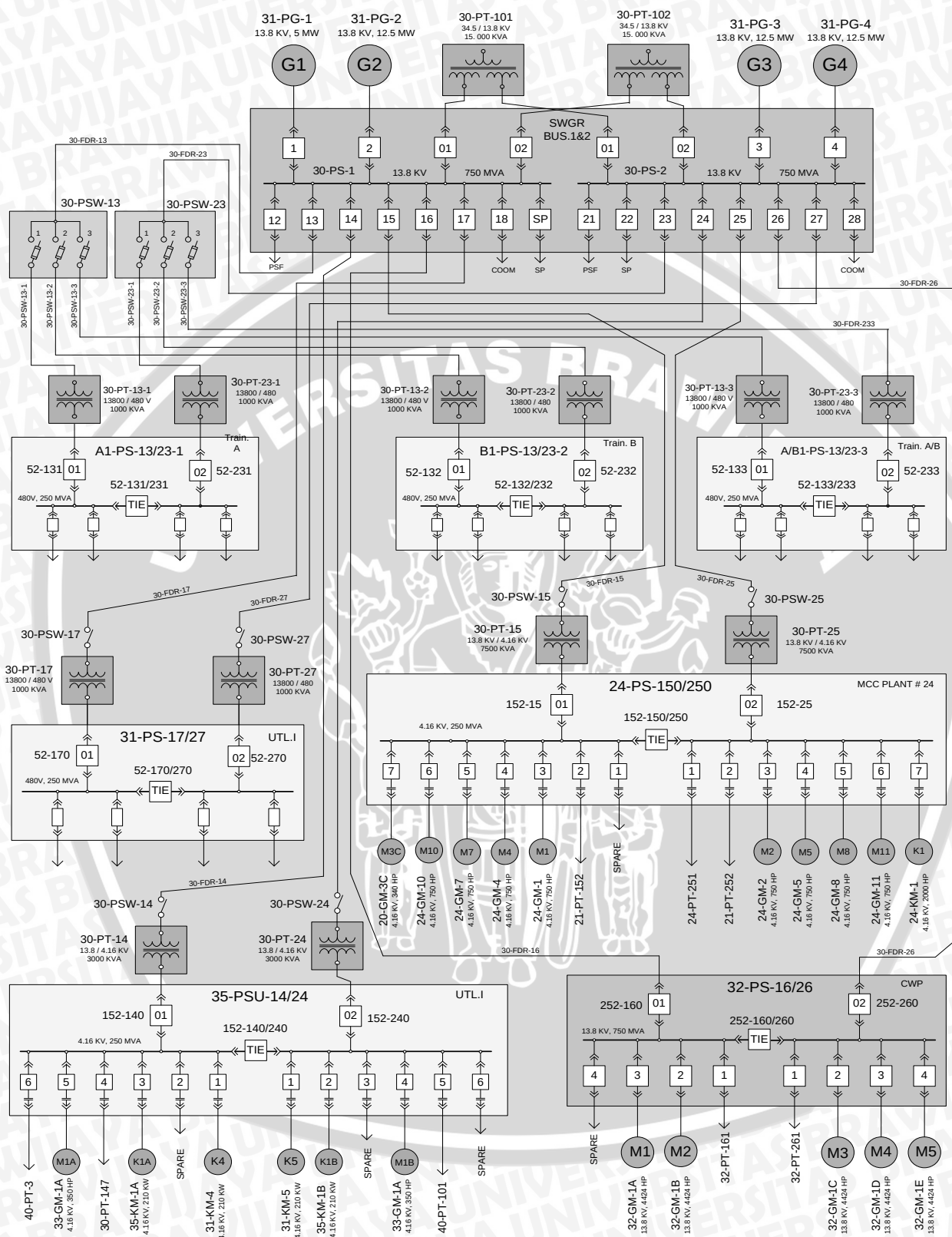
Lampiran 2 – Module 1

Module -1 terdiri atas:

1. *LNG liquefaction unit, Train A/B/C/D*
2. *Utilities-1*
3. 11 unit boiler
4. 1 unit *Diesel Generator* (5 MW)
5. 6 unit *steam turbine generator* (@ 12.5 MW)
6. 1 unit *gas turbine generator* (12.5 MW)
7. 2 unit *switchgear* dengan level tegangan 34.5 kV
8. 4 unit *switchgear* dengan level tegangan 13.8 kV dengan rincian yaitu:
 - 1) *Bus-bar. 30-PS-1* disuplai oleh generator 31-PG-1 & 31-PG-2
 - 2) *Bus-bar. 30-PS-2* disuplai oleh generator 31-PG-3 & 31-PG-4
 - 3) *Bus-bar. 30-PS-3* disuplai oleh generator 31-PG-5 & 31-PG-6
 - 4) *Bus-bar. 30-PS-4* disuplai oleh generator 31-PG-7 & 31-PG-8
9. 2 unit MCC 4.16 kV
10. 2 unit MCC 0.480 kV
11. 2 Unit MCC 13.8 kV
12. 10 Unit *Cooling Water Motor (CWP) @ 3.3 MW* (1 Train *LNG Liquefaction unit* membutuhkan 2 unit *Motor Cooling Water Pump*)
13. Beban Motor dan *Community*

Didalam *Module-1*, Terdapat 4 unit bus dengan level tegangan 13,8 kV, dimana masing-masing bus disuplai oleh 2 unit pembangkit dengan tegangan yang sama.

Lampiran 3 – Single Line Diagram Swictgear 30-PS-1/2 (Module-1)



A. Beban Switchgear 30-PS-1/2

1. Beban Switchgear 32-PS-12 (*PSF & Community*)

2. Beban Switchgear 32 PS-13/23

- 1) Beban Switchgear A1 -PS-13/23-1 (*MCC Train A, 480 V*)
- 2) Beban Switchgear A1 -PS-13/23-2 (*MCC Train B. 480 V*)
- 3) Beban Switchgear A1 -PS-13/23-3 (*MCC Train A/B. 480 V*)

3. Beban Switchgear 35-PS-140/240 (4.16 kV)

- 1) *Motor Fresh Water Fire Pump : 33-GM-1A*
- 2) *Motor Fresh Water Fire Pump : 33-GM-1B*
- 3) *Motor Air Compressor Isopac : 35-KM-1A*
- 4) *Motor Air Compressor Isopac : 35-KM-1B*
- 5) *Motor Force Draft Fan Boiler # 4: 31-KM-4*
- 6) *Motor Force Draft Fan Boiler # 5: 31-KM-5*
- 7) *Power Transformatior 40-PT-3, 4.16 kV / 480 V. Security Light*
- 8) *Power Transformer 40-PT-101, 4.16 kV / 480 V. Security Light*
- 9) *Power Transformer 30-PT-147, 4.16 kV / 480 V (MCC: Plant #19)*

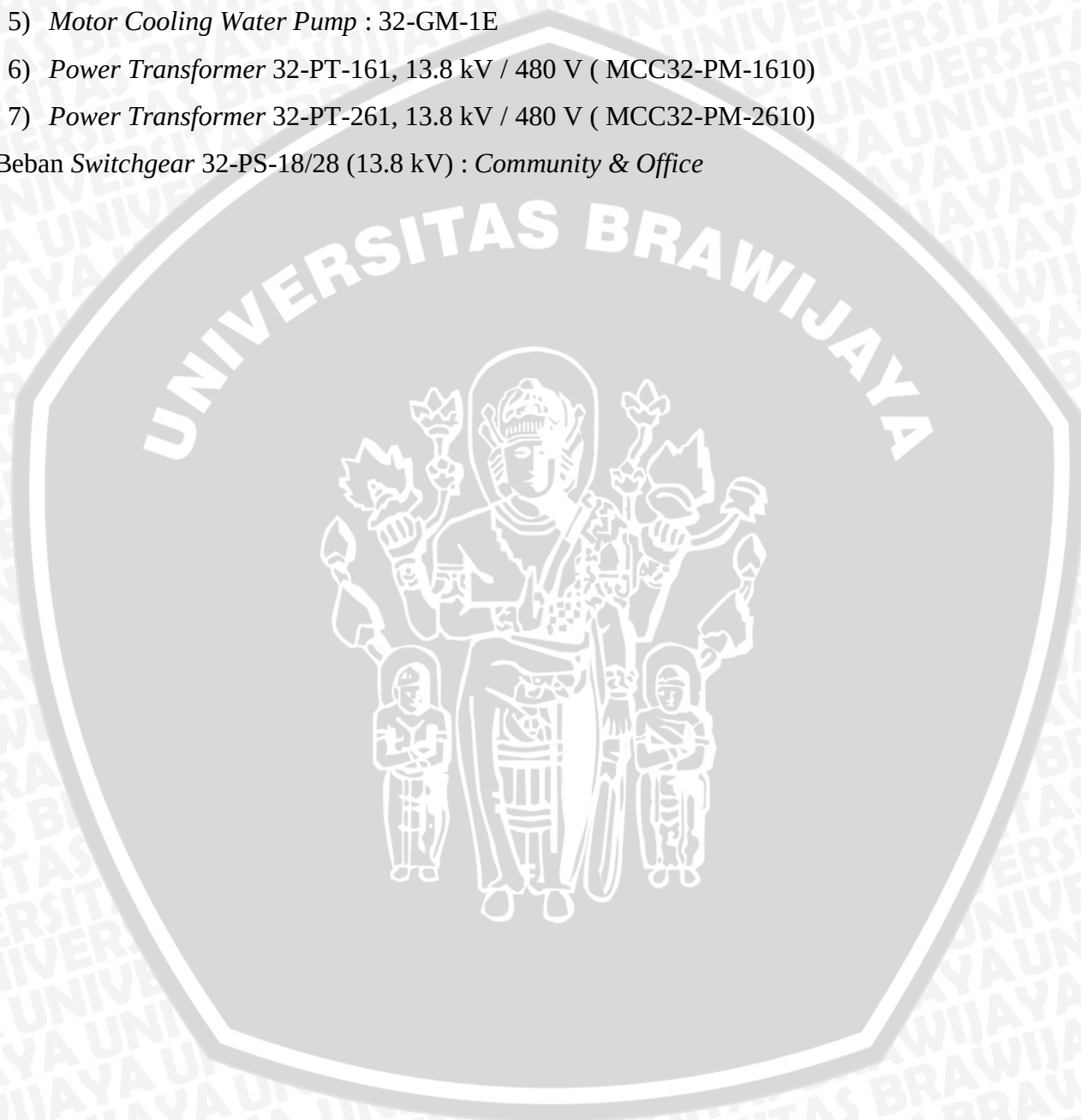
4. Beban Switchgear 24-PS-150/250 (4.16 kV)

- 1) *Motor Condensate Export : 20-GM-3C*
- 2) *Motor LNG Loading : 24-GM-1*
- 3) *Motor LNG Loading : 24-GM-2*
- 4) *Motor LNG Loading : 24-GM-4*
- 5) *Motor LNG Loading : 24-GM-5*
- 6) *Motor LNG Loading : 24-GM-7*
- 7) *Motor LNG Loading : 24-GM-8*
- 8) *Motor LNG Loading : 24-GM-10*
- 9) *Motor LNG Loading : 24-GM-11*
- 10) *Motor BOG Compressor : 24-KM -1*
- 11) *Power Transformer 24-PT-152, 4.16 kV / 480 V (MCC: 24-PM-152)*
- 12) *Power Transformer 24-PT-251, 4.16 kV / 480 V (MCC: 24-PM-251)*
- 13) *Power Transformer 24-PT-252, 4.16 kV / 480 V (MCC: 24-PM-252)*

