

**OFFICE OF THE DIRECTOR
ARUNACHAL PRADESH ENERGY DEVELOPMENT AGENCY
URJA BHAWAN, T.T. MARG, ITANAGAR – 791 111.**

No. APEDA/W-248/BVIP/2008-09

Dtd. Itanagar, the 3rd June'09

NOTICE INVITING TENDER

Sealed Tenders are invited by Arunachal Pradesh Energy Development Agency (APEDA) for designing, manufacturing, supplying, installing, testing and commissioning of electro-mechanical equipments for micro and mini hydro electric projects of different capacities for border village illumination / electrification in the state of Arunachal Pradesh.

Sl. No.	Capacity of Projects (KW)	Numbers of Projects.
1	1X10	23
2	1X15	8
3	1X25	22
4	1X50	7
5	2X50	4
6	2X100	3

The eligibility criteria and complete bidding documents are available on the **website www.apeda.co.in** Interested bidders can download the bidding documents to commence preparation of bids **to gain time**. However, they will be required to purchase pre-authenticated copy of the documents from the office of the **Director, APEDA, Urja Bhawan, T.T. Marg, P.O. Itanagar-791-111, e-mail: apedita@sancharnet.in; director@apeda.co.in, Phone: +91-360-2211160 , 2217870, Fax: +91-360-2214426. Addendum / Corrigendum / Extension (if any) pertaining to this tender will be published in above website only. For this Bidders are requested to visit the website regularly till the opening of this NIT. **In case of any discrepancy between the documents downloaded by the prospective bidder (s) and the documents issued by the Department, the later shall prevail.** Tender documents will be issued during office working hours from **25th June 2009 to 17th July 2009** on payment of **Rs. 2000.00** in cash or in Demand Draft drawn in favour of **Director, APEDA, Itanagar** and it will be opened on **20th July 2009 at 3.00 PM**. Application for purchase of tender documents should**

be given in Company's Letter Head. Turbine Manufacturers of repute or Firms / Companies having dealership of proven turbines from reputed turbine manufacturers or having Joint Venture agreement with turbine manufacturers are eligible to participate in the Tender and proof thereof should be enclosed along with their application.

Tenders will be opened by a Board formed for the purpose and in the presence of the intending tenderers one day after the last date of sale of tender document and if it falls on a holiday then they will be opened on the next working day.

A pre-Bid meeting has been fixed on **18th June 2009 at 11.00 AM** in the Conference Room of the MNRE Office, Block No. 14, CGO Complex , New Delhi and intending bidders are requested to attend the same.

Sd/-

Director, APEDA

Memo No. APEDA/W-248/BVIP/2008-09
Copy to :-

Dtd. Itanagar, the 3rd June'09

1. The Director, IPR, Govt. of Arunachal Pradesh, Naharlagun with the request to publish above NIT immediately in two of the National Dailies and two of the Local Dailies.
2. The Adviser (SHP), Ministry of New & Renewable Energy, Block No. 14, C.G.O. Complex, Lodhi Road, New Delhi for information please.
3. The Chairman, APEDA, Itanagar for information please.
4. The C.S.-cum- Secy.(P & NCER), Govt. of AP, Itanagar for information please.
5. The Accountant, APEDA for information and record.
6. Office Copy.

Director, APEDA.

SECTION – I
PROJECT DETAILS AND SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Gomkang MHP, 25KW

1.1 LOCATION OF SCHEME

- a. Village : New Sharbang
- b. Circle : Lumla
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 50.00 Km
- d. Distance from road head (Manual Cartage) : 1.20 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 33 00 N
- b. Longitude : 91 42 10 E
- c. Topographical Map Reference : 78M/10

1.2 SITE PARAMETERS

- a. Name of Stream : Gomkang
- b. Gross Head : 65 M
- c. Design Discharge : 0.075 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Bomlachu MHP, 25KW

1.1 LOCATION OF SCHEME

- a. Village : Klemta
- b. Circle : Tawang
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 40 Km
- d. Distance from road head (Manual Cartage) : 1.10 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 42 42 N
- b. Longitude : 91 54 20 E
- c. Topographical Map Reference : 78M/14

1.2 SITE PARAMETERS

- a. Name of Stream : Bumlachu
- b. Gross Head : 60 M
- c. Design Discharge : 0.075 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Paidhar Rong MHP, 10KW

1.1 LOCATION OF SCHEME

- a. Village : New Paidhar
- b. Circle : Tawang
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 20.00 Km
- d. Distance from road head (Manual Cartage) : 1.25 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 34 20 N
- b. Longitude : 91 51 00 E
- c. Topographical Map Reference : 78M/14

1.2 SITE PARAMETERS

- a. Name of Stream : Paidhar Rong
- b. Gross Head : 58 M
- c. Design Discharge : 0.050 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Tsamling Chu MHP, 25KW

1.1 LOCATION OF SCHEME

- a. Village : Burding
- b. Circle : Zemithang
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 101 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 43 12 N
- b. Longitude : 91 44 46 E
- c. Topographical Map Reference : 78M/10

1.2 SITE PARAMETERS

- a. Name of Stream : Tsamling Chu
- b. Gross Head : 52 M
- c. Design Discharge : 0.138 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Taktsang Chu MHP, 50KW

1.1 LOCATION OF SCHEME

- a. Village : Taktsang
- b. Circle : Zemithang
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 58 Km
- d. Distance from road head (Manual Cartage) : 0.800 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 43 20 N
- b. Longitude : 91 48 00 E
- c. Topographical Map Reference : 78M/14

1.2 SITE PARAMETERS

- a. Name of Stream : Taktsang Chu
- b. Gross Head : 61 M
- c. Design Discharge : 0.275 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

- 1.0 NAME AND CAPACITY OF PROJECT : Kharung Chu MHP, 25KW**
- 1.1 LOCATION OF SCHEME**
- a. Village : New Kharung
 - b. Circle : Mukto
 - c. District : Tawang
 - d. District HQ : Tawang
 - d. State : Arunachal Pradesh
- 1.1.1 Access**
- a. Rail head (Name of last railway station) : Tezpur
 - b. Road head (Name of District HQ) : Tawang
 - c. Distance of Road Head from Dist. HQ : 50.00 Km
 - d. Distance from road head (Manual Cartage) : 5.00 Km
- 1.1.2 Geographical Co-ordinates**
- a. Latitude : 27 31 30 N
 - b. Longitude : 91 47 10 E
 - c. Topographical Map Reference : 78M/14
- 1.2 SITE PARAMETERS**
- a. Name of Stream : Kharung Chu
 - b. Gross Head : 73 M
 - c. Design Discharge : 0.0 75 cumecs
- 1.3 TURBINE**
- a. Type : Crossflow/Pelton/Targo-Impulse
 - b. Output at the Shafts : 25 KW
 - c. Number : One
 - d. Material : Stainless Steel Nickel Chromium
- 1.4 GENERATOR**
- a. Type : Synchronous
 - b. Number : One
 - c. Power Output Rating : 25 KW
 - d. Nominal Voltage of generation : 415 V \pm 5%
 - e. Frequency : 50 Hz \pm 3%
 - f. Power Factor : 0.8 lag.
 - g. Cooling : Natural Open air.
 - h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Gyamdong Chu MHP, 50KW

1.1 LOCATION OF SCHEME

- a. Village : Nosh Gompa
- b. Circle : Mukto
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 55.00 Km
- d. Distance from road head (Manual Cartage) : 5.20 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 32 35 N
- b. Longitude : 91 52 00 E
- c. Topographical Map Reference : 78M/14

1.2 SITE PARAMETERS

- a. Name of Stream : Gyamdong Chu
- b. Gross Head : 64 M
- c. Design Discharge : 0.250 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Selarong MHP, 50KW

1.1 LOCATION OF SCHEME

- a. Village : Babrang
- b. Circle : Jang
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 55 Km
- d. Distance from road head (Manual Cartage) : 0.800 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 32 28 N
- b. Longitude : 92 02 24 E
- c. Topographical Map Reference : 83A/02

1.2 SITE PARAMETERS

- a. Name of Stream : Selarong
- b. Gross Head : 58 M
- c. Design Discharge : 0.250 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Biga Rong MHP, 10KW

1.1 LOCATION OF SCHEME

- a. Village : Kitkhar
- b. Circle : Tawang
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 28 Km
- d. Distance from road head (Manual Cartage) : 1.30 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 33 50 N
- b. Longitude : 91 52 00 E
- c. Topographical Map Reference : 78M / 14

1.2 SITE PARAMETERS

- a. Name of Stream : Biga Rong
- b. Gross Head : 40 M
- c. Design Discharge : 0.050 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Kyaleng Rong MHP, 15KW

1.1 LOCATION OF SCHEME

- a. Village : Sangeyling
- b. Circle : Tawang
- c. District : Tawang
- d. District HQ : Tawang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Tawang
- c. Distance of Road Head from Dist. HQ : 20.00 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 33 30 N
- b. Longitude : 91 52 15 E
- c. Topographical Map Reference : 78M / 14

1.2 SITE PARAMETERS

- a. Name of Stream : Kyaleng Rong
- b. Gross Head : 40 M
- c. Design Discharge : 0.075 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 15 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 15 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Melong Kang Nallah MHP, 25KW

1.1 LOCATION OF SCHEME

- a. Village : Melong Kang
- b. Circle : Dirang
- c. District : West Kameng
- d. District HQ : Bomdila
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Bomdila
- c. Distance of Road Head from Dist. HQ : 53.00 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 24 18 N
- b. Longitude : 92 04 59 E
- c. Topographical Map Reference : 83A / 03

1.2 SITE PARAMETERS

- a. Name of Stream : Melong Kang Nallah
- b. Gross Head : 42 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Jangtangpu MHP, 10 KW

1.1 LOCATION OF SCHEME

- a. Village : Gungtanka
- b. Circle : Thembang
- c. District : West Kameng
- d. District HQ : Bomdila
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Bomdila
- c. Distance of Road Head from Dist. HQ : 40.00 Km
- d. Distance from road head (Manual Cartage) : 0.70 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 22 07 N
- b. Longitude : 92 21 25 E
- c. Topographical Map Reference : 83A / 05

1.2 SITE PARAMETERS

- a. Name of Stream : Jangtangpu
- b. Gross Head : 36 M
- c. Design Discharge : 0.055 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : **Dulakho MHP, 2 x 100 KW**

1.1 LOCATION OF SCHEME

- a. Village : Tsering Pam
- b. Circle : Singchung
- c. District : West Kameng
- d. District HQ : Bomdila
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Bomdila
- c. Distance of Road Head from Dist. HQ : 21.00 Km
- d. Distance from road head (Manual Cartage) : 0.50Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 11 54 N
- b. Longitude : 92 28 38 E
- c. Topographical Map Reference : 83A / 08

1.2 SITE PARAMETERS

- a. Name of Stream : Dulakho
- b. Gross Head : 75 M
- c. Design Discharge : 0.500 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 100 KW
- c. Number : Two
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : Two
- c. Power Output Rating : 100 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : **Khadibe MHP, 2 x 100 KW**

1.1 LOCATION OF SCHEME

- a. Village : Tania
- b. Circle : Thrizino
- c. District : West Kameng
- d. District HQ : Bomdila
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Bomdila
- c. Distance of Road Head from Dist. HQ : 117.00 Km
- d. Distance from road head (Manual Cartage) : 0.50Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 18 37 N
- b. Longitude : 92 45 00 E
- c. Topographical Map Reference : 83A / 15

1.2 SITE PARAMETERS

- a. Name of Stream : Khadibe
- b. Gross Head : 67 M
- c. Design Discharge : 0.750 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Targo-Impulse
- b. Output at the Shafts : 100 KW
- c. Number : Two
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : Two
- c. Power Output Rating : 100 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Hathi Nallah MHP, 50 KW

1.1 LOCATION OF SCHEME

- a. Village : Kameng Bari
- b. Circle : Bhalukpong
- c. District : West Kameng
- d. District HQ : Bomdila
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Bomdila
- c. Distance of Road Head from Dist. HQ : 117.00 Km
- d. Distance from road head (Manual Cartage) : 0.50Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 04 05 N
- b. Longitude : 92 25 05 E
- c. Topographical Map Reference : 83B / 08

1.2 SITE PARAMETERS

- a. Name of Stream : Hathi Nallah
- b. Gross Head : 45 M
- c. Design Discharge : 0.250 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Para Ph-I MHP, 25 KW

1.1 LOCATION OF SCHEME

- a. Village : Kesse Bagang
- b. Circle : Chayang Tajo
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 91.00 Km
- d. Distance from road head (Manual Cartage) : 07.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 46 00 N
- b. Longitude : 93 11 00 E
- c. Topographical Map Reference : 83E / 01

1.2 SITE PARAMETERS

- a. Name of Stream : Para
- b. Gross Head : 15.54 M
- c. Design Discharge : 0.500 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : **Para Ph-II MHP, 25 KW**

1.1 LOCATION OF SCHEME

- a. Village : Yangfo
- b. Circle : Chayang Tajo
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 92.00 Km
- d. Distance from road head (Manual Cartage) : 07.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 43 39 N
- b. Longitude : 93 08 22 E
- c. Topographical Map Reference : 83E / 02

1.2 SITE PARAMETERS

- a. Name of Stream : Para
- b. Gross Head : 18 M
- c. Design Discharge : 0.250 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Wada MHP, 15 KW

1.1 LOCATION OF SCHEME

- a. Village : Wada bagang
- b. Circle : Chayang Tajo
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 95 Km
- d. Distance from road head (Manual Cartage) : 08.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 42 34 N
- b. Longitude : 93 10 27 E
- c. Topographical Map Reference : 83E / 02

1.2 SITE PARAMETERS

- a. Name of Stream : Wada
- b. Gross Head : 25 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 15 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 15 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Lama MHP, 10 KW

1.1 LOCATION OF SCHEME

- a. Village : Keyang
- b. Circle : Chayang Tajo
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 92 Km
- d. Distance from road head (Manual Cartage) : 05.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 43 27 N
- b. Longitude : 94 07 22 E
- c. Topographical Map Reference : 83E / 02

1.2 SITE PARAMETERS

- a. Name of Stream : Lama
- b. Gross Head : 15.5 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : **Wabung MHP, 10 KW**

1.1 LOCATION OF SCHEME

- a. Village : Bengdey
- b. Circle : Sawa
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 46 Km
- d. Distance from road head (Manual Cartage) : 4.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 40 12 N
- b. Longitude : 93 03 00 E
- c. Topographical Map Reference : 83E / 02

1.2 SITE PARAMETERS

- a. Name of Stream : Wabung
- b. Gross Head : 18 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : **Kari MHP, 10 KW**

1.1 LOCATION OF SCHEME

- a. Village : Naringwa
- b. Circle : Seppa
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 10.00 Km
- d. Distance from road head (Manual Cartage) : 4.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 18 34 N
- b. Longitude : 93 01 00 E
- c. Topographical Map Reference : 83E / 03

1.2 SITE PARAMETERS

- a. Name of Stream : Kari
- b. Gross Head : 16 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : **Neking MHP, 25 KW**

1.1 LOCATION OF SCHEME

- a. Village : Watte
- b. Circle : Seppa
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 18.00 Km
- d. Distance from road head (Manual Cartage) : 2.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 17 44 N
- b. Longitude : 92 57 25 E
- c. Topographical Map Reference : 83A / 15

1.2 SITE PARAMETERS

- a. Name of Stream : Neking
- b. Gross Head : 21 M
- c. Design Discharge : 0.250 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Kaya MHP, 10 KW

1.1 LOCATION OF SCHEME

- a. Village : Richukrong
- b. Circle : Richukrong
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 85.00 Km
- d. Distance from road head (Manual Cartage) : 1.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 24 00 N
- b. Longitude : 92 51 13 E
- c. Topographical Map Reference : 83A / 15

1.2 SITE PARAMETERS

- a. Name of Stream : Kaya
- b. Gross Head : 17 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Khu MHP, 10 KW

1.1 LOCATION OF SCHEME

- a. Village : Pankar
- b. Circle : Richukrong
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 85.00 Km
- d. Distance from road head (Manual Cartage) : 4.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 24 55 N
- b. Longitude : 92 49 38 E
- c. Topographical Map Reference : 83A / 15

1.2 SITE PARAMETERS

- a. Name of Stream : Khu
- b. Gross Head : 15.5 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Lichiso MHP, 25 KW

1.1 LOCATION OF SCHEME

- a. Village : Lorah
- b. Circle : Bameng
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 35.00 Km
- d. Distance from road head (Manual Cartage) : 2.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 34 18 N
- b. Longitude : 92 58 09 E
- c. Topographical Map Reference : 83E / 02

1.2 SITE PARAMETERS

- a. Name of Stream : Lichiso
- b. Gross Head : 16 M
- c. Design Discharge : 0.500 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Pabia MHP, 50 KW

1.1 LOCATION OF SCHEME

- a. Village : Pakke Camp
- b. Circle : Bameng
- c. District : East Kameng
- d. District HQ : Seppa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tezpur
- b. Road head (Name of District HQ) : Seppa
- c. Distance of Road Head from Dist. HQ : 50.00Km
- d. Distance from road head (Manual Cartage) : 1.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 30 41 N
- b. Longitude : 93 00 51 E
- c. Topographical Map Reference : 83A / 14

1.2 SITE PARAMETERS

- a. Name of Stream : Pabia
- b. Gross Head : 22 M
- c. Design Discharge : 0.500 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Purchi MHP, 100 KW

1.1 LOCATION OF SCHEME

- a. Village : Sate
- b. Circle : Sarli
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 53 Km
- d. Distance from road head (Manual Cartage) : 0.200 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 59 34 N
- b. Longitude : 93 11 27 E
- c. Topographical Map Reference : 83E / 01

1.2 SITE PARAMETERS

- a. Name of Stream : Purchi
- b. Gross Head : 50 M
- c. Design Discharge : 0.500 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : Two
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : Two
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Wachi MHP, 10 KW

1.1 LOCATION OF SCHEME

- a. Village : Sewaring
- b. Circle : Sarli
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 47 Km
- d. Distance from road head (Manual Cartage) : 45 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 57 00 N
- b. Longitude : 93 13 30 E
- c. Topographical Map Reference : 83E / 01

1.2 SITE PARAMETERS

- a. Name of Stream : Wachi
- b. Gross Head : 40 M
- c. Design Discharge : 0.050 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Tapih MHP, 10 KW

1.1 LOCATION OF SCHEME

- a. Village : Chello
- b. Circle : Koloriang
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 0.500 Km
- d. Distance from road head (Manual Cartage) : 22 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 57 00 N
- b. Longitude : 93 17 30 E
- c. Topographical Map Reference : 83E / 05

1.2 SITE PARAMETERS

- a. Name of Stream : Tapih
- b. Gross Head : 64 M
- c. Design Discharge : 0.050 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Segia MHP, 15 KW

1.1 LOCATION OF SCHEME

- a. Village : Tapin
- b. Circle : Koloriang
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 7.00 Km
- d. Distance from road head (Manual Cartage) : 24.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 56 15 N
- b. Longitude : 93 26 15 E
- c. Topographical Map Reference : 83E / 05

1.2 SITE PARAMETERS

- a. Name of Stream : Segia
- b. Gross Head : 35 M
- c. Design Discharge : 0.075 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 15 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 15 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Muju MHP, 50 KW

