




Business Continuity Manual

Business Continuity Plan: E1 Emergency Power System

| | | Signature | Revision | Effective Date |
|-------------|---|---|----------|----------------|
| Updated By | Senior Manager E&E, TSI |  James Ng | 35 | May 2024 |
| Reviewed By | Assistant General Manager BCP, SSBC |  Emily Chu | | |
| Approved By | General Manager SSBC |  David Jea | | |

Blank Page

BCP – E1. Emergency Power Systems Table of Contents

| <u>ITEM</u> | <u>SUBJECT MATTER</u> | <u>PAGE</u> |
|---|---|--------------------|
| Part I – Emergency Power Systems (Terminal) | | |
| A | System Description | E1.5 |
| B | Physical System Risk | E1.7 |
| C | Contingency Procedures for Power Distribution System | E1.7 |
| D | Contingency Procedures during the Tropical Cyclones | E1.10 |
| E | Cyber Security | E1.10 |
| F | Interface with Other Operational Organizations during Contingency | E1.11 |
| Part II – Emergency Power Systems (Airfield) | | |
| A | System Description | E1.12 |
| B | Contingency Procedures for Emergency Power Supply | E1.14 |
| C | Cyber Security | E1.15 |

Blank Page

Part I - Emergency Power Systems (Terminal)

A. System Description

1.0 Emergency Generator

- 1.1 There are six sets of 11kV 5MVA emergency generators located at Generator House 1 (GH1). In case of CLP supply failure at any of 11kV substations at T1, these emergency generators will automatically start up via Generator Interfacing Panel (GIP) from Intelligent Protection, Automation, Control and Supervisory (IPACS) / High Voltage Supervisory Control and Data Acquisition (HVSCADA) system to provide backup power supply to essential services and other airport critical systems in T1.
- 1.2 A remote start push button of emergency generator was installed at PA, PB, PC & PH switch station in T1. In case of automatic generator start signal in Intelligent Protection, Automation, Control and Supervisory (IPACS) / High Voltage Supervisory Control and Data Acquisition (HVSCADA) system is mal-function, the remote start push button should be pressed manually to operate the emergency generator.
- 1.3 The 4MVA Battery Energy Storage System (BESS) located at GH1 will automatically start up and synchronize with the emergency generators as backup power supply to essential services and other airport critical systems in T1.
- 1.4 The emergency power system of APM Depot, T2 APM, T1 Annex, Ground Transportation Lounge (GTL), Ground Transportation Centre (GTC), SkyPier Terminal, T1 Satellite Concourse, T1 Midfield Concourse and Sky Bridge consists of LV Generators and is used to backup main power supply. When the main power is lost, the Emergency Power System would automatically cut-in within 15 seconds and provide power supply to those equipment classified as “essential”.
- 1.5 In normal operation, main power feeder supplies power to both essential and non-essential loads while the local LV emergency generators are on standby status. When city main power is unstable or loss, the generators would automatically startup and changeover to supply power to the essential loads within 15 seconds, while non-essential loads would be shed from power supply. When city main power recovers, the system would automatically resume to normal operation status, i.e. main power would be changeover and restore all essential and non-essential loads, generator would automatically turn off.

1.6 Generator Schedule

| Station | Rating | Room No. |
|--|--|--------------------------------|
| Ground Transportation Centre (GTC) | 1713 KVA | 4G041 |
| CP4 | 85 KVA | Generator room |
| Limousine Lounge | 300 KVA | 3L017 |
| HKIAT | 1500 KVA | Zone 98 3NT020 |
| HKIAT 2 | 1 no. 480kVA | G/F FS Genset Room |
| | 1 no. 2500kVA | G/F Non FS Genset Room |
| HKIA Commercial Building | 1500 KVA | 3ST020 |
| GH1 - 6 x HV gensets - Battery Energy Storage System | 6 nos. 5000 KVA | 1L012 |
| | 1 no. 4000 kVA | |
| SkyPier Terminal | 2nos. 1600 KVA | 4P005 |
| | 1no. 1250 KVA | Generator room |
| | 3 nos. 1675 KVA | Generator room |
| T1 Satellite Concourse | 1500 KVA | 8NC104 |
| | 1100 KVA | 8NC103 |
| T1 Midfield Concourse | 1 no. 2500kVA 1 no. 2000kVA 2 nos. 1500kVA 1 no. 1250kVA 2 nos. 1000kVA 1 nos. 200kVA | T1 Midfield Generator Rooms |