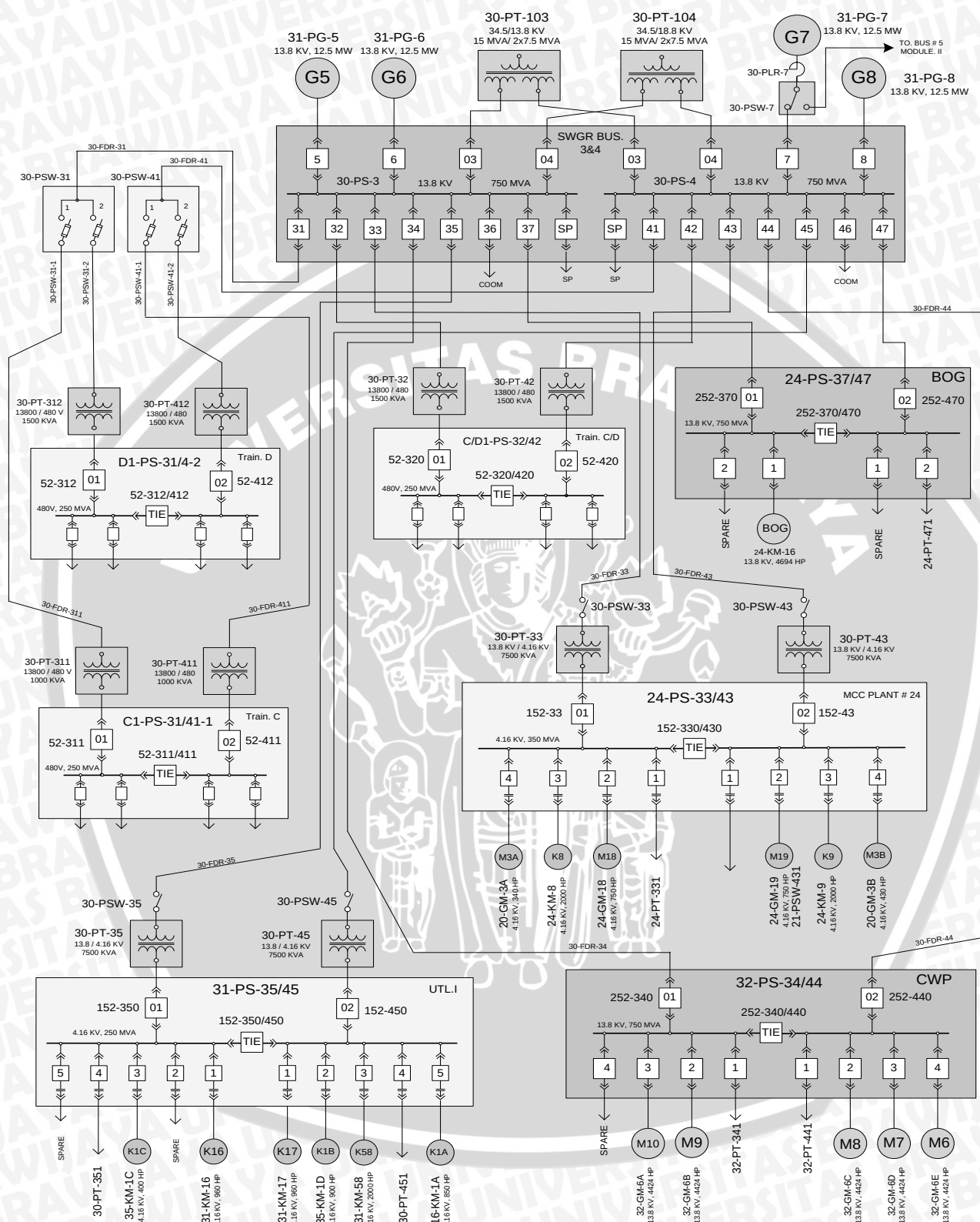
5. Beban Switchgear 32-PS-160/260 (13.8 kV)

- 1) *Motor Cooling Water Pump* : 32-GM-1A
- 2) *Motor Cooling Water Pump* : 32-GM-1B
- 3) *Motor Cooling Water Pump* : 32-GM-1C
- 4) *Motor Cooling Water Pump* : 32-GM-1D
- 5) *Motor Cooling Water Pump* : 32-GM-1E
- 6) *Power Transformer* 32-PT-161, 13.8 kV / 480 V (MCC32-PM-1610)
- 7) *Power Transformer* 32-PT-261, 13.8 kV / 480 V (MCC32-PM-2610)

6. Beban Switchgear 32-PS-18/28 (13.8 kV) : *Community & Office*



Lampiran 4 – Single Line Diagram Swictgear 30-PS-3/4 (Bus 3 & 4)



A. Beban Switchgear 30-PS-3/4 (Bus-3 & Bus-4)

1. Beban Switchgear 32-PS-31/41

- 1) Beban Switchgear C1-PS-31/41-1 (MCC Train C 480 V)
- 2) Beban Switchgear D1-PS-31/41-2 (MCC Train D 480 V)
- 3) Beban Switchgear C/D1-PS-32/42 (MEA, MCC Train C/D 480 V)

2. Beban Switchgear 24-PS-330/430 (4.16 kV)

- 1) Motor Condensate Export : 20-GM-3A
- 2) Motor Condensate Export : 20-GM-3B
- 3) Motor LNG Loading Pump : 24-GM-18
- 4) Motor LNG Loading Pump : 24-GM-28
- 5) Motor BOG Compressor : 24-KM-8
- 6) Motor BOG Compressor : 24-KM-9
- 7) Power Transformer 24-PT-331, 4.16 kV/480V (MCC: 24-PM-3310)

3. Beban Switchgear 32-PS-34/44 (13.8 kV)

- 1) Motor Cooling Water : 32-GM -6A (CWP- 6)
- 2) Motor Cooling Water : 32-GM -6B (CWP- 7)
- 3) Motor Cooling Water : 32-GM -6C (CWP- 8)
- 4) Motor Cooling Water : 32-GM -6D (CWP- 9)
- 5) Motor Cooling Water : 32-GM -6E (CWP- 10)
- 6) Power Transformer 32-PT-341, 13.8 kV / 480 V (MCC32-PM-3410)
- 7) Power Transformer 32-PT-441, 13.8 kV / 480 V (MCC32-PM-4410)

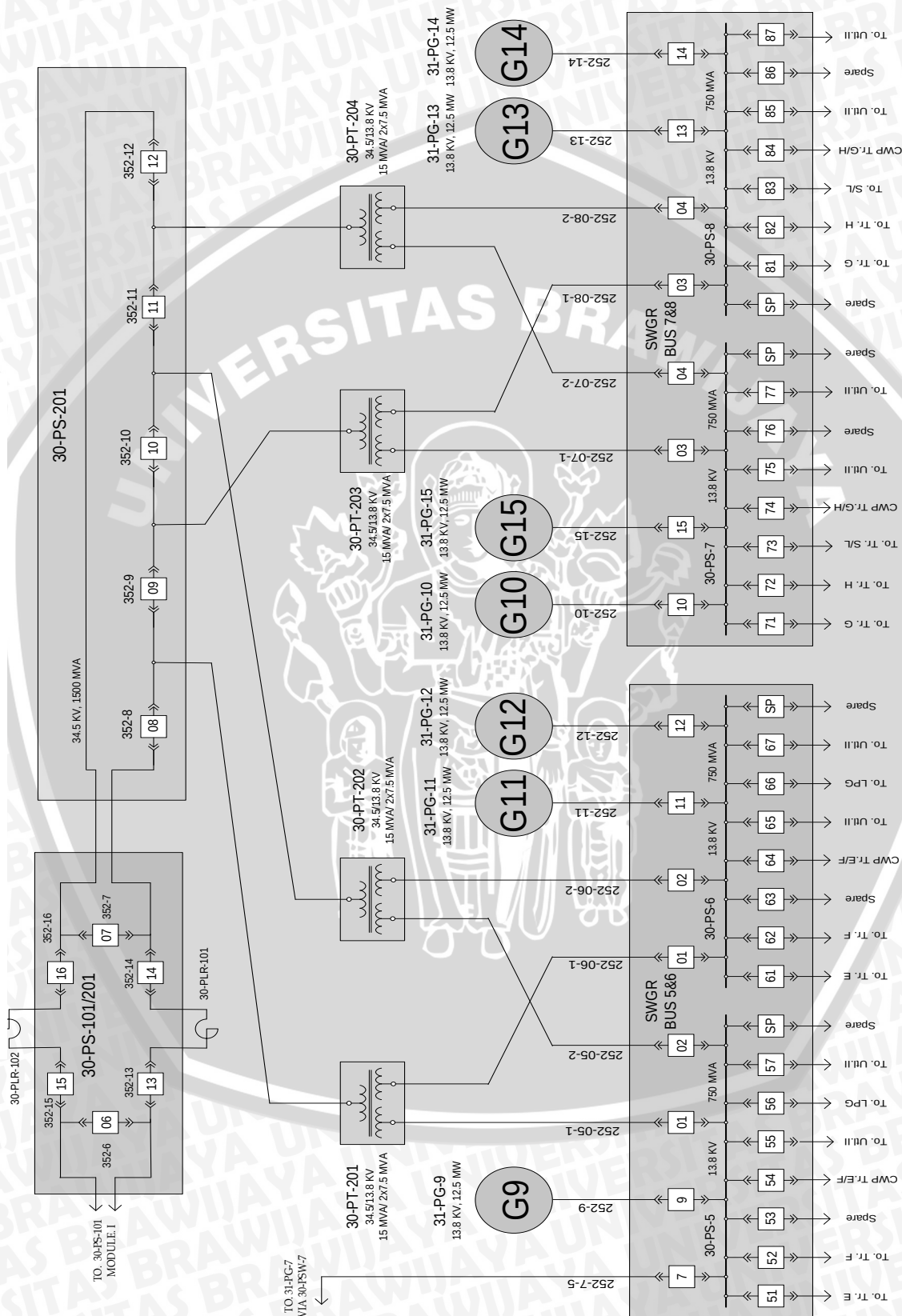
4. Beban Switchgear 31-PS-350/450 (4.16 kV)

- 1) Motor Boiler Feed Water Pump : 31-KM-58
- 2) Motor Air Compressor Isopac : 35-KM-1C
- 3) Motor Air Compressor Isopac : 35-KM-1D
- 4) Motor Force Draft Fan Boiler #9 : 31-KM-16
- 5) Motor Force Draft Fan Boiler #10 : 31-KM-17
- 6) Power Transformer 30-PT-351, 4.16 kV/480 V. (MCC: 31-PM-3510)
- 7) Power Transformer 30-PT-451, 4.16 kV/480 V. (MCC: 31-PM-4510)

5. Beban Switchgear 31-PS-36/46 (Community & Office)

6. Beban Switchgear 32-PS-370/470 (13.8 kV)

- 1) Motor BOG Compressor: 24-KM -16.
- 2) Power Transformer 24-PT-471, 13.8 kV /480 V. (MCC: 24-PM-4710)



