

Appendix 5 Cost Estimation Borne by the Recipient Country

No.	Item	Q'ty	Cost
1	Removal of VHF Radio Communication Equipment at Mt. Phulchoki	1 lot	N.Rupee 156,200
	Total		N.Rupee 156,200 (US\$ 2,304)

US\$1 = N.Rupee 67.8

Appendix 6-1 TIA Power Capacity Calculation

1. Load List

	Load Item	Load Capacity (kVA)	Demand Factor (%)	Load for Transformer (kVA)	Load for Generator (kVA)
A	Radar operation building				
a	UPS 30kVA	45	100	45	45
b	Building power load	26	70	18.2	18.2
c	Building lighting load	25	60	15	15
B	Existing operation building			105	105
a	Calculated from existing panel(DP-4) current 150A $150(A) \times 400(V) \times 1.73 = 103.8 \rightarrow 105kVA$				
b	UPS 10kVA	15	100	15	15
C	Future load	20	100	20	0
	Total load			218.2	198.2

2. Capacity to be required for Transformer

$$\begin{aligned} \text{Transformer capacity(kVA)} &= \text{Total load for transformer} \times \text{Safety margin} \\ \text{Safety margin} &= 20\% \\ &= 218.2 \times 1.2 = 261.8 \end{aligned}$$

Then, rated capacity of 300kVA is selected because of being just above 261.8 kVA

3. Capacity to be required for Generator set

$$\begin{aligned} \text{3-1 Generator capacity(kVA)} &= \text{Total load for Generator} \times \text{Safety margin} \\ \text{Safety margin} &= 10\% \\ &= 198.2 \times 1.1 = 218.0 \end{aligned}$$

Compensation against surrounding condition

Output drop by surrounding condition is as follows.

Above altitude 150m, 3.5% drop per each 300m rise

Altitude of TIA is approx. 1400m

$$\{ (1400 - 150) \div 300 \} \times 3.5 = 14.6\%$$

$$218.0kVA \div (1 - 0.146) = 255.3kVA$$

Rated capacity of 250kVA is selected

3-2 Diesel engine out put PE(PS)

$$PE = PG \times PFG \div (0.736 \times \eta_g)$$

PG : Generator capacity 250

PFG: Power factor of load 0.8

η_g : Efficiency of generator 0.9

$$= 250 \times 0.8 \div (0.736 \times 0.9)$$

$$= 301.9 \text{ PS}$$

Output of diesel engine is more than 301.9 PS

Appendix 6-2 Saonthimi Training Center Power Capacity Calculation

1. Load List

	Load Item	Load Capacity (kVA)	Demand Factor (%)	Load for Transformer (kVA)	Load for Generator (kVA)
A	Training Center				
a	CVCF 30kVA	45	50	22.5	22.5
b	Radar Laboratory	10	100	10	10
c	Building power load	58	70	40.6	40.6
d	Building lighting load	35	60	21	21
	Total load			94.1	94.1

2. Capacity to be required for Generator set

$$\begin{aligned}
 \text{2-1 Generator capacity(kVA)} &= \text{Total load for Generator} \times \text{Safety margin} \\
 \text{Safety margin} &= 10 \% \\
 &= 94.1 \times 1.1 = 103.5 \text{ kVA}
 \end{aligned}$$

Compensation against surrounding condition

Output drop by surrounding condition is as follows.

Above altitude 150m, 3.5% drop per each 300m rise

Altitude of Saonthimi Training Center is approx.1400m

$$\{ (1400 - 150) \div 300 \} \times 3.5 = 14.6\%$$

$$103.5\text{kVA} \div (1 - 0.146) = 121.2\text{kVA}$$

Rated capacity of 150kVA is selected

2-2 Diesel engine output PE(PS)

$$PE = PG \times PFG \div (0.736 \times \eta g)$$

PG : Generator capacity 150

PFG: Power factor of load 0.8

ηg : Efficiency of generator 0.9

$$= 150 \times 0.8 \div (0.736 \times 0.9)$$

$$= 181.2\text{PS}$$

Output of diesel engine is more than 181.2 PS

Appendix 6-3 Phulchoki Repeater Station Power Capacity Calculation

1. Load List

	Load Item	Load Capacity (kVA)	Demand Factor (%)	Load for Transformer (kVA)	Load for Generator (kVA)
A	Air to ground radio				
a	DC charger(DC-48V)	2.7	100	2.7	2.7
b	DC charger(DC48V)	6.7	100	6.7	6.7
B	Building				
a	Building power load	5	70	3.5	3.5
b	Building lighting load	10	60	6	6
C	Other equipment	5	100	5	5
	Total load			23.9	23.9

2. Capacity to be required for AVR

$$\begin{aligned} \text{AVR capacity(kVA)} &= \text{Total load for transformer} \times \text{Safety margin} \\ \text{Safety margin} &= 20 \% \\ &= 23.9 \times 1.2 = 28.7 \end{aligned}$$

Then, rated capacity of 30kVA is selected because of being just above 28.7 kVA

3. Capacity to be required for Generator set

$$\begin{aligned} \text{3-1 Generator capacity(kVA)} &= \text{Total load for Generator} \times \text{Safety margin} \\ \text{Safety margin} &= 10 \% \\ &= 23.9 \times 1.1 = 26.3 \end{aligned}$$

Compensation against surrounding condition

Output drop by surrounding condition is as follows.

Above altitude 150m, 3.5% drop per each 300m rise

As altitude of Phulchoki Repeater Station is approx. 2,800m,

$$\{ (2,800 - 150) \div 300 \} \times 3.5 = 30.9 \%$$

$$26.3\text{kVA} \div (1 - 0.309) = 38.1 \text{ kVA}$$

Rated capacity of 37.5kVA is selected

3-2 Diesel engine out put PE(PS)

$$PE = PG \times PFG \div (0.736 \times \eta g)$$

PG : Generator capacity 38.5

PFG: Power factor of load 0.8

ηg : Efficiency of generator 0.9

$$= 37.5 \times 0.8 \div (0.736 \times 0.9)$$

$$= 42.5\text{PS}$$

Output of diesel engine is more than 42.5 PS

Appendix 6-4 Commercial Power Interruption of Sanothimi Radar Training Center
(11KV THIMI feeder from THIMI S/S OF NEA)

YEAR 1998 MONTH	LOAD SHEDDING		TRIPPING		SYSTEM FAILURE		TOTAL	
	TIMES	DURATION	TIMES	DURATION	TIMES	DURATION	TIMES	DURATION
JAN. - FEB.	6	3:03	2	0:14	0	0	8	3:17
FEB. - MAR.	6	8:53	2	0:10	6	1:12	14	10:15
MAR. - APR.	16	19:49	6	0:25	2	1:38	24	21:52
APR. - MAY.	8	20:23	9	0:40	7	7:40	24	28:43
MAY. - JUN.	33	68:04	11	0:55	1	1:45	45	70:44
JUN. - JUL.	36	70:44	3	0:15	3	0:45	42	71:44
JUL. - AUG.	0	0	5	0:17	4	0:18	9	0:35
AUG. - SEP.	5	9:57	0	0	4	5:08	9	15:05
SEP. - OCT.	12	6:14	4	0:20	9	2:19	25	8:53
OCT. - NOV.	14	12:53	2	0:10	1	0:17	17	13:02
NOV. - DEC.	11	15:27	7	0:22	4	0:42	22	16:31
DEC. - JAN.	14	10:51	2	0:43	1	0:08	17	11:42
TOTAL(year)	161	246:00	53	4:31	42	21:52	256	272:23

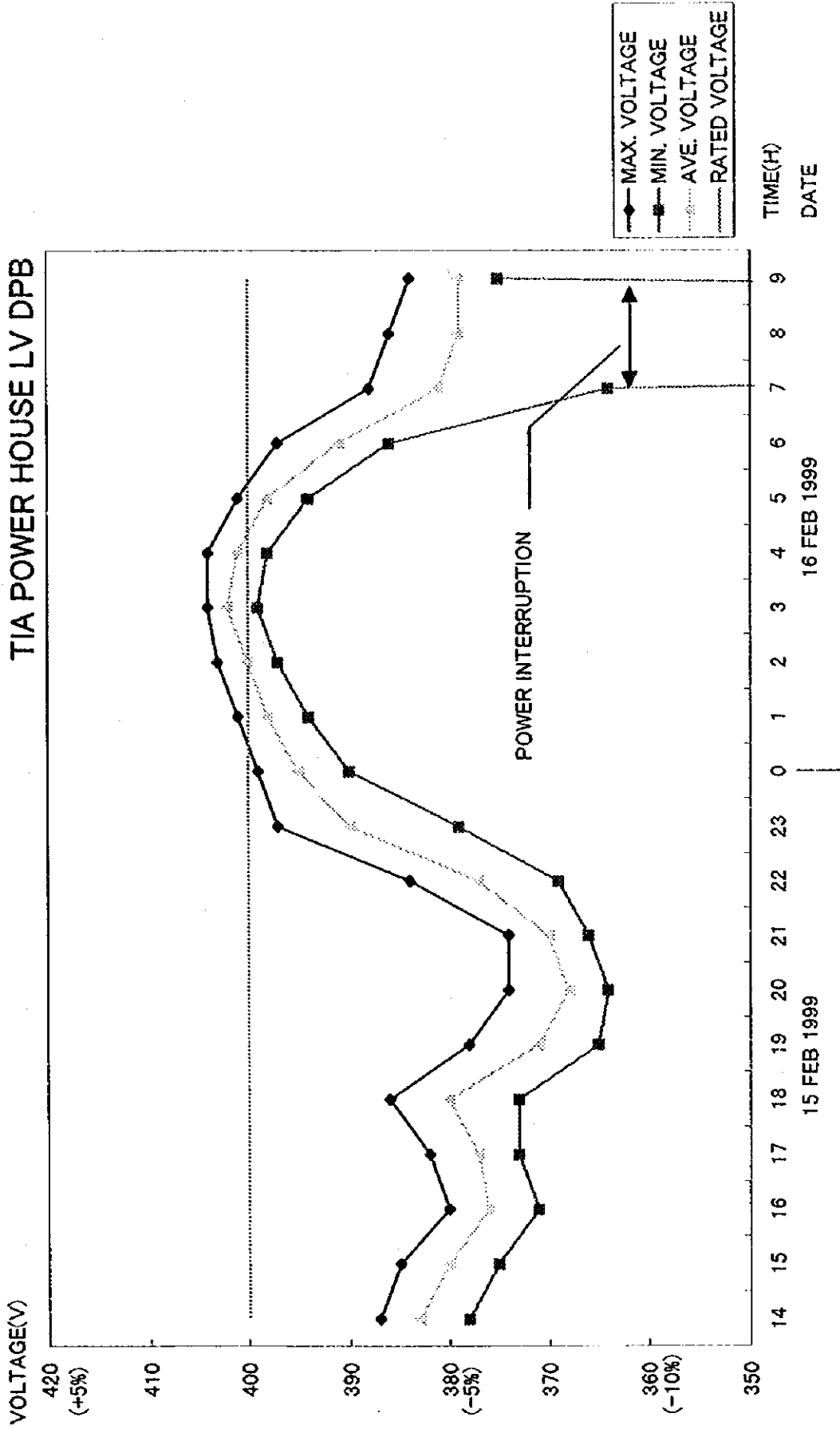
**Appendix 6-5 Commercial Power Interruption of Phulchoki Repeater Station
(11KV GODAWARI - I feeder from BANASWAR S/S of NEA)**

YEAR 1998 MONTH	LOAD SHEDDING		TRIPPING		SYSTEM FAILURE		TOTAL	
	TIMES	DURATION	TIMES	DURATION	TIMES	DURATION	TIMES	DURATION
JAN. - FEB.	0	0	12	5:49	0	0	12	5:49
FEB. - MAR.	4	7:55	6	1:32	3	1:04	13	10:31
MAR. - APR.	6	3:34	17	5:11	2	1:32	25	10:17
APR. - MAY.	2	2:28	29	8:44	10	6:04	41	17:16
MAY. - JUN.	24	59:40	13	2:56	3	2:00	40	64:36
JUN. - JUL.	26	60:55	25	18:49	1	0:39	52	80:23
JUL. - AUG.	12	22:53	14	9:37	1	0:33	27	33:03
AUG. - SEP.	6	3:32	16	5:05	14	5:57	36	14:34
SEP. - OCT.	7	5:45	14	0:39	6	2:17	27	8:41
OCT. -NOV.	0	0	11	1:37	0	0	11	1:37
NOV. - DEC.	4	8:00	12	1:32	3	1:01	19	10:33
DEC. -JAN.	9	17:29	11	1:19	0	0	20	18:48
TOTAL(year)	100	192:11	168	62:50	43	21:07	311	276:08