| | | |
|------------------------------------|----------------|------------------|
| Sky Bridge | 1 no. 800kVA | 6SB219 |
| | 1 no. 1362kVA | 5SB224 |
| Chiller Building | 1 nos. 2270kVA | Generator Room |
| | 3 nos. 1710kVA | |
| T1 Annex | 2 nos. 2250kVA | 3CP4008 |
| | 1250kVA | 3A017 |
| Ground Transportation Lounge (GTL) | 37kVA | Generator Room |
| South Annex Building | 2000kVA | 0SA005 |
| | 3 nos. 2250kVA | 0SA001, 032, 092 |
| | 825kVA | 0SA035 |
| APM Depot | 2 nos. 2015kVA | 3ND003 |
| | 2500kVA | 3ND012 |

B. Physical System Risk

| Risk | Description | Mitigation |
|-------------|---|--|
| Trespassers | Unauthorized operation of the equipment | Master Key System had been applied for the access control of the GH 1, all LV switch rooms and LV generator rooms. |
| Fire | Damage of equipment due to fire | Protected by smoke detectors / Pre-action system |

C. Contingency Planning

1.0 Criteria for activating contingency plan

- 1.1 In case of power failure, the related generator(s) will be automatically activated.
- 1.2 The 11KV system changeover and the status situation can be remotely monitored on HVSCADA workstations.

2.0 Services and manpower involved

Duty Switching Operator must be the Authorized Person as defined in the Procedure TS-I-P/T/003 “Electrical System – Operation and Maintenance”, who shall be registered and authorized by AA.

3.0 Contingency Procedures

| Step | Immediate Action to be taken | Work Location | Responsible person |
|------|---|---|---|
| 1 | <ul style="list-style-type: none"> Alert FRT & Ad-hoc Emergency Team for GH1 auto start up function failure. | <ul style="list-style-type: none"> FRTMO | <ul style="list-style-type: none"> Duty System Controller or his delegate |
| 2 | <ul style="list-style-type: none"> Inform IAC, TOD, LD and Manager, Electrical Services Maintenance for GH1 auto start up function failure. | <ul style="list-style-type: none"> FRTMO | <ul style="list-style-type: none"> Duty System Controller or his delegate |
| 3 | <ul style="list-style-type: none"> Switch the local / auto selector to local at generator control panel. Ad-hoc emergency team's A.P. should be standby at GH1. Inform CLP Power System Control Center | <ul style="list-style-type: none"> GH1 | <ul style="list-style-type: none"> FRT's Authorized Person Ad-hoc Emergency Team's A.P. |
| 4 | <ul style="list-style-type: none"> In case of power failure, carry out emergency power restoration under manual switching sequence if necessary. | <ul style="list-style-type: none"> GH1 | <ul style="list-style-type: none"> Duty System Controller or his delegate Maintenance Contractor Authorized Persons Ad-hoc Emergency Team's A.P. |
| 5 | <ul style="list-style-type: none"> Call maintenance contractor to take follow-up action and carry out fault rectification of the auto function of the emergency power supply system within 4 hours. | <ul style="list-style-type: none"> GH1 | <ul style="list-style-type: none"> Maintenance Team |
| 6 | <ul style="list-style-type: none"> If the system is resumed, reinstate the auto / local selector switch to auto after obtain approval. | <ul style="list-style-type: none"> GH1 | <ul style="list-style-type: none"> Duty System Controller or his delegate Maintenance Contractor Authorized Persons Ad-hoc Emergency Team's A.P. |
| 7 | <ul style="list-style-type: none"> Inform IAC, TOD, LD, Manager, Electrical Services Maintenance and CLP Power System Control Center after emergency power system resumed to normal condition. | <ul style="list-style-type: none"> FRTMO | <ul style="list-style-type: none"> Duty System Controller or his delegate |