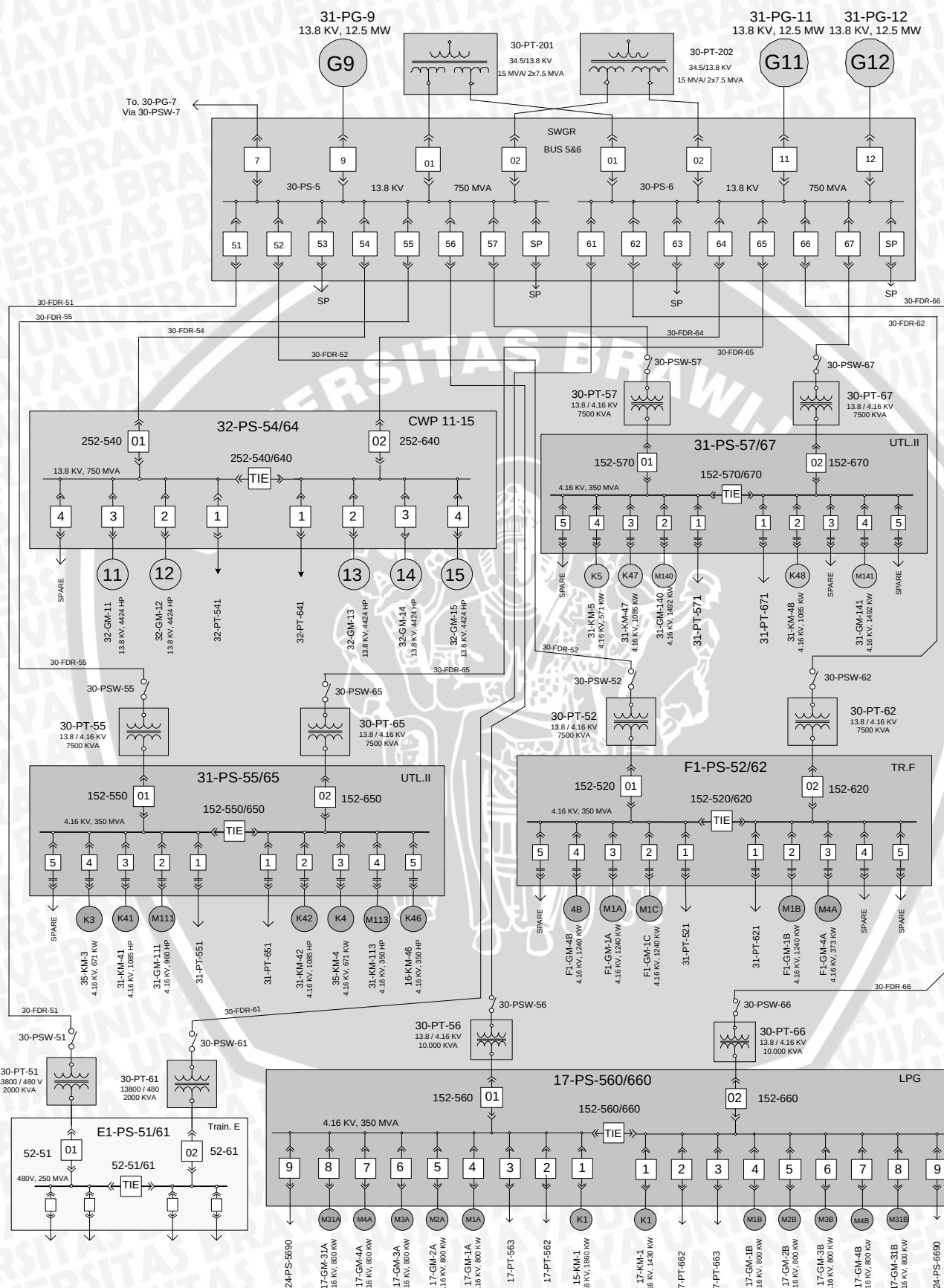
Lampiran 6 – Module 2

Module-2 terdiri atas:

1. *LNG liquefaction Unit, Train E/F/G/H*
2. *Utilities-2*
3. 10 unit boiler
4. 6 unit *steam turbine generator* (@ 12.5 MW)
5. 1 unit *gas turbine generator* (15 MW)
6. 2 unit *switchgear* dengan level tegangan 34.5 kV
7. 4 unit *switchgear* dengan level tegangan 13.8 kV dengan rincian yaitu:
 - 1) Bus-bar. 30-PS-5 disuplai oleh generator 31-PG-7 & 31-PG-9
 - 2) Bus-bar. 30-PS-6 disuplai oleh generator 31-PG-11 & 31-PG-12
 - 3) Bus-bar. 30-PS-7 disuplai oleh generator 31-PG-10 & 31-PG-15
 - 4) Bus-bar. 30-PS-8 disuplai oleh generator 31-PG-13 & 31-PG-14
8. 4 unit MCC 4.16 kV
9. 4 unit MCC 0.408 kV
10. 4 Unit MCC 13.8 kV
11. 12 Unit *Cooling Water Motor (CWP) @ 3.3 MW* (1 Train *LNG Liquefaction* membutuhkan 2 unit motor *cooling water*)
12. Beban Motor dan *Community*

Didalam *Module-2*, Terdapat 4 unit bus-bar dengan level tegangan 13,8 kV, dimana masing-masing busbar disuplai oleh 2 unit pembangkit dengan tegangan yang sama.

Lampiran 7 – Single Line Diagram Swictgear 30-PS-5/6 (Bus 50 & 51 ; Module-2)



A. Beban *Switchgear* 30-PS-5/6

1. Beban *Switchgear* E1-PS-51/61 (MCC Train E. 480 V)

2. Beban *Train F. Switchgear* F1-PS-52/62 (4.16 kV)

1) *Motor Lean Amine Pump* : F1-GM-1A

2) *Motor Lean Amine Pump* : F1-GM-1B

3) *Motor Lean Amine Pump* : F1-GM-1C

4) *Motor Lean Amine Boster Pump* : F1 -GM-4A

5) *Motor Lean Amine Boster Pump* : F1 -GM-4B

6) *Power Transformator* 31-PT-521, 4.16 kV /480 V (MCC F1-PM-5210)

7) *Power Transformator* 31-PT-621, 4.16 kV /480 V (MCC F1-PM-6210)

3. Beban *CWP Switchgear* : 32-PS-54/64 (13.8 kV)

1) *Motor Cooling Water* : 32-GM-11

2) *Motor Cooling Water* : 32-GM-12

3) *Motor Cooling Water* : 32-GM-13

4) *Motor Cooling Water* : 32-GM-14

5) *Motor Cooling Water* : 32-GM-15

6) *Power Transformator* 32-PT-541, 13.8 kV / 480V (MCC 32-PM-5410)

7) *Power Transformator* 32-PT-641, 13.8 kV / 480V (MCC 32-PM-6410)

4. Beban *Switchgear* 31-PS-55/65 (4.16 kV)

1) *Motor Boiler Feed Water Pump* : 31-KM-111

2) *Motor Boiler Feed Water Pump* : 31-KM-113

3) *Motor Air Compressor Isopac* : 35-KM-3

4) *Motor Air Compressor Isopac* : 35-KM-4

5) *Motor Force Draft Fan Boiler # 21* : 31-KM-41

6) *Motor Force Draft Fan Boiler # 22* : 31-KM-42

7) *Motor Force Draft Fan Boiler # 23* : 31-KM-46

8) *Power Transformator* 30-PT-651, 4.16 kV / 480V (MCC: 31-PM-6510)

9) *Power Transformator* 30-PT-551, 4.16 kV / 480V (MCC: 31-PM-5510)

5. Beban *LPG. Switchgear* : 17-PS-560/660 (4.16 kV)

1) *Motor : LPG. Loading Pump* : 17-GM-1A

2) *Motor : LPG. Loading Pump* : 17-GM-1B

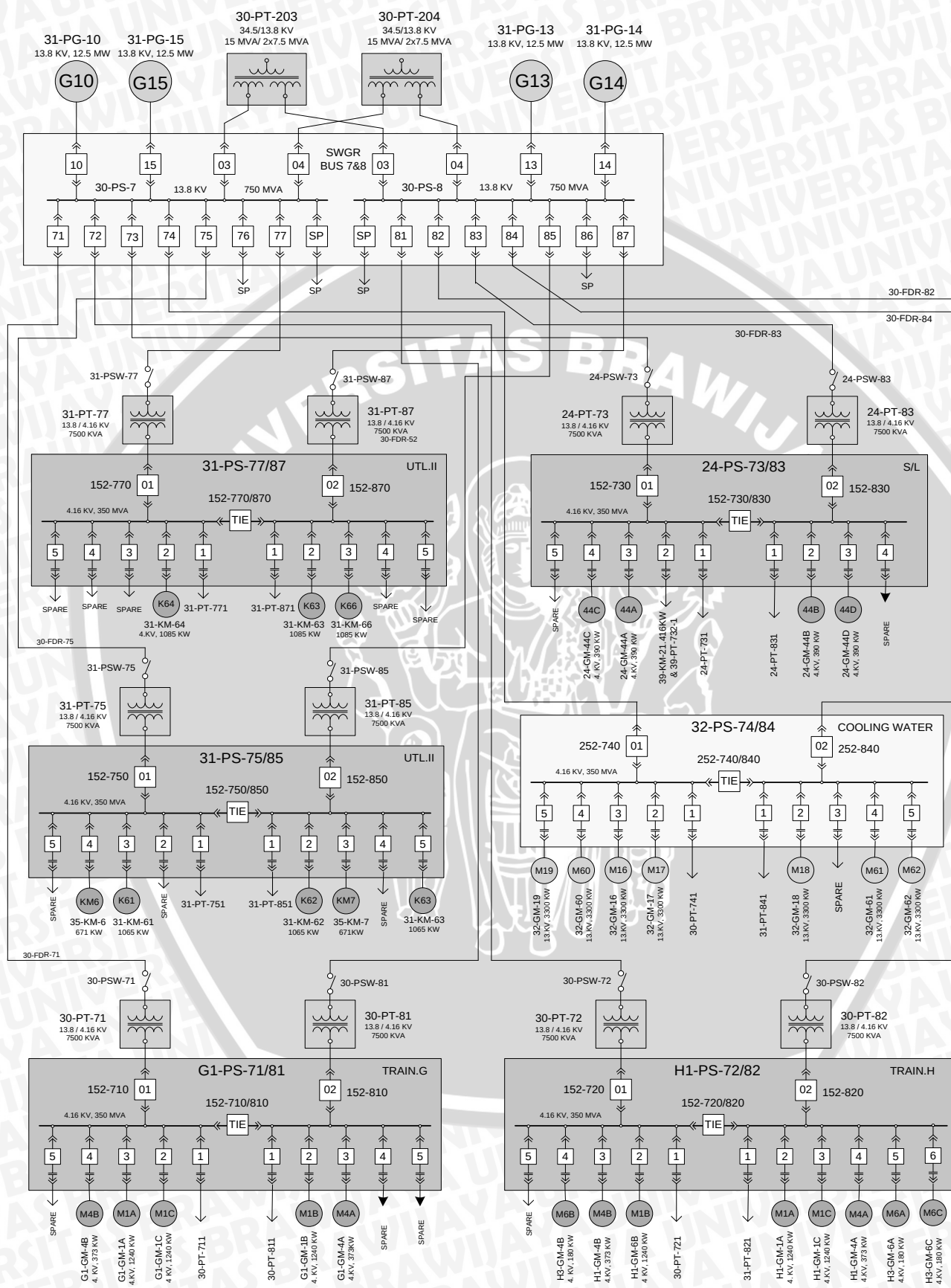
3) *Motor : LPG. Loading Pump* : 17-GM-2A

4) *Motor : LPG. Loading Pump* : 17-GM-2B

5) *Motor : LPG. Loading Pump* : 17-GM-3A

- 6) Motor : *LPG. Loading Pump* : 17-GM-4A
 - 7) Motor : *LPG. Loading Pump* : 17-GM-3B
 - 8) Motor : *LPG. Loading Pump* : 17-GM-4B
 - 9) Motor : *LPG. Loading Pump* : 17-GM-31A
 - 10) Motor : *LPG. Loading Pump* : 17-GM-31B
 - 11) Motor *LPG. Refrigeration Compressor* : 15-KM -1
 - 12) Motor *LPG. Compressor* : 17-KM -1
 - 13) Power Transformer 17-PT-562/662, 4.16 kV /480V (MCC: 17-PM-5620/6620)
 - 14) Power Transformer 17-PT-563/663, 4.16 kV /480V (MCC: 17-PM-5630/6630)
 - 15) Power MCC. 24-PS-5690/6690.
6. Beban Switchgear 31-PS-57/67 (4.16 kV)
- 1) Motor Boiler Feed Water Pump : 31-KM-140
 - 2) Motor Boiler Feed Water Pump : 31-KM-141
 - 3) Motor Air Compressor Isopac : 35-KM-5
 - 4) Motor Force Draft Fan Boiler #24 : 31-KM-47
 - 5) Power Transformer 31-PT-571, 4.16 kV / 480 V. (MCC: 31-PM-5710)
 - 6) Motor Force Draft Fan Boiler # 25 : 31-KM-48
 - 7) Power Transformer 31-PT-671, 4.16 kV / 480 V. (MCC: 31-PM-6710)

Lampiran 8 – Single Line Diagram Switchgear 30-PS-7/8 (Bus 52 & 53 ; Module-2)



A. Beban Switchgear 30-PS-7/8

2. Beban Switchgear Train-G : G1-PS-710/810 (4.16 kV)

- 1) *Motor Lean Amine Pump* : G1-GM-1A
- 2) *Motor Lean Amine Pump* : G1-GM-1B
- 3) *Motor Lean Amine Pump* : G1-GM-1C
- 4) *Motor Lean Amine Boster Pump* : G1-GM-4A
- 5) *Motor Lean Amine Boster Pump* : G1-GM-4B
- 6) *Power Transformer* 30-PT-711, 4.16 kV /480 V (MCC: G1-PM-7110)
- 7) *Power Transformer* 30-PT-811, 4.16 kV /480 V. (MCC: G1-PM-8110)