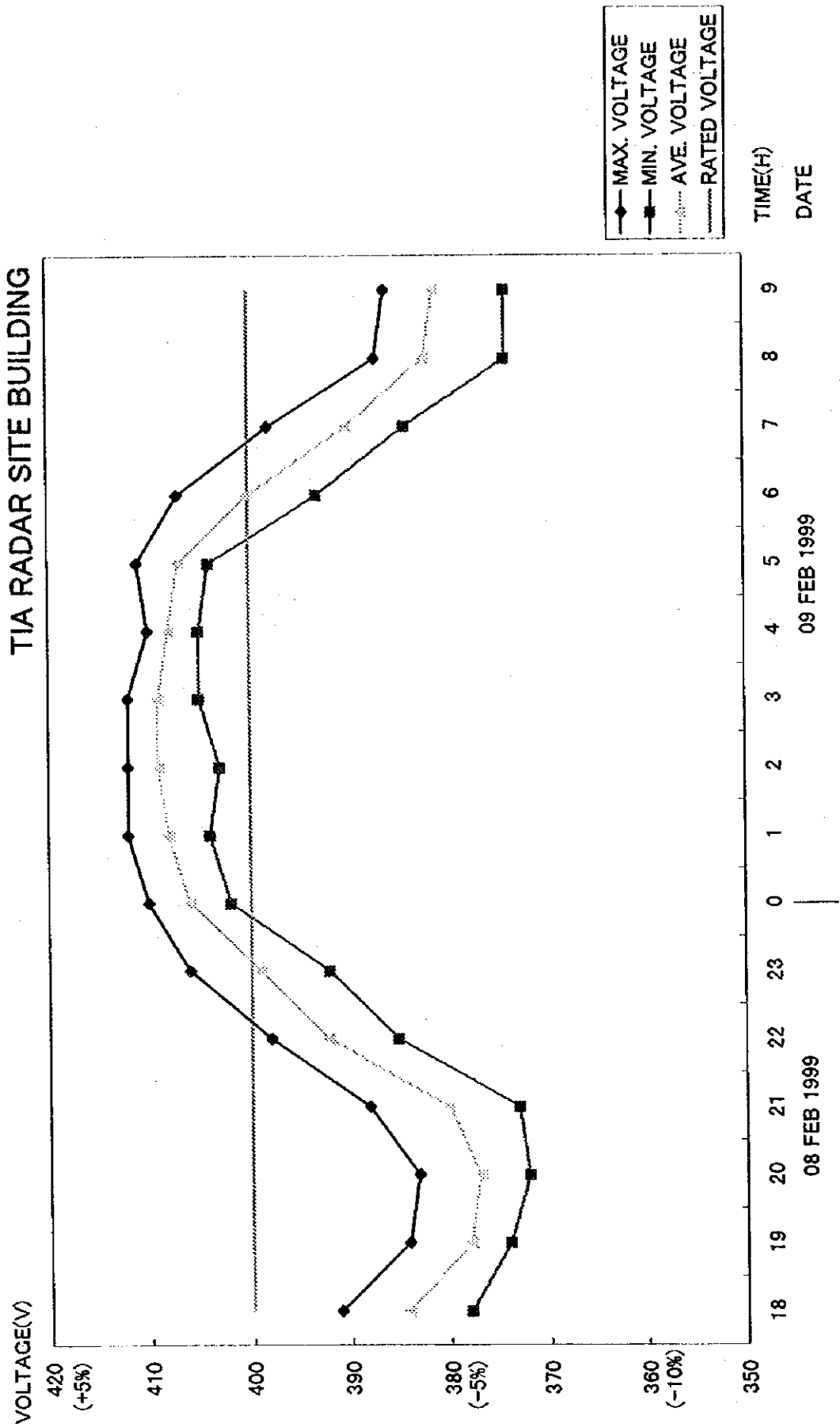
Appendix 6-6 Voltage Fluctuation of AC Power

Survey Site	Voltage Fluctuation	Percentage of Voltage Fluctuation	Date of Survey
TIA			
Power House LV DPB	364 ~ 404V	-9.0 ~ +1.0 %	15 ~ 16 FEB 1999
Radar Site Building	372 ~ 412V	-7.0 ~ +3.0%	08 ~ 09 FEB 1999
Radar Operation Building	368 ~ 400V	-8.0 ~ +0.0%	16 ~ 17 FEB 1999
Radar Operation Building UPS out put (Only for reference)	233 ~ 236V	-1.3 ~ +2.6%	17 FEB 1999
Sanothimi Training Center			
LV DPB	382 ~ 430V	-4.5 ~ +7.5%	12 ~ 13 FEB 1999
Mt.Phulchoki Repeater Station			
LV DPB	338 ~ 406V	-15.5 ~ +1.5 %	09 ~ 10 FEB 1999

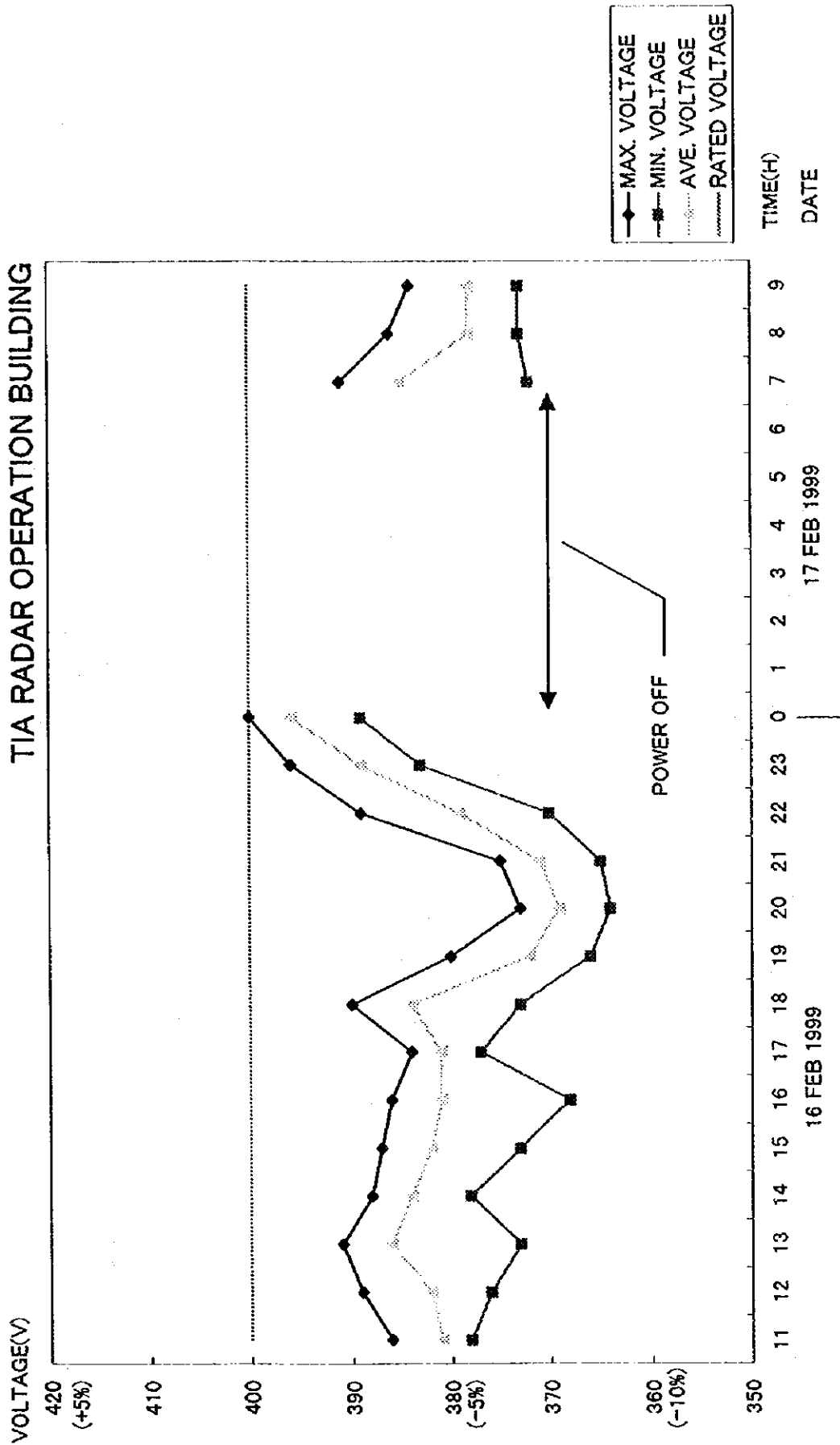
Appendix 6-6-1 Voltage Fluctuation
(TIA Power House)



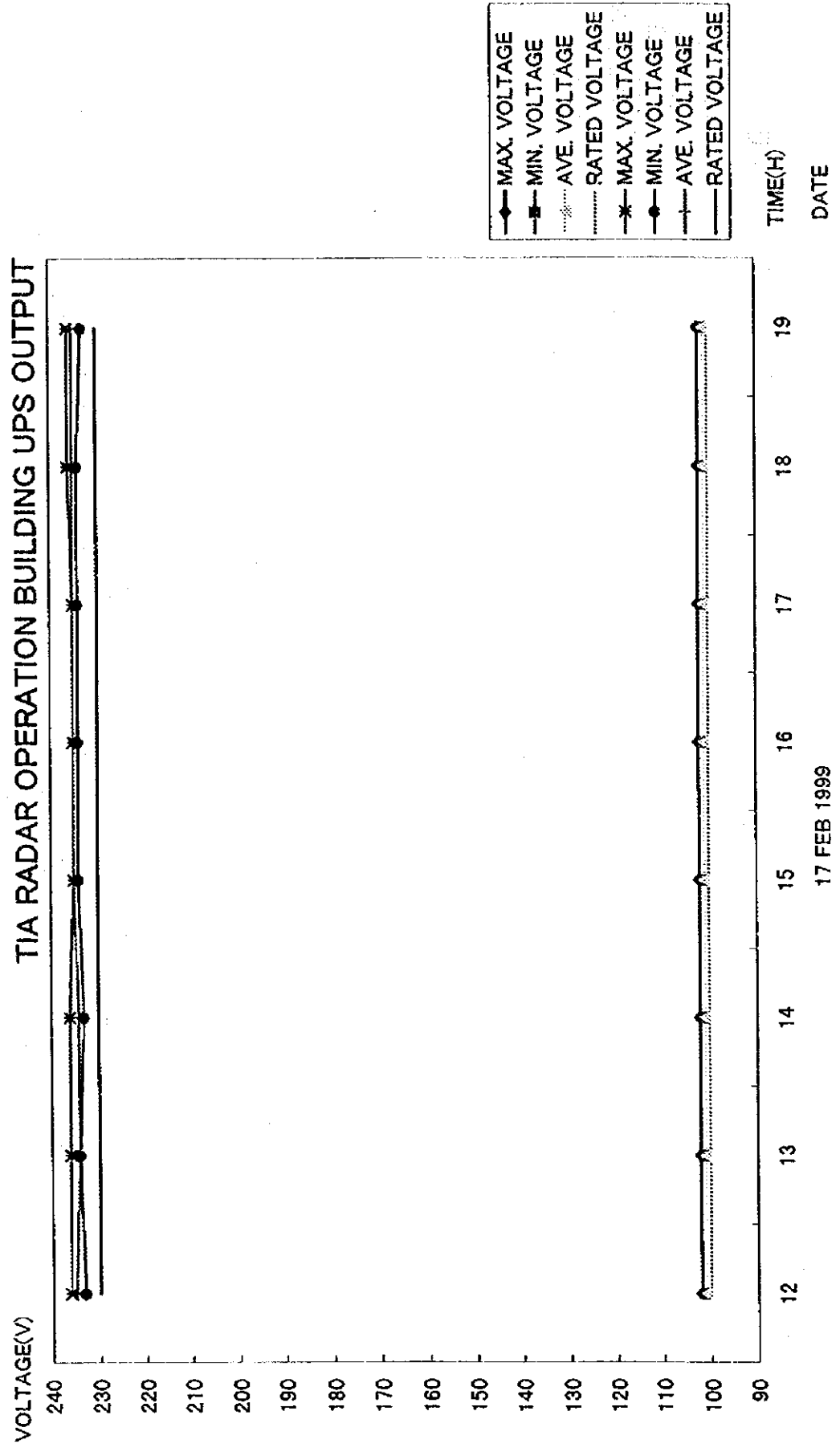
Appendix 6-6-2 Voltage Fluctuation
(Radar Site Building)