D Contingency Procedures during the passage of Tropical Cyclones

- 1.1 When typhoon signal no. 1 or above is hoisted, maintenance contractor shall be alerted by TSI Typhoon Support Team or Assistant Manager, Fault Response for performing the typhoon precautionary work such as electrical plant rooms inspection with checklist to ensure the electrical system are under normal condition when instructed.
- 1.2 TSI Typhoon Support Team shall coordinate with maintenance contractor to provide typhoon duty staff roster to ensure sufficient manpower as stipulated in the maintenance contract, with all necessary tools and equipment to perform the typhoon precautionary work in a safe and efficient manner.
- 1.3 After lowering of the typhoon signal and completion of the inspection of all electrical plant rooms and ensure the electrical system are under normal condition, TSI Typhoon Support Team may official dismiss maintenance contractor's typhoon precautionary team

E. Cyber Security

System cyber security threat level based on the following risk rating:

| Threat Level | System |
|--------------|---|
| Low | System uses no IT-based systems. |
| Medium | System uses some closed data-collection and/or alarm systems based on sensors or IoT devices. |
| High | System uses integrated SCADA systems, cloud-based data collections systems, or IP-based monitoring and control systems. |

- Emergency Power Systems (Terminal) – Threat Level: High

Rationale for threat level

System uses HVSCADA and IPACS system for monitoring the status of the HV distribution system and GBMS system for monitoring the status of the LV distribution system.

Mitigation actions taken

Access to the locations of system workstations are restricted. Only authorized person is allowed to control the system. Further action may be taken on the results of the TS OT Systems Information System Cybersecurity Vulnerabilities survey.

In case of suspected cyber-attack, Risk & Cybersecurity Team of ITD shall be informed for further investigation.

F. Interface with Other Operational Organizations during Contingency

- 1.1 FRTMO
- 1.2 IAC
- 1.3 CLP Power System Control Center
- 1.4 TOD
- 1.5 LD

Part II - Emergency Power Systems (Airfield)

A. System Description

1.0 Introduction

- 1.1 AAHK Airfield Infrastructure Power Network is composed by city main CLP power and Emergency Power System. The emergency power system consists of LV Generators and is used to backup city main power supply. When the city main CLP power is lost, the Emergency Power System would automatically cut-in within 15 seconds and provide power supply to those equipment classified as “essential”.
- 1.2 In normal operation, city main CLP power feeder supplies power to both essential and non-essential loads while the local LV emergency generators are on standby status. When city main power is unstable or loss, the generators would automatically startup and changeover to supply power to the essential loads within 15 seconds, while non-essential loads would be shed from power supply. When city main power recovers, the system would automatically resume to normal operation status, i.e. city main power would changeover, and restore all essential and non-essential loads, and generators would automatically turn off.
- 1.3 In case of local LV generator failure, three mobile LV generators could be mobilized and provide power to the essential loads.
- 1.4 The LV substations and the respective backup LV generators are tabulated as below:

| No. | Generator Set | Rating | Backup S/S | Load Description |
|-----|---------------|-------------|------------|--|
| 1 | GL1 | 2 x 1000kVA | V | AGL Vault B, Security check point 1, Gate house 3, Customs point and Communication room CR71. |
| 2 | GL2 | 2 x 1000kVA | M | AGL Vault A, Communication room CR58, Fence lighting, ILS for CAD facilities building (GP, LLZ and New GBAS & Antenna Platform) |
| 3 | GL3 | 1 x 1500kVA | X | Sewage pump station 4 & 5, Aviation fuel system in forward area, AOC, Eastern Airfield Tunnel, Government facilities MET enclosure; Northern Fire Fighting Station. |
| 4 | GL4 | 1500kVA | I | Apron lighting in Cargo Terminal area, fence lighting, Gate House 3, Eastern Airfield Tunnel, ILS for CAD facilities building (GP) |
| 5 | GL5 | 1000kVA | H | Fence lighting, Gate House 1, TCSS |
| 6 | GL7 | 1000kVA | Q, N | S/S Q: Apron Lighting, Sewage pump station 8, Fence Lighting, Oil separator & pumping station 4. S/S N: Security system, communication system, AGMB |