1.1 LOCATION OF SCHEME

- a. Village : Buyang
- b. Circle : Koloriang
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 25 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 57 07 N
- b. Longitude : 93 16 90 E
- c. Topographical Map Reference : 83E / 05

1.2 SITE PARAMETERS

- a. Name of Stream : Muju
- b. Gross Head : 54 M
- c. Design Discharge : 0.250 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Naya Phum MHP,10 KW

1.1 LOCATION OF SCHEME

- a. Village : Fua
- b. Circle : Koloriang
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 28 Km
- d. Distance from road head (Manual Cartage) : 03.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 57 00 N
- b. Longitude : 93 16 30 E
- c. Topographical Map Reference : 83E / 05

1.2 SITE PARAMETERS

- a. Name of Stream : Naya Phum
- b. Gross Head : 50 M
- c. Design Discharge : 0.050 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Patuk MHP,10 KW

1.1 LOCATION OF SCHEME

- a. Village : Patuk
- b. Circle : Parsi -Parlo
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 13.00 Km
- d. Distance from road head (Manual Cartage) : 72 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28 02 24 N
- b. Longitude : 93 27 00 E
- c. Topographical Map Reference : 82H / 08

1.2 SITE PARAMETERS

- a. Name of Stream : Patuk
- b. Gross Head : 35 M
- c. Design Discharge : 0.050 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 10 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 10 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Pacho MHP, 25 KW

1.1 LOCATION OF SCHEME

- a. Village : Picha II
- b. Circle : Yangte
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 83.00 Km
- d. Distance from road head (Manual Cartage) : 0.300 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28 50 58 N
- b. Longitude : 93 38 68 E
- c. Topographical Map Reference : 82E / 09

1.2 SITE PARAMETERS

- a. Name of Stream : Pacho
- b. Gross Head : 38 M
- c. Design Discharge : 0.125 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : **Langa MHP, 2 x 50 KW**

1.1 LOCATION OF SCHEME

- a. Village : Ringte
- b. Circle : Yangte
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 86 Km
- d. Distance from road head (Manual Cartage) : 2.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 50 43 N
- b. Longitude : 93 39 10 E
- c. Topographical Map Reference : 83E / 09

1.2 SITE PARAMETERS

- a. Name of Stream : Langa
- b. Gross Head : 47M
- c. Design Discharge : 0.500 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : Two
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : Two
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Parchang MHP,25 KW

1.1 LOCATION OF SCHEME

- a. Village : Youndo
- b. Circle : Passang
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 96.00 Km
- d. Distance from road head (Manual Cartage) : 15.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 44 72 N
- b. Longitude : 93 18 40 E
- c. Topographical Map Reference : 82E / 06

1.2 SITE PARAMETERS

- a. Name of Stream : Parchang
- b. Gross Head : 75 M
- c. Design Discharge : 0.075 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 25 KW
- c. Number : One
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : One
- c. Power Output Rating : 25 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Pallu MHP, 2 x 50 KW

1.1 LOCATION OF SCHEME

- a. Village : Nyapin H/Q
- b. Circle : Nyapin
- c. District : Kurung Kumey
- d. District HQ : Koloriang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Koloriang
- c. Distance of Road Head from Dist. HQ : 81 Km
- d. Distance from road head (Manual Cartage) : 0.100 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27 44 21 N
- b. Longitude : 93 22 70 E
- c. Topographical Map Reference : 83E / 06

1.2 SITE PARAMETERS

- a. Name of Stream : Pallu
- b. Gross Head : 40M
- c. Design Discharge : 0.500 cumecs

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo-Impulse
- b. Output at the Shafts : 50 KW
- c. Number : Two
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : Two
- c. Power Output Rating : 50 KW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Tyanu MHP (2x100 kW)

1.1 LOCATION OF SCHEME

- a. Village : Khasa
- b. Circle : Panchau
- c. District : Tirap
- d. District HQ : Khonsa
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Khonsa
- c. Distance of Road Head from Dist. HQ : 76.00 Km
- d. Distance from road head (Manual Cartage) : 2.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 26° 42' 36" N
- b. Longitude : 95° 22' 19" E
- c. Topographical Map Reference : 83 N/06

1.2 SITE PARAMETERS

- a. Name of Stream : Tyanu
- b. Gross Head : 79.00 M
- c. Design Discharge : 0.500 cumecs. (Total for both the machine)

1.3 TURBINE

- a. Type : Crossflow/Pelton/ Turgo Imp
- b. Rating : 100 kW
- c. Number : 2 (Two)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 2 (Two)
- c. Power Output Rating : 100 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Sarti MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Sarti
- b. Circle : Wallong
- c. District : Anjaw
- d. District HQ : Hayuliang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Hayuliang
- c. Distance of Road Head from Dist. HQ : 115.00 Km
- d. Distance from road head (Manual Cartage) : 0.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 00' 28" N
- b. Longitude : 96° 57' 47" E
- c. Topographical Map Reference : 91 D/16

1.2 SITE PARAMETERS

- a. Name of Stream : Sarti
- b. Gross Head : 18.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Sup Nallah MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Suplang - II
- b. Circle : Hayuliang
- c. District : Anjaw
- d. District HQ : Hayuliang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Hayuliang
- c. Distance of Road Head from Dist. HQ : 13.00 Km
- d. Distance from road head (Manual Cartage) : 1.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 02' 37" N
- b. Longitude : 96° 36' 18" E
- c. Topographical Map Reference : 91 D/12

1.2 SITE PARAMETERS

- a. Name of Stream : Sup Nallah
- b. Gross Head : 58.00 M
- c. Design Discharge : 0.075 cumecs.

1.3 TURBINE

- a. Type : Crossflow/Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1(one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Mompani MHP (15 kW)

1.1 LOCATION OF SCHEME

- a. Village : Chirang
- b. Circle : Hayuliang
- c. District : Anjaw
- d. District HQ : Hayuliang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Hayuliang
- c. Distance of Road Head from Dist. HQ : 24.00 Km
- d. Distance from road head (Manual Cartage) : 0.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 02' 15" N
- b. Longitude : 96° 26' 21" E
- c. Topographical Map Reference : 91 D/12

1.2 SITE PARAMETERS

- a. Name of Stream : Mompani
- b. Gross Head : 22.00 M
- c. Design Discharge : 0.125 cumecs.

1.3 TURBINE

- a. Type : Crossflow/Pelton/Turgo Imp
- b. Rating : 15 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1(one)
- c. Power Output Rating : 15 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Gam Nallah MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Danglat
- b. Circle : Goiliang
- c. District : Anjaw
- d. District HQ : Hayuliang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Hayuliang
- c. Distance of Road Head from Dist. HQ : 12.00 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 06' 28" N
- b. Longitude : 96° 35' 09" E
- c. Topographical Map Reference : 91 D/12

1.2 SITE PARAMETERS

- a. Name of Stream : Gam
- b. Gross Head : 46.00 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1(one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Kathang Nallah MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Tulung Kunnung
- b. Circle : Hawai
- c. District : Anjaw
- d. District HQ : Hayuliang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Hayuliang
- c. Distance of Road Head from Dist. HQ : 72.00 Km
- d. Distance from road head (Manual Cartage) : 2.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 27° 51' 37" N
- b. Longitude : 96° 49' 13" E
- c. Topographical Map Reference : 91 A/13

1.2 SITE PARAMETERS

- a. Name of Stream : Kathang Nallah
- b. Gross Head : 30.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1(one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Jheblum Nallah MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Mithulang Kap
- b. Circle : Chaglagam
- c. District : Anjaw
- d. District HQ : Hayuliang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Hayuliang
- c. Distance of Road Head from Dist. HQ : 40.00 Km
- d. Distance from road head (Manual Cartage) : 0.80 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 13' 37" N
- b. Longitude : 96° 33' 31" E
- c. Topographical Map Reference : 91 D/11

1.2 SITE PARAMETERS

- a. Name of Stream : Jheblum Nallah
- b. Gross Head : 19.20 M
- c. Design Discharge : 0.125 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1(one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Ayu Nallah MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Aronli
- b. Circle : Ethalin
- c. District : Dibang Valley
- d. District HQ : Anini
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Anini
- c. Distance of Road Head from Dist. HQ : 126.00 Km
- d. Distance from road head (Manual Cartage) : 1.25 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 37' 21" N
- b. Longitude : 95° 55' 18" E
- c. Topographical Map Reference : 82 P/08

1.2 SITE PARAMETERS

- a. Name of Stream : Ayu Nallah
- b. Gross Head : 18.00 M
- c. Design Discharge : 0.125 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROCT : Athunli Nallah MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Athunli
- b. Circle : Italin
- c. District : Dibang Valley
- d. District HQ : Anini
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Anini
- c. Distance of Road Head from Dist. HQ : 30.00 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 39' 22" N
- b. Longitude : 96° 02' 20" E
- c. Topographical Map Reference : 82 P/07

1.2 SITE PARAMETERS

- a. Name of Stream : Athunli Nallah
- b. Gross Head : 20.00 M
- c. Design Discharge : 0.125 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Aya MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : New Endulin
- b. Circle : Arzoo
- c. District : Dibang Valley
- d. District HQ : Anini
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Anini
- c. Distance of Road Head from Dist. HQ : 95.00 Km
- d. Distance from road head (Manual Cartage) : 0.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 30' 07" N
- b. Longitude : 95° 49' 58" E
- c. Topographical Map Reference : 83 P/14

1.2 SITE PARAMETERS

- a. Name of Stream : Aya Nallah
- b. Gross Head : 100.00 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Eyi MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Emuli
- b. Circle : Anini
- c. District : Dibang Valley
- d. District HQ : Anini
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Anini
- c. Distance of Road Head from Dist. HQ : 15.00 Km
- d. Distance from road head (Manual Cartage) : 3.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 46' 12" N
- b. Longitude : 95° 51' 38" E
- c. Topographical Map Reference : 82 P/13

1.2 SITE PARAMETERS

- a. Name of Stream : Eyi Nallah
- b. Gross Head : 20.00 M
- c. Design Discharge : 0.125 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Tape MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Beyanli
- b. Circle : Mipi
- c. District : Dibang Valley
- d. District HQ : Anini
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Tinsukia
- b. Road head (Name of District HQ) : Anini
- c. Distance of Road Head from Dist. HQ : 51.00 Km
- d. Distance from road head (Manual Cartage) : 12.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 59' 40" N
- b. Longitude : 95° 48' 33" E
- c. Topographical Map Reference : 82 O/12

1.2 SITE PARAMETERS

- a. Name of Stream : Tape Stream
- b. Gross Head : 20.00 M
- c. Design Discharge : 0.125 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Bishing MHP (15 kW)

1.1 LOCATION OF SCHEME

- a. Village : Bishing
- b. Circle : Gelling
- c. District : Upper Siang
- d. District HQ : Yingkiang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Yingkiang
- c. Distance of Road Head from Dist. HQ : 295.00 Km
- d. Distance from road head (Manual Cartage) : 18.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : N. A.
- b. Longitude : N. A.
- c. Topographical Map Reference : 82 K/16

1.2 SITE PARAMETERS

- a. Name of Stream : Bishing
- b. Gross Head : 18.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 15 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 15 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Bona MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Bona
- b. Circle : Gelling
- c. District : Upper Siang
- d. District HQ : Yingkiang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Yingkiang
- c. Distance of Road Head from Dist. HQ : 295.00 Km
- d. Distance from road head (Manual Cartage) : 0.20 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : N. A.
- b. Longitude : N. A.
- c. Topographical Map Reference : 82 K/16

1.2 SITE PARAMETERS

- a. Name of Stream : Bona
- b. Gross Head : 30.00 M
- c. Design Discharge : 0.075 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Singot MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Singing
- b. Circle : Tuting
- c. District : Upper Siang
- d. District HQ : Yingkiang
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Yingkiang
- c. Distance of Road Head from Dist. HQ : 140.00 Km
- d. Distance from road head (Manual Cartage) : 2.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 54' 26" N
- b. Longitude : 94° 42' 11" E
- c. Topographical Map Reference : 82 L/13

1.2 SITE PARAMETERS

- a. Name of Stream : Singot
- b. Gross Head : 30.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Yorko MHP (2x50 kW)

1.1 LOCATION OF SCHEME

- a. Village : Yorko
- b. Circle : Mechuka
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 260.00 Km
- d. Distance from road head (Manual Cartage) : 0.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 36' 28" N
- b. Longitude : 94° 05' 59" E
- c. Topographical Map Reference : 82 L/02

1.2 SITE PARAMETERS

- a. Name of Stream : Shuru
- b. Gross Head : 31.00 M
- c. Design Discharge : 0.750 cumecs. (Total for both the machine)

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 50 kW
- c. Number : 2 (Two)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 2 (Two)
- c. Power Output Rating : 50 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Libung MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Paktung (Hamlet)
- b. Circle : Kaying
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 115.00 Km
- d. Distance from road head (Manual Cartage) : 2.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 24' 26" N
- b. Longitude : 94° 42' 11" E
- c. Topographical Map Reference : 82 L/11

1.2 SITE PARAMETERS

- a. Name of Stream : Libung
- b. Gross Head : 40.00 M
- c. Design Discharge : 0.125 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Gorjenphu Nallah MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Dorjeeling
- b. Circle : Mechuka
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 250.00 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 36' 40" N
- b. Longitude : 94° 10' 50" E
- c. Topographical Map Reference : 82 L/02

1.2 SITE PARAMETERS

- a. Name of Stream : Gorjenphu
- b. Gross Head : 10.00 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Sile Sokong MHP (15 kW)

1.1 LOCATION OF SCHEME

- a. Village : Yapik
- b. Circle : Tato
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 160.00 Km
- d. Distance from road head (Manual Cartage) : 80.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 30' 61" N
- b. Longitude : 94° 29' 04" E
- c. Topographical Map Reference : 82 L/06

1.2 SITE PARAMETERS

- a. Name of Stream : Sile Sokong
- b. Gross Head : 20.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 15 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 15 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Rimang MHP (50 kW)

1.1 LOCATION OF SCHEME

- a. Village : Manigong
- b. Circle : Manigong
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 220.00 Km
- d. Distance from road head (Manual Cartage) : 45.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : N.A.
- b. Longitude : N.A.
- c. Topographical Map Reference : 82 L/01

1.2 SITE PARAMETERS

- a. Name of Stream : Rimang
- b. Gross Head : 42.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 50 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 50 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Heyong Sokong MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Geching
- b. Circle : Manigong
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 215.00 Km
- d. Distance from road head (Manual Cartage) : 32.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 44' 35" N
- b. Longitude : 94° 16' 45" E
- c. Topographical Map Reference : 82 L/06

1.2 SITE PARAMETERS

- a. Name of Stream : Heyong Sokong
- b. Gross Head : 35.00 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Pame Sire MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Pame
- b. Circle : Payum
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 130.00 Km
- d. Distance from road head (Manual Cartage) : 0.80 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 30' 29" N
- b. Longitude : 94° 39' 08" E
- c. Topographical Map Reference : 82 L/10

1.2 SITE PARAMETERS

- a. Name of Stream : Pame Sire
- b. Gross Head : 30.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Sili MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Pame
- b. Circle : Payum
- c. District : West Siang
- d. District HQ : Along
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : Silapathar
- b. Road head (Name of District HQ) : Along
- c. Distance of Road Head from Dist. HQ : 130.00 Km
- d. Distance from road head (Manual Cartage) : 55.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 29' 28" N
- b. Longitude : 94° 38' 20" E
- c. Topographical Map Reference : 82 L/10

1.2 SITE PARAMETERS

- a. Name of Stream : Sili
- b. Gross Head : 30.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Genung MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Ebiya
- b. Circle : Nacho
- c. District : Upper Subansiri
- d. District HQ : Daporijo
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Daporijo
- c. Distance of Road Head from Dist. HQ : 115.00 Km
- d. Distance from road head (Manual Cartage) : 0.50 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 23' 10" N
- b. Longitude : 93° 59' 64" E
- c. Topographical Map Reference : 82 H/15

1.2 SITE PARAMETERS

- a. Name of Stream : Genung
- b. Gross Head : 33.00 M
- c. Design Discharge : 0.250 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Kobu Nallah MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Charu
- b. Circle : Nacho
- c. District : Upper Subansiri
- d. District HQ : Daporijo
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Daporijo
- c. Distance of Road Head from Dist. HQ : 115.00 Km
- d. Distance from road head (Manual Cartage) : 6.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 22' 48" N
- b. Longitude : 93° 52' 59" E
- c. Topographical Map Reference : 82 H/15

1.2 SITE PARAMETERS

- a. Name of Stream : Kobu Nallah
- b. Gross Head : 69.00 M
- c. Design Discharge : 0.075 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Medi Kro MHP (15 kW)

1.1 LOCATION OF SCHEME

- a. Village : Ngoju
- b. Circle : Limiking
- c. District : Upper Subansiri
- d. District HQ : Daporijo
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Daporijo
- c. Distance of Road Head from Dist. HQ : 150.00 Km
- d. Distance from road head (Manual Cartage) : 0.80 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 48' 36" N
- b. Longitude : 93° 44' 28" E
- c. Topographical Map Reference : 82 H/11

1.2 SITE PARAMETERS

- a. Name of Stream : Medi Kro
- b. Gross Head : 55.50 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 15 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 15 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Ledi Ishi MHP (15 kW)

1.1 LOCATION OF SCHEME

- a. Village : Poing
- b. Circle : Nacho
- c. District : Upper Subansiri
- d. District HQ : Daporijo
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Daporijo
- c. Distance of Road Head from Dist. HQ : 130.00 Km
- d. Distance from road head (Manual Cartage) : 1.20 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 24' 00" N
- b. Longitude : 93° 47' 24" E
- c. Topographical Map Reference : 82 H/11

1.2 SITE PARAMETERS

- a. Name of Stream : Ledi Ishi
- b. Gross Head : 41.00 M
- c. Design Discharge : 0.075 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 15 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 15 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Thru MHP (25 kW)

1.1 LOCATION OF SCHEME

- a. Village : Nava
- b. Circle : Limiking
- c. District : Upper Subansiri
- d. District HQ : Daporijo
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Daporijo
- c. Distance of Road Head from Dist. HQ : 170.00 Km
- d. Distance from road head (Manual Cartage) : 1.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 28' 30" N
- b. Longitude : 93° 41' 10" E
- c. Topographical Map Reference : 82 H/11

1.2 SITE PARAMETERS

- a. Name of Stream : Thru
- b. Gross Head : 88.00 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 25 kW
- c. Number : 1 (one)
- d. Mater : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 25 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Kope MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Ngus (Orak)
- b. Circle : Limiking
- c. District : Upper Subansiri
- d. District HQ : Daporijo
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Daporijo
- c. Distance of Road Head from Dist. HQ : 160.00 Km
- d. Distance from road head (Manual Cartage) : 2.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 29' 28" N
- b. Longitude : 93° 40' 30" E
- c. Topographical Map Reference : 82 H/11

1.2 SITE PARAMETERS

- a. Name of Stream : Kope
- b. Gross Head : 35.00 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

PROJECT DETAILS & SPECIFICATIONS

1.0 NAME AND CAPACITY OF PROJECT : Ksui MHP (10 kW)

1.1 LOCATION OF SCHEME

- a. Village : Tamachujung Army Camp
- b. Circle : Limiking
- c. District : Upper Subansiri
- d. District HQ : Daporijo
- d. State : Arunachal Pradesh

1.1.1 Access

- a. Rail head (Name of last railway station) : North Lakhimpur
- b. Road head (Name of District HQ) : Daporijo
- c. Distance of Road Head from Dist. HQ : 230.00 Km
- d. Distance from road head (Manual Cartage) : 30.00 Km

1.1.2 Geographical Co-ordinates

- a. Latitude : 28° 26' 10" N
- b. Longitude : 93° 21' 36" E
- c. Topographical Map Reference : 82 H/07

1.2 SITE PARAMETERS

- a. Name of Stream : Ksui
- b. Gross Head : 42.00 M
- c. Design Discharge : 0.050 cumecs.