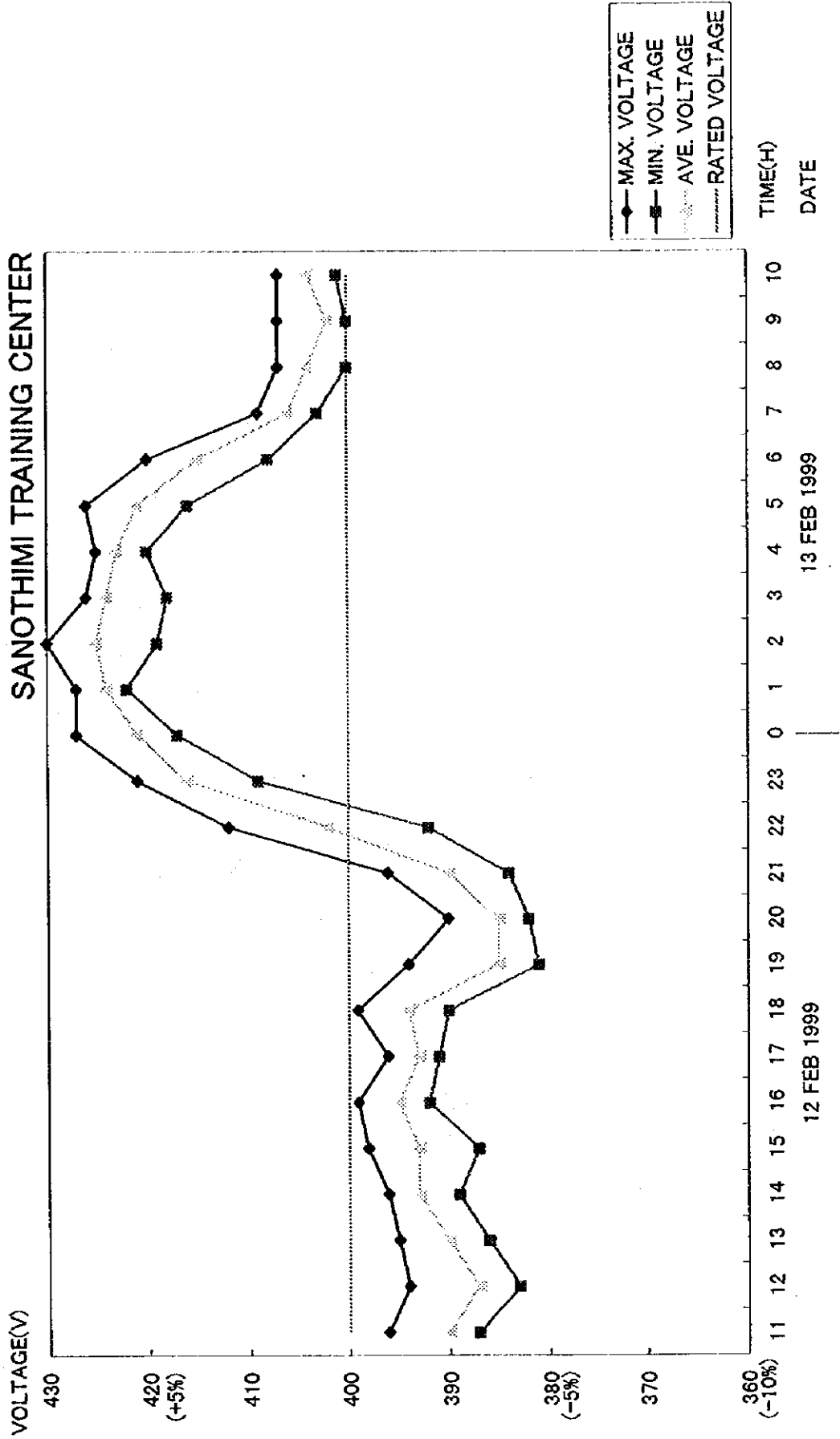
Appendix 6-6-3 Voltage Fluctuation
(TIA Radar Operation Building)



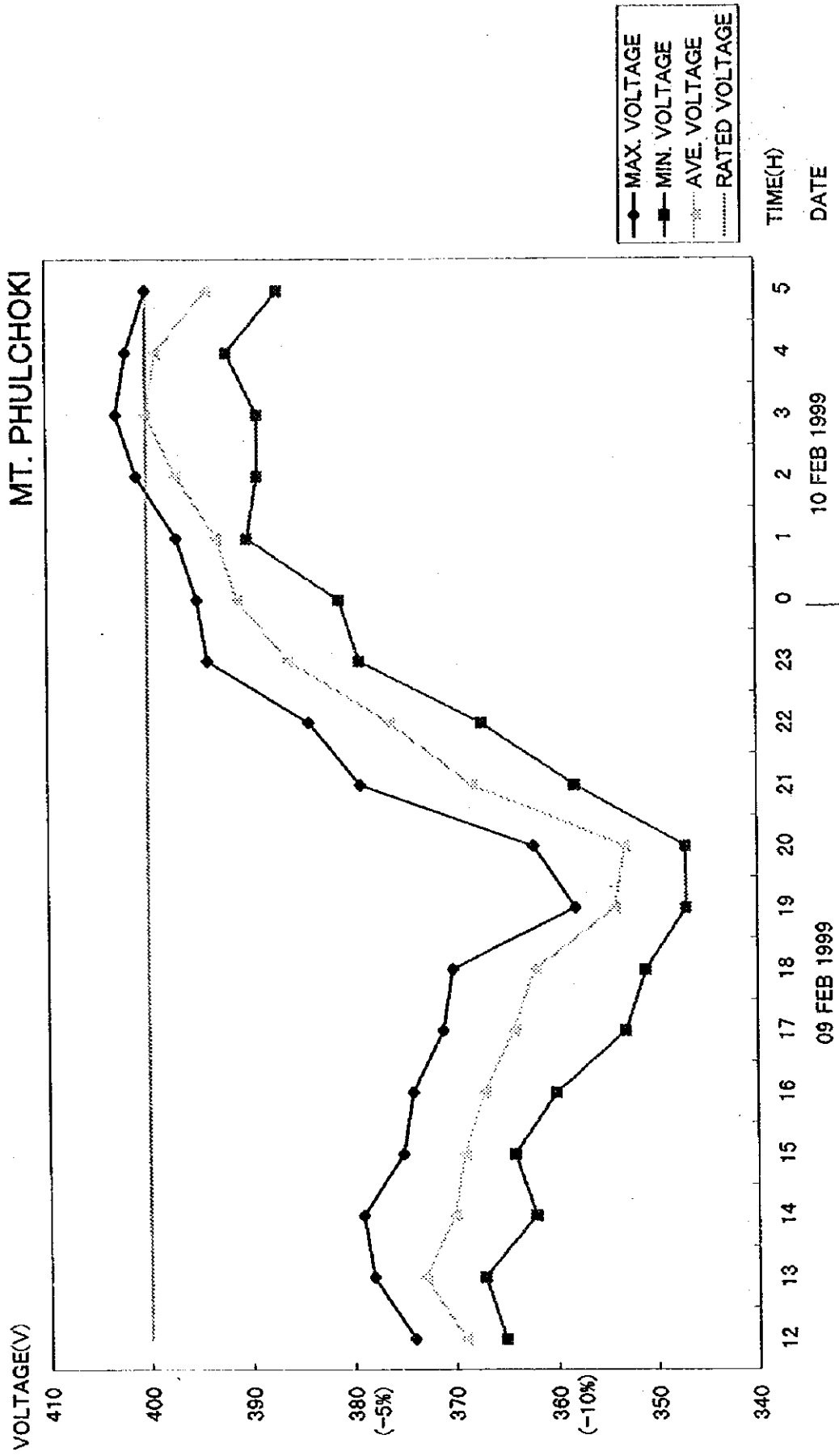
Appendix 6-6-4 Voltage Fluctuation
 (TIA Radar Operation Building UPS output)



Appendix 6-6-5 Voltage Fluctuation
(Sanothimi Training Center)



Appendix 6-6-6 Voltage Fluctuation
(Phulchoki Repeater Station)



Appendix 6-7 Daily Service Oil Tank Capacity Calculation for Emergency Generator

1. Design condition

1) Oil : Heavy duty diesel oil (specific gravity 0.85)

2) Time flowed from Daily Service Oil Tank

TIA : 5H

Oil is pumped up from Existing underground tank (40,000 liter) to new daily service oil tank by automatic pump

Sanothimi Training Center 20H

Oil is pumped up from drum can or oil tank vehicle manually

Phulchoki Repeater Station 5H

Oil is flowed from existing oil tank (2000 liter) to new oil tank which is inside of emergency generator by automatic pump

2. Capacity calculation of Daily Service Oil Tank

1) Calculation form

$$C = h \times P.S. \times O / S$$

C : Capacity of daily service tank

h : Generator operation time from service tank : mentioned above

P.S. : Out put of diesel engine

TIA 310.9 P.S. (250 kW)

Sanothimi Training Center 181.2 P.S. (150 kW)

Phulchoki Repeater Station 45.3 P.S. (37.5 kW)

O : Oil consumption rate 0.2 (kg/PS/h) 250~450 P.S.

0.22 (kg/PS/h) 30~250 P.S.

S : Specific gravity of
of heavy duty diesel oil 0.85

2) Calculation

TIA

$$C = 5 \times 310.9 \times 0.2 / 0.85 = 355.2 \text{ liter} \rightarrow \underline{400 \text{ liter tank}}$$

Sanothimi training center

$$C = 20 \times 181.2 \times 0.22 / 0.85 = 938.0 \text{ liter} \rightarrow \underline{1,000 \text{ liter tank}}$$

Phulchoki repeater station

$$C = 5 \times 45.3 \times 0.22 / 0.85 = 58.6 \text{ liter} \rightarrow \underline{100 \text{ liter tank}}$$

Appendix 6-8-1 TIA UPS Capacity Calculation

1. Load List

	Load	Load list	Actual Load for UPS (VA)
A	Existing control building		
a	VHF RX 118.1Mz (M)	50	50×0.2=10 0.2 is demand factor
b	VHF RX 118.1Mz (S)	50	
c	VHF RX 121.9Mz (M)	50	
d	VHF RX 121.9Mz (S)	50	
e	VHF RX 118.5Mz (E)	50	
b	VHF TX 118.1Mz (M)	500	500×0.2=100 0.2 is demand factor
c	VHF TX 118.1Mz (S)	500	
d	VHF TX 121.9Mz (M)	500	
e	VHF TX 121.9Mz (S)	500	
f	VHF TX 118.5Mz (E)	500	
g	VFR CCU	2,500	
h	Tape Recorder 1	100	100
i	Tape Recorder 2	100	100
j	Tape Recorder 3	100	100
k	Remote WX data TX	900	900
l	WX Report Edit	400	400
m	WX Collect EQ	450	450
n	ATIS	300	300
O	future load	2,000	2,000
	Total	9,600	6,960

2. Capacity to be required for UPS

$$\begin{aligned} \text{UPS capacity (VA)} &= \text{Total load for UPS} \times \text{Safety margin} \\ \text{Safety margin} &= 30\% \\ &= 6960 \times 1.3 = 9,048 \end{aligned}$$

Rated capacity of 10 kVA is selected

3. Capacity to be required for UPS battery

60 minutes back up times at rated output of 10kVA

a) Design condition

- (1) Battery discharge period : 340 V (= 1.77V/cell)
- (2) Design temperature : +5 °C
- (3) Battery type : MSE Type Lead-Acid Storage Battery
2V×6cell×32unit = 384V

(4) Discharge current

$$\begin{aligned} I &= P \times \text{P.F.} / (\eta \times V) \\ &= 10,000 \times 0.8 / (0.9 \times 340) \\ &= 26.1 \text{ (A)} \end{aligned}$$

P : UPS Capacity (VA)

P.F. : Power Factor

η : Efficiency (DC-AC)

V : DC minimum voltage

b) Calculation of battery capacity

$$\begin{aligned} C &= (1/L) \times K \times I \\ &= (1/0.8) \times 2.0 \times 26.1 \\ &= 65.3 \text{ (Ah)} \end{aligned}$$

L : Life factor 0.8

K : The rating factor decided by discharge time, minimum allowable voltage at battery terminal and battery temperature. : 2.0

I : Discharge current

Appendix 6-8-2 Sanothimi Training Center UPS Capacity Calculation

1. Load List

	Load	Calculation	Load for UPS (VA)
A	Computer room		
a		$100V \times 10.35A =$	1050
	Sub-Total A		1,050
B	Simulator room(100V)		
a	100V	$100V \times 6.4A =$	640
b	PILOT 1	$100V \times 1.5A =$	150
c	SUPER	$100V \times 1.5A =$	150
d	SYSTEM	$100V \times 1.6A =$	160
e	PILOT 2	$100V \times 1.4A =$	140
f	VDU	$100V \times 0.9A =$	90
	Sub-Total B		1,330
C	Simulator room(230V)		
a	230V	$230V \times 6.6A =$	1,518
b	DEDS1	$230V \times 2.3A =$	529
c	DEDS2	$230V \times 2.3A =$	529
d	DEDS3	$230V \times 2.3A =$	529
	Sub-Total C		3,105
	Total A+B+C		5,485

Note: Current of each load is measured by clamp type current meter

2. Capacity to be required for UPS

$$\begin{aligned} \text{UPS capacity(VA)} &= \text{Total load for UPS} \times \text{Safety margin} \\ \text{Safety margin} &= 30\% \\ &= 5,485 \times 1.3 = 7,130 \end{aligned}$$

Rated capacity of 10 kVA is selected

3. Capacity to be required for UPS battery

10 minutes back up times at rated out put of 10kVA

a) Design condition

- (1) Battery discharge period : 340 V (= 1.77V/cell)
- (2) Design temperature : +5 °C
- (3) Battery type : MSE Type Lead-Acid Storage Battery
2V×6cell×32unit = 384V

(4) Discharge current

$$\begin{aligned} I &= P \times P.F. / (\eta \times V) \\ &= 10,000 \times 0.8 / (0.9 \times 340) \\ &= 26.1 \text{ (A)} \end{aligned}$$

P : UPS Capacity (VA)
P.F.: Power Factor
 η : Efficiency (DC-AC)
V : DC minimum voltage

b) Calculation of battery capacity

$$\begin{aligned} C &= (I/L) \times K \times I \\ &= (1/0.8) \times 0.8 \times 26.1 \\ &= 26.1 \text{ (Ah)} \end{aligned}$$

L : Life factor 0.8
K : The rating factor decided by discharge time, minimum allowat voltage at battery terminal and battery temperature. :0.8
I : Discharge current

Appendix 6-9 Inventory List of Power Supply Equipment (1/2)