3. Beban Switchgear Train-H : H1-PS-720/820 (4.16 kV)

- 1) *Motor Lean Amine Pump* : H1-GM-1A
- 2) *Motor Lean Amine Pump* : H1-GM-1B
- 3) *Motor Lean Amine Pump* : H1-GM-1C
- 4) *Motor Lean Amine Boster Pump* : H1-GM-4A
- 5) *Motor Lean Amine Boster Pump* : H1-GM-4B
- 6) *Motor Depropanizer Reflux Pump* : H1-GM- 6A
- 7) *Motor Depropanizer Reflux Pump* : H1-GM- 6B
- 8) *Motor Depropanizer Reflux Pump* : H1-GM- 6C
- 9) *Power Transformer* 30-PT-721, 4.16 kV /480 V (MCC: G1-PM-7210)
- 10) *Power Transformer* 30-PT-821, 4.16 kV /480 V. (MCC: G1-PM-8210)

4. Beban Switchgear 24-PS-730/830 (4.16 kV)

- 1) *Motor LNG Loading Pump* : 24-GM-44A
- 2) *Motor LNG Loading Pump* : 24-GM-44B
- 3) *Motor LNG Loading Pump* : 24-GM-44C
- 4) *Power Transformer* 24-PT-731, 4.16 kV /480V (MCC: 24-PM-7310)
- 5) *Motor LNG Loading Pump* : 24-GM-44D
- 6) *Power Transformer* 24-PT-831, 4.16 kV /480V (MCC: 24-PM-8310)

5. Beban CWP Switchgear : 32-PS-740/840 (13.8 kV)

- 1) *Motor Cooling Water Pump* : 32-GM-16
- 2) *Motor Cooling Water Pump* : 32-GM-17
- 3) *Motor Cooling Water Pump* : 32-GM-18
- 4) *Motor Cooling Water Pump* : 32-GM-19
- 5) *Motor Cooling Water Pump* : 32-GM-61
- 6) *Motor Cooling Water Pump* : 32-GM-60

- 7) *Motor Cooling Water Pump* : 32-GM-62
- 8) *Power Transformer* 32-PT-741, 13.8 kV /480 V (MCC32-PM-7410)
- 9) *Power Transformer* 32-PT-841, 13.8 kV /480 V (MCC32-PM-8410)
6. *Beban Switchgear* 31-PS-75/85 (4.16 kV)
 - 1) *Motor Air Compressor Isopac* : 35-KM-6
 - 2) *Motor Air Compressor Isopac* : 35-KM-7
 - 3) *Motor Force Draft Fan Boiler #26* : 31-KM-61
 - 4) *Motor Force Draft Fan Boiler #27* : 31-KM-62
 - 5) *Motor Force Draft Fan Boiler #28* : 31-KM-63
 - 6) *Power Transformer* 30-PT-851, 4.16 kV / 480 V (MCC: 31-PM-8510)
 - 7) *Power Transformer* 30-PT-751, 4.16 kV / 480 V (MCC: 31-PM-7510)
7. *Beban Switchgear* : 31-PS-770/870 (4.16 kV)
 - 1) *Motor Force Draft Fan Boiler # 28* : 31-KM- 63
 - 2) *Motor Force Draft Fan Boiler # 29* : 31-KM- 64
 - 3) *Motor Force Draft Fan Boiler # 30* : 31-KM- 65
 - 4) *Power Transformer* 31-PT-771, 4.16 kV / 480 V. (MCC: 31-PM-7710)
 - 5) *Power Transformer* 31-PT-871, 4.16 kV / 480 V. (MCC: 31-PM-8710)

Lampiran 9 - Data Generator, Transformator, dan Beban

➤ Data Generator PG-2 s.d. PG-6 dan PG-8 s.d PG-14 (Primemover : Steam Turbine)

Parameter	Nilai	Satuan
Tegangan (V)	13800	V
Arus (I)	654	A
Daya keluaran (P)	12500	kW
Daya Nyata (S)	15625	kVA
Frequency	50	Hz
Power factor	0.8	Lagging
n	3000	rpm
Exciter Field (V)	42	V
Exciter Field (Ampere)	13.5	A
Rotor Winding	Two Pole-Strap Wound	
Phase	3	

Sumber : Module Electrical Distribution PT Badak NGL, PG : Power Generator

➤ Data Generator PG-1 (Diesel Generator)

Parameter	Nilai	Satuan
Manufacture General	Electric Machinery	
Tegangan (V)	13800	V
Arus (I)	262	A
Daya keluaran (P)	5020	kW
Daya Nyata (S)	6275	kVA
Frequency	50	Hz
Power factor	0.8	Lagging
n	3000	rpm
Exciter Field (V)	48	V
Exciter Field (Ampere)	10.3	A
Rotor Winding	-	
Phase	3	

Sumber : Module Electrical Distribution PT Badak NGL , PG : Power Generator

➤ **Data Generator PG-7 dan PG-15 (Primemover : Gas Turbine)**

Parameter	Nilai	Satuan
Tegangan (V)	13800	V
Arus (I)	262	A
Daya keluaran (P)	-	kW
Daya Nyata (S)	19500	kVA
Frequency	50	Hz
Power factor	0.8	Lagging
n	3000	rpm
Exciter Field (V)	110	V
Exciter Field (Ampere)	7.4	A
Rotor Winding	-	
Phase	3	

Sumber : Module Electrical Distribution PT Badak NGL, PG : Power Generator

➤ **Data Generator PT Badak NGL Beserta Primemover dan Sistem Operasinya**

No	Generator Unit-	Kode Perangkat	Kapasitas (Daya)	Primemover	Governor	Operasi
1.	31 - PG - 1	G-1	5 MW	Diesel	-	Droop
2.	31 - PG - 2	G-2	12.5 MW	Steam Turbine	Back Pressure	Droop
3.	31 - PG - 3	G-3	12.5 MW	Steam Turbine	Back Pressure	Droop
4.	31 - PG - 4	G-4	12.5 MW	Steam Turbine	Condensing	Isochronous
5.	31 - PG - 5	G-5	12.5 MW	Steam Turbine	Condensing	Isochronous
6.	31 - PG - 6	G-6	12.5 MW	Steam Turbine	Back Pressure	Droop
7.	31 - PG - 7	G-7	12.5 MW	Gas Turbine	-	Isochronous
8.	31 - PG - 8	G-8	12.5 MW	Steam Turbine	Back Pressure	Droop
9.	31 - PG - 9	G-9	12.5 MW	Steam Turbine	Back Pressure	Droop
10.	31 - PG -10	G-10	12.5 MW	Steam Turbine	Back Pressure	Droop
11.	31 - PG -11	G-11	12.5 MW	Steam Turbine	Condensing	Isochronous
12.	31 - PG -12	G-12	12.5 MW	Steam Turbine	Condensing	Isochronous
13.	31 - PG -13	G-13	12.5 MW	Steam Turbine	Back Pressure	Droop
14.	31 - PG -14	G-14	12.5 MW	Steam Turbine	Condensing	Isochronous
15.	31 - PG -15	G-15	12.5 MW	Gas Turbine	-	Isochronous

Sumber : Module Electrical Distribution PT Badak NGL

Tag Number Generator

31-PG-2 31 : Plant # 31
 31-PG-10 PG : Power Generator
 31-PG-15 2, 10, 15 : No Urut Equipment

➤ **Data Switchgear**

No.	Data Penomoran	Tegangan	Lokasi
1.	30 – PT-101 / 102 / 103/ 104	34.5 kV / 13.8 kV	Utilities - I
2.	30 – PT- 201 / 202 / 203 / 204	34.5 kV / 13.8 kV	Utilities - II
3.	30 – PT – 35 / 45	13.8 kV / 4.16 kV	Utilities - I
4.	30 – PT – 351 / 451	4.16 kV / 480 V	Utilities - I
5.	30 – PT – 311 / 411	13.8 kV / 480 V	Train C / D
6.	30 – PT – 55 / 65	13.8 kV / 4.16 kV	Utilities – II
7.	30 – PT – 551 / 651	4.16 kV / 480 V	Utilities – II
8.	30 – PT – 51 / 61	13.8 kV / 480 V	Train E

Sumber : *Module Electrical Distribution* PT Badak NGL

Tag Number Switchgear

30 – PS-101	30	:	Plant # 30
30 – PS – 1/2	PG	:	Power Switchgear
30 – PS – 7/8	101, 1/2, 7/8	:	No Urut Equipment

➤ Data Transformator

No.	Tag Number	Tegangan	Lokasi
1.	30 – PT-101 / 102 / 103/ 104	34.5 kV / 13.8 kV	Utilities - I
2.	30 – PT- 201 / 202 / 203 / 204	34.5 kV / 13.8 kV	Utilities - II
3.	30 – PT – 35 / 45	13.8 kV / 4.16 kV	Utilities - I
4.	30 – PT – 351 / 451	4.16 kV / 480 V	Utilities - I
5.	30 – PT – 311 / 411	13.8 KV / 480 V	Train C / D
6.	30 – PT – 55 / 65	13.8 / 4.16 KV	Utilities – II
7.	30 – PT – 551 / 651	4.16 / 480 V	Utilities – II
8.	30 – PT – 51 / 61	13.8 KV / 480 V	Train E

Sumber : *Module Electrical Distribution PT Badak NGL*

Tag Number Transformer

30 – PT-101	30	:	<i>Plant # 30</i>
30 – PT – 35/45	PT	:	<i>Power Transformer</i>
	101, 35/45	:	<i>No Urut Equipment</i>

➤ **Data Pembebanan (Motor Listrik)**

a. Level Tegangan 13.8 kV

No.	TAG NO	VOLT	kW	RPM	SER. NO.	SERVICE	MFG	INSTALL
1.	31-GM-1A	13200	3300	598	274-602	CWP	AEG	1977
2.	32-GM-1B	13200	3300	598	274-603	CWP	AEG	1977
3.	32-GM-1C	13200	3300	598	274-604	CWP	AEG	1977
4.	32-GM-1D	13200	3300	598	275-605	CWP	AEG	1977
5.	32-GM-1E	13200	3300	598	274-606	CWP	AEG	1977
6.	32-GM-6A	13200	3300	598	281-001	CWP	AEG	1983
7.	32-GM-6B	13200	3300	598	281-002	CWP	AEG	1983
8.	32-GM-6C	13200	3300	598	281-003	CWP	AEG	1983
9.	32-GM-6D	13200	3300	598	281-004	CWP	AEG	1983
10.	32-GM-6E	13200	3300	598	281-005	CWP	AEG	1983
11.	32-GM-11	13200	3300	600	85-501-566	CWP	AEG	1989

12.	32-GM-12	13200	3300	600	85-501-567	CWP	AEG	1989
13.	32-GM-13	13200	3300	600	85-501-568	CWP	AEG	1989
14.	32-GM-14	13200	3300	590	91-10-175	CWP	Toshiba	1993
15.	32-GM-15	13200	3300	590	91-10-176	CWP	Toshiba	1993
16.	32-GM-16	13200	3300	590	9510146	CWP	Toshiba	1997
17.	32-GM-17	13200	3300	590	9510147	CWP	Toshiba	1997
18.	32-GM-18	13200	3300	590	9510148	CWP	Toshiba	1997
19.	32-GM-19	13200	3300	590	9510149	CWP	Toshiba	1997
20.	32-GM-60	13200	3300	590	9710202	CWP	Toshiba	1999
21.	32-GM-61	13200	3300	590	9710204	CWP	Toshiba	1999
22.	32-GM-62	13200	3300	590	9710210	CWP	Toshiba	1999
23.	24-KM-16	13200	4694 HP	1486	-	BOG	Siemens	1983