1.3 TURBINE

- a. Type : Cross flow / Multi jet Pelton / Turgo Impulse
- b. Rating : 10 kW
- c. Number : 1 (one)
- d. Material : Stainless Steel Nickel Chromium

1.4 GENERATOR

- a. Type : Synchronous
- b. Number : 1 (one)
- c. Power Output Rating : 10 kW
- d. Nominal Voltage of generation : 415 V \pm 5%
- e. Frequency : 50 Hz \pm 3%
- f. Power Factor : 0.8 lag.
- g. Cooling : Natural Open air.
- h. Run way speed : Continuous.

SECTION – II

INSTRUCTIONS TO BIDDERS

2.1 BID

Arunachal Pradesh Energy Development Agency, APEDA in short and here-in-after called the “**Purchaser**” invites sealed Bids from **Eligible Bidders** for designing, manufacturing, supply, installation, testing and commissioning of Electro-Mechanical Equipments for Micro and Mini Hydro Electric Power Plants for Border Village Illumination / Electrification in Arunachal Pradesh.

2.2 SCOPE

The scope of work comprises of designing, manufacturing, supply, transportation, installation, testing, and commissioning of Electro-Mechanical Equipments for Hydro Electric Power Plants of Micro and Mini range for Border village Illumination / electrification in the state of Arunachal Pradesh on **TURN KEY** basis. The scope of work will also cover one year of warrantee from the date of commission or 1000 hours of operation whichever is earlier for the equipments and **AMC** for 4 (Four) years from the date of commissioning. **Offers with incomplete scope shall be ignored.**

2.3 QUALIFICATION OF THE BIDDER

- a) The bidder should have installed at least 1 (One) plant of a similar or larger capacity during the last 5 (Five) years which must be running successfully.
- b) The bidder should have an annual minimum turnover of Rs.100 (one hundred) lakhs during the last 2 (Two) years.
- c) The bidder should either be a manufacturer of turbines or an authorized dealer of a reputed turbine manufacturer or having joint venture agreement with a turbine manufacturer.

The above requisite qualifications are to be fulfilled for taking part in the tender.

2.4 PRE-BID MEETING

A pre-Bid meeting will be convened in the Conference Room of the MNRE Office, New Delhi on **18th Jun 2009 at 11:00 A.M.** to clarify issues and doubts on any matter related to the tender that may be raised at that stage by the Bidders. The Bidders or their authorized official representatives are advised to attend the meeting in their own interest.

The Bidders are required to submit any question(s) in writing by Speed Post / Fax to reach the purchaser not later than 3 days before the meeting. Minutes of meeting, including copies of the questions raised and responses given, will be furnished expeditiously to all those who had been issued the bid Documents exclusively through the issuance of an addendum and shall make modifications of the Tender Documents or technical specifications, which may become necessary as a result of the pre-Bid meeting.

2.5 AMENDMENT OF BID DOCUMENTS

At any time prior to the deadline for submission of bid documents, purchaser may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, modify the bid document by amendment. The amendment will be notified in writing by Speed Post / Fax to all prospective bidders, to whom bid document have been issued, and the same will be binding on them. In order to afford prospective bidders reasonable time to enable them to take the amendment into account in preparing their bid document, purchaser may, at its discretion, extend the deadline for the submission of bid documents.

2.6 SUBMISSION OF BID

The Bid must be submitted by Registered Post / Speed Post / by hand / by courier so as to reach the Purchaser by the scheduled date and time. Any bid received after the due date and time of submission on account of delay of any kind shall not be opened. **Telegraphic / Faxed Bids shall not be considered.**

2.7 PROFORMA / SCHEDULES TO BE FILLED IN

The bidder must furnish required information in the specified Proforma / Schedule. If this information is not furnished, the Purchaser shall not be responsible for any error in evaluation of bid and the bidder shall have no claim whatsoever, on this account.

2.8 SIGNING OF BID

Bidder shall put initials on each and every page of the bid. Last page of each document shall bear full signatures under official seal fully disclosing the Name, Designation and Relationship of the Signatory with the firm / bidder. In case of partnership concern, the bid shall be signed by one of them, holding Power of Attorney. In case of Corporation / Companies, bid shall be signed either by the President or the Secretary or any other person authorized to bid in the legal name of the Company. Copies of such Authorities are to be furnished with the offer.

2.9 PRICE REVISION

Any action on the part of the bidder to revise the price(s) and / or change the structure of price (s) at his own after the opening of the bid may result in **rejection** of the bid and **forfeiture of the earnest money.**

2.10 SITE VISIT

The bidders are advised to visit the Site and obtain all the information as required before bidding.

2.11 LANGUAGE OF BID

The bid, any correspondence and all documents connected with shall be in English language.

2.12 COMPOSITION OF BID

The bid shall be submitted in two Parts in two separate envelopes to be submitted simultaneously.

Part-I : It shall contain only the Technical & Commercial offer.

Part-II : It shall contain the only the Price Bid /offer.

2.13 EARNEST MONEY

An lump sum amount of **Rs 10.00 lakhs** (Rupees ten lakhs only), in the form of a Demand Draft of any scheduled bank payable at SBI, Itanagar pledged /drawn in favour of the Director, APEDA shall be submitted as Earnest Money along with Technical & Commercial Bid (Part-I). The Earnest Money will be forfeited if

- a. the bidder withdraws the bid after submission of Bid documents,
- b. the successful bidder fails within the specified time limit to sign the Contract Agreement,
- c. the successful bidder cannot complete the work and hand it over in time.

The Earnest Money of the successful bidder will be retained and will be adjusted in the security money. Those of the unsuccessful bidders will be released within six months or after finalization of the bid, whichever is earlier.

NOTE: No price shall be indicated in any manner in any of the Forms & Schedules, which are not meant for it.

2.14 BID CURRENCY:

Prices shall be quoted and payable in Indian Rupees only.

2.15 BID VALIDITY:

Bids shall be valid for 120 calendar-days from the date of opening / extended date of opening of bids. Bid with lesser validity will not be considered qualified.

2.16 DEADLINE FOR SUBMISSION OF BIDS:

Bids must be received by the Purchaser not later than the date specified or notified.

2.17 LATE BIDS

Any bid received after the dead line for submission of the bids, shall be rejected.

2.18 OPENING OF TECHNICAL & COMMERCIAL PROPOSALS:

The Purchaser will open the Technical and Commercial Bids (Part-I) and Price Bids (Part-II), (including modifications made if any) separately on separate dates through a Board constituted for the purpose in the presence of bidders or their authorized representatives, who choose to attend on /at appointed date, time and venue. Date of

opening of Part-I Bid will remain as stated in the NIT and the date of opening of Part –II Bid will be announced on a later date after opening of the Part-I Bid.

2.19 EVALUATION OF BID DOCUMENT:

The bids shall be evaluated by a Committee / Board formed for the purpose. If any bidder quotes payment terms and other conditions which is in deviation from what is given in the Tender Document it will be subject to negotiation and may or may be accepted depending on the justification made by the bidder.

Any rebate/discount linked with quality, term of payment or any other condition shall not be considered for the purpose of evaluation and comparison of such offer. However, the same will be availed while placing orders with such successful bidders. Where slab rates are quoted, each slab will be treated as separate offer.

If the bidders fail to quote prices for any of the items components as asked for, the highest prices as quoted in other bid documents for the same shall be considered or added.

2.20 AWARD OF CONTRACT

The successful bidder will have to enter into a **Contract Agreement** with the Purchaser as per conditions of the bid document and as per the conditions of the award letter.

For signing the contract, a duly authorized representative of the successful bidder shall be required to sign and accept the contract within the time specified in the letter of intent or Award Letter failing which action as deemed fit shall be taken.

2.21 ACCEPTANCE OF LOWEST TENDER AND AWARD OF WORK

It will not be binding on the Purchaser to accept the Lower Tender and the work may be awarded to more than one contractor at the rate that will be accepted by the Purchaser.

SECTION-III GENERAL CONDITIONS OF CONTRACT

DEFINITIONS

The following words and expressions shall have meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

3.1.1 The Contract

- i. **“Contract”** means the Contract Agreement, the conditions, the Purchaser’s Requirements, the Bid, and the further documents (if any) which are listed in the contract agreement and all correspondences and communication in connection therewith.
- ii. **“Purchaser’s Requirement”** (**“Specifications”**) means the document entitled Purchaser’s requirement, as included in the Contract, and any additions and modifications to such document in accordance with the Contract.
- iii. **“Bid”** means the contractor’s signed offer for the works and documents submitted therewith as included in the Contract and any document, communication connected therewith.
- iv. **“Performance Guarantees”** and **“Schedule of Payments”** mean the documents so named (if any), as included in the contract.

3.1.2 Parties And Persons

- i. **“Party or Parties”** means the Purchaser or the Contractor or both, as the context requires.

“Purchaser” means **“Arunachal Pradesh Energy Development Agency”**, in short APEDA represented by the Director and his representatives or the legal successors in title to this person(s).

“Contractor” means the person(s) named as contractor or supplier in the contract agreement and the legal successors in title to his person(s).

“Purchaser’s Representative” or **“Engineer”** means the person(s) named/appointed by the Purchaser from time to time who acts on behalf of the Purchaser.

“Contractor’s Representative” means the person(s) named/appointed by the contractor in the contract or appointed from time to time, who acts on his behalf.

“Arbitrator” means the person(s) appointed under Sub-Clause 3.20.4.

3.1.3 Dates, Tests, Periods and Completion

- i. **“Base Date”** will mean the date of purchase of tender documents.
“Commencement Date” means the date notified under relevant Sub-Clause (*Commencement and Time for Completion of Works*), unless otherwise stated in the contract agreement

“Time for Completion” means the time for completion of works or a section (as the case may be) under relevant Sub-Clause (*Commencement and Time for completion of works*), as stated in the Special Conditions (with any extension under Sub-Clause (*Extension of Time for Completion*)), calculated from the commencement date.

“Tests on Completion” means the tests which are specified in the contract or agreed by both the parties or instructed as a variation, and which are carried out under relevant Clause

(*Tests on Completion*) before the works or a section [as the case may be] are taken over by the Purchaser.

“Taking-Over Certificate” means a certificate issued under the Clause (*Purchaser’s Taking Over*)

“Tests after Completion” means the tests specified in the contract and are to be done under Clause (*Defects Liability*) after the works or a section (as the case may be) are taken over by the Purchaser.

“Defects Notification Period” means the period for notifying defects in works or a section under Sub-Clause (*Completion of Outstanding Works and Remedying Defects*) and (*Extension of Defects Notification Period*) calculated from the date on which the works or section is complete as certified under Sub-Clause (*Purchaser Taking over*). If no such period is stated in the Special conditions, the period shall be 1 (One) year.

“Performance Certificate” means the certificate issued under Sub-Clause (*Unfulfilled Obligations*).

“Day” means a calendar day, **“month”** means a calendar month and **“Year”** means a calendar year.

“Commercial Use” means the use of the plant, machinery, material and works which the contract contemplates for which it is commercially capable.

3.1.4 Money and Payments

i. **“Contract Price”** means the agreed amount stated in the contact agreement.

“Cost” means all expenditure reasonably incurred / or to be incurred by the contractor, whether on or off the site, including overhead and similar charges, but does not include profit.

“Final Statement” means the statement defined in Sub-Clause (*Statement at Completion and Applicable for Payment*).

3.1.5 Equipment and Works

i. **“Materials”** means things of all kinds intended to form/forming part of works.

“Permanent Works” means permanent works to be executed by Contractor.

“Plant” means apparatus, machinery and vehicles forming part of works.

“Works” include Plant Equipment, Material and Works.

3.1.6 Others

i. **“Force-Majeure”** is as defined in Clause of (*Force-Meajure*).

ii. **“Performance Security”** means the security (or securities, if any) under Sub-Clause of (*Performance Security*).

iii. Wherever, the word “Approved”, “Subject to Approval”, “As directed” “Determined”, “Accepted”, “Permitted”, “Judged”, “As per Approval” or words and phrases of like importance, are used, the approval, judgment, direction etc. is understood to be a function of the Purchaser or his Engineer.

3.2 LAWS

Contract shall be governed by the laws of the land (India / Bharat and the State concerned).

3.3 CONTRACT AGREEMENT

The contract shall come into full force and take effect on the date stated in the contract agreement. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the contract agreement shall be borne by the Purchaser or Contractor or by both as would be mutually decided at the time of such need.

3.4 ASSIGNMENT

The Contractor shall not assign the whole or any part of the contract or any benefit or interest in or under the contract unless approved otherwise by the Purchaser.

3.5 PURCHASER'S CLAIM

If Purchaser considers himself entitled to any payment, he shall give notice to the contractor as soon as practicable after the Purchaser became aware of the event or circumstances giving rise to the claim. The Purchaser may deduct this amount from any moneys due, or to become due to the contractor.

3.6 PURCHASER'S ADMINISTRATION

3.6.1 Purchaser's Representative / Personnel

The Director, Deputy Director, Project Officer or the Junior Engineer of Arunachal Pradesh Energy Development Agency shall be the Purchaser's Representative (also referred as "Engineer") and he may, from time to time, assign duties and delegate authority to assistants, and may also revoke such assignment or delegation.

3.6.2 Delegated Persons

- i.** Unless otherwise stated in the delegated person's communication relating to such act, it shall not relieve the contractor from responsibility he has under the contract.
- ii.** Any failure to disapprove any work, plant or materials shall not constitute approval, and shall, therefore, not prejudice the right of the Purchaser to reject the work, plant or materials.

3.6.3 Determinations

Whenever these conditions provide that the Purchaser shall proceed to agree or determine the matter, the Purchaser shall consult the contractor in an endeavor to reach agreement. If agreement is not reached, the Purchaser shall make a fair determination as per the contract and give notice to the contractor of each agreement or determination, with supporting Specials. Each party shall give effect to each agreement or determination, unless the contractor gives notice of his dissatisfaction with a determination within 14 days of receiving it. Either party may then refer the dispute to the arbitration in accordance with Sub-Clause of (*Arbitration*).

3.7 THE CONTRACTOR

3.7.1 Contractor's Representative

The contractor may appoint his representative who shall carry out all the duties assigned to him by the contractor and the contractor shall be responsible for his acts.

3.7.2 Performance Security

Contractor shall provide (at his cost) a performance security for proper performance, as per the Special conditions, which shall be returned to the contractor within 21 days after the contractor has become entitled to receive the performance certificate.

3.7.3 Safety Procedures

The contractor shall comply with all applicable safety regulations and provide fencing, lighting, guarding and watching of the works until Completion and Taking Over under Clause of (*Purchaser's Taking Over*).

3.7.4 Site Data

The Purchaser shall have made available to the contractor for his information, prior to the base date, all relevant data in the Purchaser's possession. The contractor shall be responsible for verifying and interpreting all such data and the Purchaser shall have no responsibility for the accuracy, sufficiency or completeness of such data. The contractor should verify, acquire and confirm such data on their own.

3.7.5 Rights of Way and Facilities

The contractor shall bear all costs and charges for special and/or temporary rights-of-way which he may require.

3.7.6 Protection of the Environment

The contractor shall take all reasonable steps to protect the environment.

3.7.7 Electricity, Water and Gas etc.

The contractor shall be responsible for the provision of all power, water and other services he may require at the site.

3.7.8 Progress Reports

Unless otherwise stated in the Special Conditions, monthly progress reports shall be prepared by the contractor and submitted to the Purchaser in 3 copies.

3.7.9 Security of the Site

Contractor shall be responsible for keeping un-authorized persons off the site.

3.7.10 Fossils

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the site shall be placed under the care and authority of the Purchaser. The contractor shall take reasonable precautions to prevent contractor's personnel or other persons from removing or damaging any of these findings.

3.8 DESIGN

3.8.1 General Design Obligations

The contractor shall be deemed to have scrutinized, prior to the base date, the Purchaser's requirements and be responsible for the design of the works and for the accuracy of such Purchaser's requirements (including design criteria and calculations).

3.8.2 Technical Standards and Regulations

The design, the contractor's documents, the execution and the completed works shall comply with the relevant Standards, environmental laws, laws applicable to the product being produced for the works etc.

3.8.3 Training

The Contractor shall carry out the training of Purchaser's Personnel in the O&M of the Works.

3.8.4 As-Built Documents

The Contractor shall prepare and keep up-to-date, a complete set of '**As-Built**' records of the Works, showing the exact as-built locations, sizes and details of the work as executed. These records shall be kept on the Site. 2 (Two) copies shall be supplied to the Purchaser prior to the Commencement of the Tests on Completion. In addition, the Contractor shall supply to the Purchaser "**As-Built**" drawings of the Works, showing all works as executed, and submit them to the Purchaser for review and record.

3.8.5 Operation and Maintenance (O&M) Manuals

Prior to commencement of the Tests on Completion, the Contractor shall supply to the Purchaser provisional O&M manuals in sufficient detail for the Purchaser to operate, maintain, dismantle, reassemble, adjust and repair the Plant.

3.9 LABOUR LAWS

The Contractor shall comply with all the relevant Labour Laws.

3.10 PLANT, MATERIALS AND WORKMANSHIP

3.10.1 Inspection

Engineer shall, at all times, have full access to all parts of the Site, work and equipments supplied, places from which natural Materials are being obtained, during production, manufacture and construction and be entitled to examine, inspect, measure and test materials and workmanship, and check the progress of manufacture of Plant and production of Materials. No such activity shall relieve the Contractor from any obligation or responsibility.

3.10.2 Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any). The Purchaser may vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract. The Contractor shall forward to the Purchaser duly certified reports of the tests.

3.10.3 Rejection

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials, design or workmanship is found defective or not in accordance with the Contract, the Purchaser may reject the Plant, Materials, design or workmanship by giving notice with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Purchaser requires this Plant, Materials, design or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Purchaser to incur additional costs, the Contractor shall subject to Clause 3.5 (*Purchaser's Claim*) pay these costs to the Purchaser.

3.10.4 Royalties

The Contractor shall pay all royalties, rents and other payments for: (i) Natural Materials obtained from outside the Site and (ii) The disposal of material from demolitions and excavations and of other surplus material (natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

3.11 COMMENCEMENT, DELAYS AND SUSPENSION

3.11.1 Commencement and Time for Completion of Works

The Commencement Date shall be reckoned from **14th day after award** of the work through Award Letter or Letter of Intent and it will be treated that the Contract had become effective or come into full force from this date and the Contractor shall complete whole of the Work within the Time for Completion as per Clause of (*Delivery / Completion of Works*)

3.11.2 Programme

The Contractor shall submit a time programme within 28 days after commencement date and a revised programme, whenever the previous one is inconsistent with actual progress. Unless otherwise stated in the Contract, each programme shall include:

- i.** The order in which the Contractor intends to carry out the Works, including the anticipated timing of each major stage of the Works.
- ii.** The periods for reviews.
- iii.** The sequence and timing of inspections and tests specified in the Contract.