1) Tribhuvan International Airport

Equipment	Specification	Manufacturer	Country	Installation year
11kV OCB panel	Rated voltage : 12 kA Rated current : 630 A Short circuit current : 20kA Impulse voltage withstand : 75 kV	Yorkshire switchgear & engineering co., ltd.	U.K.	1985
11kV LBS panel	Rated voltage : 17.5 kV Service voltage : 11kV	E.I.B.	Belgium	1985
Main power transformer A	Capacity : 750/1,000 kVA (ONAN/ONAF) Voltage : 11,000/400V	Dongmi enterprise co., ltd.	Korea	1985
Main power transformer B	Capacity : 750/1,000 kVA (ONAN/ONAF) Voltage : 11,000/400V	Dongmi enterprise co., ltd.	Korea	1985
Voltage regulator	Capacity : 110kVA Primary voltage : 11,000V+-10% Single phase 50Hz 100A	Siemens-allis	Germany	1985
LV distribution panel	Voltage : 400/230V Rated bus bar current : 1600A	Gold star instrument & electric co., ltd.	Korea	1985
Emergency generator A	Capacity : 625 kVA (500kW) Voltage : 400/230V 3phase	Stanford (generator) Cummins (engine)	U.K.	1994
Emergency generator B	Capacity : 450 kVA (360kW) Voltage : 400/230V 3phase	Caterpillar	USA	1985

Appendix 6-9 Inventory List of Power Supply Equipment (2/2)

2) Sanothimi Training Center

Equipment	Specification	Manufacturer	Country	Installation year
Emergency generator	Capacity : 25 kVA (20kW) Voltage : 400/230V 3phase	Lister diesel	England	1970

3) Phulchoki Repeater Station

Equipment	Specification	Manufacturer	Country	Installation year
Emergency generator	Capacity : 30 kVA (24kW) Voltage : 380/220V 3phase	LSA	--	1989
Auto voltage regulator	Capacity : 50 kVA Supply voltage : 380+-20% Use voltage : 380+- 1%	Reorgin	--	--
Surge suppression transformer	Capacity : --- kVA Primary voltage : 380V Secondary voltage : 380V	Bagneres de Biggore	France	1989
Battery charger (Main)	Primary voltage/current : 380V / 14.5A Secondary voltage/current : 24V / 200A	AE Simplex	France	1989
Battery charger (Stand-by)	Primary voltage/current : 380V / 14.5A Secondary voltage/current : 24V / 200A	AE Simplex	France	1989
Battery	Sealed batteries (Maintenance free) 400bH x 2bank = 800Ah	Fulmen	France	1989

**CIVIL AVIATION AUTHORITY OF NEPAL
CIVIL AVIATION TRAINING CENTRE
ACTION PLAN OF MAIN PROGRAMMES FOR THE FISCAL YEAR 1999/2000**

S.No.	Name of Programmes	Time (Month)	Time											
			July.17- Aug.16	Aug.17- Sept.17	Sept.18- Oct.17	Oct.18- Nov.16	Nov.17- Dec.15	Dec.16- Jan.14	Jan.15- Feb.12	Feb.13- Mar.13	Mar.4- Apr.12	Apr.14- May.14	May.15- June.14	June.15- July.15
			1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
1	Basic ATS Course (14 Participants)													
2	ATS Conversion Course (14 Participants)													
3	Flight Dispatch Orientation (14 Participants)													
4	AIP Course (As per demand)													
5	Aviation Security (Officer Level, 14 Participants)													
6	Aviation Security (Asst. Level, 14 Participants)													
7	Basic Fire Fighting (14 Participants)													
8	Fire Refresher (14 Participants)													
9	Terminal Announcement Course (14 Participants)													
10	Workshops/Seminars (48 Participants)													

Action Plan For Radar Courses For 1999 and 2000 at Sanathimi, Kathmandu, Nepal

Name of Course	Time (Month)	July-17-Aug. 16		Aug. 17- Sept. 17		Sept. 18- Oct. 17		Oct. 18- Nov. 16		Nov. 17- Dec. 15		Dec. 16- Jan. 14		Jan. 15- Feb. 12		Feb. 13- Mar. 13		Mar. 4- Apr. 12		Apr. 14- May. 14		May. 15- June 14		June 15- July 16	
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th												
Radar Maintenance Course (6-8 Participants)																									
Radar Refresher Course for Maintenance (5-6 Participants)																									
Familiarization to Transistor Technique and Digital Technology (10-12 Participants)																									

Submitted by : **D. B. Thapa**
 Chief, Civil Aviation Training Centre

Approved by : **N. P. Ghimire**
 Director General
 Head Office, Civil Aviation Authority of Nepal.

Action Plan For Radar Courses For 2000 and 2001 at Sanathimi, Kathmandu, Nepal

Name of Course	Time (Month)	Time Period											
		July 17-Aug 16	Aug 17-Sept 17	Sept 18-Oct 17	Oct 18-Nov 16	Nov 17-Dec 15	Dec 16-Jan 14	Jan 15-Feb 12	Feb 13-Mar 13	Mar 14-Apr 12	Apr 13-May 14	May 15-June 14	June 15-July 15
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	
Radar Maintenance Course (6-8 Participants)													
Radar Refresher Course for Maintenance (5-6 Participants)													
Familiarization to Transistor Technique and Digital Technology (10-12 Participants)													

Submitted by : **C. B. Thapa**
 Chief, Civil Aviation Training Centre

Approved by : **N. P. Ghimire**
 Director General
 Head Office, Civil Aviation Authority of Nepal.

Action Plan For Basic Regional Radar Course For ATC during 2001 - 2002 at Sanohimi, Kathmandu, Nepal

Main Activities	Time (Month)	July.17-Aug.16	Aug.17-Sept.17	Sept.18-Oct.17	Oct.18-Nov.16	Nov.17-Dec.15	Dec.16-Jan.14	Jan.15-Feb.12	Feb.13-Mar.13	Mar.4-Apr.12	Apr.14-May.14	May.15-June.14	June.15-July.16
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
Preparation and consultation phase													
Marketing phase													
Course commencement phase													

Appendix 8 Specification

(1) Air Traffic Control and Communication Facilities

<Tower Control Facilities>

(a) 25W VHF Dual Transmitter

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Transmission Mode	: A3E
-Channel Spacing	: 25 kHz
-RF Output Power	: 25W carrier
-RF Output Impedance	: 50 Ω unbalanced
-Oscillator	: Synthesizer
-Frequency Stability	: ± 0.001 %
-Spurious Radiation	: Less than minus 70 dB
-Modulation	: Up to 95 % depth
-Modulation Distortion	: Not more than 5 percent when modulated in 90 percent at 1kHz
-Hum and Noise Level	: Less than minus 45 dB
-A.F. Response	: Within ± 3 dB between 300 Hz and 3 kHz ref. 1 kHz
-A.F. Input Level	: -20dBm~ +10dBm into 600 Ω balanced
-Supply Voltage	: Single-phase AC 230V ± 10 %, 50 Hz ± 10 %, DC24V ± 10 %
-Temperature Range	: -20°C to +50°C
-Reference Dimensions	: Approx.482W, 200H, 400D [mm]
-Reference Weight	: Approx. 20kgf

VHF Antenna Changeover for Tx

-Frequency Range	: 118~136 MHz
-Number of Control Channels	: 1 CH
-Handling Power	: Up to 100W (CW)
-Impedance	: 50 Ω unbalanced
-Monitoring Function	: Power ON Remote/Local select Main (No.1) Operation/Standby (No.2)Operation Main (No. 1) Alarm/Standby (No.2) Alarm
-Local Control Function	: Power ON

	Remote/Local Select
	Main (No. 1)/Standby (No.2) Select
-Remote Control Function	: Main (No.1)/Standby (No.2) Select by Manual Mode Automatic Transfer (No.1 to No.2) by Auto Mode Press Power ON Remote Alarm Reset

(b) 25W VHF Single Transmitter

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Transmission Mode	: A3E
-Channel Spacing	: 25 kHz
-RF Output Power	: 25W carrier
-RF Output Impedance	: 50 Ω unbalanced
-Oscillator	: Synthesizer
-Frequency Stability	: ± 0.001 %
-Spurious Radiation	: Less than minus 70 dB
-Modulation	: Up to 95 % depth
-Modulation Distortion	: Not more than 5 percent when modulated in 90 percent at 1 kHz
-Hum and Noise Level	: Less than minus 45 dB
-A.F. Response	: Within ± 3 dB between 300 Hz and 3 kHz ref. 1 kHz
-A.F. Input Level	: -20dBm~+10dBm into 600 Ω balanced
-Supply Voltage	: Single-phase AC 230V ± 10 %, 50 Hz ± 10 %, DC24V ± 10 %
-Temperature Range	: -20°C to +50°C
-Reference Dimensions	: Approx.482W, 200H, 400D [mm]
-Reference Weight	: Approx. 20kgf

(c) VHF Transmitter Antenna

-Type	: Wide band dipole antenna
-Frequency	: 118~136 MHz
-Impedance	: 50 Ω (nominal)
-V.S.W.R.	: Less than 1.5 (118 MHz to 136 MHz)
-Gain	: 0 dB (Compared to the halfwave length dipole antenna)
-Power Rating	: 200W - PEP
-Reference Dimensions	: Approx. \varnothing 160, 2300H [mm]

-Reference Weight : Approx. 7.5kgf

(d) VHF Transmitter Rack

-Function : Max.4 sets VHF Transmitters shall be installed
-Reference Dimensions : Approx.550W, 1800H, 600D [mm]
-Reference Weight : Approx. 250kgf

(e) VHF Dual Receiver

-Frequency Range : 118~136 MHz
-Number of Channels : 1 CH
-Type of Receiver : Synthesizer
-Mode of Modulation : A3E
-RF Input Impedance : 50 Ω unbalance
-Sensitivity : Better than 1 micro volt input for 500mW audio output
with 10 dB S/N and 30 percent modulation
-Selectivity : ± 7.5 kHz at 6 dB down point;
 ± 20 kHz at 60 dB down point
-Frequency Stability : 0.002 % or better
-Squelch Control : Adjustable
-Channel Spacing : 25 kHz
-AGC : Not more than 3 dB change in audio output
for input signals in the range 1 μ V to 100 mV
-Spurious Suppression
Image Rejection : 70 dB or better
Spurious Rejection : 70 dB or better
-Monitor Output : 1W in 8 Ω internal loudspeaker
-Line Output : 600 Ω balanced. Adjustable from -20dBm to +10dBm
-Frequency Response : Within ± 3 dB of response from 300 Hz to 3kHz
reference 1 kHz
-Distortion : Not more than 5 % at 30 % modulation
-Supply Voltage : Single-phase AC230V ± 10 %, 50 Hz ± 10 %,
DC24V ± 10 %
-Temperature Range : -20°C to +50°C
-Humidity : Up to 95 %
-Reference Dimensions : Approx.482W, 100H, 350D [mm]
-Reference Weight : Approx. 5kgf

VHF Antenna Changeover for Rx

-Frequency Range	: 118~136 MHz
-Number of Control Channels	: 1 CH
-Impedance	: 50 Ω unbalanced
-Monitoring Function	: Power ON Remote/Local select Main (No.1) Operation/Standby (No.2)Operation Main (No.1) Alarm/Standby (No.2) Alarm
-Local Control Function	: Power ON Remote/Local select Main (No.1) /Standby (No.2) Select
-Remote Control Function	: Main (No.1) /Standby (No.2) Select by Manual Mode Automatic Transfer (No.1 to No.2) by Auto Mode SQ ON/OFF Function Power ON Remote Alarm Reset

(f) VHF Single Receiver

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Type of Receiver	: Synthesizer
-Mode of Modulation	: A3E
-RF Input Impedance	: 50 Ω unbalance
-Sensitivity	: Better than 1 micro volt input (open voltage), for 500mW audio output with 10 dB S/N and 30 percent modulation
-Selectivity	: ± 7.5 kHz at 6 dB down point; ± 20 kHz at 60 dB down point
-Frequency Stability	: 0.002 % or better
-Squelch Control	: Adjustable
-Channel Spacing	: 25 kHz
-AGC	: Not more than 3 dB change in audio output for input signals in the range 1 μ V to 100 mV
-Spurious Suppression	
Image Rejection	: 70 dB or better
Spurious Rejection	: 70 dB or better
-Monitor Output	: 1W in 8 Ω internal loudspeaker
-Line Output	: 600 Ω balanced. Adjustable from -20dBm to +10dBm
-Frequency Response	: Within ± 3 dB of response from 300 Hz to 3kHz

	reference 1 kHz
-Distortion	: Not more than 5 % at 30 % modulation
-Supply Voltage	: Single-phase AC230V ± 10%, 50 Hz ± 10%, DC24V ± 10%
-Temperature Range	: -20°C to +50°C
-Humidity	: Up to 95 %
-Reference Dimensions	: Approx.482W, 100H, 350D [mm]
-Reference Weight	: Approx. 5kgf

(g) VHF Receiver Antenna

-Type	: Wide band dipole antenna
-Frequency	: 118~136 MHz
-Impedance	: 50 Ω (nominal)
-V.S.W.R.	: Less than 1.5 (118 MHz to 136 MHz)
-Gain	: 0 dB (Compared to the halfwave length dipole antenna)
-Power Rating	: Approx.Ø160, 2300H [mm]
-Reference Weight	: Approx. 7.5kgf

(h) VHF Receiver Rack

-Function	: Max.8 sets VHF Receivers shall be installed
-Reference Dimensions	: Approx.550W, 1800H, 600D [mm]
-Reference Weight	: Approx. 200kgf