Sumber : *Electrical Distribution Module PT Badak NGL*

b. Level Tegangan 4.16 kV

NO	TAG NUMBER	VOLT	kW / HP	RPM	MFG	SERVICE EQUIPMENT	INSTALL
1.	15-KM-1	4000	1860 KW	1470	Fuji Electric	LPG Refrigeration Compr.	1983
2.	17-KM-1	4000	1430 HP	367	Toshiba	LPG Comp.	1983
3.	20-GM-3A	4000	430 HP	2975	Toshiba	Condensate Export Pump	1989
4.	20-GM-3B	4000	430 HP	2975	Toshiba	Condensate Export Pump	1989
5.	20-GM-3C	4000	400 KW	2980	Fuji Electric	Condensate Export Pump	1997
6.	24-KM-1	4000	2000 HP	1485	Toshiba	BOG Compressor	1977
7.	24-KM-8	4000	2000 HP	1485	Toshiba	BOG Compressor	1977
8.	24-KM-9	4000	2000 HP	1485	Toshiba	BOG Compressor	1983
9.	31-GM-111	4000	200 HP	1488	Westinghouse	Boiler Feed Water Pump	1989
10.	31-GM-113	4000	200 HP	1488	Westinghouse	Boiler Feed Water Pump	1989
11.	31-GM-140	4000	200 HP	1488	Westinghouse	Boiler Feed Water Pump	1993
12.	31-GM-141	4000	200 HP	1488	Westinghouse	Boiler Feed Water Pump	1993
13.	31-GM-58	4000	2000 HP	1500	Reliance	Boiler Feed Water Pump	1983
14.	31-KM-16	4160	960 KW	980	Shinko	Force Draft Fan Boiler #9	1982
15.	31-KM-17	4160	960 KW	980	Shinko	Force Draft Fan Boiler #10	1982
16.	31-KM-4	4160	210 KW	595	Shinko	Force Draft Fan Boiler #4	1977
17.	31-KM-41	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #21	1989
18.	31-KM-42	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #22	1989
19.	31-KM-46	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #23	1993
20.	31-KM-47	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #24	1993
21.	31-KM-48	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #25	1993
22.	31-KM-5	4160	210 KW	595	Shinko	Force Draft Fan Boiler #5	1977
23.	31-KM-61	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #26	1997
24.	31-KM-62	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #27	1997
25.	31-KM-63	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #28	1999
26.	31-KM-64	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #29	1999
27.	31-KM-65	4000	1085 KW	980	Toshiba	Force Draft Fan Boiler #30	1999
28.	33-GM-1A	4000	350 HP	1485	Toshiba	Fresh Water Fire Pump	1977

29.	33-GM-1B	4000	350 HP	1485	Toshiba	<i>Fresh Water Fire Pump</i>	1977
30.	35-KM-1A	4000	900 HP	2973	Westinghouse	<i>Air Compressor</i>	1977
31.	35-KM-1B	4000	900 HP	2973	Westinghouse	<i>Air Compressor</i>	1977
32.	35-KM-1C	4000	900 HP	2973	Westinghouse	<i>Air Compressor</i>	1983
33.	35-KM-1D	4000	900 HP	2973	Westinghouse	<i>Air Compressor</i>	1983
34.	35-KM-3	4000	900 HP	2975	Siemens	<i>Air Compressor</i>	1989
35.	35-KM-4	4000	900 HP	2975	Siemens	<i>Air Compressor</i>	1993
36.	35-KM-5	4000	900 HP	2975	Siemens	<i>Air Compressor</i>	1993
37.	35-KM-6	4000	900 HP	2975	Siemens	<i>Air Compressor</i>	1997
38.	F1-GM-1A	4000	1240 KW	1400	Toshiba	<i>Lean Amine Pump</i>	1993
39.	F1-GM-1B	4000	1240 KW	1400	Toshiba	<i>Lean Amine Pump</i>	1993
40.	F1-GM-1C	4000	1240 KW	1400	Toshiba	<i>Lean Amine Pump</i>	1993
41.	F1-GM-4A	4000	500 HP	1489	Reliance	<i>Lean Amine Booster Pump</i>	1993
42.	F1-GM-4B	4000	500 HP	1489	Reliance	<i>Lean Amine Booster Pump</i>	1993
43.	G1-GM-1A	4000	1663 HP	2981	Westinghouse	<i>Lean Amine Pump</i>	1997
44.	G1-GM-1B	4000	1663 HP	2981	Westinghouse	<i>Lean Amine Pump</i>	1997
45.	G1-GM-1C	4000	1663 HP	2981	Westinghouse	<i>Lean Amine Pump</i>	1997
46.	G1-GM-4A	4000	469 HP	1489	Reliance	<i>Lean Amine Booster Pump</i>	1997
47.	G1-GM-4B	4000	469 HP	1489	Reliance	<i>Lean Amine Booster Pump</i>	1997
48.	H1-GM-1A	4000	1541 HP	2979	Westinghouse	<i>Lean Amine Pump</i>	1999
49.	H1-GM-1B	4000	1541 HP	2979	Westinghouse	<i>Lean Amine Pump</i>	1999
50.	H1-GM-1C	4000	1541 HP	2979	Westinghouse	<i>Lean Amine Pump</i>	1999
51.	H1-GM-4A	4000	536 HP	1483	Westinghouse	<i>Lean Amine Booster Pump</i>	1999
52.	H1-GM-4B	4000	536 HP	1483	Westinghouse	<i>Lean Amine Booster Pump</i>	1999
53.	H3-GM-6A	4000	300 HP	2970	Westinghouse	<i>Depropanizer Reflux Pump</i>	1999
54.	H3-GM-6B	4000	300 HP	2970	Westinghouse	<i>Depropanizer Reflux Pump</i>	1999
55.	H3-GM-6C	4000	300 HP	2970	Westinghouse	<i>Depropanizer Reflux Pump</i>	1999

Sumber : *Electrical Distribution Module PT Badak NGL*

Lampiran 10 – Typical Generator Data

Table 5.1 Typical Machine Data for Solid Rotor Machine

Parameter	50 MVA ST	30 MVA GT	300 MVA Fossil	600 MVA Nuclear
MVA	50	120	300	600
KV	13.8	13.8	13.8	18.0
H	6	3.3	4	3.5
D	1	1	1	1
X_d	2.13	1.65	1.3	1.9
X_d'	0.26	0.26	0.25	0.29
X_d"	0.18	0.18	0.23	0.22
X_q	1.98	1.58	1.75	1.75
X_q'	0.37	0.41	0.47	0.44
X_q"	0.18	0.18	0.23	0.22
T_{do}'	5.44	5.32	4.8	6.8
T_{do}"	0.02	0.03	0.35	0.035
T_{qo}'	0.57	0.38	1.50	0.41
T_{qo}"	0.04	0.07	0.07	0.07
X_l	0.16	0.08	0.15	0.15

Sumber : Natarajan (2002 : 5.13)



Lampiran 11 – Typical AVR Data

Table 4.3. Typical data for AVR control systems

Parameter	Low	Values Typical	High
G_a	250	500	1500
T_a	0.01	0.04	0.1
K_f	0.02	0.05	0.1
T_{f1}	0.1	0.4	0.6
T_{f2}	0.3	1.5	2.5
$V_{\max}$	5.0	15.0	20.0
$V_{\min}$	0.0	0.0	0.0
K_e	1.0	1.0	1.0
T_e	0.05	0.4	1.2
S_{E75}	0.45	0.75	0.96
S_{E100}	0.80	0.90	0.96
A	0.07	0.08	0.1
B	0.4	0.5	0.6
G_z	0.3	0.35	0.4
T_{r1}	0.01	0.02	0.03
T_{r2}	0.01	0.02	0.03
K_{da}	0.03	0.04	0.06

Sumber : Sheldrake (2003 : 97)

Lampiran 12 – Typical Turbine Data

Table 2.7. Typical data for simulating gas-turbine control systems

Parameter	Low	Values Typical	High
H note i)	1.2	1.5	2.0
G_h	0.25	0.33	0.42
C_w	1.0	1.0	1.0
K_{g1}	1.0	1.0	1.0
T_{g1}	0.05	0.01	0.015
K_{g2} note ii)	10.0	20.0	40.0
T_{g2}	0.02	0.04	0.15
K_{dg}	0.02	0.04	0.08
T_{g3}	0.25	0.50	0.75
T_{g4}	1.0	1.50	1.75
T_{f1}	0.01	0.02	0.05
$f_{\max}$	1.2	1.35	1.5
$f_{\min}$	-0.2	-0.15	0
K_{f1}	1.0	1.0	1.0
T_{f1}	0.3	0.6	0.9
T_{f2}	1.2	1.4	2.0
K_{f2}	0.4 (1.0)	0.5 (1.0)	0.6 (1.0)
K_{c1}	0.4 (0)	0.5 (0)	0.6 (0)
T_{c1}	T_{t2} (0)	T_{t2} (0)	T_{t2} (0)
$C_{\max}$	1.1 (0)	1.2 (0)	1.3 (0)
$C_{\min}$	0	0	0
K_{a1}	2.0 (0)	2.5 (0)	3.0 (0)
C_{a2}	0.38 (0)	0.4 (0)	0.42 (0)
C_{z1}	0.38 (0)	0.4 (0)	0.42 (0)
C_{z2}	0.48 (0)	0.5 (0)	0.52 (0)

Notes:

i) $G_h = \frac{1.0}{2H}$

ii) $K_{g1}, K_{g2} \simeq$ a constant value

iii) Data in brackets () apply to the single-shaft mathematical model.

Sumber : Sheldrake (2003 : 58)

Lampiran 13 - Data Konduktor/Kabel

Table 9.21. Land based Installations. 8700/15,000 V. Cu/XLPE/PVC/AWA/PVC single core Cu/XLPE/PVC/SWA/PVC three cores

Nominal conductor area (mm ²)	Single core in trefoil		3 cores	
	Resistance at 90°C (ohm/km)	Reactance at 50 Hz (ohm/km)	Resistance at 90°C (ohm/km)	Reactance at 50 Hz (ohm/km)
16			1.47	0.147
25			0.927	0.138
35			0.668	0.129
50	0.494	0.144	0.494	0.123
70	0.343	0.135	0.343	0.115
95	0.248	0.129	0.248	0.109
120	0.196	0.124	0.196	0.105
150	0.159	0.121	0.159	0.102
185	0.128	0.117	0.128	0.0986
240	0.098	0.113	0.098	0.0952
300	0.080	0.108	0.080	0.0922
400	0.064	0.107	0.064	0.0893

Sumber : *Handbook of Electrical Engineering: For Practitioners in the Oil, Gas and Petrochemical Industry*, Alan L. Sheldrake

Lampiran 14 – Batas Tegangan Yang Disarankan

CC 2.0 Karakteristik Unjuk Kerja Jaringan

CC 2.1 P3B dan semua Pemakai Jaringan harus berusaha semaksimal mungkin agar pada setiap titik sambungan, unjuk kerja berikut ini dipenuhi:

- frekuensi nominal 50 Hz, diusahakan untuk tidak lebih rendah dari 49,5 Hz. atau lebih tinggi dari 50,5 Hz, dan selama waktu keadaan darurat (*emergency*) dan gangguan, frekuensi Sistem diizinkan turun hingga 47.5 Hz atau naik hingga 52.0 Hz sebelum unit pembangkit diizinkan keluar dari operasi;
- tegangan Sistem harus dipertahankan dalam batasan sebagai berikut:

Tegangan Nominal	Kondisi Normal
500 kV	+5%, -5%
150 kV	+5%, -10%
70 kV	+5%, -10%
20 kV	+5%, -10%

Sumber : Permen-ESDM 03-2007

Lampiran 15 – Simbol-Symbol Ketenagalistrikan

CCA3 7.0 Konvensi simbol

Item	Simbol	Keterangan
PMT tertutup		Berwarna penuh sesuai warna Rel
PMT terbuka		Kosong, tidak berwarna
PMS tertutup		Berwarna penuh sesuai warna Rel Dalam <i>single line diagram</i>
PMS terbuka		Blank, tidak berwarna Dalam <i>single line diagram</i>
PMS-tanah tertutup		Berwarna sesuai warna rel
PMS-tanah terbuka		Berwarna sesuai warna rel
PMT racked in		Berwarna penuh sesuai warna rel
PMT racked out		Blank, tidak berwarna
Generator		
Trafo 2 belitan		Berwarna sesuai warna rel
Trafo 3 belitan		Berwarna sesuai warna rel
Reaktor		Berwarna sesuai warna rel
Kapasitor		Berwarna sesuai warna rel
Status tegangan "on"		Putih
Status tegangan "off"		Tidak berwarna, <i>blank</i>