3.11.3 Extension of Time for Completion

The Contractor shall be entitled, subject to Sub-Clause 3.12.1(*Contractor's Obligations*), to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 3.13 (*Purchase's Taking over*) is or will be delayed by any of the following causes:

- i.** A Variation (unless an adjustment to the Time for Completion has been agreed).
- ii.** Any delay attributable to the Purchaser.

3.11.4 Delay Damages

If the Contractor fails to complete the work in time, he shall, subject to Clause 3.5 (*Purchaser's Claims*), pay delay damages.

These shall be the only delay damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 3.16.2 (*Termination by Purchaser*). These delay damages shall not relieve the Contractor from his obligation to complete the Work, or from any other duties, obligations or responsibilities under the Contract.

3.11.5 Suspension of Work

The Purchaser may at any time instruct the Contractor to suspend progress or part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

3.11.6 Consequences of Suspension

If Contractor suffers delay and /or incurs cost from complying with the Purchaser's instructions under Sub-Clause 3.11.5 (*Suspension of Work*) and /or from resuming the work, the Contractor shall give notice and be entitled subject to Sub-Clause 3.20.1 (*Contractor's Claims*) to: i. An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 3.11.3 (*Extension of Time for completion*), and ii. payment of any such Cost, which shall be added to the Contract Price, but after having a thorough justification. On receipt of this notice, the Purchaser shall proceed as per Sub-Clause 3.6.3(*Determinations*) to agree or determine these matters. The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 3.11.5 (*Suspension of Works*).

3.11.7 Payment for Plant and Materials in the Event of Suspension

The Contractor shall be entitled to payment of the value (as at the date of-suspension) of Plant and /or Materials which have been delivered to Site if the work has been suspended for a considerable period.

3.11.8 Resumption of Work

After the permission or instruction to proceed is given, the Parties shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect or loss of the Works or Plant or Materials, which has occurred during the suspension.

3.12 TESTS ON COMPLETION

3.12.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion as per Clause and Sub-Clause 3.10.2 (*Testing*), after providing the documents in accordance with Sub-Clause 3.8.5(*Operation and Maintenance Manual*).

Unless otherwise stated in the Special Conditions, the Tests on Completion shall be carried out in the following sequence:

- i. Pre-commissioning tests
- ii. Trial operation, which shall demonstrate that the Works or Section perform reliably and in accordance with the Contract.

- iii. Trial operation shall not constitute a taking-over under Clause 3.13 (*Purchaser's Taking over*).

3.12.2 Re-Testing

If the Works, or a Section, fail to pass the Tests Sub-Clause 3.10.2 (*Testing*) shall apply, and the Purchaser or the Contractor may require the failed Tests and Tests on Completion on any related work, to be repeated under the same terms and conditions.

3.12.3 Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 3.12.2 (*Re-Testing*), the Purchaser shall be entitled to:

- i. Order further repetition of Tests under Sub-Clause 3.12.2 (*Re-Testing*);

If the failure deprives the Purchaser of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Purchaser shall have the same remedies as are provided in Sub Paragraph (iii) of Sub-Clause 3.14.4 (*Failure to Remedy Defects*).

3.13 PURCHASER'S TAKING OVER

Except as stated in Sub-Clause 3.12.3 (*Failure to Pass Tests on Completion*), the Works shall be taken over by the Purchaser when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 3.11.1 (*commencement and time for completion of works*) and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

3.14 DEFECTS LIABILITY

3.14.1 Completion of Outstanding Work and Remedying Defects

The Contractor shall complete any work which is outstanding and execute all work required to remedy defects or damage.

3.14.2 Cost of Remedying Defects

All work referred to in Sub-Clause 3.14.1 (*Above*) shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

- i. The design of the Works,
- ii. Plant, Materials or workmanship not being in accordance with the Contract,
- iii. Improper O&M attributable to matters for which the Contractor is responsible under Sub-Clauses 3.8.4 (*As built Documents*) to 3.8.5 (*Operation and Maintenance Manual*).

3.14.3 Extension of Defects Notification Period

The Purchaser shall be entitled, subject to Clause 3.5 (*Purchaser's Claims*) to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used, for the purpose for which they are intended, by reason of a defect or damage.

3.14.4 Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by the Purchaser, for remedying. If the Contractor fails to remedy by this notified date and this remedial work which was to be executed at the cost of the Contractor under Sub-Clause 3.14.2 (*above*), the Purchaser may (at his option):

- i. Carry out the work himself or by others, at the Contractor's cost, but the Contractor shall have no responsibility for this work.
- ii. Agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.6.3 (*Determinations*).
- iii. If defect or damage deprives the Purchaser of substantially the whole benefit of the Works or a major part there-of, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Purchaser shall, then, be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

3.14.5 Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and the Purchaser gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items or to provide other appropriate security.

3.14.6 Performance Certificate (PC)

Performance of the Contractor's obligations shall not be considered completed until the Purchaser has issued PC, which shall be issued by him within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon as thereafter the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. If the Purchaser fails to issue the Performance Certificate then:

- i. Performance Certificate shall be deemed to have been issued on the date 28 days after the date on which it should have been issued, as per this Sub-Clause .
- ii. Sub-Paragraph (a) of Sub-Clause 3.15.5 (*Discharge*) shall be inapplicable.

Note: The P C shall be deemed to constitute acceptance of the Works.

3.14.7 Unfulfilled Obligations

After the Performance Certificate has been issued, each Party shall remain liable for the fulfillment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

3.15 CONTRACT PRICE AND PAYMENT

3.15.1 The Contract Price

Unless otherwise stated in the Special conditions or pronounced separately,

- i. Payment for the works shall be made on the basis of the lump sum contract price, subject to adjustments in accordance with the contract.
Contractor shall pay all taxes, duties and fees required to be paid by him as per the contract and the contract price shall not be adjusted for any of these costs.

3.15.2 Schedule of Payments

- i. Contractor shall, on submitting the bill(s) as per Payment Schedule, be entitled to receive payment provided the bills are complete, duly supported by details, in order in every respect, and is for the actual quantities of the work done.
Deduction towards Income Tax (as per the Act in force) shall be made from the gross amount of bill including the cost of material etc. Income Tax shall not be deducted, if the contractor produces a certificate from the Income Tax Department stating that he is exempted from such deductions.

3.15.3 Payment of Retention Money

When the Taking-over certificate has been issued, and the works have passed all specified tests, the first half of the retention money shall be paid to the contractor. Promptly after the latest of the expiry dates of the defects notification periods, the outstanding balance of the retention money shall be paid to the contractor.

3.15.4 Statement of Completion of work and Application for Payment

The contractor shall submit to the Purchaser 3 (Three) copies of a statement of completion of work with necessary supporting documents showing:

- i. The value of all work done in accordance with the contract up to the date stated in the Taking – Over certificate for the works.
- ii. Any further sums which the contractor considers to be due.
- iii. An estimate of any other amounts which the contractor considers will become due to him under the contract. Estimated amounts shall be shown separately in this statement at completion.

The Purchaser shall then give notice to the contractor and make payment which may be found due after checking.

If the Purchaser disagrees with the draft final statement, the contractor shall submit such further information as the Purchaser may reasonably require and make such changes in the draft as may be agreed. The contractor shall then prepare and submit the final statement as agreed.

3.15.5 Discharge

When submitting the final statement, the contractor shall submit a written discharge, which confirms that the total of the final statement represents full and final settlement of all moneys due to the contractor under or in connection with the contract.

3.15.6 Final payment

The Purchaser shall pay to the contractor the amount which is finally due, less all amounts paid.

3.15.7 Cessation of Purchaser's Liability

Purchaser shall not be liable to the Contractor for any matter under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have

included an amount expressly for it in the Final Statement and also in the statement at completion described in Sub-Clause-3.15.4 (Statement of Completion).

3.16 TERMINATION BY PURCHASER

3.16.1 Notice to Correct

If the Contractor fails to carry out any obligation, the Purchaser may, by notice, require the Contractor to make good the failure within a specified reasonable time.

3.16.2 Termination by the Purchaser

The Purchaser shall be entitled to terminate the Contract, if the Contractor:

- i.** Fails to comply with Sub-Clause 3.7.2 (*Performance Security*) or with notice; under Sub-Clause 3.16.1(*Notice to Correct*).
- ii.** Abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract.
- iii.** Without reasonable excuse, fails to proceed with the Works in accordance with Clause 3.11 (*Commencement, Delay and Suspension*).
- iv.** Subcontracts the whole of the Works without the required agreement,
- v.** Becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events.

3.16.3 Valuation at Date of Termination

As soon as practicable after a notice of termination under Sub-Clause 3.16.2 (*Termination by Purchaser*) has taken effect, the Purchaser shall proceed in accordance with Sub-Clause 3.6.3 (*Determinations*) to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed.

3.16.4 Payment after Termination

The Purchaser may:

- i.** Proceed in accordance with Clause 3.5 (*Purchaser's Claims*).
- ii.** With-hold further payments to the Contractor until the costs of design, execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Purchaser, have been established, and / or
- iii.** Recover from the Contractor any losses and damages incurred by the Purchaser and any extra costs of completing the Works.

3.17 RISK AND RESPONSIBILITY

3.17.1 Indemnities

The Contractor shall indemnify and hold harmless the Purchaser, the Purchaser's Personnel, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- i.** Bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the design, execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, willful act or breach

of the Contract by the Purchaser, the Purchaser's Personnel, or any of their respective agents, and

- ii. Damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss:
 - a. Arises out of or in the course of or by reason of the design, execution and completion of the Works and the remedying of any defects.

Is not attributable to any negligence, fulfill act or breach of Contract by the Purchaser, the Purchaser's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

3.17.2 Contractor's Care of the Works

The Contractor shall be fully responsible for care of the Works and Equipments from the Commencement date until the Taking-Over Certificate.

3.18 INSURANCE

- i. Contractor shall arrange, secure & maintain insurance to protect his own interest and of the purchaser against all risks.

All damages and shortages after its delivery to site and storage there-after shall be notified by the contractor's site representative by registered post to purchaser and action taken by him within 30 days for making good the damage or loss by way of replacement/repair/new supply against the equipment damaged or lost.

The contractor shall take up the matter with insurance company on his own for finalization of claims. All actions in connection with making and settling of claims, if any, will be carried out by the contractor himself for which no extra payment will be made by the purchaser to the contractor in this regard.

The contractor shall be responsible to make good the damage or loss by way of repairs and/ or replacement of equipment free of cost, irrespective of the fact whether claim is accepted by the insurance company or not, without waiting for settlement of claims.

3.19 FORCE-MAJEURE (FM)

3.19.1 Definition of FM

The "FM" means exceptional event (s) / circumstance (s), here-in-after called the "Eventualities", which are:

- i. Beyond a Party's control,
- ii. Which such Party could not reasonably have provided against before entering into the Contract,
- iii. Which, having arisen, a Party could not reasonably have avoided or overcome,
- iv. Which is not substantially attributable to the other Party.

FM may include, but is not limited to, eventualities of the kind listed below, so long as conditions (i) to (ii) above are satisfied:

- a. War, hostilities, invasion, act of foreign enemies,
- b. Rebellion, terrorism, revolution, insurrection, military, usurped power, or civil war, riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel/Employees of the Contractor and Sub-contractors.

- c. Munitions of war, explosive materials, ionizing, radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity.
- d. Natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

3.19.2 Notice of FM

If a Party is prevented from performing its obligation(s) under the Contract by FM, then it shall give notice to the other Party of the event / circumstances constituting the FM and specify the obligations, the performance of which is or will be prevented.

The Party shall, having given notice, be excused performance of such obligations for so long as such FM prevents it from performing them.

3.19.3 Consequences of FM

3.19.3.1 If the Contractor is prevented from performing any of his obligations under the Contract by FM of which notice has been given under Sub-Clause 3.19.2 (Notice of FM), and suffers delay and /or incurs Cost by reason of such FM, the Contractor shall be entitled to:

- i. An extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 3.11.3 (*Extension of Time for Completion*)
- ii. If the event or circumstance is of the kind described in Sub-Paragraphs (a) to (e) of Sub-Clause 3.19.1 (*Defination of FM*) and, in the case of Sub-Paragraphs (b) to (d) occur in the Country, payment of any such Cost.

3.19.3.2 After receiving this notice, the Purchaser shall proceed in accordance with Sub-Clause 3.6.3 (*Determinations*) to agree or determine these matters.

3.20 CLAIMS, DISPUTES AND ARBITRATION

3.20.1 Contractor's Claims

- i. If the Contractor fails to give notice of a claim within such period of 15 days from the date of completion of a work or part thereof, the Time for Completion shall not be extended. The Contractor shall not be entitled to additional payment, and the Purchaser shall be discharged from all liability in connection with the claim, otherwise, the following provisions of this Sub-Clause shall apply.
- ii. Within 30 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other Approved period, the contractor shall send to the Purchaser a full detailed claim which includes full supporting Specials of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:
 - a. This fully detailed claim shall be considered as interim.
 - b. The Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further Specials as the Purchaser may reasonably require.
 - c. The Contractor shall send a final claim within 15 days after the end of the effects resulting from the event or circumstance, or within the Approved such other period.

- d. Within 30 days after receiving a claim or any further Specials supporting a previous claim, or within such other period as may be proposed by the Purchaser and approved by the Contractor, the Purchaser shall respond with approval, or with disapproval and detailed comments.

The Purchaser shall proceed in accordance with Sub-Clause 3.6.3 (*Determinations*) to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 3.11.3 (*Extension of Time for Completion*), and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

3.20.2 Disputes

Dispute (s), if any, shall be settled by mutual agreement through Amicable Settlement (Sub-Clause 3.20.3 (*Amicable Settlement*)) and in case of failure, through Arbitration under Sub-Clause 3.20.4 (*Arbitration*.)

3.20.3 Amicable Settlement

Both parties (the contractor and the purchaser) shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the forty-fifth day after the day on which notice of dissatisfaction was given, even if no attempt at amicable settlement has been made.

3.20.4 Arbitration

Unless settled amicably, any dispute shall be finally settled by arbitrator(s) who shall be appointed from amongst the suitably qualified person(s) to be agreed by both the parties for arbitrations.

SECTION – IV

SPECIAL CONDITIONS OF CONTRACT

DELIVERY/ COMPLETION OF WORKS

- 4.1.1** The delivery should be affected in serviceable lots / sets of equipment.

4.1.2 The completion period shall be 12 months counted from the date of signing of Contract Agreement or from the 15th day of issuance of Award Letter or Letter of Intent whichever is earlier.

4.2 ASSIGNMENT, SUBLETTING CONTRACT AND PURCHASED ITEMS

The Contractor shall not sublet his Contract, or any substantial part thereof other than for supply of raw materials, for minor details, or for any part of the work of which the makers are named in the Contract provided that consent of the Purchaser is taken by him. Such consent shall not relieve the Contractor from any obligation, duty or responsibility under the Contract.

4.3 SUBMISSION OF PERFORMANCE BANK GUARANTEE

4.3.1 The Contractor shall also furnish Performance Security @ **10%** (Ten percent) of the Contract Value towards successful performance of the plant in accordance with the guaranteed technical particulars of the equipment at the time of taking over of the machines by the purchaser after commissioning or otherwise **10%** of the Contract Price/ Value shall be retained by the Purchaser for the period of Warrantee of 1(one) year. Performance security shall be in the form of a BANK GUARANTEE duly executed on non-judicial stamp paper of requisite value.

4.4 MANUALS

The contractor shall furnish 5(Five) sets of bound copies of erection, commissioning and operation, maintenance manuals giving detailed instructions, procedures, precautions for all the equipments to the Purchaser.

4.5 SAFETY

All units with respect to their location, layout, general arrangement and design and equipment, structural design, etc. shall be safe to the personnel and conform to the relevant safety rules and regulations / statutory requirement issued by the State Government and the Central Government as well as to: i. Indian Electricity Rules ii. Indian Electricity Act iii. Indian Explosives Manual and iv. Fire Protection Manual issued by Tariff Advisory Committee (India).

4.6 WATER FOR CONTRACTOR'S USE

The contractor can use the water available at site at free of cost.

4.7 WORK SCHEDULE/ RE-SCHEDULING & PROGRESS OF WORK

Contractor shall submit a detailed PERT network within 15 (Fifteen) days after the date of Award of Contract. Approved PERT network shall form part of the contract to be signed within 15 (Thirty) days from the date of receipt of Letter of Intent/ Letter of Award of Contract.

4.8 GUARANTEE & WARRANTY

4.8.1 The Contractor shall give guarantee/ warranty of the performance of the equipment and works as specified in Technical Specifications of the items and will ensure trouble free operation of the systems for a complete period of 1(one) year.

4.8.2 The Contractor shall further warrant that the equipment supplied/ works executed shall have no defect arising from design, material or workmanship or from any act or omission of the Contractor that may develop under normal use. Warranty shall remain valid for **8000 hours of operation or 12 (twelve) months** after commissioning and handing over the equipment, whichever is earlier.

If it becomes necessary for the Contractor to replace or renew any defective parts of the plant/works pursuant to the warranty clause, the Warranty Period for such parts shall, notwithstanding anything to the contrary contained herein, be operative for a further period of 12 (Twelve) months from the date of such repair/replacement.

4.9 PRICE VARIATION, TAXES and DUTIES & LEVIES, VAT / ENTRY TAX ETC.

Prices to be charged by the Contractor under the contract shall not vary from the quoted price in his Bid during the entire duration of Contract. Payments of taxes/ duties shall be made as per actual on production of proof of payments actually made, for which the amount included in the contract value shall be deemed to be based on the rates prevailing on the date 15 (Fifteen) days prior to the date of opening of the Bid and the balance amount payable if any, shall be the difference between the amount calculated at the rates as per the documentary proof and the amount already included in the contract value.

Entry Tax / VAT which may be charged by the Govt. of Arunachal Pradesh shall be presumed to have been included in the bid prices and the contractor should pay the same at the time of entry of materials into the State.

4.10 CONTRACT DRAWINGS AND TECHNICAL SPECIFICATIONS

4.10.1 Within 90 (ninety) days from the effective date of the Contract, the Contractor shall send to the Engineer a list of all the drawings with their respective titles and the dates on which they shall be supplied to the Purchaser.

4.10.2 The contractor shall furnish 3 (Three) prints of each of the following drawings within 90 (ninety) days of the effective date of order:

- i.** General arrangement drawings of the equipment offered.
Dimensional drawings and descriptive literature of the components.
Basic electrical drawings.
Foundation drawings
Power House lay out.

4.10.3 The Purchaser's Representative shall return to the contractor one print of each drawing; (a). Stamped APPROVED or (b). Marked up with Comments. The contractor shall

correct his drawings to conform to the comments and re-submit in the same manner as stated above, within 2(Two) weeks after the receipt of the marked up print by him.

4.10.4 The contractor shall furnish one direct reading reproducible set of each drawing and bill of materiel within 2 (Two) Weeks of receipt of final APPROVED set.