(i) Tape Recorder

-System/Architecture	: Stand-alone digital recording system
-Channel Capacity	: 24 channel
-Recording Modes	: Dual 1, dual 2, serial, endless, single
-Voice Sampling	: 8 kHz 8 bits CODEC (μ-law)
-Recording Capacity	: 850 channel hours (DAT)
-Archival Recording	: Dual DAT DDS-2 drives
-Input Impedance	: 10 kΩ or more (1 kHz)
-Frequency Response	: 300 Hz to 3400 Hz (+3 dB / -6 dB)
-Supply Voltage	: Single-phase AC100V ± 10%, 50Hz ± 5%
-Reference Dimensions	: Approx.432W, 222H, 435D [mm]
-Reference Weight	: Approx.22kgf

(j) Re-producer

-System Architecture	: Stand-alone digital re-producing system
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-Channel Capacity	: 24 channel
-Search Functions Channel	: Date and time
-Playback	: Normal, 2 times fast speed, 0.25 times slow speed
-Typical Search Time	: 2 minutes (DAT)
-Typical Load Time	: 2 minutes (DAT)
-Input Impedance	: 10 k Ω or more (1 kHz)
-Frequency Response	: 300 Hz to 3400 Hz (+3 dB / -6 dB)
-Supply Voltage	: Single-phase AC100V \pm 10%, 50Hz \pm 5%
-Reference Dimensions	: Approx.432W, 222H, 435D [mm]
-Reference Weight	: Approx.22kgf

<Area Control Facilities>

(a) 50W VHF Dual Transmitter

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Transmission Mode	: A3E
-Channel Spacing	: 25 kHz
-RF Output Power	: 50W carrier
-RF Output Impedance	: 50 Ω unbalanced
-Oscillator	: Synthesizer
-Frequency Stability	: \pm 0.001 %
-Spurious Radiation	: Less than minus 70 dB
-Modulation	: Up to 95 % depth
-Modulation Distortion	: Not more than 5 percent when modulated in 90 percent at 1 kHz
-Hum and Noise Level	: Less than minus 45 dB
-A.F. Response	: Within \pm 3 dB between 300 Hz and 3 kHz ref. 1 kHz
-A.F. Input Level	: -20dBm ~ +10dBm into 600 Ω balanced
-Supply Voltage	: Single-phase AC 230V \pm 10%, 50 Hz \pm 10 %, DC24V \pm 10%
-Temperature Range	: -20 $^{\circ}$ C to +50 $^{\circ}$ C
-Reference Dimensions	: Approx.482W, 200H, 400D [mm]
-Reference Weight	: Approx. 20kgf

VHF Antenna Changeover for Tx

-Frequency Range	: 118~136 MHz
-Number of Control Channels	: 1 CH

-Handling Power	: Up to 100W (CW)
-Impedance	: 50 Ω unbalanced
-Monitoring Function	: Power ON Remote/Local select Main (No.1) Operation/Standby (No.2) Operation Main (No.1) Alarm/Standby (No.2) Alarm
-Local Control Function	: Power ON Remote/Local Select Main (No.1)/Standby (No.2) Select
-Remote Control Function	: Main (No.1)/Standby (No.2) Select by Manual Mode Automatic Transfer (No.1 to No.2) by Auto Mode Press Power ON Remote Alarm Reset

(b) 50W VHF Single Transmitter

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Transmission Mode	: A3E
-Channel Spacing	: 25 kHz
-RF Output Power	: 50W carrier
-RF Output Impedance	: 50 Ω unbalanced
-Oscillator	: Synthesizer
-Frequency Stability	: ±0.001 %
-Spurious Radiation	: Less than minus 70 dB
-Modulation	: Up to 95 % depth
-Modulation Distortion	: Not more than 5 percent when modulated in 90 percent at 1 kHz
-Hum and Noise Level	: Less than minus 45 dB
-A.F. Response	: Within ±3 dB between 300 Hz and 3 kHz ref. 1 kHz
-A.F. Input Level	: -20dBm~ +10dBm into 600 Ω balanced
-Supply Voltage	: Single-phase AC 230V ± 10%, 50 Hz ± 10 %, DC24V ± 10 %
-Temperature Range	: -20°C to +50°C
-Reference Dimensions	: Approx.482W, 200H, 400D [mm]
-Reference Weight	: Approx. 20kgf

(c) VHF Transmitter Antenna

-Type	: Wide band dipole antenna
-Frequency	: 118~136 MHz
-Impedance	: 50 Ω (nominal)
-V.S.W.R.	: Less than 1.5 (118 MHz to 136 MHz)
-Gain	: 0 dB (Compared to the halfwave length dipole antenna)
-Power Rating	: 200W - PEP
-Reference Dimensions	: Approx. \varnothing 160, 2300H [mm]
-Reference Weight	: Approx. 7.5kgf

(d) VHF Transmitter Rack

-Function	: Max.4 sets VHF Transmitters shall be installed
-Reference Dimensions	: Approx.550W, 1800H, 600D [mm]
-Reference Weight	: Approx. 250kgf

(e) VHF Dual Receiver

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Type of Receiver	: Synthesizer
-Mode of Modulation	: A3E
-RF Input Impedance	: 50 Ω unbalance
-Sensitivity	: Better than 1 micro volt input for 500 mW audio output with 10 dB S/N and 30 percent modulation
-Selectivity	: \pm 7.5 kHz at 6 dB down point; \pm 20 kHz at 60 dB down point
-Frequency Stability	: 0.002 % or better
-Squelch Control	: Adjustable
-Channel Spacing	: 25 kHz
-AGC	: Not more than 3 dB change in audio output for input signals in the range 1 μ V to 100 mV
-Spurious Suppression	
Image Rejection	: 70 dB or better
Spurious Rejection	: 70 dB or better
-Monitor Output	: 1W in 8 Ω internal loudspeaker
-Line Output	: 600 Ω balanced. Adjustable from -20dBm to +10dBm
-Frequency Response	: Within \pm 3 dB of response from 300 Hz to 3kHz reference 1 kHz
-Distortion	: Not more than 5 % at 30 % modulation

- Supply Voltage : Single-phase AC230V \pm 10 %, 50 Hz \pm 10 %, DC24V \pm 10 %
- Temperature Range : -20°C to +50°C
- Humidity : Up to 95 %
- Reference Dimensions : Approx.482W, 100H, 350D [mm]
- Reference Weight : Approx. 5kgf

VHF Antenna Changeover for Rx

- Frequency Range : 118~136 MHz
- Number of Control Channels : 1 CH
- Impedance : 50 Ω unbalanced
- Monitoring Function : Power ON
Remote/Local select
Main (No.1) Operation/Standby (No.2) Operation
Main (No.1) Alarm/Standby (No.2) Alarm
- Local Control Function : Power ON
Remote/Local select
Main (No.1) /Standby (No.2) Select
- Remote Control Function : Power ON
Main (No.1) /Standby (No.2) Select by Manual Mode
Automatic Transfer (No.1 to No.2) by Auto Mode
SQ ON/OFF Function
Remote Alarm Reset

(f) VHF Single Receiver

- Frequency Range : 118~136 MHz
- Number of Channels : 1 CH
- Type of Receiver : Synthesizer
- Mode of Modulation : A3E
- RF Input Impedance : 50 Ω unbalance
- Sensitivity : Better than 1 micro volt input (open voltage),
for 500mW audio output with 10 dB S/N and
30 percent modulation
- Selectivity : \pm 7.5 kHz at 6 dB down point;
 \pm 20 kHz at 60 dB down point
- Frequency Stability : 0.002 % or better
- Squelch Control : Adjustable
- Channel Spacing : 25 kHz

-AGC	: Not more than 3 dB change in audio output for input signals in the range 1 μ V to 100 mV
-Spurious Suppression	
Image Rejection	: 70 dB or better
Spurious Rejection	: 70 dB or better
-Monitor Output	: 1W in 8 Ω internal loudspeaker
-Line Output	: 600 Ω balanced. Adjustable from -20dBm to +10dBm
-Frequency Response	: Within ± 3 dB of response from 300 Hz to 3kHz reference 1 kHz
-Distortion	: Not more than 5 % at 30 % modulation
-Supply Voltage	: Single-phase AC230V $\pm 10\%$, 50 Hz $\pm 10\%$, DC24V $\pm 10\%$
-Temperature Range	: -20°C to +50°C
-Humidity	: Up to 95 %
-Reference Dimensions	: Approx.482W, 100H, 350D [mm]
-Reference Weight	: Approx. 5kgf

(g) VHF Receiver Antenna

-Type	: Wide band dipole antenna
-Frequency	: 118~136 MHz
-Impedance	: 50 Ω (nominal)
-V.S.W.R.	: Less than 1.5 (118 MHz to 136 MHz)
-Gain	: 0 dB (Compared to the halfwave length dipole antenna)
-Power Rating	: 200W - PEP
-Reference Dimensions	: Approx. \varnothing 160, 2300H [mm]
-Reference Weight	: Approx. 7.5kgf

(h) VHF Receiver Rack

-Function	: Max.8 sets VHF Receivers shall be installed
-Reference Dimensions	: Approx.550W, 1800H, 600D [mm]
-Reference Weight	: Approx. 200kgf

(i) 25W VHF Single Transmitter (Preparation for Phulchoki Repeater Station)

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Transmission Mode	: A3E
-Channel Spacing	: 25 kHz
-RF Output Power	: 25W carrier

-RF Output Impedance	: 50 Ω unbalanced
-Oscillator	: Synthesizer
-Frequency Stability	: ± 0.001 %
-Spurious Radiation	: Less than minus 70 dB
-Modulation	: Up to 95 % depth
-Modulation Distortion	: Not more than 5 percent when modulated in 90 percent at 1 kHz
-Hum and Noise Level	: Less than minus 45 dB
-A.F. Response	: Within ± 3 dB between 300 Hz and 3 kHz ref. 1 kHz
-A.F. Input Level	: -20dBm ~ +10dBm into 600 Ω balanced
-Supply Voltage	: Single-phase AC 230V ± 10 %, 50 Hz ± 10 %, DC 24V ± 10 %
-Temperature Range	: -20°C to +50°C
-Reference Dimensions	: Approx. 482W, 200H, 400D [mm]
-Reference Weight	: Approx. 20kgf

(j) VHF Transmitter/Receiver Antenna (Preparation for Phulchoki Repeater Station)

-Type	: Wide band dipole antenna
-Frequency	: 118~136 MHz
-Impedance	: 50 Ω (nominal)
-V.S.W.R.	: Less than 1.5 (118 MHz to 136 MHz)
-Gain	: 0 dB (Compared to the halfwave length dipole antenna)
-Power Rating	: 200W - PEP
-Reference Dimensions	: Approx. $\varnothing 160$, 2300H [mm]
-Reference Weight	: Approx. 7.5kgf

(k) VHF Transmitter Rack (Preparation for Phulchoki Repeater Station)

-Function	: Max.4 sets VHF Transmitters shall be installed
-Reference Dimensions	: Approx. 550W, 1800H, 600D [mm]
-Reference Weight	: Approx. 250kgf

(l) VHF Single Receiver (Preparation for Phulchoki Repeater Station)

-Frequency Range	: 118~136 MHz
-Number of Channels	: 1 CH
-Type of Receiver	: Synthesizer
-Mode of Modulation	: A3E
-RF Input Impedance	: 50 Ω unbalance
-Sensitivity	: Better than 1 micro volt input (open voltage),

	for 500 mW audio output with 10 dB S/N and 30 percent modulation
-Selectivity	: ± 7.5 kHz at 6 dB down point; ± 20 kHz at 60 dB down point
-Frequency Stability	: 0.002 % or better
-Squelch Control	: Adjustable
-Channel Spacing	: 25 kHz
-AGC	: Not more than 3 dB change in audio output for input signals in the range 1 μ V to 100 mV
-Spurious Suppression	
Image Rejection	: 70 dB or better
Spurious Rejection	: 70 dB or better
-Monitor Output	: 1W in 8 Ω internal loudspeaker
-Line Output	: 600 Ω balanced. Adjustable from -20dBm to +10dBm
-Frequency Response	: Within ± 3 dB of response from 300 Hz to 3kHz reference 1 kHz
-Distortion	: Not more than 5 % at 30 % modulation
-Supply Voltage	: Single-phase AC230V $\pm 10\%$, 50 Hz $\pm 10\%$, DC24V $\pm 10\%$
-Temperature Range	: -20°C to +50°C
-Humidity	: Up to 95 %
-Reference Dimensions	: Approx.482W, 100H, 350D [mm]
-Reference Weight	: Approx. 5kgf

(m) 25m High Antenna Tower (Preparation for Phulchoki Repeater Station)

-Function	: 4 VHF Antenna attachments
-Equipment installed	: 3 VHF Antennas
-Wind Speed	: 60 m/sec
-Tower Style	: Self-supporting square steel tower
-Structure	: Equal angle steel truss
-Joining	: Bolt fastening
-Tower Height	: 25m
-Tower Width	: Top section 1.2m, Bottom section 2.0m
-Appurtenances	: Ladder, Lightning rod, Feeder rack, Platform in top section (covered with expanded metal)

(n) VHF Receiver Rack (Preparation for Phulchoki Repeater Station)

-Function	: Max.8 sets VHF Receivers shall be installed
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- Reference Dimensions : Approx.550W, 1800H, 600D [mm]
- Reference Weight : Approx. 200kgf

(o) Existing UHF LINK Interface Unit

- Voice frequency : 300Hz to 2700Hz
- Control frequency
 - Mark : 3320Hz
 - Space : 3150Hz
 - Key off signal : 3060Hz
- Output to remote control line : -13dBm (± 10 dB) 600 Ω
- Input to remote control line : -13dBm (± 10 dB) 600 Ω
- Line impedance : 600 Ω , balanced; 4-wire
- Transmission speed : 200 bauds
- Data input requirements : Ground signal 8V to 48V, 5mA at maximum
- Data output condition : Relay contact, 50V, 0.2A
- Supply Voltage : DC24V or 48V (Supplied from existing UHF rack)
- Operating temperature : 0°C to 50°C
- Maximum item numbers : 40 or 80 items at maximum