Lampiran 16 – Penomoran Generator, Busbar, & Transformator

➤ Penomoran Generator

No.	Generator	Kode Perangkat
1	30-PG-01	G-1
2	30-PG-02	G-2
3	30-PG-03	G-3
4	30-PG-04	G-4
5	30-PG-05	G-5
6	30-PG-06	G-6
7	30-PG-07	G-7
8	30-PG-08	G-8
9	30-PG-09	G-9
10	30-PG-10	G-10
11	30-PG-11	G-11
12	30-PG-12	G-12
13	30-PG-13	G-13
14	30-PG-14	G-14
15	30-PG-15	G-15

➤ Penomoran Transformator & Rating Perangkat

No.	Trafo	Kode Rating Perangkat	Vp (kV)	Vs (kV)	Daya (kVA)
1	TR-01	PT-13	13,8	0,48	1500
2	TR-02	PT-14	13,8	4,16	3500
3	TR-03	PT-15	13,8	4,16	7500
4	TR-04	PT-16	13,8	0,48	1000
5	TR-05	PT-17	13,8	0,48	1000
6	TR-06	PT-18	13,8	0,48	1000
7	TR-07	PT-21	13,8	0,22	1000
8	TR-08	PT-23	13,8	0,48	1000
9	TR-09	PT-24	13,8	4,16	3500
10	TR-10	PT-25	13,8	4,16	7500
11	TR-11	PT-26	13,8	0,48	1000
12	TR-12	PT-27	13,8	0,48	1000
13	TR-13	PT-28	13,8	0,22	1000
14	TR-14	PT-31	13,8	0,48	1000
15	TR-15	PT-32	13,8	0,48	1500
16	TR-16	PT-33	13,8	4,16	7500
17	TR-17	PT-34	13,8	0,48	1000

No.	Trafo	Kode Rating Perangkat	Vp (kV)	Vs (kV)	Daya (kVA)
18	TR-18	PT-35	13,8	4,16	7500
19	TR-19	PT-36	13,8	0,22	1000
20	TR-20	PT-41	13,8	0,48	1000
21	TR-21	PT-42	13,8	0,48	1500
22	TR-22	PT-43	13,8	4,16	7500
23	TR-23	PT-44	13,8	0,48	1000
24	TR-24	PT-45	13,8	4,16	7500
25	TR-25	PT-46	13,8	0,22	1000
26	TR-26	PT-47	13,8	0,48	750
27	TR-27	PT-251	4,16	0,48	750
28	TR-32	PT-51	13,8	4,16	2000
29	TR-33	PT-52	13,8	4,16	7500
30	TR-34	PT-54	13,8	0,48	1500
31	TR-35	PT-55	13,8	4,16	7500
32	TR-36	PT-57	13,8	4,16	7500
33	TR-37	PT-61	13,8	4,16	2000
34	TR-38	PT-62	13,8	4,16	7500
35	TR-39	PT-64	13,8	0,48	1500
36	TR-40	PT-65	13,8	4,16	7500
37	TR-41	PT-66	13,8	4,16	10000
38	TR-42	PT-67	13,8	4,16	7500
39	TR-43	PT-71	13,8	4,16	7500
40	TR-44	PT-72	13,8	4,16	7500
41	TR-45	PT-73	13,8	4,16	7500
42	TR-46	PT-74	13,8	0,48	1250
43	TR-47	PT-75	13,8	4,16	7500
44	TR-48	PT-77	13,8	4,16	7500
45	TR-49	PT-81	13,8	4,16	7500
46	TR-50	PT-82	13,8	4,16	7500
47	TR-51	PT-83	13,8	4,16	7500
48	TR-52	PT-84	13,8	0,48	1250
49	TR-53	PT-85	13,8	4,16	7500
50	TR-54	PT-87	13,8	4,16	7500

➤ Transformator Tiga-Fasa Tiga-Belitan

No.	Trafo	Kode Rating Perangkat	Vp (V)	Vs (V)	Vt (V)	Daya (kVA)
1	TR-28	PT-101	34500	13800	13800	15000
2	TR-29	PT-102	34500	13800	13800	15000
3	TR-30	PT-103	34500	13800	13800	15000
4	TR-31	PT-104	34500	13800	13800	15000
5	TR-55	PT-101	34500	13800	13800	15000
6	TR-56	PT-102	34500	13800	13800	15000
7	TR-57	PT-103	34500	13800	13800	15000
8	TR-58	PT-104	34500	13800	13800	15000

➤ **Penomoran Busbar (PV Bus, PQ Bus)**

No.	Bus	Kode Perangkat	No.	Bus	Kode Perangkat
1	1	PS-1	43	43	PS-341
2	2	PS-2	44	44	PS-441
3	3	PS-3	45	45	PS-461
4	4	PS-4	46	46	PS-101
5	5	PS-PG-01	47	47	PS-102
6	6	PS-PG-02	48	48	PS-103
7	7	PS-PG-03	49	49	PS-104
8	8	PS-PG-04	50	50	PS-5
9	9	PS-PG-05	51	51	PS-6
10	10	PS-PG-06	52	52	PS-7
11	11	PS-PG-07	53	53	PS-8
12	12	PS-PG-08	54	54	PS-PG-09
13	13	PS-13	55	55	PS-PG-11
14	14	PS-14	56	56	PS-PG-12
15	15	PS-15	57	57	PS-PG-10
16	16	PS-16	58	58	PS-PG-15
17	17	PS-17	59	59	PS-PG-13
18	18	PS-18	60	60	PS-PG-14
19	19	PS-21	61	61	PS-51
20	20	PS-23	62	62	PS-52
21	21	PS-24	63	63	PS-54
22	22	PS-25	64	64	PS-55
23	23	PS-26	65	65	PS-57
24	24	PS-27	66	66	PS-61
25	25	PS-28	67	67	PS-62
26	26	PS-31	68	68	PS-64
27	27	PS-32	69	69	PS-65
28	28	PS-33	70	70	PS-66
29	29	PS-34	71	71	PS-67
30	30	PS-35	72	72	PS-71
31	31	PS-36	73	73	PS-72
32	32	PS-37	74	74	PS-73
33	33	PS-41	75	75	PS-74
34	34	PS-42	76	76	PS-75
35	35	PS-43	77	77	PS-77
36	36	PS-44	78	78	PS-81
37	37	PS-45	79	79	PS-82
38	38	PS-46	80	80	PS-83
39	39	PS-47	81	81	PS-84
40	40	PS-161	82	82	PS-85
41	41	PS-251	83	83	PS-87
42	42	PS-261	84	84	PS-541

No.	Bus	Kode Perangkat
85	85	PS-641
86	86	PS-741
87	87	PS-841
88	88	PS-201
89	89	PS-202
90	90	PS-203
91	91	PS-204
92	92	PS101/102
93	93	PS201/202

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Lampiran 17 - Perhitungan dan Data Parameter Konduktor

➤ Data Saluran Antar-Bus

No.	Dari-	Ke-	Panjang saluran (km)	R at 90 (Ω/km)	X at 50 Hz (Ω/km)	R (Ω)	X (Ω)	R (p.u.)	X (p.u.)	Description
										Line FDR
1	46	47	0,080	0,064	0,0893	0,00512	0,00714	0,0004201	0,0005861	30FDR-12, 3/C,4/0, 2405m,500mm ²
2	47	48	0,076	0,064	0,0893	0,00486	0,00679	0,0003991	0,0005568	30FDR-12, 3/C,4/0, 2405m,500mm ²
3	48	49	0,036	0,064	0,0893	0,00230	0,00321	0,0001890	0,0002638	30FDR-12, 3/C,4/0, 2405m,500mm ²
4	49	46	0,085	0,064	0,0893	0,00544	0,00759	0,0004463	0,0006228	30FDR-12, 3/C,4/0, 2405m,500mm ²
5	88	89	0,080	0,064	0,0893	0,00512	0,00714	0,0004201	0,0005861	30FDR-12, 3/C,4/0, 2405m,500mm ²
6	89	90	0,076	0,064	0,0893	0,00486	0,00679	0,0003991	0,0005568	30FDR-12, 3/C,4/0, 2405m,500mm ²
7	90	91	0,036	0,064	0,0893	0,00230	0,00321	0,0001890	0,0002638	30FDR-12, 3/C,4/0, 2405m,500mm ²
8	91	88	0,085	0,064	0,0893	0,00544	0,00759	0,0004463	0,0006228	30FDR-12, 3/C,4/0, 2405m,500mm ²

(Sumber : Hasil perhitungan, $S_{\text{base}} = 15.625 \text{ MVA}$, $V_{\text{base}} = 13.8 \text{ kV}$)

➤ Data Saluran Melalui Trafo Tiga-Fasa Tiga-Belitan

No.	Dari-	Ke-	Keterangan	R (trafo)	X (Trafo)	R (line_1)	X (line_1)	R (line_2)	X (line_2)	R (Total)	X (Total)
			(melalui)	(p.u)	(p.u)	(p.u)	(p.u)	(p.u)	(p.u)	(p.u)	(p.u)
1.	1	2	TR-28	0,00001641	0,00001641	0,00042008	0,00070232	0,000603865	0,001009586	0,00104035	0,00172832
2.	1	2	TR-29	0,00001641	0,00001641	0,00039908	0,00066720	0,000399076	0,000667205	0,00081456	0,00135082
3.	3	4	TR-30	0,00001641	0,00001641	0,00042008	0,00070232	0,00078765	0,001316852	0,00122414	0,00203558
4.	3	4	TR-31	0,00001641	0,00001641	0,00036232	0,00060575	0,000362319	0,000605752	0,00074105	0,00122791
5.	50	51	TR-55	0,00001641	0,00001641	0,00028700	0,00018411	0,00033918	0,00021759	0,00064259	0,00041811
6.	50	51	TR-56	0,00001641	0,00001641	0,00033918	0,00021759	0,00028700	0,00018411	0,00064259	0,00041811
7.	52	53	TR-57	0,00001641	0,00001641	0,00033918	0,00021759	0,00033918	0,00021759	0,00069477	0,00045159
8.	52	53	TR-58	0,00001641	0,00001641	0,00027395	0,00017574	0,00027395	0,00017574	0,00056432	0,00036790

(Sumber : Hasil perhitungan, $S_{\text{base}} = 15.625 \text{ MVA}$, $V_{\text{base}} = 13.8 \text{ kV}$)

➤ Data Saluran PV bus ke Ring-Bus Dengan Level Tegangan 34,5 kV

No.	Dari-	Ke-	R (trafo)	X (Trafo)	R (line)	X (line)	R Total	X Total
			(p.u)	(p.u)	(p.u)	(p.u)	(p.u)	(p.u)
1.	1	46	0,00001641	0,00001641	0,00042008	0,00070232	0,00043649	0,00071873
2.	1	47	0,00001641	0,00001641	0,00039908	0,00066720	0,00041549	0,00068361
3.	2	46	0,00001641	0,00001641	0,00060386	0,00100959	0,00062027	0,00102600
4.	2	47	0,00001641	0,00001641	0,00039908	0,00066720	0,00041549	0,00068361
5.	3	48	0,00001641	0,00001641	0,00042008	0,00070232	0,00043649	0,00071873
6.	3	49	0,00001641	0,00001641	0,00036232	0,00060575	0,00037873	0,00062216
7.	4	48	0,00001641	0,00001641	0,00078765	0,00131685	0,00080406	0,00133326
8.	4	49	0,00001641	0,00001641	0,00036232	0,00060575	0,00037873	0,00062216
9.	50	88	0,00001641	0,00001641	0,00028700	0,00018411	0,00030341	0,00020052
10.	50	89	0,00001641	0,00001641	0,00033918	0,00021759	0,00035559	0,00023400
11.	51	88	0,00001641	0,00001641	0,00033918	0,00021759	0,00035559	0,00023400
12.	51	89	0,00001641	0,00001641	0,00028700	0,00018411	0,00030341	0,00020052
13.	52	90	0,00001641	0,00001641	0,00033918	0,00021759	0,00035559	0,00023400
14.	52	91	0,00001641	0,00001641	0,00027395	0,00017574	0,00029036	0,00019215
15.	53	90	0,00001641	0,00001641	0,00033918	0,00021759	0,00035559	0,00023400
16.	53	91	0,00001641	0,00001641	0,00027395	0,00017574	0,00029036	0,00019215