4.10.5 Others

- i.** Single line diagram of all electrical equipment and Electrical equipment lay out.
- ii.** Front view and General Arrangement diagrams for panel(s).
- iii.** Schematic drawings for control panel / protection system, Lightning protection, drawings showing coverage of all equipment, structures, buildings etc.
- iv.** Grounding / Earthing layout drawing covering internal / external rings and connections to equipment structures etc.

4.10.6 Information Category Drawings/Documents

- i.** Cable schedule indicating type of cables, from to via, route, total length size of cable and a final summary sheet indicating total requirement of all types of cables (for control and power both).
- ii.** Core wise control cable termination details indicating ferrule no. terminal block no. for each cable/ each equipment.
- iii.** Internal wiring diagram for panel(s).

Catalogues for each type of equipment, relays, meters etc.

Installation and commissioning manuals for each equipment relay etc.

O & M Manuals indicating trouble shooting procedure for all Equipment.

Type Test Certificates for all the major equipment.

Details of Test results, for test conducted at works for all equipment.

Details of Test results, for tests conducted at site for all equipment.

Spare part list, Nos, and ordering procedure for all recommended spares.

Overall General Arrangement (GA) of all the panels/equipment.

Fixing details of all the panels/equipment supporting structures etc.

Static and dynamic loading of each equipment.

Floor cutouts and wall opening details for cables and light conduits etc.

Details and location of various inserts, base plates, bolts, etc. required to be provided for support of cable structure, panel etc.

As executed drawings incorporating site changes along with reproducible.

4.11 INSPECTION & TESTING

4.11.1 The Engineer shall, on giving 10 (Ten) days notice in writing to the contractor setting out any ground of objections which he may have in respect of the work, be at liberty to reject all or any plant or workmanship connected with such work, which, in his opinion, are not in accordance with the contract, or are, in his opinion, defective for any reason whatsoever; provided that, if such notice be not sent to the contractor within reasonable time after the grounds upon which such notice is based have come to the knowledge of the engineer, he shall not be entitled to reject the said plant or workmanship on such

grounds. Unless specifically provided otherwise, all tests shall be made on contractor's works before shipment.

4.11.2 The contractor shall give the Engineer notice of any material being ready for testing, and the Engineer (and his Representatives) if so desired, shall, on giving 24 (Twenty Four) hours previous notice in writing to the contractor, attend at the contractor's premises within 15 (Fifteen) days of the date on which the material is notified as being ready; failing which the contractor may proceed with the tests, which shall be deemed to have been made in the Engineer's presence, and he shall forthwith forward to the Engineer duly certified copies of the test, in duplicate.

4.11.3 The contractor shall give 15 (Fifteen) days notice to the Purchaser's Representative of every lot of material being ready, duly packed for dispatch, along with routine test results of the material offered and details of dispatches made against last authorization for dispatch.

4.11.4 The purchaser reserves the right to draw required number of samples of other major items of raw material. These samples shall, however, be drawn and sealed in the presence of contractor (or his Authorized Representative). The Purchaser further reserves the right to get these samples tested from any Govt. recognized test house/ laboratory.

4.11.5 At Works

- i.** The offered equipment must have been fully type tested as per relevant ISS and/ or other specified International Standards, during the last 5 (Five) years' period, to be reckoned from the date of opening of tender. Photocopy of such type test reports/certificates must be submitted along with the tender. Type test certificate(s) of prototype manufactured and tested by foreign collaborators of the bidder(s) at their works shall not be acceptable for indigenously manufactured equipment.
- ii.** If the equipment is being manufactured in India under foreign collaboration, it shall have 3 (Three) years' satisfactory operating experience under tropical climate.
- iii.** The offered indigenously manufactured equipment should have been type tested and the test report submitted with the bid.

4.11.6 Inspection of Works

- i.** During erection, re-assembly, commissioning and trial operation, the Contractor shall perform at suitable intervals all inspections and tests in the presence of the Engineer in order to prove the orderly execution of the works in accordance with the Contract.
- ii.** Arrangement for testing at site and of the works and charges associated with it shall be borne by the Contractor. This includes the measuring devices - properly calibrated, and any pertinent accessories which shall be made available by the Contractor for the entire duration of the tests. The Contractor shall delegate his experts to perform the tests at site.

4.12 PACKING

The Contractor shall make separate package for each consignment and mark all containers with the implementing document number pertinent to the shipment. Each shipping container shall also be clearly marked on at least two sides as follows:

(a). Consignee, (b). Contract No, (c). Package No., (d). Description (e). Item No. (f). Net and gross weight (g).Volume.

4.13 DELIVERY OF PLANT AND DESPATCH DOCUMENTS

Following dispatch documents shall be sent with the packages:

- i.** 3 copies of the invoice showing description, quantity, unit price, and total amount.
- ii.** 3 copies of packing list showing contents of Package, Container, Bundle and loose materials forming part of each consignment shall be described in full in the packing account and full details of the contents of packages and quantity of material(s) shall be given.
- iii.** Delivery note / railway receipt / truck receipt.

Manufacturer's / Contractor's guarantee certificate.

Inspection certificate issued by the nominated inspection agency, and the Contractor's factory inspection report.

4.14 LIQUIDATED DAMAGES (LD)

- i.** If the work(s) is not completed within Time, the Purchaser shall be entitled to LD payable @ 1 % of the Contract Price per week or part of week subject to maximum of 10 (Ten) % of the Contract Price.

Without prejudice to the right of the Purchaser under the Contract and to the LD, the Purchaser shall be entitled additionally to terminate the Contract without being liable, in any manner whatsoever, to the Contractor and / or to have the WORKS completed at the risk and cost of the Contractor, by a communication in writing to the Contractor in the following events:

- a.** LD have become payable but the maximum limit of the amount of LD payable hereunder by the Contractor has reached / not reached and the Contractor has failed to complete the delayed WORKS within 30 (Thirty) days of receipt of notice; **OR**
- b.** The Contractor, being in breach of any of the provisions of the Contract, has failed to remedy such breach/fault within 30 (Thirty) days or such further period as may be mutually agreed between the Purchaser and the Contractor.

4.15 TERMS OF PAYMENT

Subject to any deductions from the contract price as per the Contract, the contractor shall be entitled to receive the contract price in the following manner:

i. Terms

- a.** Payment shall be made as per the Schedule after receiving the bills from the contractor subject to fulfillment of terms and conditions laid down in the preceding clauses.
- b.** Performance Security or Performance Guarantee or/ and Bank Guarantee which are required to be submitted as per the contract shall be done by the contractor without fail.

ii. Mode of Payment

- a.** All payments to be made to the Contractor under the contract shall be done in Indian rupees only.
- b.** All costs, damages or expenses which the Purchaser may have paid to the Contractor, for which under the Contract the Contractor is liable, may be deducted by the Purchaser from any money due or may become due to him by the Contractor under this contract, or may be recovered by due process of law.

4.16 POWER TO VARY OR OMIT WORK

No alterations, amendments, omissions, additions, suspensions or variations of the work (hereinafter referred to as "Variations") under the Contract as shown by the contract drawings or the Specifications shall be made by the Contractor except as directed in writing by the Engineer, but the Engineer shall have full power, subject to the provision hereinafter contained, from time to time during the execution of the Contract by notice in writing to instruct the Contractor to make such variations without prejudice to the Contract, and the Contractor shall carry out such instructions, and be bound by the same conditions, as far as applicable, as though the said variations occurred in the specification. If any suggested variations would, in the opinion of the Contractor, if carried out, prevent him from fulfilling any of the obligations or guarantees under the Contract, he shall notify the Engineer thereof in writing, and the Engineer shall decide forthwith whether or not the same shall be carried out, and if the Engineer confirms his instructions, the Contractor's obligations and guarantees shall be modified to such an extent as may be justified. The difference of cost if any, occasioned by any such variations, shall be added to, or deducted from, the contract price as the case may require.

4.17 NEGLIGENCE

If the Contractor shall neglect to execute the work with due diligence and expedition, or shall refuse or neglect to comply with any reasonable orders given to him in writing by the Engineer in connection with the work, or shall contravene any provision of the Contract, the Purchaser may give seven days notice in writing to the Contractor, to make good the failure, neglect, or contravention complained of, and if the Contractor shall fail to comply with the notice within a reasonable time from the date of service of notice thereof then in such case the Purchaser shall be at liberty to employ other workmen, and forthwith perform such work as the Contractor may have neglected to do, or if the Purchaser shall think fit, it shall be lawful for him to take the work wholly, or in part, out of Contractor's hands and give it to another person on contract at a reasonable price.

4.18 DEATHS, BANKRUPTCY ETC.

If the Contractor shall die or commit any act of Bankruptcy, or being a corporation commence to be wound up except for reconstruction purposes or carry on its business under a Receiver, the executors, successors, or other representative in law of the estate of the Contractor or any such Receiver, liquidator, or any person in whom the contract may become vested, shall forthwith give notice thereof in writing to the Purchaser and shall for one month, during which he shall take all reasonable steps to prevent a stoppage of the works, have the option of carrying out the contract, subject to his or their providing such guarantee as may be required by the Purchaser, but not exceeding the value of the work, for the time being remaining unexecuted.

4.19 LIABILITY FOR ACCIDENTS AND DAMAGE

- i. Contractor shall be responsible for the loss, damage or depreciation of the plant until the same is Taken Over under Clause 4.26 (Taking over) or is deemed under that Clause to have been taken over, provided ALWAYS that the Contractor shall not be responsible for any such loss, damage and depreciation occurring during such period that plant is operated by the Purchaser's staff prior to being taken over in accordance with Clause 4.25. (Rejection of defective plant).
- ii. Until the plant is taken over or is deemed to have been taken over as aforesaid, the Contractor shall also be liable for and shall indemnify the Purchaser in respect of all injury to person or damage to property resulting from the negligence of the Contractor or his workmen or sub-contractors or from defective design or work, but not from any other cause.
- iii. The Contractor shall indemnify and keep the Purchaser harmless against all actions, suits, claims, costs, or expenses arising in connection with injuries other than such as may be attributable to the Purchaser or his employees suffered prior to the date when the plant shall have been taken over under Clause 4.26 hereof, by persons employed by the Contractor or his sub-Contractor on the works, whether at Common Law or under the Workmen's Compensation Act 1923, or any other Statute in force.

4.20 REPLACEMENT OF DEFECTIVE PLANT OR MATERIALS

If during the progress of the work the Purchaser's Representative shall decide and notify in writing to the Contractor that the Contractor has executed any unsound or imperfect work or has supplied any plant inferior in quality to that specified, the contractor, on receiving details of such defects or deficiency shall, at his own expense, within such time as may be reasonably necessary for making it good, proceed to alter, reconstruct or remove such work, or supply fresh materials up to the standard of the specification, and in case the Contractor shall fail so to do, the purchaser may, on giving the Contractor 10 (Ten) days' notice in writing of his intention so to do, proceed to remove the work complained of, and at the cost of the Contractor, perform all such works or supply all such materials, provided that nothing in this clause shall be deemed to deprive the purchaser of or affect any rights under the Contract which he may otherwise have in respect of such defects or deficiencies.

4.21 CERTIFICATES OF PURCHASER'S REPRESENTATIVE

Every application to the Purchaser's Representative for a certificate must be accompanied by a detailed invoice (in duplicate) setting forth in the order of the Schedule of prices, particulars of the plant supplied and the certificates as to such plant, as is in the reasonable opinion of the Engineer in accordance with the Contract, shall be issued within 14 (Fourteen) days of the application for the same as is reasonably necessary on communication with the site. The Engineer may, by any certificate, make any correction or modification in any previous certificate which shall have been issued by him and payments shall be regulated and adjusted accordingly.

4.22 CERTIFICATE NOT TO EFFECT RIGHTS

No certificate of the Engineer on account, nor any sum paid on account by the Purchaser, nor any extension of time granted shall affect or prejudice the rights of the Purchaser against the Contractor, either under this Agreement or under the law, or relieve the Contractor of his obligations for the due performance of the contract, or be interpreted as approval of the work or of the material supplied. No certificate of the Engineer shall create liability on the purchaser to pay for any alternation, amendments, variations or additions not ordered in writing by the Engineer, or absolve the Contractor of his liability for the payment of damages whether due, ascertained, or certified or not or of any sum against the payment of which he is bound to indemnify the Purchaser nor shall any such certificate nor the acceptance by him of any sum paid on account or otherwise affect or prejudice the rights of the Contractor against the Purchaser, under this agreement or under the law.

4.23 PRICE REDUCTION CLAUSE

If the Contractor shall fail in the due performance of his Contract within the time fixed by the Contract or any extension thereof, the Contractor agrees to accept a reduction of the Contract price by ½% (Half Percent) per week reckoned on the contract value of such portion only of the plant as cannot, in consequence of the delay, be used commercially

and efficiently during each week between the appointed or extended time, as the case may be, and the actual time of acceptance under Clause 4.27 (Maintenance), and such reduction shall be in full satisfaction of the Contractor's liability for delay but shall not in any case exceed 10% (Ten percent) of the contract value of such portion of the plant.

4.24 TESTS ON COMPLETION

Whenever possible all tests shall be carried out before shipment. Should, however, it be necessary for the final test as to performance and guarantees to be held over until plant is erected at site, they shall be carried out in the presence of the Contractor's representative within one month of completion of erection. If the result of these tests shall not come within the margin specified, the tests shall, if required, be repeated within one month from the date the plant is ready for re-test, and the Contractor shall re-pay to the Purchaser all reasonable expenses to which he may be put by such tests.

4.25 REJECTION OF DEFECTIVE PLANT

- i. If the completed plant, or any portion thereof, before it is Taken Over under Clause 4.26 (Taking over) be found to be defective, or fails to fulfill the requirements of the Contract, the Engineer shall give the Contractor notice setting forth particulars of such defects of failure, and the Contractor shall forthwith make the defective plant good, or alter the same to make it comply with the requirements of contract. If the Contractor fails to do so within a reasonable time the Purchaser may reject and replace, at the cost of the contractor, the whole or any portion of the plant, as the case may be, which is defective
- ii. In the event of such rejection, the Purchaser shall be entitled to the use of the plant in a reasonable and proper manner for a time reasonably sufficient to enable him to obtain other replacement plant. During the period the rejected plant is used commercially the Contractor shall be entitled to a reasonable sum as payment for such use.

4.26 TAKING OVER

In the event of final or any outstanding tests being held over until the plant is erected, such Taking over Certificate shall be issued subject to the results of such final or outstanding tests which shall be carried out as per the Clause 4.25.

4.27 MAINTENANCE

For a period of 12 (twelve) calendar months, commencing from the date on which the plant is taken over or is deemed to have been Taken Over under Clause 4.26 (Taking over), the Contractor shall remain liable to replace any defective parts that may develop in plant of his own manufacture or those of his sub-contractors approved under Clause 4.2, under conditions provided for by the Contract under proper use and arising solely from faulty design, materials or workmanship, PROVIDED ALWAYS that such defective parts as are not repairable at the site and are not essential in the meantime to the

maintenance in commercial use of the plant, are promptly returned to the Contractor's works at the expense of the Contractor unless otherwise arranged.

If it becomes necessary for the Contractor to replace or renew any defective parts of the plant under this clause, the provisions of the first paragraph of this clause shall apply to the parts of the plant so replaced or renewed until the expiration of 6 (Six) months from the date of such replacement or renewal or until the end of the above mentioned period of the 12 (Twelve) months, whichever may be the later. If any defects be not remedied within a reasonable time, the Purchaser may proceed to do the work at the Contractor's risk and expense, but without prejudice to any other rights which the purchaser may have against the Contractor in respect of such defects. The Contractor shall bear reasonable cost of minor repairs carried out on his behalf at site.

4.28 CERTIFICATE OF COMPLETION OF WORKS

Before taking over the works into commercial use, the purchaser shall issue a certificate of completion based on the following certifications by the Engineer:

- i. Acceptable quality and workmanship of works.
- ii. Acceptance of field tests by the Engineer after commissioning the works.

4.29 FINAL ACCEPTANCE CERTIFICATES (FAC)

- i. It shall be issued by Purchaser within 30 (Thirty) days of expiry of the Guarantee/Warranty Period or the date of rectification of outstanding deficiencies/ damages/defects, whichever is later.
- ii. Request for issue of FAC by the Contractor shall be accompanied by a list of documents already handed over, as per the Contract.

4.30 CLEARANCE OF SITE ON COMPLETION

On completion of works, contractor shall clear away and remove from the site all the remaining construction equipment, surplus materials, rubbish and temporary works of every kind, and leave the whole of the site and works of every kind clean and in a workmanlike condition to the satisfaction of the Engineer.

4.31 TRAINING OF PURCHASER'S PERSONNEL

The Contractor shall train Purchaser's representatives/ personnel / operators who would be involved in the operation and maintenance of the plants at free of cost at site of work for a required period of 2 (two) months. It will be to the Choice of the contractor to impart training to the representatives of the Purchaser in the shops where the equipment will be manufactured or in any other power plant where similar equipments are manufactured or installed to enable them to become familiar with the equipment being supplied by the contractor. In the event of the Purchaser, for any reasons, failing to avail the training facilities, he shall not be entitled for any rebate whatsoever on this account. The Contractor will arrange necessary accommodation and other facilities such as conveyance etc. at the site of training for trainees or representative of the Purchaser at free of cost.

4.32 MISCELLANEOUS

Stores required at site by contractor shall be constructed by him at his own cost.

4.33 JUDICIAL JURISDICTION

All disputes arising out of the contract shall be settled with mutual understanding amicably and in case it is not possible to resolve then it will be referred to the Court of the Deputy Commissioners of the concerned jurisdiction or to the Guwahati High Court at Itanagar Permanent Bench.

4.34 APPLICATION

These Special Contract Conditions shall prevail over the General Conditions of Contract, in case of contradiction, if any.

SECTION – V

GENERAL TECHNICAL SPECIFICATIONS

5.1 STANDARDS

Standard(s) referred to shall mean the current Edition / Revision together with Amendments issued. A list of some of the Standards is given in the Appendix.

5.2 DRAWINGS / DOCUMENTS / MANUALS

5.2.1 Drawings to be submitted

i. General Arrangement (GA) and Layout Drawings

General arrangement and layout drawings will show the lay out plan of the power house building and the plan of equipments to be installed inside and outside of the power house building.

ii. Assembly and Sub-Assembly Drawings

These shall show: (a) all elements, dimensions of components, embedment in plan, cross-section, side and top views and include erection drawings, piping diagrams piping arrangement etc. (b) Sub-assembly of principal components of Works requiring dismantling, assembly and adjustments at site for maintenance, giving overall dimensions, adjustment, clearances, fitting tolerances etc. (c) Instructions for heat treatment, pressure tests, surface preparation, anti-corrosive protection etc. (d) Details of parts subject to wear and tear and also for which adjustment is provided, (e) Methods and sequencing of installation, field joints, erection and lifting devices, jacks, grout plugs, anchoring details, etc.

iii. Foundation Drawings

The Contractor shall submit foundation drawings well in advance before the construction of power house building indicating all pertinent dimensions, static and dynamic loads, etc. The drawings shall clearly indicate the embedment and 1st, 2nd, 3rd stage RCC/ C.C. lines. These shall include openings, sleeves, and details of conduits, drainage and dewatering system slopes, arrangement of supporting structure.

iv. Schematic Diagrams

Schematic diagrams of turbine, alternator, control panel and all auxiliary systems should be submitted.

v. Single-Line Diagrams

A single line diagram, containing all required technical information of electrical works and those of individual main components and switchboards showing control, metering, protection devices etc. shall be supplied.

vi. Circuit Diagrams

Power circuits in all phases with the main apparatus as well as pilot circuits shall be shown. The control part shall be subdivided into separately drawn "current paths", each showing all its components regardless of their actual physical location. Individual circuits shall be drawn in a straight-line sequence, avoiding line crossings. The current paths, designated by numbers, shall be drawn starting from two horizontal lines, which represent the control voltage source. All devices shall appear between these two lines.

vii. Block Diagrams

Block Diagrams shall be used to show, in a simplified manner, the main inter-relationships between the elements of a system' by means of symbols, block symbols and pictures without necessarily showing all the connections.

viii. Terminal Diagrams

These shall be prepared for terminal box / kiosk, marshalling rack, control cubicle, switchboard, etc. and contain: (a) Terminal No. of terminal board with targets (terminal no. and current path) of incoming and outgoing cables and wires (b) Cable type, designation, No. and Cross-section of conductors.