<Tower Control Console>

(a) Aerodrome Control Console

- Operation and Display of Radio Communication
- Two (2) Speaker for Radio Communication
- Operation and Display of Intercom Communication
- Operation and Display of Hot Line Communication (Police, Hospital, Town Fire)
- Operation and Display of Voice Control
- Operation for Crash Siren Control
- Operation and Display of Runway in Use
- Digital Clock Display
- Weather Data Indication
 - (Wind Speed/Direction, Pressure, RVR, Ceilometer, Temperature, Precipitation)
- NAVAIDS Monitor (DVOR/DME, Locator)
- Operation and Display of Tower Hot Line Communication
 - (Between tower console and APP console)
- Installation of Strip Holder
- Operation and Display of AFL (Runway/Approach/PAPI/REILS/SFL)
- Monitoring of APP Control Frequencies
- Reference Dimensions : Approx.1000W, 1050H, 1000D [mm]

(b) Coordinator Console

- Operation and Display of Radio Communication
- Two (2) Speaker for Radio Communication
- Operation and Display of Intercom Communication
- Operation and Display of Hot Line Communication (Police, Hospital, Town Fire)
- Operation and Display of PABX Communication
- Operation and Display of Voice Control
- Digital Clock Display
- Operation and Display Part of Tower Hotline (Between tower console and ACC console)
- Installation of Strip Holder
- Reference Dimensions : Approx.1000W, 1050H, 1000D [mm]

(c) Surface Movement Control Console

- Operation and Display of Radio Communication
- Two (2) Speaker for Radio Communication
- Operation and Display of Intercom Communication
- Operation and Display of PABX Communication
- Operation and Display of Hot Line Communication (Police, Hospital, Town Fire)
- NAVAIDS Monitor (DVOR/DME, Locator)
- Installation of Strip Holder
- Operation and Display of AFL (Taxiway/Apron/Floodlight/OB Light/ABN/Wind Socks)
- Display of AFL system and power system (Mimic panel)
- Operation and Display of Voice Control
- Operation for Crash Siren Control (3 sirens)
- Operation and Display of Runway in Use
- Digital Clock Display
- Weather Data Indicator Specified under Other Specification
(Wind Speed/Direction, Pressure, RVR, Ceilometer, Temperature, Precipitation)
- Reference Dimensions : Approx.1650W, 1050H, 1000D [mm]

(d) Flight Data Console

- Operation and Display of Intercom Communication
- Operation and Display of Hot Line Communication
- Operation and Display of PABX Communication
- Operation and Display of Voice Control
- Two (2) of Fifteen (15) Flight Progress Strip Cards Mount Bay
- Digital Clock Display

- Space for VHF AM Transceiver Specified under Other Specification
- Reference Dimensions : Approx.1000W, 1050H, 1000D [mm]

<Area Control Console>

(a) Flight Data console

- Two (2) Speaker for Radio Communication
- Operation and Display of intercom Communication
- Operation and Display of PABX Communication
- Operation and Display of Voice Control
- Spot Light with Dimmer Adjustment
- Digital Clock Display
- Operation and Display of Hot Line Communication
(Between APP and ACC console)
- Installation of Strip Holder
- Reference Dimensions : Approx.1200W, 1900H, 1632D [mm]

(b) Communication console

- Operation and Display of Radio Communication
- Two (2) Speaker for Radio Communication
- Operation and Display of Intercom Communication
- Operation and Display of PABX Communication
- Operation and Display of Voice Control
- Spot Light with Dimmer Adjustment
- Lighting for Flight Strip Holder with Dimmer Adjustment
- Digital Clock Display
- Weather Data Indication
(Temperature, Humidity, Pressure, Cloud Height, RVR, WS/WD)
- Space for NAVAIDS Monitor Equipment Specified under Other Specification
- Installation of Strip Holder
- Operation and Display of Runway in Use
- Monitoring APP Control Frequencies
- Reference Dimensions : Approx.700W,1900H,1632D [mm]

<Communication Control>

(a) Communication Control Unit

- Function :
Radio Communication

Intercom Communication
 Hot Line Communication
 PABX Communication
 Crash Siren Control
 Runway in Use Indication and Control
 Power Supply to VFR Console (ADC, COR, SMC, FDC)

-Channel Capacity :

VFR : 16 channels (include Main/Standby)
 ACC : 16 channels (include Main/Standby)
 Intercom Channel : 20 channels (exclude among consoles)
 Hotline Channel : 8 channels
 PABX Communication : 2 channel (for VFR console)
 : 2 channel (for ACC console)
 (Total 4 channels)
 Recording Channel : 24 channels (per console and per radio frequency)

-Radio Communication

Output Level : 0dBm \pm 3dB, adjustable
 Input Level : from -10dBm to +3dBm
 Line Impedance : 600 Ω balanced
 PTT Output : Contact (transmitting : close)
 Channel Select Output : Contact (selection : close)

-Intercom Communication

Interface : Common battery telephone interface
 Output level : -10dBm \pm 3dB, adjustable
 Input level : from -15dBm to -5dBm
 Line Impedance : 600 Ω balanced

-Hotline Communication

Interface : Local battery telephone interface
 Output level : -10dBm \pm 3dB, adjustable
 Input level : from -15dBm to -5dBm
 Line Impedance : 600 Ω balanced

-PABX Communication

Interface : Common battery telephone interface
 Dial Signal : Tone (DTMF) dial type
 Output level : -10dBm \pm 3dB, adjustable
 Input level : from -15dBm to -5dBm
 Line Impedance : 600 Ω balanced

- Recording Output
 - Output level : 0dBm±3dB, adjustable
 - Line Impedance : 600 Ω balanced
- Input Power : Single-phase AC230V±10%, 50 Hz±5%
- Reference Dimensions : Approx.1200W, 1800H, 850D [mm]

<Aeronautical Telecommunication>

(a) ATIS

1) The ATIS equipment (dual) shall be fully digital system, and ATIS message shall be input from menu of operation terminal. The ATIS message shall be able to spoken several different voices.

2) Operation terminal shall carries out the operation and control, such as follows :

- System control
- Generate and edit ATIS message with menu of monitor display
- Reviews of recording data and transfer to other media.
- Add to system vocabulary

3) This equipment shall be able to edit the following information through Menu-driven, and generate voice message for broadcasting.

-Airport information

Airport name

IFR approach (ILS approach) · VFR approach

Runway in use (Departure/Landing)

QNH

-Current weather

Wind direction · Wind speed

Runway Visual Range

Temperature

Dew point

Height of cloud

-NOTAM

- 4) This equipment shall convert ATIS message to voice signal, and digital signal, and then records digital signal in a dual semiconductor memory, and reproduce it and outputs it repeatedly to the radio transmitter.
- 5) The recording and reproducing unit shall be equipped with a operation panel function switch.
- 6) The operator terminal shall provide menu-driven display to input ATIS message and control commands.
- 7) The microphone shall be used input direct voice signal to be broadcast. The input voice signal shall be recorded in memory, and repeatedly played back.

-Broadcasting System (Recording and reproducing unit)

1) Performance

Audio input/output

Reproducing output level	:	Within 0 ± 1 dBm (Terminal resistance 600 Ω) (Measurement frequency : 1000Hz)
Level setting range	:	-10dBm to +10dBm (Terminal resistance 600 Ω) (Measurement frequency : 1000Hz)
Frequency characteristic	:	Within ± 3 dB at 300Hz to 3000Hz (Based on the level at 1000Hz)
Distortion	:	3% or less at an output level of 0dBm (Terminal resistance 600 Ω) (Measurement frequency : 1000Hz)
S/N ratio	:	40dB or above at an output level of 0dBm (Terminal resistance 600 Ω) (Measurement frequency : 1000Hz)
Monitor speaker	:	1W, 8 Ω with digital volume control
Monitor output(Headphone)	:	-10dBm or above (Terminal resistance 600 Ω)
Microphone input sensitivity	:	-60dBm or below

Voice system

Recording time	:	Maximum 5 minutes
Recording system	:	PCM system

2) Function (Operation panel)

Control function

START

The memory module in the stand-by state enters the recording ready state, and records a voice signal via the microphone of the operation panel. To retry the recording from the beginning while recording, press this switch again.

STOP

The recording state of the memory unit, which is derived by the START function in (a), is released. Then the memory unit plays back the newly recorded signal repeatedly. By doing this, the information is updated.

First recorded signal will be automatically dubbed into the playback memory module.

ERASE

This control returns the opening condition of the stand-by memory unit to the condition before start control is performed. This control is effective after start control is performed. This control initializes the memory module.

DIRECT ON

This control causes voice signal from mike input to be directly broadcast.

The recording memory module to be ready for sound-recording and the voice signal from the mike will be recorded.

DIRECT OFF

This control release DIRECT control. The recorded signal is played back repeatedly.

PROGRAM CUT

This control inhibits broadcasting output which is transmitted from the recording and reproducing equipment to radio transmitting equipment.

TX1/TX2

Transmitters select control.

TX ON

Transmitter power ON/OFF control.

TX OP

Transmitter press select ON/OFF control.

Other functions

Measures sound-recording time in the recording and reproducing unit.

The following signal shall be able to be selected using a head phone for monitoring.

Mike input (MIC) / Broadcasting output (LINE) / RX input (AIR)

TIME UP

Alarm for excessive sound-recording capacity (time) of the recording and reproducing unit.

REMOTE/LOCAL

Message input select control.

REMOTE : input from operation terminal

LOCAL : input from operation console

-Operation terminal

Central Computer	: 333MHz PentiumII, 64MB SDRAM, 4MB SGRAM 6.4GB HDD, 14/32 CD-ROM 1.4MB Floppy Disk RS232C Serial interface Keyboard (U.S. type keyboard), Mouse
Monitor Display	: CRT size 15 inches Resolution SVGA (800×600)
Operation System	: Windows 98 or Windows NT
Capacity of vocabulary	: Maximum 400 words

-Power supply unit

Voltage/Phase	: Single-phase AC230V±10%, 50Hz±5%
Power consumption	: Less than 300VA

-I/F unit

Input

Transmitter press select ON/OFF control signal

Output

Transmitter power ON/OFF control signal
Dual transmitter select ON/OFF control signal
Audio signal

-VHF receiver

Receiver Frequency	: 108~142MHz
Receiver sensibility	: AM0.5μV
Frequency step	: 5kHz
Power supply	: DC12V (Supplied from power supply unit)

-Environmental conditions

Ambient temperature	: +5 to +35°C
Relative humidity	: Max.80%RH, non condensing.

-Equipment size and weight

Reference Dimensions	: Approx.1200W, 1200H, 700D [mm]
Reference Weight	: Less than 100kgf

(b) AMSS

1) The automatic message switching system(AMSS) shall be able to function as a relay station,

send and receive telecommunication messages to/from AFTN intelligent terminals (AIT) and other AFTN stations automatically. The system shall consist of PC-based active/standby automatic message switching equipment (AMSE), an AFTN interface equipment (AIE), AFTN intelligent terminals (AIT) and local area network (LAN). The AMSS shall be 4 types of position prescribed as follows.

Supervisory Position (AMSE)

This position shall be responsible for controlling and monitoring all circuits and system operations. This position also shall support the following functions.

- a) Traffic control
- b) Routing control
- c) Operation condition inquiry
- d) Message composition/transmission
- e) Message retrieval/modification
- f) Message retransmission
- g) Preformat message management
- h) Print out/display of system message
- i) Print out of a statistics information on a daily basis

Reject Position

This position shall be responsible for retrieving, modifying and retransmitting reject messages. The position shall support the following functions.

- a) Reject message retrieval/modification/transmission
- b) Preformat message management
- c) Print out of reject message
- d) Print out of received message

Statistics Position

This position shall be responsible for creating a statistics data. The created data shall be as follows.

- a) The Daily List should consist of the followings :
- b) Total of messages transmitted for each channel
- c) Final transmitted message CSN for each channel
- d) Total of messages received for each channel
- e) Final received message CSN for each channel
- f) Grand total of message transmitted
- g) Grand total of messages received
- h) Total of messages transmitted and received

Message Entry Position (AIT)

This position shall be responsible for ATS message composition, transmission, and also for printing out the messages addressed to this position.

-Automatic Message Switching Equipment (AMSE)

General Requirement

The AMSEs shall have the active/standby computers for redundant configuration. When the active AMSE fails, the standby AMSE should automatically take over the on-line processing function. The AMSE shall have automatic message storage and switching capability. The AMSE shall handle the messages in accordance with ICAO Annex 10 format. Printer shall be connected with the AMSE to print out AFTN messages and supervisory data. The AMSE shall be assured to maintain the power for continuous operations for minimum period of 15 minutes by a small uninterrupted power supply (UPS).

Functional Requirement

Message Routing

The AMSE shall initially store the received messages on the hard-disk after reading the message address, and should transmit the stored message to their corresponding circuits one after another.

Message Diversion (Alternative Routing)

The AMSE shall be capable of diverting traffic to an alternative routes by means of appropriate command(s) from the Supervisory Position.

Message Format

The AMSE shall be able to check the ITA-2 and IA-5 message formats and address according to ICAO Annex 10.