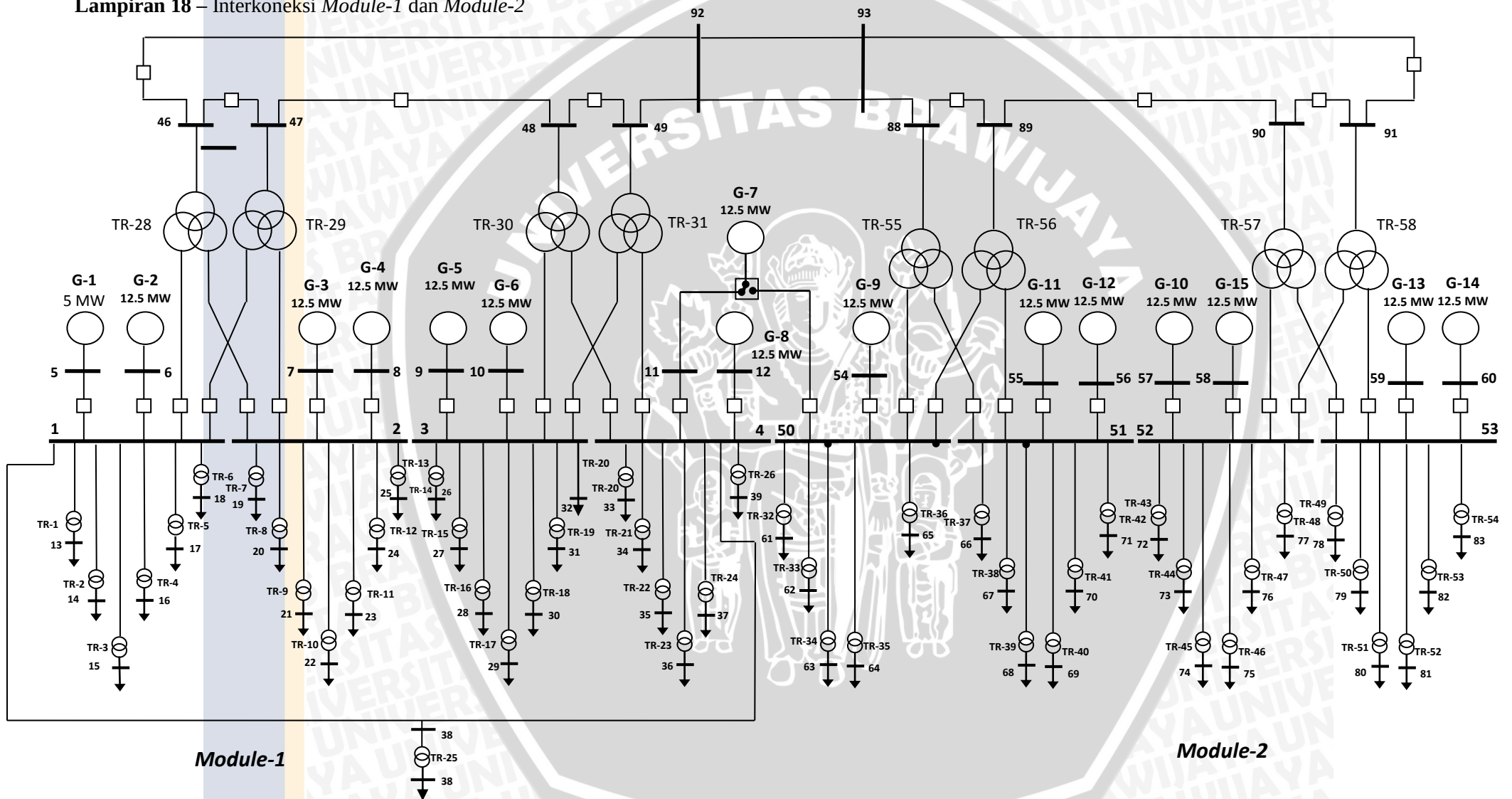
➤ Data Saluran

No.	Dari-	Ke-	Panjang saluran	R at 90	X at 50 Hz	R (Ω)	X (Ω)	R (p.u.)	X (p.u.)	Description
			(km)	(Ω/km)	(Ω/km)					Line FDR
1	1	36	2,40500	0,06400	0,10700	0,15392	0,25734	0,01262865	0,02111352	30FDR-12, 3/C,4/0, 2405m,400mm2
2	1	13	0,23000	0,06400	0,10700	0,01472	0,02461	0,00120773	0,00201917	30FDR-13, 3/C,4/0, 230m,400mm2
3	1	14	0,29500	0,06400	0,10700	0,01888	0,03157	0,00154904	0,00258981	30FDR-14, 3/C,4/0, 295m,400mm2
4	1	15	1,00000	0,06400	0,10700	0,06400	0,10700	0,00525100	0,00877901	30FDR-15A/B, 3/C,4/0, 1000m,400mm2
5	1	16	3,78200	0,06400	0,10700	0,24205	0,40467	0,01985927	0,03320222	30FDR-16A/B/C/D, 3/C,4/0, 3782m,400m2

No.	Dari-	Ke-	Panjang saluran (km)	R at 90 (Ω /km)	X at 50 Hz (Ω /km)	R (Ω)	X (Ω)	R (p.u.)	X (p.u.)	Description
Line FDR										
6	1	17	0,21300	0,06400	0,10700	0,01363	0,02279	0,00111846	0,00186993	30FDR-17 3/C,4/0, 213m,400mm ²
7	1	18	3,60400	0,06400	0,10700	0,23066	0,38563	0,01892460	0,03163956	30FDR-18, 3/C,4/0, 3604m,400mm ²
8	1	19	2,40500	0,06400	0,10700	0,15392	0,25734	0,01262865	0,02111352	30FDR-21, 3/C,4/0, 2405m,400mm ²
9	2	20	0,16400	0,06400	0,10700	0,01050	0,01755	0,00086116	0,00143976	30FDR-23, 3/C,4/0, 164m,400mm ²
10	2	21	0,27900	0,06400	0,10700	0,01786	0,02985	0,00146503	0,00244934	30FDR-24, 3/C,4/0, 279m,400mm ²
11	2	22	1,00000	0,06400	0,10700	0,06400	0,10700	0,00525100	0,00877901	30FDR-25A/B, 3/C,4/0, 1000m,400mm ²
12	2	23	3,85700	0,06400	0,10700	0,24685	0,41270	0,02025310	0,03386065	30FDR-26A/B/C/D, 3/C,4/0, 3857m,400mm ²
13	2	24	0,19700	0,06400	0,10700	0,01261	0,02108	0,00103445	0,00172947	30FDR-27, 3/C,4/0, 197m,400mm ²
14	2	25	3,72900	0,06400	0,10700	0,23866	0,39900	0,01958097	0,03273693	30FDR-28, 3/C,4/0, 3729m,400mm ²
15	3	26	0,32000	0,06400	0,10700	0,02048	0,03424	0,00168032	0,00280928	30FDR-31, 3/C,4/0, 320m,400mm ²
16	3	27	0,29500	0,06400	0,10700	0,01888	0,03157	0,00154904	0,00258981	30FDR-32, 3/C,4/0, 295m,400mm ²
17	3	28	1,00000	0,06400	0,10700	0,06400	0,10700	0,00525100	0,00877901	30FDR-33A/B, 3/C,4/0, 1000m,400mm ²
18	3	29	3,78200	0,06400	0,10700	0,24205	0,40467	0,01985927	0,03320222	30FDR-34A/B, 3/C,4/0, 3782m, 400mm ²
19	3	30	0,21300	0,06400	0,10700	0,01363	0,02279	0,00111846	0,00186993	30FDR-35, 3/C,4/0, 213m,400mm ²
20	3	31	1,50000	0,19600	0,10500	0,29400	0,15750	0,02412177	0,01292238	30FDR-36A/B, 3/C,4/0, 1500M,120mm ²
21	3	32	2,14000	0,09800	0,09520	0,20972	0,20373	0,01720686	0,01671524	30FDR-37, 3/C,4/0, 2140m,240mm ²
22	4	33	0,16400	0,06400	0,10700	0,01050	0,01755	0,00086116	0,00143976	30FDR-41, 3/C,4/0, 164m, 400mm ²
23	4	34	0,27900	0,06400	0,10700	0,01786	0,02985	0,00146503	0,00244934	30FDR-42, 3/C,4/0, 279m, 400mm ²
24	4	35	1,00000	0,06400	0,10700	0,06400	0,10700	0,00525100	0,00877901	30FDR-43A/B, 3/C,4/0, 1000m, 400mm ²
25	4	36	3,86700	0,06400	0,10700	0,24749	0,41377	0,02030561	0,03394844	30FDR-44A/B, 3/C,4/0, 3867m, 400mm ²
26	4	37	1,19700	0,06400	0,10700	0,07661	0,12808	0,00628544	0,01050848	30FDR-45, 3/C,4/0, 164m, 400mm ²
27	4	38	1,50000	0,06400	0,10700	0,09600	0,16050	0,00787650	0,01316852	30FDR-46A/B, 3/C,4/0, 1500m, 400mm ²
28	4	39	2,14000	0,06400	0,10700	0,13696	0,22898	0,01123714	0,01878709	30FDR-47, 3/C,4/0, 2140m, 400mm ²
29	50	61	0,20500	0,15900	0,10200	0,03260	0,02091	0,00267432	0,00171560	30FDR-51, 1-3/C, 205m, 150mm ²

No.	Dari-	Ke-	Panjang saluran (km)	R at 90 (Ω /km)	X at 50 Hz (Ω /km)	R (Ω)	X (Ω)	R (p.u.)	X (p.u.)	Description
			(km)	(Ω /km)	(Ω /km)					Line FDR
30	50	62	0,23000	0,15900	0,10200	0,03657	0,02346	0,00300045	0,00192482	30FDR-52-2, 2-3/C, 230m, 150mm ²
31	50	63	1,21500	0,15900	0,10200	0,19319	0,12393	0,01585022	0,01016806	30FDR-55A/B, 2-3/C, 1215m, 150mm ²
32	50	64	1,78200	0,15900	0,10200	0,28334	0,18176	0,02324699	0,01491316	30FDR-56A/B, 2-3/C, 1782m, 150mm ²
33	50	65	0,21300	0,08000	0,09220	0,01704	0,01964	0,00139808	0,00161129	30FDR-57, 2-3/C, 213m, 300mm ²
34	51	66	0,27600	0,15900	0,10200	0,04388	0,02815	0,00360054	0,00230978	30FDR-61, 2-3/C, 276m, 150mm ²
35	51	67	0,24100	0,15900	0,10200	0,03832	0,02458	0,00314395	0,00201688	30FDR-62, 2-3/C, 241m, 150mm ²
36	51	68	2,16400	0,08000	0,09220	0,17312	0,19952	0,01420395	0,01637005	30FDR-64A/B, 2-3/C, 2164m, 300mm ²
37	51	69	1,27900	0,15900	0,10200	0,20336	0,13046	0,01668513	0,01070367	30FDR-65A/B, 2-3/C, 1279m, 150mm ²
38	51	70	1,00000	0,15900	0,10200	0,15900	0,10200	0,01304545	0,00836878	30FDR-66A/B, 2-3/C, 1000m, 150mm ²
39	51	71	0,25700	0,15900	0,10200	0,04086	0,02621	0,00335268	0,00215078	30FDR-67, 2-3/C, 257m, 150mm ²
40	52	72	0,29500	0,15900	0,10200	0,04691	0,03009	0,00384841	0,00246879	30FDR-71, 2-3/C, 295m, 150mm ²
41	52	73	1,00000	0,15900	0,10200	0,15900	0,10200	0,01304545	0,00836878	30FDR-72, 2-3/C, 1000m, 150mm ²
42	52	74	0,21600	0,15900	0,10200	0,03434	0,02203	0,00281782	0,00180766	30FDR-73, 2-3/C, 216m, 150mm ²
43	52	75	0,21300	0,08000	0,09220	0,01704	0,01964	0,00139808	0,00161129	30FDR-74, 2-3/C, 213m, 300mm ²
44	52	76	0,21400	0,15900	0,10200	0,03403	0,02183	0,00279173	0,00179092	30FDR-75, 2-3/C, 214m, 150mm ²
45	52	77	3,60400	0,15900	0,10200	0,57304	0,36761	0,04701579	0,03016107	30FDR-77, 2-3/C, 3604m, 150mm ²
46	53	78	0,295	0,159	0,102	0,04691	0,03009	0,0038484	0,0024688	30FDR-81, 2-3/C, 295m, 150mm ²
47	53	79	1	0,159	0,102	0,159	0,102	0,0130455	0,0083688	30FDR-82, 2-3/C, 1000m, 150mm ²
48	53	80	0,216	0,159	0,102	0,03434	0,02203	0,0028178	0,0018077	30FDR-83, 2-3/C, 216m, 150mm ²
49	53	81	0,213	0,08	0,0922	0,01704	0,01964	0,0013981	0,0016113	30FDR-84, 2-3/C, 213m, 300mm ²
50	53	82	0,214	0,159	0,102	0,03403	0,02183	0,0027917	0,0017909	30FDR-85, 2-3/C, 214m, 150mm ²
51	53	83	3,604	0,159	0,102	0,57304	0,36761	0,0470158	0,0301611	30FDR-87, 2-3/C, 3604m, 150mm ²