5.2.2 Lists and Schedules

i. Cable Lists / Interconnection Lists

Cable Lists shall include for each individual cable: (a) Cable number as per Identification System. (b) Cable type, voltage, Overall dia. (c) Connection point at each end with Cubicle / Works identification and terminal numbers. (d) Cable routing, Termination, Number, material and size of conductors.

ii. Alarm Lists

List shall indicate all alarms and contain: (a) Description and denomination of alarm (b) Data of alarm detector (contact) referring to applicable circuit diagram and (c) Data of alarm enunciator (location and clear text labelling).

iii. List of Final Control Elements

List shall indicate control actuators, control valves and contain: (a) Data of pipe, valve connections and layout (b) Maximal required and rated power.

5.2.3 Calculations

i. The Contractor shall submit for checking, the calculations for determining the main sizes, stress levels, dimensions and operational characteristics, safety factors, clearly indicating the principles on which the calculations were based.

ii. The calculations shall include formulae, standards, test results, basic assumptions, etc.

5.2.4 Operation and Maintenance Manuals

O&M Manuals shall be prepared in MS Word with enclosures (computerised drawings and scanned figures and supplied on CD along with 3 (Three) hard copies. They shall contain following information in sufficient details to enable maintain, dismantle, re-assemble, adjust and operate the equipments and components with all the accessories and items installed.

Table of Contents, List of Illustrations, Introduction.

Detailed description of Works, components and ancillaries, their assembling and dismantling, list stating clearances, tolerances, temperatures, fits, etc.

Operating Instructions containing sequences of individual manipulations required for operation making use of tables, lists and graphic presentations, wherever possible, for making the description readily understandable and an appropriate trouble-shooting list.

Entire testing and adjustment procedure required after overhauls and during operation.

Preventive maintenance instructions indicating periodical inspections, a tabular summary of required Daily, Weekly, Monthly, Quarterly and Yearly activities containing: (a) Repair and adjustment procedures including fault tracing (b) List of spare parts, containing all necessary data for ordering. The list shall include all spare parts (to be supplied and those not to be supplied under the present Contract). ***Detailed drawing for each item of spare parts shall be supplied.*** (c) Tool lists, containing all necessary data for identification of tools to be delivered under the present Contract. (d) As-built drawings

5.2.5 Installation and Commissioning Manuals

These shall be prepared in MS Word with enclosures (computerised drawings and Scanned figures) and supplied on CD along with 3 (Three) hard copies in properly bound form. The manuals shall contain (i) Installation Procedures, (ii) Pre-Commissioning Tests and Procedures, (iii) Commissioning Procedures.

5.2.6 Progress Reports during Design and Manufacturing

Contractor shall submit quarterly progress reports to the office of the Director, APEDA and to the concerned Project Officer of the concerned area which shall contain (but not be limited to) the following information:

- i. General description of Works performed during the reporting period on each main activity, including any notable problems encountered.
- ii. Total overall % of design and manufacturing works completed, w. r. t. the CPM programme with appropriate comments explaining differences, if any.
- iii. % of each main work activity completed during the reported quarter w. r. t. the scheduled programme with comments explaining difference(s), if any.
- iv. A list of activities to be started within the next 2 (Two) months, with expected starting and completion date(s), with explanation if dates differ from the CPM network.

5.2.7 Progress Reports during Installation at Site

The Contractor shall submit during erection the fortnightly progress reports to the office of the Director, APEDA and to the concerned Project Officer of the concerned area about the details of work done during the preceding month. The report shall contain the following information with appropriate comments explaining problems and differences, if any:

Works performed during the reporting period on each main activity.

Total overall % of erection work completed, w. r. t. the CPM programme.

% of each main activity completed during the reported fortnight w. r. t. Scheduled programme.

A list of activities scheduled to be started within the next fortnight. with expected starting and completion date(s).

Progress photographs of significant events.

A statement detailing the status of progress on the overall programme and how to regain any lost time or setbacks which may have occurred.

5.3 SPARE PARTS, TOOLS AND SITE CONSUMABLES

5.3.1 Spare Parts

- i. All the spare parts supplied shall be of same material / workmanship and interchangeable with the corresponding parts of the executed work, protected against corrosion and marked **Approved** with identification labels. Spare parts supplied shall not be given to the Contractor for use during erection and commissioning for replacing the defective or damaged original components of his supplies of works.
- ii. The Contractor shall provide 5 (Five) %, but at least two pieces of all types of bolts, screws, nuts, washers, spanner rings and coffer.

5.3.2 Tools and Appliances

- i.. The scope of works include:
 - a. All customary and special tools, as well as auxiliary devices i.e. lifting devices, ropes, etc. necessary for assembly and disassembly of all parts.
 - b. All accessories for maintenance.
 - c. Special lifting devices and tools designed and supplied for the project, can be used by the Contractor during erection and handed over to Purchaser in good working condition without any wear and tear. However, ropes, slings, small hoists and winches etc. shall be handed over in new condition.
- ii. All lifting devices and wire ropes slings to be used at site shall be tested at works and test certificate supplied.

5.3.3 Site Consumables, Lubricating Oil and Grease for First Filling

The Scope of work shall include:

Supply of all site consumables in fairly sufficient quantity so that erection and commissioning activity is not held up for want of these items.

Supply of lubricating oils, insulating oils and greases etc. required for first filling in the plant and equipment plus 20 (Twenty) %.

5.4 DESIGN REQUIREMENTS

5.4.1 Working Stress

Conservative factors of safety shall be used throughout the design. For rotating parts of the generator and exciters due to runaway speed of turbine shall not exceed two-thirds of the yield point. For other materials used in the manufacture of the generator and exciter etc. the maximum stresses due to the most severe operating conditions shall not exceed one-third of the yield point nor one-fifth of the ultimate strength of the material. For temporary overloads, unit stresses not exceeding one-half the yield point stress will be permitted.

5.4.2 Steel Casting

All steel castings shall conform to 'Standard Specification for Mild to Medium strength carbon steel casting' (A.S.T.M. Designation A27-46-T, grade 63-35, of the American Society for Testing Materials).

Casting shall not be warped or otherwise distorted, nor shall their dimensions be oversized to such an extent as to interfere with the proper fit with other parts of the apparatus. The structure of the casting shall be homogeneous. An excessive segregation of impurities or alloys at critical points in a casting will be cause for its rejection.

5.4.3 Steel Plates

- i. Steel plates for all the principal stress-carrying parts shall be fire-box quality grade B and for generating housing cover plates and other moderately stressed parts shall be fire box quality grade A or B, conforming to the 'Standard specifications for Low Tensile Strength Carbon-Steel plates of Flange and Fire box Qualities' (ASTM Designation: 185-49 T) or other relevant Standards.
- ii. The dimensions of the parts, which are exposed to repetitive and alternating stresses as well as to impacts and vibrations, shall take into account the safety measures and appropriate allowable stresses.

5.4.4 Seismic Loads

The forces being caused by earthquake including hydraulic loads, which may occur Additionally, shall be taken into account for the computations. Stresses resulting after including these loads shall not exceed permissible stresses.

5.4.5 Mechanical Strength

Generator, turbine, switchyard equipment (wherever included) and structure be designed to safely withstand earthquake acceleration force prescribed for Zone-V of both in the vertical and horizontal direction.

5.4.6 Natural Frequency

Natural frequency of the machine be kept well away (higher) from the magnetic frequency of 100 Hz (twice the generator frequency). The natural frequency must be much away from multiple of runner blades passing frequency.

5.4.7 Generator Stator Support and Bearing Brackets

Generator stator and bearing brackets of turbine and generator shall be designed to safely withstand horizontal and vertical forces due to earthquake.

5.4.8 Vibration Detector

Vibration detectors or eccentricity meters on turbines and generators may be provided for alarm and shut down.

5.4.9 Mercury Contacts

Anti-vibration type mercury switch shall be used.

5.4.10 Fits and Tolerances

Fits and tolerances shall be given in accordance with ISO Standard. Fits shall be selected for the smooth functioning of the components for fairly long life.

5.4.11 Materials

Due regard shall be given to the humid tropical conditions under which equipment is to work while choosing materials and their finishes. Material specifications, including grade or class shall be shown on drawings submitted to the Purchaser.

5.5 MANUFACTURING REQUIREMENTS

5.5.1 Materials

Materials used, shall be new and of first class quality free from rust, defects and imperfections. Inspection records of all materials shall be compiled before actual use. The Engineer shall review the inspection records of materials of major components. Materials of limited shelf life shall not be used after their expiry date.

5.5.2 Welding and Heat Treatment

5.5.2.1 Welding

All welding (except welding of thin plates or piping of small sizes) shall be performed by the electric-arc method.

Butt welds, which can be welded from one side, only, shall be provided with back strips on the whole length of the seam to be welded.

Welds shall be cleaned of slag and show uniform sections, smoothness of weld metal, feathered edges without overlap, and no porosity and clinker. Each layer shall be thoroughly preened before the next layer is applied.

All welds transverse to the direction of flow shall be ground flush with the plates on the inside and on the outside, wherever dynamic stress occurs.

Due care shall be taken in aligning and separating the edges of the members to be joined by butt-welding so that complete penetration and fusion at the bottom of the joint is ensured. Where fillet welds are used, the members shall fit closely and be held together during welding.

The cut surfaces of plates requiring weld joints shall be free of all visible defects, such as laminations, surface defects caused by shearing or flame-cutting operations. The edges and surfaces to be welded shall be free of rust, mill scale, grease, oil, paint or any other foreign matter.

5.5.2.2 Welding Qualifications

For welding of principal stress carrying parts, the standard of welding procedures etc., shall conform to Standards equivalent to the requirements of the ASME Boiler and Pressure Vessel Code, Sections X and XI, or DIN 8560, DIN 8563, EN 287. For welding of less important parts, the standards and qualifications shall conform either to the AWS Standard Qualification Procedure or equivalent.

5.5.2.3 Quality and Procedure Control

- i. Quality control methods (radiography, ultrasonic crack detection, etc.), shall be used as per appropriate manufacturing code.
- All welded joints, which have to be tight, shall be inspected or tested by dye-penetration tests.
- iii. All major welds carried out on parts under hydraulic pressure shall be at least 10 % radio-graphically and 100% ultrasonic examined. All welds on the skin-plates shall be additional dye penetration tested as Directed.
 - iv. The Contractor shall indicate in the corresponding drawings the type of non-destructive testing to be carried out during manufacture and at Site.

5.5.2.4 Defects and Repairs

Plates with laminations discovered after cutting shall be rejected unless the laminated portion is only local, easily repairable but only if approved.

Defects in welds to be repaired shall be chipped out to sound metal and the areas tested by DP (Dye-penetration) or ultrasonically to ensure that the defective material has been completely removed before repair of welding is carried out. Repairs shall be carried out in accordance with the relevant Standards and to the approval of the Engineer.

- iii. The Work shall be 100% inspected again by the method used first to ensure to determine that there is no faulty work.

5.5.2.5 Heat Treatment

Heat treatment shall be performed:

- i. On all fabricated parts which are stressed during fabrication as per the approved heat treatment/weld procedure and are to be finish machined.
- ii. On field erection welding seams, performed according to the approved specifications for the welding procedure for the corresponding parts.

5.6 TECHNICAL WORKS AND STEEL STRUCTURE

5.6.1 Bolts, Screws, Nuts, etc.

- i. All bolts, studs, screws, nuts, and washers shall be to the ISO metric system mild steel. Bolts and nuts shall be of the precision cold forged or hot forged type with machined faces parallel to one another.
- ii. The Contractor shall supply net quantities plus 5 % of all permanent bolts, screws and similar items / materials required for installation at the Site.

5.6.2 Seals

- i. Rubber Seals shall be mounted type and extruded ones, designed and mounted in a manner that these are adjustable, water tight and readily removable and replaceable.
- ii. All adjusting screws and bolts for securing the seals and seal assembly in place shall be of stainless steel.
- iii. Seals shall be made of synthetic rubber suitable for site conditions and of proven quality material. Joints shall be water/oil tight.

5.6.3 Drives

- i. Moving parts of machinery including shafts, couplings, collars, projecting key heads, rope/belt-drives shall be completely guarded for full protection.
- ii. All setscrews on revolving shafts shall be countersunk or suitably protected.
- iii. All guards shall be arranged for removal without disturbing the main parts. All bearings shall be mounted in dust-proof housings. Base of bearing supports shall be machined, and rest on machined-surfaces.

5.6.4 Oils and Lubricants

Efficient means of lubrication, suitable for use under site conditions, shall be provided for all moving parts. Approved quality lubricates shall be used.

5.6.5 Piping, Fittings, Valves and Gates

i. Materials of Pipes & Fittings

- a. Water, air admission and drain piping less than 25mm nominal bore shall be of galvanized heavy grade as per IS-1239, Part-I or to schedule `STD' conforming to ANSI B36.10 or equivalent Standards for steel pipe or copper.
- b. Water, air admission and drain piping equal to or greater than 25 mm nominal bore shall be galvanized heavy grade as per IS-1239, Part I/IS-3589 or to schedule `STD' conforming to ANSI B36.10 or equivalent Standards.
- c. Oil piping of greater than 25 mm nominal bore shall be of seamless high quality steel pipe conforming to minimum API-5L GR.B or equivalent grade as per process requirement and the pipes of less than 25 mm bore of stainless steel.
- d. Steel pipes of diameter 100 mm and above for a pressure of not more than PN 10 may be used in Welded type.
- e. The minimum steel pipe wall thickness shall be the "normal" or "standard" wall thickness as per the applicable Standards.

ii. Fabrication of Pipe Work

- a. Steel pipe work for water, air admission and drains smaller than 65 NB shall be galvanized and joined by screwed fittings. After fitting, unprotected steel be wire brushed and painted with two coats of zinc-rich paint. Leak-free joint shall be ensured by the contractor.
- b. Steel pipe work for water, air admission and drains 65 NB and over shall be welded ends black pipe hot-dip galvanized after fabrication.

iii. Painting

Un-galvanized steel piping shall be painted on the exterior. The paint treatment shall be of the same system as used for the turbine exterior.

iv. Pressure Testing

- a. Hydraulic piping shall be pressure tested after erection at site. The pressure shall be maintained without loss for one hour.
- b. The lubricating oil piping shall be pressure tested, without loss for one hour, after erection at a pressure 50% greater than maximum pump pressure.

v. Valves & Gates

- a. Valves shall be leak-proof in either flow direction (except for non-return valves) when the nominal pressure is applied.
- b. Valves with design pressures higher than PN 10 and diameters larger than DN 100 shall be workshop-tested for tightness and soundness of materials.

vi. Pipe Supports and Hangers

All pipe work and accessories shall be mounted and supported in a safe and neat manner. All brackets, stays, frames, hangers and supports for carrying and staying the pipes, including their fasteners shall be included in the supply and completed by the Contractor at the Site. Pipes and fittings shall be supported at or near flanges wherever possible.

5.6.6 Mechanical Instruments

- i. Mechanical parts of instruments shall be suitably protected against shocks, vibrations, heat, humidity splash water, etc.
- ii. Pressures gauges shall be provided with a damping liquid, e.g., glycerine, to compensate vibrations, unless approved otherwise.

5.7 ELECTRICAL WORKS

5.7.1 General

- i. All components shall be of Approved design and rating.
- ii. Works shall be pre-assembled to the extent possible in the Contractor's workshop complete with all devices and wired up to common terminal blocks.
- iii. Short-circuit calculations shall be evaluated giving full evidence that every electrical component can withstand the maximum stresses under fault conditions, for fault levels and durations under the worst conditions.
- iv. All Works shall be suitable for the prevailing climatic conditions.

5.7.2 Clearances

Clearances shall be provided as per the Indian Electricity Rules and Standards for ready access for O & M whilst the remaining sections of Equipment are alive.

5.7.3 Electrical Supplies for Auxiliary Equipment

The electricity supply for Auxiliary Equipment shall be:

- i. For power: 415 V, 3-phase, 50Hz, 4-wire or 230 V, 1-phase, 50 Hz, 2-wire.
- ii. For lighting, indication, and anti-condensation heaters: 220 V, 1- phase, 50 Hz
- iii. For essential indication, controls, protection, alarms and circuit breaker closing and tripping supplies: 24 V D.C

5.7.4 Alternating Current Supply Practice

- i. Switch -Fuse system shall be provided for all mains supplies.
- ii. Double-pole switches shall be used to break single-phase A.C. mains supplies.

5.7.5 Direct Current Supply

- i. It shall be possible to remove/replace cards from / to electronic equipment Without damage and without interfering with the operation of the rest of the equipment or system; if necessary, otherwise, switching-off the supplies locally to a card to prevent inadvertent interference to the equipment or system during removing/replacing a card may be considered.
- ii. Power supply bus bars in cubicles shall be carefully routed and each bus bar shall be shrouded. Inadvertent short circuiting of bus bars either between themselves or to the earth should not be possible.

5.7.6 Electric Motors

i. General

- a. All motors shall be of approved manufacture, high starting torque and comply with motor dimensions as per relevant IS.
- b. The general construction shall be stiff, rigid and corrosion proof. Light metal alloy casings shall not be accepted.
- c. AC motors shall have squirrel cage type rotors.

ii. Motor Ratings

The voltage and power rating of electric motors shall be as follows:

- a. A. C. Motors up to 0.75 kW :
 - Service voltage : Single-Phase 230 V A. C., 50 Hz
 - Mode of starting : Condenser
- b. D. C. Motors :
 - Service voltage : 24 V D.C.
 - Mode of starting : Resistor

- c. Motors of Higher Ratings : As approved
- d. A. C. motors shall be capable of operating continuously under rated output, 50 Hz \pm 3% frequency, \pm 10% voltage variation and transient over voltage of 130% of the nominal voltage.
- e. Motors shall be capable of maintaining stable operation when running at 70% nominal voltage for 10 seconds. The pullout torque for continuously loaded motors shall be at least 160% of the rated torque and for intermittently loaded motors 200% of the rated torque.
- f. D.C. motors shall be capable of operating continuously under rated output and \pm 10% voltage variation with a fixed brush setting for all loads. Unless otherwise approved, the speed drop between no-load and full-load shall not exceed 10% of no-load speed.