Message Numbering Control

Channel sequence number (CSN) of incoming and outgoing messages shall be check for every circuit. The CSN shall be 3 and 4 digits.

Collective Address (Group Address)

The AMSE shall reserve a space for 100 group address indicators and an address indicator for a group addressee should accommodate up to 32 addressee indicators.

Priority Handling

Message shall be divided into three (3) priority groups, 1, 2 and 3. Messages with the same priority are transmitted in order of their reception, and alarm shall be provided for SS message.

- a) SS message
- b) DD, FF messages
- c) GG, KK messages

Message Format Errors

Message with error(s) which cannot be automatically corrected shall be rejected to the Supervisory Position for operator handling.

Channel Check Messages

The system shall check the output circuits at every 20 minutes in interval and should generate on each idle circuit a channel check message.

Channel Test Transmission

The system shall be able to output channel test message on any outgoing channel by means of appropriate command(s) from the Supervisory Position.

Service Message

The system shall automatically generate the following service messages.

- a) Last sent service message
- b) Last received service message
- c) Service restored message

Storage and Retrieval

The system shall be retained the last 30 day's traffic volume on the hard-disk. Every message shall have three (3) letter channel sequence numbers assigned to it, one in the system, another according to each incoming and outgoing circuit. These channel sequence numbers shall serve as key codes for any subsequent reference.

Alternate-Terminal Assigning

The AMSE shall be able to forward messages addressed to an AIT to another. This change in addressee shall effect by means of appropriate command(s) from the Supervisory Position.

Transmission Blocking

The AMSE shall be able to suspend and resume message transmission to a specific adjacent AFTN station or an AIT by means of appropriate command(s) from the Supervisory Position.

Reception Blocking

The AMSE shall be able to suspend and resume message reception from a specific adjacent AFTN station by means of appropriate command(s) from the Supervisory Position.

Message Retransmission

The AMSE shall be able to retransmit a message once transmitted, whether its addressee is an adjacent AFTN station or an AIT. This retransmission shall be made at the request from an AIT. A one-time transmission should include up to ten (10) consecutive messages.

Traffic Journal

The AMSE shall record reception journal and transmission journal on the hard-disk. These journal messages shall be able to retrieve at the Supervisory Position.

Traffic Statistics

The AMSE shall be able to produce a statistical data list every day. This list named "Daily List" shall be printed out at the Supervisory Position around midnight daily.

- a) The Daily List should consist of the followings :
- b) Total of messages transmitted for each channel
- c) Final transmitted message CSN for each channel
- d) Total of messages received for each channel
- e) Final received message CSN for each channel
- f) Grand total of message transmitted
- g) Grand total of messages received
- h) Total of messages transmitted and received

Routing List Management

The AMSE shall be able to change the routing list at the Supervisory Position, while the system is operation on-line.

Control and Monitoring

The AMSE shall be able to monitor the condition of channels and system status at the Supervisory Position.

Message Correction and Corrected-Message Transmission

The rejected messages shall be able to retrieve on the screen at the Supervisory Position and the rejected messages shall be able to be modified for correction. Keys for rejected message retrieval shall be as follows :

- a) Channel Identification
- b) Channel Sequence Number (CSN)
- c) Date

Supervisory Commands

Supervisory commands entered at the Supervisory Position shall include the following commands.

- a) Traffic Control Command
- b) Opening/closing a channel
- c) Blocking outgoing/incoming transmission
- d) Sending test message
- e) Routing Control Command
- f) Diversion routing
- g) Terminal alternation
- h) Operational Condition Inquiry
- i) System and channel status
- j) Queue messages
- k) Current channel sequence number (CSN)
- l) Numbers of transmitted and received messages

-AFTN Interface Equipment (AIE)

General Requirement

The AIE shall convert the message from telegraph interface to LAN interface, and vice versa. The AIE shall be assured to maintain the power for continuous operation for a minimum period of 15 minutes by a small UPS.

Interface Requirements

Interface requirements are as follows :

- a) Number of channel : 16 maximum
- b) Telegraph Interface
 - Communication code : ITA-2
 - Communication speed : 50,75,110,150,300bps (asynchronous)
 - Communication protocol : None
 - Current Data interface : Single current 0 / +20mA
Double current +/- 20mA
Voltage +/- 48V or +/- 96V

- c) Modem interface
 - Communication code : IA-5
 - Communication speed : 1200, 2400bps (asynchronous)
 - Communication protocol : COP-B and X.25
 - Operation mode : 4 wire full duplex
 - Interface : V24 / V28 RS232C
- d) LAN : IEEE 802.3

-AFTN Intelligent Terminal (AIT)

General Requirement

The AIT shall be provided for entering and displaying of AFTN messages and data. The printer shall be connected with the AIT to print out AFTN messages and data. The AIT shall be assured to maintain the power for continuous operation for a minimum period of 15 minutes by a small UPS.

Functional Requirement

Message Composition and Transmission

- a) A message of ATS, AIS and Meteorological shall be composed for transmission to the AFTN station.
- b) Up to 69 characters shall be able to enter in one line.
- c) Up to 2100 characters (including the alignment function) shall be able to enter for each message.

Message Retrieval

- a) AFTN messages transmitted/received via AFTN station or AIT shall be able to retrieve on any terminal.
- b) Messages for previous 30 days shall be retrieved.
- c) Keys for message retrievals should as follows;
 - Channel Identification
 - Channel Sequence Number (CSN)
 - Date

Message Retransmission

- a) A message transmitted to an AIT shall be able to regenerate(reprint).
- b) A one-time transmission shall include up to ten (10) consecutive.
- c) Keys for message retransmission should be as follows :
 - Channel Identification
 - Starting CSN and Ending CSN
 - Date

Preformat Message

- a) The AIT shall accept and store preformat messages in hard-disk.

- b) The preformat messages shall be retrievable by appropriate keywords for subsequent reprocessing.
- c) The AIT shall store at least 50 preformat messages.
- d) A preformat message shall be registered, deleted and modified.
- e) The AIT shall be displayed a list of preformat messages stored.

-ENVIRONMENT CONDITIONS

Operating temperature	: 5 ~ 35 °C
Humidity	: Max.80%, non condensing
Voltage Supply	: Single-phase AC230V±10%, 50Hz±10%

(2) Meteorological Facilities

(a) RVR Sensor

-Measuring Range	: 50m to 2000m
-Accuracy (RVR)	: ±25m up to 200m, ±50m between 200m and 800m, ±100m between 800m and 1400m, ±200m above 1400m
-Supply Voltage	: Single-phase AC230V±10%, 50Hz±10%
-Reference Dimensions	: Approx.1600W, 3000H, 1600D [mm]
-Reference Weight	: Approx. 110kgf

(b) Cloud Ceilometer

-Measuring Range	: 0 to 25,000 ft (0 to 7,500m)
-Accuracy (RVR)	: ±2% ±1/2 x [resolution]
-Resolution	: 50 ft
-Measuring period	: 15 seconds
-Supply Voltage	: Single-phase AC230V±10%, 50Hz±10%
-Reference Dimensions	: Approx.650W, 1600H, 580D [mm]
-Reference Weight	: Approx. 110kgf

(c) Wind Sensor

-Measuring Range	: Wind Speed 0 to 60 m/sec Wind Direction 0 to 360°
-Accuracy	: Wind Speed 0.1 m/sec up to 10 m/sec, 2% above 10 m/sec Wind Direction ±2.8°
-Threshold	: 0.4 m/sec
-Supply Voltage	: Single-phase AC230V±10%, 50Hz±10%

- Reference Dimensions : Approx.400W, 800H, 400D [mm]
- Reference Weight : Approx. 10kgf

(d) Temperature and Humidity Probe

- Measuring Range
 - Air Temperature : -50 to +50°C
 - Dew-Point temperature : -50 to +50°C
 - Relative Humidity : 0 to 100%
- Accuracy
 - Air Temperature : $\pm 0.3^{\circ}\text{C}$ rms.
 - Humidity : $\pm 2\%$ up to 90% RH
- Resolution
 - Air/Dew-Point Temperature : 0.1°C
 - Relative Humidity : 1%
- Supply Voltage : Supplied from Remote Weather Data Transmission
- Reference Dimensions : Approx.700W, 500H, 300D [mm] (with shelter)
- Reference Weight : Approx. 25kgf

(e) Rainfall Gauge Sensor

- Resolution : 0.5 mm
- Accuracy : ± 0.5 mm up to 20 mm
- Amount : 0 to 999.5 mm
- Intensity : 0.1 to 200 mm/h by Present Weather identifier
- Supply Voltage : Supplied from Remote Weather Data Transmission
- Reference Dimensions : Approx. $\phi 210$ (Diameter), 450H [mm]
- Reference Weight : Approx. 10kgf

(f) Remote Weather Data Transmission

- Function : The remote weather data transmission shall collect sensor data from the following sensors
 - Air Temperature / Humidity
 - Rain and Precipitation / Air Pressure
- Supply Voltage : Single-phase AC230V $\pm 10\%$, 50Hz $\pm 10\%$
- Reference Dimensions : Approx.810W, 1250H, 880D [mm]
- Reference Weight : Approx. 120kgf

(g) Weather Data Collecting Equipment

- Platform : 68000/CPU or equivalent and its peripherals

- Intelligent unit : Independent CPU, and software
- Input/Output
 - Input : Max 3-RVR sensors, 3-Wind stations,
2-Ceilometer, and 1-Remote Weather Data Transmission
 - Output : RS-232C ports
(Wind, RVR, and Surface weather)
- Supply Voltage : Single-phase AC230V \pm 10%, 50Hz \pm 10%
- Reference Dimensions : Approx.570W, 1750H, 630D [mm]
- Reference Weight : Approx. 200kgf

(h) Weather Report Editing System

- Computer : DOS/V Personal Computer, Intel-Pentium processor
- Hardware : Main memory 32MB or more
1-FDD (3.5"), HDD (2GB), CD-ROM,
RS-232C, TCP/IP, Analog RGB interface
- Software : Windows-NT or Windows 95
- Display : Full color CRT, 17-inch or more
- Printer : Laser shot page printer
- Supply Voltage : Single-phase AC230V \pm 10%, 50Hz \pm 10%
- Reference Dimensions : Approx.1200W, 1130H, 800D [mm]
- Reference Weight : Approx. 150kgf

(i) VDU

- Display Function : Air temperature, Dew-point, Temperature/Humidity,
Barometric pressure, Precipitation
- Display type : 640 \times 400 dots Full Color CRT (21 inches)
- Supply Voltage : Supplied from Weather Data Collecting Equipment ,Weather
Report Editing System
- Reference Dimensions : Approx.400W, 650H, 600D [mm]
- Reference Weight : Approx. up to 15kgf

(j) Printer

- Operation mode : LIPSIII
- Printing method : Semiconductor laser + Dry electrophotography
- Print resolution : 1,200 dpi \times 1,200 dpi
- Printing speed : 12 pieces of images / min
(A4 sideways x both sides)
- Paper feed : Cassette with a paper tray

- Paper size : Cassette A4
- Interface : IEEE1284 compatible parallel interface
Expandable interface x 2
- Supply Voltage : Supplied from Weather Report Editing System
- Reference Dimensions : Approx.490W, 586H, 674D [mm]
- Reference Weight : Approx. 23kgf

(k) Wind Display

- Function : Averaged wind direction (WD)
Direction variance (CW/CCW)
Averaged wind speed (WS)
Maximum & minimum speed (MAX/MIN)
Runway designator
Dimmer knob
Selector for runway designator
Cross wind
- Display type : 7 segments LED
- Supply Voltage : Supplied from each console
- Reference Dimensions : Approx.260W, 84H, 200D [mm]
- Reference Weight : Approx. 5kgf

(l) RVR Display

- Function : minute averaged RVR data
Runway designator
Scale out (Plus or Minus)
Dimmer knob
Tendency of RVR data (Up or Down)
- Display type : 7 segments LED
- Supply Voltage : Single-phase AC230V \pm 10%, 50Hz \pm 10%
- Supply Voltage : Supplied from each console
- Reference Dimensions : Approx.260W, 56H, 200D [mm]
- Reference Weight : Approx. 2kgf

(m) EL/MET Display

- Function : Air temperature, Dew-point, Temperature/Humidity,
Barometric pressure, Precipitation
- Display type : 640x400 dots Electro-Luminescence
- Supply Voltage : Supplied from each console

- Reference Dimensions : Approx.210W, 180H, 220D [mm]
- Reference Weight : Approx. 6kgf

(3) Power Facilities

<Power Facilities for TIA>

(a) 11kV VCB Panel

- Voltage rating : 12kV
- Current rating : More than 630A
- Reference Dimensions : Approx.1000W, 2450H, 2000D [mm]

(b) 11kV Transformer Panel

- Load switching capacity : 1250A
- Transformer capacity : 300kVA
- Type : Dry epoxy-resin molded type (ONAN)
- Input voltage : 11kV 3-phase 3-wire
- Output voltage : 400/230V 3-phase 4-wire
- Frequency : 50Hz
- Reference Dimensions : Approx.3000W, 2350H, 2000D [mm]

(c) Low Voltage Panel

- Function : Electric power shall be provided to fixed various equipment after switching 250kVA emergency generator power and commercial power (MCCB : 10 pieces).
- Reference Dimensions : Approx.800W, 1950H, 600D [mm]

(d) 250kVA Diesel Generator for emergency

- Function : Auto start for commercial power interruption and auto stop for commercial power recovery shall be provided (for back-up of commercial power). Generator shall be directly connected to engine.
More than 215kVA output shall be performed at altitude of 1400m.
- Composition : Diesel engine generator 1 set
Control panel 1 set
Battery for starting 1 set
Fuel tank (400 l) 1 set
Silencer 1 set

Flexible exhaust pipe 1 set
Fuel pump and piping 1 set

-Operating condition

Temperature : -5°C~+40°C
Humidity : up to 90% RH
Altitude : up to 1400m

-Diesel engine

Type : Water cooled 4-cycle 6-cylinder
Overload endurance : 110% for 30 minutes
Rotation : 1500rpm
Engine rating : Based on ISO 3046/I standard
Over speed endurance : 110% for one minutes
Fuel to be used : Heavy duty diesel oil
Cooling system : Radiator
Direction of rotation : Clockwise looking from exciter end
Starting system : DC motor

-Generator

Type : Open self cooled rotating field type with damper winding
Output capacity : 250kVA
Voltage : AC400/230V ± 10% 3-phase 4-wire
Current : Approx.360A
Frequency : 50Hz ± 10%
Winding : Star
Insulation : F class
Exciting system : Brushless self-exciting system
Power factor : 80% lag
Control circuit voltage : DC 24V

-Engine Generator Control Panel function

Automatic operation :

- 1) Usually, the mains power will be supplied to the load through the control panel of the generator set.
- 2) If mains power fails, standby engine generator will automatically start.
- 3) Then, the engine generator will automatically take over the load after its output voltage had built up.
- 4) When mains power recover, AC power supply will be changed over to mains power after a confirming time delay. Then the engine generator is automatically stopped.
- 5) If the operating generator fails in any of the fault condition listed below, such generator will be automatically shut down.