(Sumber : Hasil perhitungan, $S_{\text{base}} = 15.625 \text{ MVA}$, $V_{\text{base}} = 13.8 \text{ kV}$)

Lampiran 18 – Interkoneksi *Module-1* dan *Module-2*

Lampiran 19 - Data Dinamik Generator

No.	Parameter	PG-2 s.d PG-14 (Kecuali PG-7 & PG-15)	PG-1	PG-7 & PG-15	Satuan
1.	S	1	0,502	1,2	p.u.
2.	R	0,001	0,003	0,001	p.u.
3.	X _d	2,13	1,40	1,650	p.u.
4.	X' _d	0,26	0,35	0,260	p.u.
5.	X'' _d	0,18	0,25	0,180	p.u.
6.	X _q	1,98	0,80	1,580	p.u.
7.	X' _q	0,37	-	0,410	p.u.
8.	X'' _q	0,18	-	0,180	p.u.
9.	X _l	0,16	0,16	0,080	p.u.
10.	T _{d'} o	5.44	5,50	5,320	s
11.	T _{d''} o	0,02	0,04	0,030	s
12.	T _{q'} o	0,57	-	0,380	s
13.	T _{q''} o	0,04	0,06	0,070	s
14.	H	6	1,50	3,30	kJ/kVA
15.	D	1	0	1,0	-

Lampiran 20 – Data Transformator

No.	Kode Trafo	Trafo	Vp (kV)	Vs (kV)	Daya (kVA)	Z (%)	(X/R)	R (p.u ; baru)	X (p.u ; baru)
1	TR-1	30PT-13	13,8	0,48	1500	7,12	6,2	0,01134	0,07029
2	TR-2	30PT-14	13,8	4,16	3500	5,5	7,0	0,00778	0,05445
3	TR-3	30PT-15	13,8	4,16	7500	5,76	7,0	0,00815	0,05702
4	TR-4	32PT-16	13,8	0,48	1000	5,76	6,2	0,00917	0,05687
5	TR-5	30PT-17	13,8	0,48	1000	7,12	6,2	0,01134	0,07029
6	TR-6	30PT-18	13,8	0,48	1000	7,12	6,2	0,01134	0,07029
7	TR-7	30PT-21	13,8	0,22	1000	7,12	7,2	0,00979	0,07052
8	TR-8	30PT-23	13,8	0,48	1000	7,0	6,2	0,01115	0,06911
9	TR-9	30PT-24	13,8	4,16	3500	5,5	7,0	0,00778	0,05445
10	TR-10	30PT-25	13,8	4,16	7500	5,85	7,0	0,00827	0,05791
11	TR-11	32PT-26	13,8	0,48	1000	5,66	6,2	0,00901	0,05588
12	TR-12	30PT-27	13,8	0,48	1000	7,04	6,2	0,01121	0,06950
13	TR-13	30PT-28	13,8	0,22	1000	7,12	7,2	0,00979	0,07052
14	TR-14	30PT-31	13,8	0,48	1000	7,13	6,2	0,01135	0,07039
15	TR-15	30PT-32	13,8	0,48	1500	5,62	6,8	0,00818	0,05560
16	TR-16	30PT-33	13,8	4,16	7500	5,85	7,0	0,00827	0,05791
17	TR-17	32-PT-34	13,8	0,48	1000	7,0	6,2	0,01115	0,06911
18	TR-18	30-PT-35	13,8	4,16	7500	5,85	7,0	0,00827	0,05791
19	TR-19	30PT-36	13,8	0,22	1000	7,12	7,2	0,00979	0,07052
20	TR-20	30PT-41	13,8	0,48	1000	6,96	6,2	0,01108	0,06871
21	TR-21	30PT-42	13,8	0,48	1500	5,69	6,8	0,00828	0,05630
22	TR-22	30PT-43	13,8	4,16	7500	5,81	7,0	0,00822	0,05752
23	TR-23	32-PT-44	13,8	0,48	1000	6,94	6,2	0,01105	0,06852
24	TR-24	30-PT-45	13,8	4,16	7500	5,88	7,0	0,00832	0,05821
25	TR-25	30PT-46	13,8	0,22	1000	7,12	7,2	0,00979	0,07052
26	TR-26	24PT-47	13,8	0,48	750	5,88	2,9	0,01929	0,05555
27	TR-32	30PT-51	13,8	4,16	2000	8,08	7,0	0,01143	0,07999
28	TR-33	30PT-52	13,8	4,16	7500	5,6	7,0	0,00792	0,05544
29	TR-34	32PT-54	13,8	0,48	1500	5,69	6,8	0,00828	0,05630
30	TR-35	31PT-55	13,8	4,16	7500	5,52	7,0	0,00781	0,05465
32	TR-36	31PT-57	13,8	4,16	7500	5,63	7,0	0,00796	0,05573

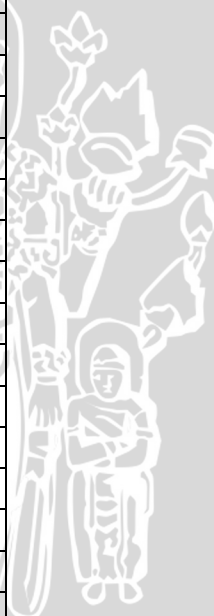
33	TR-37	30PT-61	13,8	4,16	2000	7,83	7,0	0,01107	0,07751
34	TR-38	30PT-62	13,8	4,16	7500	5,6	7,0	0,00792	0,05544
35	TR-39	32PT-64	13,8	0,48	1500	5,69	6,8	0,00828	0,05630
36	TR-40	31PT-65	13,8	4,16	7500	5,5	7,0	0,00778	0,05445
37	TR-41	30PT-66	13,8	4,16	10000	5,7	7,0	0,00806	0,05643
38	TR-42	31PT-67	13,8	4,16	7500	5,68	7,0	0,00803	0,05623
39	TR-43	31PT-71	13,8	4,16	7500	5,5	7,0	0,00778	0,05445
40	TR-44	30PT-72	13,8	4,16	7500	5,65	7,0	0,00799	0,05593
41	TR-45	24PT-73	13,8	4,16	7500	5,62	7,0	0,00795	0,05564
42	TR-46	31PT-74	13,8	0,48	1250	5,5	6,4	0,00849	0,05434
43	TR-47	31PT-75	13,8	4,16	7500	6,41	7,0	0,00907	0,06346
44	TR-48	31PT-77	13,8	4,16	7500	5,41	7,0	0,00765	0,05356
45	TR-49	31PT-81	13,8	4,16	7500	5,5	7,0	0,00778	0,05445
46	TR-50	30PT-82	13,8	4,16	7500	5,43	7,0	0,00768	0,05375
47	TR-51	24PT-83	13,8	4,16	7500	5,51	7,0	0,00779	0,05455
48	TR-52	31PT-84	13,8	0,48	1250	5,5	6,4	0,00849	0,05434
49	TR-53	31PT-85	13,8	4,16	7500	6,31	7,0	0,00892	0,06247
50	TR-54	31PT-87	13,8	4,16	7500	5,41	7,0	0,00765	0,05356

Daya Dasar (S_{Base}) = 15.625 MVA

Tegangan Dasar (V_{Base}) = 13.8 kV

Lampiran 21 – Data Pembebanan

No.	Pembebanan	Kode Beban	P (p.u)	Q (p.u.)
1	13	PS-13	0,02953	0,01830
2	14	PS-14	0,05742	0,03558
3	15	PS-15	0,16492	0,10221
4	16	PS-16	0,07264	0,04502
5	17	PS-17	0,00909	0,00563
6	18	PS-18	0,19114	0,11846
7	19	PS-21	0,01357	0,00841
8	20	PS-23	0,09087	0,05632
9	21	PS-24	0,09242	0,05728
10	22	PS-25	0,30233	0,18737
11	23	PS-26	0,69780	0,44723
12	24	PS-27	0,05452	0,03379
13	25	PS-28	0,09061	0,05615
14	26	PS-31	0,07270	0,04505
15	27	PS-32	0,02726	0,01689
16	28	PS-33	0,16523	0,10240
17	29	PS-34	0,46839	0,29028
18	30	PS-35	0,09871	0,06118
19	31	PS-36	0,26103	0,16177
20	32	PS-37	0,21122	0,13090
21	33	PS-41	0,05452	0,03379
22	34	PS-42	0,03635	0,02253
23	35	PS-43	0,15330	0,09501
24	36	PS-44	0,66918	0,41472
25	37	PS-45	0,31272	0,19381
26	38	PS-46	0,20186	0,12510
27	39	PS-47	0,04089	0,02534
28	61	PS-51	0,03635	0,02253
29	62	PS-52	0,23782	0,14739
30	63	PS-54	0,48073	0,29793
31	64	PS-55	0,25435	0,15763
32	65	PS-57	0,26898	0,16670
33	66	PS-61	0,02673	0,02272
34	67	PS-62	0,12595	0,07806
35	68	PS-64	0,23808	0,14749
36	69	PS-65	0,14180	0,08788
37	70	PS-66	0,50238	0,31135
38	71	PS-67	0,17401	0,10784



No.	Pembebanan	Kode Beban	P (p.u)	Q (p.u.)
39	72	PS-71	0,18827	0,11668
40	73	PS-72	0,12384	0,07675
41	74	PS-73	0,09030	0,05596
42	75	PS-74	0,87570	0,54271
43	76	PS-75	0,06815	0,04224
44	77	PS-77	0,11033	0,06838
45	78	PS-81	0,13049	0,08087
46	79	PS-82	0,23289	0,14433
47	80	PS-83	0,06809	0,04220
48	81	PS-84	0,88342	0,54749
49	82	PS-85	0,21606	0,13390
50	83	PS-87	0,02726	0,01689



Lampiran 21 – Unit Pembangkitan & Kilang PT Badak NGL Bontang-Kaltim



Unit Pembangkit

Facilities	
LNG Train, unit	8
LNG Tank cap, m ³	630,000
LPG Tank cap, m ³	200,000
Boiler cap, Ton Steam/hrs	7,000
Power Generator, MW	180
Sea Cooling Water Pump, m ³ /hrs	330,000
Loading Dock, unit	3
Production Capacity	
LNG, mtpa	22.5
LPG, mtpa	1.02
Condensate, Mbbl/y	1.0

1977	1983	1989	1993	1997	1999
Tr. A/B	Tr. C/D	LPG Tr. E	Tr. F TADD	Tr. G	Tr. H
Producers and Buyers					
Gas producers		Total Indonesia, VICO, Chevron			
LNG Buyers		Japan, Taiwan, Korea			

8 Unit Kilang LNG - PT Badak NGL (Train A/B/C/D & E/F/G/H)

Module-1
(Train A/B/C/D)
Utilities-1

Module-1
(Train A/B/C/D)
Utilities-1

Lampiran 22 – Diagram Simulasi PSAT

Berikut ini ditampilkan data dan hasil simulasi yang meliputi:

1. Diagram Simulasi *Captive Module-1*
2. Diagram Simulasi *Captive Module-2*
3. Diagram Simulasi Interkoneksi *Module-1* dan *Module-2*