5.7.7 Starting

- i. A.C. motors shall be designed for direct on-line starting and capable of being switched on to an infinite bus-bar at 110% of the nominal voltage with an inherent residual voltage of 100% even in phase opposition. For starting the motors from the individual main and auxiliary bus-bars, a momentary voltage drop of 20% referred to nominal voltage should be taken into consideration. With 85% of the nominal voltage applied to the motor terminals, each motor shall be capable of accelerating its associated load to full speed with a minimum accelerating torque of 5% of full load torque.
- ii. Maximum starting current (without tolerance) in both the cases of A. C. and D.C. shall not exceed the values recommended in the Standards followed.
- iii. The motors shall be able to withstand number of cold starts per hour as per Standards followed.

5.7.8 Insulation Class

The insulation of all motors shall be of class 'F' but maintain in operation the temperature limits of class 'B' materials.

5.7.9 Ventilation and Type of Enclosure

Motors shall be totally enclosed fan-cooled type, protection class IP 54 as per IEC Recommendation 144. Cable termination points shall be of class IP 55 or as per Standards followed.

5.7.10 Bearings

As far as possible, the motors shall have sealed ball or roller bearings lubricated for life. All other motors with ratings of about 1 kW and above shall be equipped with lubricators permitting greasing while the motor is running and preventing over-lubrication. Additionally, the bearings shall be fitted with grease nipples permitting the use of a universal grease gun.

5.7.11 Terminal Boxes and Earthing

The terminal leads, terminals, terminal boxes and associated equipment shall be suitable for terminating the respective type of cables as specified in this Document and in the section of Technical Specifications. A permanently attached connection diagram shall be mounted inside the terminal box cover.

5.7.12 Noise-Level and Vibrations

- i. The noise level of motors shall not exceed 85 dB (A).
- ii. All motors shall be statically and dynamically balanced.

5.7.13 Tests

Each motor shall be factory tested for (i) Measurement of winding resistances, (ii) No-load and short-circuit measurements, (iii) Measurement of starting current and torque, (iv) Efficiency measurement (type test), (v) Heat test run, (v). Dielectric test, (vii) Measurement of insulating resistance

5.7.14 Starters And Contactors

- i. Motor starters and contactors shall have short circuit protection and local disconnecting devices.
- ii. Starters and contactors shall comply with relevant Standards. These shall be installed in ventilated enclosures for indoor installation and weatherproof enclosures for outdoor installation. The enclosures shall be complete with locks, cable sealing boxes, conduit entries, cable gland plates, bus bars, internal wiring, terminal boards, etc. as required by the duty of the starter or contactor.
- iii. Starters and contactors shall be capable of satisfactory operation for 5 minutes at a voltage 25 percent below nominal, at nominal frequency.

5.7.15 Moulded Case Circuit Breakers (MCCB)

MCCBs shall be of 2 or 3-pole type as required, having thermal time delay and instantaneous trips with "On-Trip-Off", indicating/operating mechanism. Circuit breakers used in combination type motor starters or contactors shall have the operating mechanisms interlocked with the starter or contactor cover so that the cover cannot be opened unless the circuit breaker is open. The breakers shall comply with applicable section of IEC 157/1 or equivalent Standards.

5.7.16 Control Relays

Relays used as auxiliary control devices in conjunction with motor starters and magnetic contactors shall be of the type designed for machine tool application featuring contact convertibility. All contacts shall have a minimum thermal current rating of 10A over a range of 6 to 600 V AC.

5.7.17 Terminal Blocks

- i. All terminal blocks shall be mounted in accessible position with the spacing between adjacent blocks not less than 100 mm and space between the bottom blocks and the cable gland plate being a minimum of 200 mm. Sufficient terminals shall be provided to allow for the connection of all incoming and outgoing cables, including spare conductors and drain wires. 20 (Twenty) % spare terminals shall be provided. In enclosed cubicles, the terminal blocks shall be inclined toward the door for facilitating terminations.
- ii. Terminal blocks shall be provided with shorting links and paralleling links where applicable and mounting identification numbers and/or letters. Terminal blocks shall conform to the applicable Standards. Terminal identification shall be provided as per wire number of connected leads. Circuit terminals for 415 V AC shall be segregated from other terminals and equipped with non-flammable, transparent covers to prevent contact with live parts. Warning labels with red lettering shall be mounted thereon in a conspicuous position.

5.7.18 Equipment Wiring

All wiring connections shall be readily accessible and removable for test etc. Wiring between terminals of the various devices shall be point to point.

Multi-conductor cables shall be connected to the terminal blocks in such a manner as to minimise crossovers. Approved claw washers of crimp type connector shall be used to terminate all small wiring. Each conductor shall be individually identified at both ends through a system providing ready and permanent identification, utilising approved slip-on ferrules.

Markers may be typed individually or made up from sets of numbers and letters firmly held in place. Open markers will not be accepted. These must withstand a tropical environment and high humidity and only fungus proof materials will be accepted. **Ferrules of adhesive type are not acceptable.**

5.7.19 Cubicles and Control Panels

- i. Cubicles / control panel enclosures shall be of sheet steel (minimum thickness: 2.5 mm), rigid, self-supporting construction and supplied with channel bases.
- ii. Fitted with close fitting, gasketed, hinged, lift-off doors capable of being opened through 180 deg. The doors shall have integral lock and master key.
- iii. Cubicles /panels shall be vermin proof. Removable gland plates shall be supplied and located to provide adequate working clearance for cable terminations. Cables and wiring shall enter from bottom or top as Approved.
- iv. Instruments, control knobs and indicating lamps shall be flush mounted. Relays and other devices sensitive to vibration shall not be installed on doors or hinged panels, and no equipment shall be installed on rear access doors.

5.7.20 Earthing

Provision shall be made for earthing all equipment. All structural metal work and metal chassis shall be connected to earth..

Earthing conductors shall be at least equal in cross-sectional area to the supply conductors and capable of carrying the fault current.

Separate earthing should be provided for panel board, turbine set and neutral.

5.7.21 Labels and Plates

- i. Labels of approved material, size, lettering and arrangements shall be provided for all instruments, relays, control switches, push buttons, indication lights, breakers, etc. No levels are required if function is indicated on the device.
- ii. Instruction plates in the Contract and selected local language, the sequence diagrams or instructions for maintenance shall be fitted on the inside of the front door of the electrical switchboards.

5.7.22 Warning Labels

- i. Warning labels shall be made of synthetic resin with letters engraved in the Contract and English language.
- ii. For indoor circuit breakers, starters, etc., transparent plastic material with suitably contrasting colours and engraved lettering would be acceptable.

5.7.23 Labels for Cables

Each cable shall be of approved quality having non-corrosive labels detailing identification number of the cable, voltage, and conductor size permanently attached to each end.

5.7.24 Single-Line Diagrams

Switchgear room and the control room shall be furnished with a copy of the final as-built single-line diagram detailing all electrical data and denominations, separate for each individual switchgear / distribution board / MCC, placed under glass and frame/wall mounted at an Approved location.

5.7.25 Key System for Electric Boards

Key interlocked switches shall be provided with Approved locks for locking in the neutral position. Similar locks shall be provided for selector switches for locking the switches in any of the positions. The locks or padlocks shall be co-ordinated for different applications and supplied with three keys.

5.8 INSTRUMENTATION AND CONTROL EQUIPMENT

5.8.1 Design Criteria

i. General

- a. The Works shall be pre-assembled to the extent possible in the Contractor's workshop.
- b. All instrumentation and control functions shall be shown on the piping and instrumentation diagrams. Symbols to be used shall be as per ISO Standards and Identification system (tag numbers) as per the Approved Works identification system.
- c. Shielded cables shall be used for the control and supervisory equipment.

ii. Sizes of Indicators, Recorders, Etc.

Meters, instruments and recorders shall be of standard size. The front glasses shall be anti-glare type. The scales shall be 90 degrees type for local control panels but must be 240 degrees type for control room instrumentation.

iii. Tests

Single components and pre-erected assemblies shall undergo functional and routine tests in the Contractor's workshop. Ready mounted control and supervisory system shall undergo functional tests on Site. Calibration tests shall be made on all-important pressure gauges and other instruments.

iv. Measuring Systems

Measuring ranges of indicators, transducers, etc. shall be selected in such a way that the rated value of the measured magnitude covers approximately 75% of the range. All local instruments shall, as far as practicable, be mounted vibration free. Wherever required, damping elements shall be used.

5.8.2 Temperature Measurement

- i. Resistance thermometers and thermocouples shall be equipped with waterproof connection leads wherever applicable.
- ii. Use of dial-type contact thermometers shall be restricted to bearing metal and oil temperature measuring.

5.8.3 Pressure Measurements

- i. Pressure gauges shall be made of stainless steel, shock/ vibration-proof, and equipped with toothed wheels and toothed segments of the machined type.
- ii. If the pressure is pulsating, the devices concerned shall be connected via flexible tubes or other pulse-absorbing means.

5.8.4 Level Measurements

The liquid level measurements in reservoirs and tanks with atmospheric pressure shall be made by means of displacement-type transmitters, float-disc-transmitters or capacitance measurement type. The errors shall not exceed $\pm 1.0\%$ of the total measuring range.

5.8.5 Electrical Measurements

Electrical instruments shall be of flush mounted type, dust and moisture proof, have digital system and accuracy class not less than 1.5. D.C. measuring instruments shall have digital type systems of the same accuracy. Wattmeters shall be suitable for unbalanced systems and accuracy of energy meters should be of 0.2 % accuracy class.

5.8.6 Checking of Dimensions

Dimensions, especially clearances and fits (ISO 286) shall be carefully checked.

5.8.7 Workshop Assembly

- i. Works to be furnished shall be shop assembled to a status sufficient to prove that the design and workmanship have been executed in accordance with the Specifications, that the delivery is complete, and that no work remains to be done at Site, which reasonably can or should be done in the shop. .
- ii. During workshop assembly, all instruments, control devices and piping shall be fitted. If assembly shows defects in design or manufacture or difficulties in assembling and dismantling, these shall be eliminated.
- iii. If corrections cannot be carried out as per the above terms , the components

concerned will be rejected. The assembled parts shall subsequently be subject to tests as per applicable Standards.

5.8.8 Pressure and Leakage Tests

- i. Parts subject to internal or external pressure or containing liquids or gases temporarily or permanently during operation shall be tested prior to painting.
- ii. Official regulations shall be observed. If any liquid is used for the test that may cause corrosion, all Works and piping shall be thoroughly cleaned immediately after the test.
- iii. Leaks and defects can be repaired if permitted by the applicable Standards or as Approved. If defects are found, the Engineer may reject the defective parts, or permit welding repairs with stress relieving, radiographic examination and additional pressure tests.

5.8.9 Parts Exposed to Hydraulic Pressure

Hydraulic pressure tests shall be carried out using the liquid to be used during operation or a liquid with less viscosity. The hydraulic test pressure shall be 1.5 times the maximum operating pressure maintained for 30 minutes and afterwards the test pressure shall be reduced to the operating pressure.

5.8.10 Functional Tests

Functional tests shall be defined as tests of the function of assemblies, sub-assemblies or parts of the Works under no load conditions. Functional tests shall be performed on all Works prior to the execution of operational tests.

5.8.11 Operational Tests

- i. As far as practicable, operational test shall be carried out on all Works, simulating operating conditions.
- ii. Parts to be delivered by sub-Contractors shall be tested either at the premises of the sub-Contractor or of the Contractor, as Approved.
- iii. Testing of electrical works shall be performed as per relevant Standards and include but not be limited to tests of heating, loading, overloading, and losses.
- iv. Operational tests of lifting equipment and other machinery shall include tests under nominal load and 125 % of nominal load unless otherwise specified.

5.9 ERECTION AND COMMISSIONING

5.9.1 Reference Points

The Contractor shall be responsible for true and proper staking-out of the works and levels of reference given by the Engineer in writing, for correctness of the positions, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection with this.

5.9.2 General Notes on Installation Work

All power tools are to be handed over, on completion, in good condition to the Purchaser.

After erection, the works shall be finally painted, as per relevant I.S.

5.10 SITE INSPECTION AND TESTS

- i. During erection, commissioning and trial run, the Contractor shall perform all inspections and tests in the presence of the Engineer.
- ii. Unless otherwise specified, all costs for testing at site and of the works and charges associated with it shall be borne by the Contractor. The Contractor shall delegate his experts to perform the tests at site.
- iii. The Engineer reserves the right to have checked at his own expenses the Contractor's instruments to be used or having been used for any tests by an independent, officially acknowledged institution.

5.11 COMMISSIONING TEST

Commissioning tests shall be carried out as per relevant Standards on all generating units and other equipments to verify their rating characteristics. Field acceptance test reports shall be prepared by the Contractor and submitted to Purchaser for approval.

5.12 TRIAL RUN

The plant shall be kept on trial run for 72 (Seventy Two) hours of continuous run during which period all necessary adjustments shall be made while operating over the full load-range enabling the plant to be made ready for performance and guarantee tests.

The trial run shall be considered successful, provided that each item of the equipment can operate continuously at the specified operating characteristics, for the period of trial run.

- iii. For the period of trial operation, the time of operation with any load shall be counted. Minor interruptions not exceeding 4 (Four) hours, at a time, caused during the continuous operation shall not affect the total duration of trial operation.
- iv. A report comprising observations and recordings of various parameters measured during the above trial run shall be prepared by the Contractor. This report shall be signed by both the parties. Based on the observations, necessary modifications, repairs to the plant shall be carried out by the Contractor to the full satisfaction of the purchaser.
- v. During the trial run the Contractor shall make familiar the Purchaser's personnel with the equipment, the O&M of the Works and its auxiliaries.
- vi. If any defects or irregularities affecting the safety or reliability of the Works should arise during the trial run, the trial run shall be interrupted and started again after such defects or irregularities have been corrected by the Contractor.

5.13 ACCEPTANCE

- i. The taking-over testing shall be performed as per the test procedure agreed upon between the Engineer and the Contractor.

- ii. Immediately upon termination of any such testing, a "Protocol of Acceptance", which shall be deemed to be the Test Certificate, shall be issued by the Engineer.
- iii. This document shall be signed by both the Parties and form an integral part of the subsequent "Taking-Over Certificate".
This "Protocol of Acceptance" shall state:
 - a. The date of testing.
 - b. The quantity and type of Works concerned.
 - c. Statement of all minor defects which have to be corrected by the Contractor.
 - d. Confirmation that the guaranteed data have been proven.

The plant shall continue to be operated till the generating unit/ units have been tested and commissioned and trial run for a period of 15 days.

SECTION-VI

POWER GENERATION EQUIPMENT

6.1 HYDRO-MECHANICAL EQUIPMENT

6.1.1 Type of Turbine

The types of turbines may be of (i) Axial flow, (ii) Cross flow, (iii) Francis, (iv) Pelton, (v). Turgo impulse or (vi) any other turbine which may suit the technical requirement of site with maximum possible efficiency. A penstock adaptor must be provided at the inlet suitable for connecting the penstock pipe of appropriate size at the turbine inlet. (Manufacturer must specify the inlet penstock pipe size and flange details for which the penstock adaptor has been designed.) A butterfly valve must be provided at the inlet of each turbine.

The penstock adaptor must be provided with matching flanges with necessary fasteners for fixing of the penstock pipe.

The turbine assembly must be of sturdy and rugged construction suitable to withstand the inlet water pressure as per the specified net operating head. All bolted joints and rotating portions must be provided with gaskets/O-rings/Seals suitable for protecting against leakage of water at the operating head pressure. All welded joints shall be securely welded to ensure that there is no leakage of water during operation of the turbine. Necessary reinforcement ribs need to be provided to improve the rigidity and strength of the fabricated turbine casing.

6.1.2 Minimum Weighted Average Efficiency (η_{wav})

The weighted average efficiency of the turbine –generator unit, calculated by the following expression should not be less than 65%:

$$\eta_{wav} = 0.5 \{ \eta_{t100} \times \eta_{g100} + \eta_{t50} \times \eta_{g50} \}, \quad \text{where:}$$

$\eta_{t100}, \eta_{g100}, \eta_{t50}, \eta_{g50}$ are the efficiencies of turbine and generator at 100% and 50% rated outputs, respectively at rated head.

For efficiency of turbine, the performance curves of similar offered turbine manufactured by the manufacturer of which turbines are being quoted by the bidder, (tested by independent institution), be provided, OR the value obtained as per the field tests on the turbine carried out as specified in IEC or equivalent international or national code shall be taken.

For efficiencies of generator the value obtained as per field tests as specified in above codes shall be taken.

6.1.3 Bid Evaluation Equalization for Short Fall in η_{wav}

For each 1 (one)% or part thereof by which η_{wav} is lower than the highest offered η_{wav} in any of the bids received, 3(Three)% of total price of turbine –generator unit offered in the bid under evaluation shall be added to the offered price of each turbine-generator unit.

6.1.4 Cavitation Guarantee

The bidder shall guarantee the runner against excessive pitting/ cavitations for Eighteen (18) months from the date of commissioning or 8000 (Eight thousand) hours of operation, which is earlier.

6.1.5 Technical Specifications

6.1.5.1 Turbine (Including Auxiliaries)

i. Rating

As given in the schedule.

ii. Access

Inspection and dismantling of turbine in-situ should be easy. It must also be possible to remove the runner in- situ. Access must be allowed to all sides of the turbine and also the space to dismantle it, for lubrication and O&M work.

iii. Air Access

In case the turbine needs good amount of air (e.g. for Pelton type), then unrestricted airflow should be ensured.

iv. Water Seals

Non- contact type seals shall be provided. Labyrinth seals or stuffing boxes can be used.

v. Balancing

Turbine runner shall be statically balanced before commissioning. Large Cross-flow runners shall be dynamically balanced.

vi. Bolts

Bolts securing the turbine / generator base frame to the floor must be removable so also the runner inspection bolts. The design must ensure that water is drained away to avoid corrosion seizure of bolts.

vii. Exhaust water

Design must ensure efficient departure of exhaust water from runner.

6.1.5.2 Turbine Casing

i. The steel casing should have sufficient thickness. Webs or ribs shall be provided as stiffeners so as to reduce noise and vibration.

The turbine should have low vibrations and noise.

Where the bearing alignment and jet accuracy depends on adequate tolerances, the casing shall be checked for square ness as a rule.

6.1.5.3 Turbine /Generator Base Frame

Turbine and the generator shall be mounted on a single steel base frame fabricated from angle iron or channel, which shall be set into or fixed to the P.H. floor (separate fixing shall be avoided in order to avoid tension stresses occurring in the concrete floor). If the turbine and the generator are closely coupled (i.e. their own frames are rigidly connected to each other), then the base frame may be omitted.

- The turbine and the generator shall be fixed securely to the base frame in a workshop before installation so that correct positioning may be achieved. This shall avoid problems of bearing alignment and belt tensions during operations.
- iii. The runner must be easily removable on site.

6.1.5.4 Bearings

- i. **Position**
Pelton and propeller turbines can be either centrally mounted or overhung. Cross-flow turbines must be mounted centrally between bearings.
- ii. **Service Life**
A 5 years' service life is acceptable for small machines up-to 50 KW, but on larger machines above 50 KW, bearings must be selected to provide 10 years' service life.
- iii. **Alignment**
Bearings must be properly aligned. There should not be more than 2 bearings on one shaft.
- iv. **Housing**
With the bearing housing open, the housing shall be 1/3rd full of clean grease.
- v. **Commissioning test**
The bearing must turn freely and should not rattle. It should be possible to check with a feeler gauge that the rolling element clearance is within the tolerances recommended.
There should be no heating of the bearing housing when the turbine has run for some minutes.
c. The temperature of the bearing should not be over 60 °C when the turbine has run for 2 hours.