Airport Authority Hong Kong
Business Continuity Manual: BCP – E1. Emergency Power System

| No. | Generator Set | Rating | Backup S/S | Load Description |
|-----|---------------------------------|-----------------------------|---------------------------------|--|
| 7 | GL8 | 1000kVA | R | Oil separator & pumping station 1, TCSS, communication system |
| 8 | GL13 | 2 x 1250kVA | Z | AGL Vault C, Vault C Extension, Vault C Annex, Magnetic flowmeter and ILS for CAD facilities building (GP, LLZ & ATF) |
| 9 | GL14 | 2 x 1250kVA | P | AGL Vault D, Vault D Extension, Vault D Annex, Magnetic flowmeter and ILS for CAD facilities building (GP, LLZ & ATF) |
| 10 | GL6 | 1500kVA | L, D | S/S L: Aviation fuel system, Sewage pump station 7. S/S D: Apron lighting in general aviation/fire training pad area, Southern Fire Fighting Station, HKO underground equipment at SRW. |
| 11 | GL10 | 1000kVA | S | Sewage pump station 1 & 6, Waste treatment plant, TCSS |
| 12 | GL11 | 1500kVA | T | Sewage pumps station 2F, 2G 12F & 12G, Gate House 2 & ILS for CAD facilities building (LLZ). |
| 13 | GL12 | 1 x 1000kVA, 1 x 1500kVA | AD | HV Generator House 1, AAB, Gate House 1, GTC civil drainage sump pump 11, Vehicle Examination Centre. Backup IAC. |
| 14 | MG1 | 100kVA | -- | Mobile Generator |
| 15 | MG2 | 1500 kVA | -- | Mobile Generator |
| 16 | MG3 | 200kVA | -- | Mobile Generator |
| 17 | Generator – MSUB – G1 | 250kVA | Midfield South Utility Building | -FS Fire Pump System -Essential light & power at South Runway Road |
| 18 | Generator – MSUB - G2 | 1030kVA | Midfield South Utility Building | - South Runway Road of Storm Water Pump - SCADA / Comms System - Lighting at Underpass Road |
| 19 | Generator - Chiller Building G1 | 1650kVA | Chiller Building | -MCC-101 for Chiller Pump No.1, Associated FWP, CDWP, CHWP & Cooling Tower -Communication Room 74 |
| 20 | Generator - Chiller Building G2 | 1650kVA | Chiller Building | -MCC-102 for Chiller Pump No.2, Associated FWP, CDWP, CHWP & Cooling Tower |
| 21 | Generator - Chiller Building G3 | 1650kVA | Chiller Building | -MCC-105 for Chiller Pump No.5, Associated FWP, CDWP, CHWP & Cooling Tower |
| 22 | Generator - Chiller Building G4 | 2250kVA | Chiller Building | -MCC-104 for Chiller Pump No.4, Associated FWP, CDWP, CHWP & Cooling Tower |
| 23 | Generator – Substation B13 | 1250kVA | Substation B13 | - HML302 and pillar box |

Airport Authority Hong Kong
Business Continuity Manual: BCP – E1. Emergency Power System

| No. | Generator Set | Rating | Backup S/S | Load Description |
|-----|--|----------------------------|------------------------------------|--|
| 24 | Generator – Ancillary Building 1 (AB1) | 1250kVA | Ancillary building 1 | -Communication Room CR224 -Essential light & power in LV switch room |
| 25 | Generator - New T1 midfield screening building | 275kVA | New T1 midfield screening building | FS Equipment and Standby Power for HML L413 and L423 |
| 26 | Generator - LV plant room no.3 | 1600kVA | LV plant room no.3 | Western Tunnel light (North) control panel , Tunnel Light and Power, Tunnel Sump Pump and Jet Fan |
| 27 | Generator - LV plant room no.4 | 1100kVA | LV plant room no.4 | Western Tunnel light (South) control panel , Tunnel Light and Power, Tunnel Sump Pump and Jet Fan |
| 28 | Generator - Vault D extension | 200kVA | Vault D extension | 1. Standby Power for HML M24, M34 and M36, 2. Essential light & power in LV switch room, Essential light & power in AGL room |
| 29 | Generator – IAC | 1 x 1700kVA, 1 x 400kVA | IAC | Essential light & power for IAC |
| 30 | Generator – Substation 2 | 1500kVA | Substation 2 | Essential power for Comms equipment and fence lighting |
| 31 | Generator – ARE Store and Interim ATC Tower | 1 x 750kVA 1 x 800kVA | ARE Store & Interim ATC Tower | Essential power for ATC Equipment Room, HKO Equipment Room and AGL Equipment Room |
| 32 | Generator - Vault E | 2 x 1500kVA | Vault E | AGL Vault E, Vault E communication room, HKO equipment, HKPF equipment and ILS for CAD facilities building (GP, LLZ & ATF). |
| 33 | Generator - Vault F | 2 x 1500kVA | Vault F | AGL Vault F, Vault F communication room, HKO equipment and ILS for CAD facilities building (GP, LLZ & ATF). |
| 34 | MG4 | 1500kVA | -- | Mobile Generator |