Fault conditions:

- Low oil pressure
- High water temperature
- Generator voltage abnormal
- Over speed
- Start failure

Manual operation :

Manual start-stop and load on-off of the engine generator can be carried out by means of switch operation.

Starter Battery

Heavy duty lead-acid battery ;rated at 24V; and capacity of 200 ampere-hour at 20 hour rate.

Battery Charger

Automatic transistor type, rated for charging at 5 ampere or more; installed inside automatic control panel.

- Reference Engine generator Dimensions : Approx.3000W, 1660H, 1200D [mm]
- Reference Engine generator Weight : Approx.2450kgf
- Reference Fuel tank Dimensions : Approx.1240W, 1755H, 920D [mm]
- Reference Tank (dry) Weight : Approx.275kgf
- Reference Control panel Dimensions : Approx.800W, 1950H, 800D [mm]
- Reference Battery rack Dimensions : Approx.605W, 305H, 570D [mm]
- Reference Battery rack Weight : Approx.131kgf (battery mounted)

(e) 10kVA UPS

- Function : AC power shall be provided without interruption included battery.
- AC input voltage : 3-phase 4-wire AC400/230V \pm 10%, 50Hz \pm 5%
- Max. input current : 16A
- AC output capacity : 10kVA
- AC output voltage : Single-phase 2-wire AC230/100V \pm 2%
50Hz \pm 0.1%
- Back-up time : 60 minutes
- Reference Dimensions : Approx.2000W,1950H, 800D [mm]
- Reference Weight : Approx.1500kgf

<Power Facilities for Sanothimi Training Center>

(a) 150kVA Diesel Generator for emergency

- Function : Auto start for commercial power interruption and auto stop for commercial power recovery shall be provided (for back-up of commercial power). Generator shall be

directly connected to engine.

More than 129kVA output shall be performed at altitude of 1400m.

-Composition	: Diesel engine generator	1 set
	Control panel	1 set
	Buttery for starting	1 set
	Fuel tank (1000 l)	1 set
	Silencer	1 set
	Flexible exhaust pipe	1 set
	Engine cubicle	1 set
	(Waterproof, low noise (75dB))	
	Fuel pump and piping	1 set
-Operating condition		
Temperature	: -5°C~+40°C	
Humidity	: up to 90% RH	
Altitude	: up to 1400m	
-Diesel engine		
Type	: Water cooled 4-cycle 6-cylinder	
Overload endurance	: 110% for 30 minutes	
Rotation	: 1500rpm	
Engine rating	: Based on ISO 3046/I standard	
Over speed endurance	: 110% for one minutes	
Fuel to be used	: Heavy duty diesel oil	
Cooling system	: Radiator	
Direction of rotation	: Clockwise looking from exciter end	
Starting system	: DC motor	
-Generator		
Type	: Open self cooled rotating field type with damper winding	
Output capacity	: 150kVA	
Voltage	: AC400/230V ± 10% 3-phase 4-wire	
Current	: Approx.217A	
Frequency	: 50Hz ± 10%	
Winding	: Star	
Insulation	: F class	
Exciting system	: Brushless self-exciting system	
Power factor	: 80% lag	
Control circuit voltage	: DC 24V	
-Engine Generator Control Panel function		
Automatic operation	:	

- 1) Usually, the mains power will be supplied to the load through the control panel of the generator set.
- 2) If mains power fails, standby engine generator will automatically start.
- 3) Then, the engine generator will automatically take over the load after its output voltage had built up.
- 4) When mains power recover, AC power supply will be changed over to mains power after a confirming time delay. Then the engine generator is automatically stopped.
- 5) If the operating generator fails in any of the fault condition listed below, such generator will be automatically shut down.

Fault conditions:

- Low oil pressure
- High water temperature
- Generator voltage abnormal
- Over speed
- Start failure

Manual operation :

Manual start-stop and load on-off of the engine generator can be carried out by means of switch operation.

Starter Battery

Heavy duty lead-acid battery ;rated at 24V; and capacity of 200 ampere-hour at 20 hour rate.

Battery Charger

Automatic transistor type, rated for charging at 5 ampere or more; installed inside automatic control panel.

Reference Cubicle Dimensions	: Approx.4340W, 2620H, 1340D [mm]
Reference Cubicle Weight	: Approx.3550kgf
Reference Fuel tank Dimensions	: Approx.1600W, 884H, 1000D [mm]
Reference Tank (dry) Weight	: Approx.270kgf
Reference Control panel Dimensions	: Approx.1200W, 1000H, 800D [mm]
Reference Battery rack Dimensions	: Approx.605W, 305H, 570D [mm]
Reference Battery rack Weight	: Approx.131kgf (battery mounted)

(b) Low Voltage Panel

- Function : Electric power shall be provided to fixed various equipment after switching 150kV emergency generator power and commercial power (MCCB : 7 pieces).
- Reference Dimensions : Approx.800W, 1950H, 600D [mm]

(c) 10kVA UPS

-Function	: AC power shall be provided without interruption included battery.
-AC input voltage	: Single-phase 2-wire AC200V \pm 10%, 50Hz \pm 5%
-Max.input current	: 56A
-AC output capacity	: 10kVA
-AC output voltage	: Single-phase 2-wire AC230/200/100V \pm 2% 50Hz \pm 0.1%
-Back-up time	: 10 minutes
-Reference Dimensions	: Approx.500W, 950H, 700D [mm]
-Reference Weight	: Approx.360kgf

<Power Facilities for Phulchoki Repeater Station>

(a) 37.5kVA Diesel Generator for emergency

-Function	: Auto start for commercial power interruption and auto stop for commercial power recovery shall be provided (for back-up of commercial power). Generator shall be directly connected to engine. <u>More than 25kVA output shall be performed at altitude of 2800m</u>
-Composition	: Diesel engine generator 1 set Control panel 1 set Battery for starting 1 set Fuel tank (100 l) 1 set Silencer 1 set Flexible exhaust pipe 1 set Fuel pump and piping 1 set
-Operating condition	
Temperature	: -5°C ~ +40°C
Humidity	: up to 90% RH
Altitude	: up to 2800m
-Diesel engine	
Type	: Water cooled 4-cycle 4-cylinder
Overload endurance	: 110% for 30 minutes
Rotation	: 1500rpm
Engine rating	: Based on ISO3046/l standard
Over speed endurance	: 110% for one minutes
Fuel to be used	: Heavy duty diesel oil

Cooling system : Radiator
Direction of rotation : Clockwise looking from exciter end
Starting system : DC motor

-Generator

Type : Open self cooled rotating field type with damper winding
Output capacity : 37.5kVA
Voltage : 3-phase 4-wire AC400/230V \pm 10%
Current : Approx.57A
Frequency : 50Hz \pm 10%
Winding : Star
Insulation : F class
Exciting system : Brushless self-exciting system
Power factor : 80% lag
Control circuit voltage : DC 24V

-Engine Generator Control Panel function

Automatic operation :

- 1) Usually, the mains power will be supplied to the load through the control panel of the generator set.
- 2) If mains power fails, standby engine generator will automatically start.
- 3) Then, the engine generator will automatically take over the load after its output voltage had built up.
- 4) When mains power recover, AC power supply will be changed over to mains power after a confirming time delay. Then the engine generator is automatically stopped.
- 5) If the operating generator fails in any of the fault condition listed below, such generator will be automatically shut down.

Fault conditions:

- Low oil pressure
- High water temperature
- Generator voltage abnormal
- Over speed
- Start failure

Manual operation :

Manual start-stop and load on-off of the engine generator can be carried out by means of switch operation.

Starter Battery

Heavy duty lead-acid battery ;rated at 24V; and capacity of 120 ampere-hour at 20 hour rate.

Battery Charger

Automatic transistor type, rated for charging at 5 ampere or more; installed inside automatic

control panel.

Reference Engine generator Dimensions	: Approx.2250W, 1254H, 900D [mm]
Reference Engine generator Weight	: Approx.1450kgf
Reference Fuel tank Dimensions	: Approx.600W, 1000H, 500D [mm]
Reference Tank (dry) Weight	: Approx.280kgf
Reference Control panel Dimensions	: Approx.700W, 1950H, 600D [mm]
Reference Battery rack Dimensions	: Approx.455W, 295H, 560D [mm]
Reference Battery rack Weight	: Approx.74kgf (battery mounted)

(b) Low Voltage Panel

-Function	: Electric power shall be provided to fixed various equipment after switching 37.5kVA emergency generator power and commercial power ,and also switching this switched output power and NTC emergency diesel generator output. (MCCB : 15 pieces)
-Reference Dimensions	: Approx.800W, 1650H, 600D [mm]

(c) 30kVA AVR

-Function	: The voltage of commercial power shall be automatically regulated and a by-pass switch for malfunction of AVR shall be provided.
-Input voltage	: 3-phase 4-wire 400/230V \pm 20% 50Hz
-Output voltage	: 3-phase 4-wire 400/230V \pm 3% 50Hz
-Service rating	: Continuous
-Arresting of lightning	: Counterplot for avoiding lightning shall be provided between each lines and ground.
-Reference Dimensions	: Approx.1000W, 1750H, 800D [mm]
-Reference Weight	: Approx.980kgf

(d) 10kVA Surge suppression transformer panel

-Function	: Counter plot for arresting of lightning shall be provided .
-Capacity	: 10kVA
-Input voltage	: 3-phase 3-wire AC400V
-Output voltage	: 3-phase 3-wire AC400V
-Voltage ratio	: 1 : 1
-Service rating	: Continuous
-Cooling system	: Natural air cooling

- Dielectric strength : AC1500V for 1 minutes
- Insulation resistance : More than 50M Ω
- Reference Dimensions : Approx.1000W, 1750H, 500D [mm]
- Reference Weight : Approx.230kgf

(e) DC Power Supply Unit with Battery Charger

-Battery charger

- Charger system : Dual system
- AC input : 3-phase 3-wire 400V 50Hz
- Rating : Continuous
- Voltage accuracy : Less than $\pm 1.5\%$
- Current : 40A \times 2 (set)
- Reference Dimensions : Approx.1200W, 1450H, 600D [mm]
- Reference Weight : Approx.560kgf

-Battery

- Capacity : DC24V 400Ah \times 2(dual)
- Battery type : MSE type
- Reference Dimensions : Approx.1220W, 1155H, 635D [mm]
- Reference Weight : Approx.815kgf

The installation of above equipment should be carried under the technical standard for electronic facilities, published by the Japanese Ministry of International Trade and Industry rule.

The test and the inspection at site, specifications, manufacturer's standard construction methods and so on may be applied to, unless otherwise specified.

Appendix 9 References

No.	Title	Form		The number of pages	Original/Copy	The number of copies	Donor	Publication	Purchase/Present
1	Act No.7 of 2053 B.S.(1996) An Act made to provide for the Establishment of the Nepal Civil Aviation Authority	Paper (clipped)	A4	35	Copy	1	TIA	Government of Nepal	Present
2	Draft of CAAN Organization Structure	Paper	A4	1	Copy	1	TIA	TIA	Present
3	Fact & Figures Tribhuvan International Airport	Book	unfixed form	18	Original	1	TIA	TIA	Present
4	Budget for past 5 years Government of Nepal and Ministry of Tourism	Paper	A4	1	Copy	1	TIA	TIA	Present
5	Revenue for past 5 years DCA and TIA	Paper	A4	1	Copy	1	TIA	TIA	Present
6	Aeronautical Information Publication, 1999	Book	A4	120	Copy	1	CAAN	CAAN	Present
7	CAAN Organization Manual 7	Book	A4	83	Copy	1	CAAN	CAAN	Present
8	Leaflet of TIA improvement Project so called ADB Project, November 1998	Pamphlet	unfixed form	1	Original	1	TIA	TIA(Project Directorate)	Present
9	Annual Flight Movement 1996/1997	Papers	A4	2	Copy	1	TIA	TIA	Present

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