B. Contingency Procedures for Emergency Power Supply

1.0 Criteria for activating contingency plan

- 1.1 In case of power failure (interruption of AAHK 11kV Airfield Infrastructure Power Network), generators will be automatically activated.
- 1.2 The system changeover and the status situation can be remotely monitored on Airfield-SCADA workstations.
- 1.3 If the local generators failed to activate or malfunction, contingency measures shall be initiated by Fault Response Team (FRT) to mobilize mobile generators.

2.0 Services and manpower involved

- 2.1 All works execution involving emergency restoration shall be undertaken by appropriate Registered Electrical Worker (REW) with appropriate permitted work code.
- 2.2 All works shall comply with the latest edition of Electricity Ordinance (Cap.406), EMSD's Code of Practice for the Electricity (Wiring) Regulations and Procedure TS-I-P/T/003 "Electrical System – Operation and Maintenance".
- 2.3 Towing of mobile generator be executed by qualified person who possess appropriate Towing Vehicle License issued by Transportation Department, HKSAR Government and Airside Driving permit.

3.0 Contingency Procedures

- 3.1 When power interruption or outage is found at airfield infrastructure power network, FRT shall report the incident to IAC-ACC and notify the related AM immediately.
- 3.2 FRT shall notify the maintenance contractor(s) and coordinate to identify the affected areas and recovery time. FRT shall verify if local generator(s) has successfully changeover.
- 3.3 If the local generator fails to start up or mal-function after initiation, FRT shall immediately mobilize mobile generator(s) to the affected substation(s). FRT shall coordinate to connect mobile generator(s) to the affected substation(s).
- 3.4 If the mobile generator fails to start up or mal-function after initiation, FRT shall report the status and affected facilities to IAC-ACC. FRT shall coordinate with maintenance contractor for the emergency repair of mobile generator.

- 3.5 FRT shall initiate emergency repair for the affected electrical network facilities. If the system fault is related to CLP Power supply side, FRT shall coordinate with CLP Power for the update system status and the recovery time.
 - 3.6 For prolonged power suspension anticipated, FRT shall coordinate with maintenance contractor on the diesel fuel refilling for generators.
 - 3.7 When electrical supply is resumed normal, FRT shall verify the electrical supply restoration of all switching stations and the affected generators resume to standby mode. FRT shall notify IAC-ACC and AM for system recovery.
- 4.0 Interface with other operational organizations during contingency
- 4.1 IAC-ACC
 - 4.2 IAC-LD
 - 4.3 CAD - ATC
 - 4.4 TSI
- 5.0 Data preservation procedures

FRT shall provide a comprehensive report for the incidence with content include but not limit to, action logs, data logs retrieved from Airfield SCADA, incidence diagnosis etc.

C. Cyber Security

System cyber security threat level based on the following risk rating:

| Threat Level | System |
|--------------|---|
| Low | System uses no IT-based systems. |
| Medium | System uses some closed data-collection and/or alarm systems based on sensors or IoT devices. |
| High | System uses integrated SCADA systems, cloud-based data collections systems, or IP-based monitoring and control systems. |

- Emergency Power Systems (Airfield) – Threat Level: High

Rationale for threat level

System uses Airfield SCADA system for monitoring the status of the LV distribution system.

Mitigation actions taken

Access to the locations of system workstations are restricted. Only authorized person is allowed to control the system. Further action may be taken on the

results of the TS OT Systems Information System Cybersecurity Vulnerabilities survey.

In case of suspected cyber-attack, Risk & Cybersecurity Team of ITD shall be informed for further investigation.

End of BCP – E1

Blank Page