6.1.5.5 Pressure Gauge

A pressure gauge shall be provided in the P.H. to read the pressure of water just before it enters the turbine. It shall have scale to read approximately half- scale at gross head.

6.1.5.6 Manifold

The manifold to carry water from penstock to the turbine inlet and runner shall be designed so as not to introduce large additional head losses. This can be verified by following thumb- rules:

Do not allow the velocity of water in the penstock to increase as it passes through the penstock.

Velocity in the manifold should not exceed: (a) 3 m/s in straight pipes, (b) 2.5 m/s in bends up to 45 degrees, (c) 2.0 m/s in bends up to 90 degrees.

6.1.5.7 Manifold Valve / Isolating Valve

- i. **Provision of Manifold Valve**
A manifold valve (a valve at the foot of penstock) shall be provided unless:
 - a. It is possible to quickly, safely and in a routine manner divert water away from the turbine or the mouth of the penstock in order to shut down the turbine (e.g. on some low head sites it may be possible to divert water at the mouth of the penstock as to close a valve).
 - b. If a jet deflection system is fitted to a Pelton turbine.
 - c. If a multi- jet Pelton turbine has valves on every branch of the manifold,

If the guide vane of a Cross flow or a propeller turbine closes off the flow sufficiently.

ii. Location

The manifold valve shall be located in the P.H. and be easily accessible. It shall be rated at maximum penstock pressure.

iii. Operational Speed

The valve must be slow closing type (gate rather than a butterfly valve) or should have an apparatus which shall prohibit fast closing e.g.: (a) Fitting of a much smaller second valve in parallel to the manifold valve, which shall be pad-locked in the open position and kept open when the main valve is closed. (b) A gearing mechanism to ensure very slow closing operation.

6.1.5.8 Safety Guards

All moving parts shall be shielded by a strong and durable wire mesh. The size of the mesh shall be small enough to prevent the entry of hands and arms of the children. The guards shall be electrically earthed and kept permanently secured by locks.

6.1.5.9 Tools

i. A set of tools shall be provided as per operator's manual. It shall also include the tools to test alignment and runner & case tolerances e.g. string, steel rule, measuring tape, square, feeler gauge, dial gauge, spirit level etc.

ii. Tool Display Board

Tool locations shall be silhouetted on a tool display board so as to immediately make it apparent if a tool is in use or missing.

iii. Lifting hoist

A suitable lifting hoist shall be provided in the power house.

iv. Re-chargeable Lantern

A re-chargeable battery-powered lantern shall be provided.

6.1.6 Field Tests

The field tests shall be performed as per the IEC- 1992 specifications. The equipment offered should stand these tests successfully.

6.2 ELECTRO-MECHANICAL EQUIPMENT

6.2.1 Type of Generator

3 phase, A.C. Synchronous generator with generating voltage rating of 415 V, 50 Hz shall be provided.

6.2.2 Technical Specifications

6.2.2.1 Generator (Including Auxiliaries)

i. Nos. and Rating

Shall be as per the schedule.

ii. Nominal Voltage of Generation, Frequency, and Power factor

- a. The nominal voltage of generation with no load and load on the generator up-to 110% loading shall be 415 volts.
- b. The operating frequency shall be between 48.5 and 51.5 Hz.
- c. The power factor rating shall be 0.8 when an ELC is in use except where all loads and the ELC present unity power factor.

iii. Excitation System

Brush-less excitation system shall be provided.

iv. Run-away Speed With-Stand Capability of Generator

The generator shall be capable to continuously with-stand the run- away speed of turbine.

6.2.2.2 Protection System

i. Over Current and Earth Fault Protection

a. Over Current Protection

Miniature Circuit Breaker (MCB) or Molded Case Circuit Breaker (MCCB) of suitable rating shall be used for the purpose. These shall be placed as close as possible to the generator terminals.

b. Earth Fault Protection

An earth leakage circuit breaker (ELCB), also known as Residual current device (RCD), of suitable rating shall be provided as close to the generator terminals as possible.

c. Ratings of Above Protection

The maximum rating of the above protections shall not be more than 10 % of the current rating of the generator.

d. Location

The over current and the earth fault protection can be placed in the same box with each one clearly labeled but the mounting should not be on the generator body so as to avoid vibration damage. These shall be placed at least 1m above the floor level and as close to the generator as possible with properly fixed and sealed conduit protecting the cable to the generator.

The ELCB should be connected to the generator and then the over current trip should be connected to the ELCB.

ii. Voltage and Frequency Trips

These shall be provided to protect consumer loads from un-acceptable voltages and frequency conditions. Over Voltage, Under Voltage, Over Frequency and Under Frequency Trips shall be provided:

6.2.2.3 Lightning Protection

To protect the power house, equipments, operators etc. a set of lightning arrester be installed in the power house premise.

6.2.2.4 Instrumentation

Instruments should be provided as required; they should be readable and placed at a height at the eye level or 1.5 m above the floor level.

6.2.2.5 Controllers, Governors and Flow Regulators

An Electronic Load Controller (ELC) or a combined electronic and flow governor shall be provided. The controller must be located in the P.H. together with the ballast to ensure that the ballast is never disconnected.

6.2.2.6 Ballast

i. Location

Ballast shall be located in the P.H. so that it is never disconnected.

ii. Disconnection-proof

Cables to the ballast shall be short to be secured and temper-proof and there should be no method of disconnection.

iii. The Design

The design shall ensure that water flow is not impeded so that the ballast may not over-heat and fail and must include reliable protection against the effects of water flow blockage e.g.:

- a. Alarms for high water temperature and low level of water shall be provided for automatic disconnection of the generator field.
- b. Ballast tanks shall be made from corrosion-proof materials.
- c. Arrangement for easy flushing out of silt deposits.
- d. Provision of over flow channel to direct spill water away from electrical apparatus in case of out flow blockage.

6.2.2.7 Consumer Isolation Switch

A switch rated at current equal to or higher than that of O/C trip, shall be provided in the P.H. to isolate the distribution system from the generator.

6.2.2.8 Earthing

i. The following shall be effectively earthed:

The neutral of the generator.

All the metal casings of the electrical equipment etc.

- ii. Precaution shall be taken to prevent corrosion due to electrochemical effects, which can be done by using copper conductor/ electrode for earthing, avoiding bi-metal joints, or by maintaining air and water exclusion from bi-metal joints.
- iii. ELCB (RCD) shall be used for electrical safety.
- iv. The earth conductor (connection from the earth terminal to the earth electrode) should have a minimum cross-sectional area of not less than 25 sq. mm. A permanent level "Safety Electrical Connection – DO NOT REMOVE" shall be provided.

6.2.2.9 Lighting

- i. The P.H. shall be provided with adequate safe illumination: minimum 10 watts / sq. m. of floor area, if incandescent, or 3 watts / sq. m., if fluorescent.

- ii. A battery-charged type lantern (emergency light) shall be provided on display board.

6.2.2.10 Conduits and Cables

Strong conduits, physically secured to all enclosures by means of threaded connectors, shall be used to protect all cables.

- ii. The conduits shall be sealed to the enclosure entrances.

Since the cable inside the conduit from generator to over current- trip / ELCB box is not protected from over currents and earth faults, adequate physical strength of conduit shall be ensured,

The current carrying capacities of the cables, after taking in to account the de-rating required for use of conduit and multiple cables, shall not be less than 140% of the rating of the over current protection device(s),

If the cables are felt over- warm on touching, it is an indication of these being under-sized. The cables shall be doubled or replaced in such cases.

6.2.2.11 Sockets

Two or more sockets (outlets) shall be provided for use of electrical appliances. The sockets shall be placed at least 1 m above the floor.

6.2.2.12 Shielding

Cables and their connections to Units shall be shielded both by conduit and by their insulation. The connections shall be with in the closed casings.

All live surfaces and points shall be fully and reliably shielded from human contact.

Door interlock isolators shall be provided on control gear with voltages above 50 V so as to ensure safe working.

6.2.2.13 Fire Protection

Suitable, adequate and approved fire protection equipment / system shall be provided for the plant / equipment.

6.2.2.14 Safety Guards

Appropriate and approved safety guards shall be provided.

6.2.2.15 Tools

- i. Required number and type of tools shall be provided as per Operator's Manual.
- ii. The tools shall be suitably located on tool display board.

6.3 MAINTENANCE MANUAL AND LOG BOOK

Three (3) copies of maintenance manual shall be provided. A logbook, in the format as per the Maintenance-Training Manual, shall be provided.

SECTION – VII

LIST OF APPLICABLE STANDARDS

A. ELECTRICAL AND INSTRUMENTATION

S. No.	Description	IEC	IS
1	2	3	4
1.	Rotating Electrical Machines	IEC 34	IS:4722-1968
2.	Direct Action Indicating Electrical Measuring Instruments	IEC 51	
3.	Paper-Insulated Metal-Sheathed Cables for Rated Voltages Up To 18/30 kV	IEC 55	
4.	Insulation Co-Ordination	IEC 71	
5.	Dimensions and Output Ratings for Rotating Electrical Machines	IEC 72	
6.	Colours for Indicator Lights and Push Buttons	IEC 73	
7.	Power Transformers	IEC 76	IS:2026-1977
8.	Classification of Materials for The Insulation of Electrical Machinery	IEC 85	
9.	Primary Batteries	IEC 86	
10.	Lead Acid Starter Batteries	IEC 95	
11.	Lightning Arrestors Recommended Graphic Symbols	IEC 99	
12.	Alternating Current Disconnectors (Isolator) and Earthing Switches	IEC 129	
13.	Bushings for Alternating Voltages Above 1000 V.	IEC 137	
14.	Degrees of Protection for Low Voltage Switch Gear and Control Gear	IEC 144	
15.	Low Voltage Switchgear and Control Gear	IEC 157	
16.	Low Voltage Control Gear Tests on Indoor and Outdoor Post Insulators for Voltages Greater Than 1000 V.	IEC 168	
17.	Current Transformers	IEC 185	IS:2705-1977
18.	Voltage Transformers	IEC 186	IS:3156-1978
19.	Low Frequency Cables and Wires with P.V.C. Insulation and PVC Sheath	IEC 189	

S. No.	Description	IEC	IS
1	2	3	4
20.	Polyvinyl Chloride Insulated Cables of Rated Voltages Up To And Including 450/750 V.	IEC 227	
21.	Conductors for Insulated Cables	IEC 228	
22.	Impulse Tests on Cables and Their Accessories	IEC 230	
23.	Electrical Relays	IEC 255	IS:3231-1965
24.	Low Voltage Fuses Calculation of The Continuous Current Rating of Cables (100% Load Factor)	IEC 287	
25.	Low Voltage Motor Starter	IEC 292	
26.	Specification for New Insulating Oil for Transformers and Switchgear	IEC 296	
27.	AC Metal-Enclosed Switchgear and Control Gear For Rated Voltages above 1 kV Up To and Including 72.5 kV	IEC 298	
28.	Standard Colours for Insulation for Low Frequency Cables and Wires	IEC 304	
29.	Guide to the Calculation of Resistance of Plain and Coated Copper Conductors of Low-Frequency Cables and Wires.	IEC 344	
30.	Loading Guide for Oil Immersed Transformers	IEC 354	
31.	Marking of Insulated Conductors	IEC 391	
32.	Report on Synthetic Testing of High Voltage Alternating Current Breakers.	IEC 427	
33.	Factory-Build Assemblies of Low Voltage Switchgear and Control Gear	IEC 439	
34.	Identification of Insulated and Bare Conductors by Colours	IEC 446	
35.	Standard Directions of Movement for Actuators Which Control the Operation of Electrical Apparatus	IEC 447	
36.	Extruded Solid Dielectric Insulated Power Cables for Rated Voltages from 1 kV Up to 30 kV	IEC 502	
37.	Class 0.5, 1 and 2 Alternating Current Watt-Hour Meter	IEC 521	
38.	Test Methods for Insulations and Sheaths of Electric Cables and Cords	IEC 540	

S. No.	Description	IEC	IS
1	2	3	4
39.	Electro Mechanical Equipment for Small Hydro	IEC-61116(1992)	
40.	Guide for Commissioning, Operation and Maintenance of Hydraulic Turbines	IEC-60545 (1978)	

B. TURBINES, GENERATORS AND ANCILLARY PLANT

Sl. No.	Description	Publication
1	2	3
1.	International Code for Field Acceptance Test of Hydraulic Turbines.	IEC -41-1963
2.	International Code for Testing of Speed Governing Systems for Hydraulic Turbines' shall be an Integrated Document of the Governor Specification.	IEC - 308
3.	Test Code for Hydraulic Prime Movers, ASME Power Test Codes.	ASME-New York 1949
4.	Electromechanical Equipment Guide for Sal Hydroelectric Installations	IEC-1116-1992-10
5.	International Code for Model Acceptance Tests of Hydraulic Turbines.	193-1965-193A-1972

C. MISCELLANEOUS

Sl. No.	Description	Publication
1	2	3
1.	Bolt Calculation	VSM 14 332
2.	Vibrations	VDI 2 056
3.	Shaft Coupling	ANSI B 49.1
4.	Shaft Alignments	NEMA
5.	Rotating Electrical Machines; IEEE 30.4 to 34.11	
6.	Test Procedure for Synchronous Machine; IEEE 115	

D. INDIAN STANDARDS

S. No.	Description	IS
1	2	3
1.	Three Phase Induction Motors	IS:325-1978
2.	New Insulating Oils	IS:335-1983
3.	Code of Practice for Earthing	IS:3043-1966
4.	Stationary Cells and Batteries Lead-Acid Type (With Tubular Positive Plates)	IS:1651-1979
5.	Circuit-Breakers	IS:2516-1980
6.	Degree of Protection Provided by Enclosures for Low Voltage Switchgear and Control Gear	IS:2147-1980
7.	For Working Voltages Upto and Including 1100 V	IS:L1554(Pt.II)-1976
8.	Lines Upto and Including 11 kV, Section- 1: Design.	IS:5613(Pt.I/Sec.I) 1978

E. AMENDMENTS TO REC SPECIFICATIONS AND STANDARDS

i. Specifications

Sl. No.	REC Specification No.	Title
1	2	3
1.	1/1971 (R-1993): 2004	Hard-Drawn Stranded Alluminium and Steel Cored Alluminium Conductors for Over-head Power Lines.
2.	33/1984 (R-1993): 2004	Alluminium alloy Conductors for Overhead Power Lines
3.	3/1971 (R-1993): 2004	Porcelain Insulators and Insulator Fittings for 11 kV Overhead Power Lines.
4.	2/1971 (R-1997) :2004	Out-door type three phase, 11 kV/433-250 V Distribution Transformers upto and Including 100 kVA
5.	70/1993 (R-1997) :2004	Out-door type 3-phase 11 kV/433-250 V Conventional and Sealed Distribution Transformers with Amorphous Metal Core up to and Including 100 kVA.
6.	E-28 A	Universal Distribution Connectors

ii. Construction Standards

Sl. No.	Title
1	2
1.	REC Construction Standards: 2004

iii. New Specifications

Sl. No.	Title
1	2
1.	Technical Specification for 11 kV & 33 kV MS Cross –Arms
2.	Technical Specification for LT Switch Board for Distribution Transformer
3.	Technical Specification for Lead-Acid Battery & Charger
4.	Technical Specification for Control & Relay Panel
5.	Technical Specification for 3 Phase, 4 Wire AC, Static, CT Operated Energy Meter

F. FOR CIVIL WORKS

i. Materials

Sl. No.	Parts	Material	IS
1	2	3	4
1.	Structural steel parts	Structural steel	IS 2062
2.	Rollers and pins, brackets	Forged steel	IS 2004
3.	Seal seats	Stainless steel	IS 1570 (Pt V)
4.	Bush bearings	Aluminium bronze	IS 305
5.	Rubber seals	Rubber	IS 11855
6.	Bolts and nuts	MS	IS 3177 IS 1364

ii. Design & Installation

Sl. No.	IS	Title
1	2	3
1.	IS 5620	Recommendations for design of low head gates
2.	IS 4622	Recommendation for design of fixed wheel gates
3.	IS 807 IS 800	Recommendation for design of steel structures
4.	IS 11228	Recommendation for design of screw hoists
5.	IS 816	Metal arc welding in general construction in MS
6.	IS 822	Inspection of welds
7.	IS 823	Manual metal arc welding of mild steel
8.	IS 9595	Metal arc welding of carbon and carbon manganese steel
9.	IS 8987	Practice for air carbon arc gauging and cutting
10.	IS 14177	Guidelines for planning of hydraulic gates and hoists
11.	IS 1477(Pt II)	Inspection and testing of painted surfaces

G. OTHER STANDARDS

Standard publications issued by the following organisations of standardisation are considered being approved Standards for the works:

- AISI American Iron and Steel Institute

- ANSI American National Standards Institute
- ASME American Society of Mechanical Engineers
- ASTM American Society for Testing and Materials
- AWS American Welding Society
- BS British Standards
- CMAA Crane Manufacturers Association of America
- DIN Deutsche Institute für Normung
- IEC International Electro-technical Commission
- IEEE Institute of Electrical and Electronic Engineers
- IPCEA Insulated Power Cable Engineer's Association
- IS Indian Standards
- ISO International Standards Organisation
- JEC Standards of the Japanese Electro-technical Committee
- JIS Japan Industrial Standards
- NEMA National Electrical Manufacturers Association
- VDE Verein Deutscher Elektroingenieure
- VDI Verein Deutscher Ingenieure

Notwithstanding reference made to various standards, all equipment and works as per provisions and requirements of Relevant and latest Indian Standards shall be acceptable, unless Approved otherwise.

SECTION- VII

INSTALLATION, TESTING AND COMMISSIONING

7.1 INSTALLATION / ERECTION

Foundations drawings should be sent by the Contractor to the Purchaser well in advance so that they are ready before the E & M Equipments reach the site for installation. The cost of foundation work will be to the account of the Purchaser. But due to faulty drawings, if they are to be reconstructed or modified, the cost involved therein will be recovered from the contractor. In case of any confusion or doubt in the foundation drawings, the contractor shall promptly respond and clear the same. If in case, it is necessary to have the representative of the contractor at site, he should be deputed immediately by the Contractor. After the foundation work is over, the installation work will be immediately started by the Contractor. The Contractor should ensure that all the equipments with all the necessary required accessories and items shall be installed in a most professional way and in proper sequence and co-ordination with civil works.

7.2 TESTING

The testing of all the equipments and systems shall be done after installation as per the standards required under different load conditions. The maximum output test shall be conducted for each unit separately. The testing equipment shall be having duly calibrated certificates from national bodies.

The bidder shall supply testing results of their type design performance testing conducted by independent institutions/ laboratory at the time of testing at site.

The contractor shall carry out tests to obtain the guaranteed out put and efficiency at the site as per the plan prepared and submitted to the Purchaser by them before hand.

7.2.1 Tests at Site

The contractor shall prepare and submit to the engineer for approval site testing manual not later than two month before commissioning is due to commence. The manual shall list in detail the tests to be performed during commissioning taking into consideration field tests to be performed for turbines, generators, breakers, control and protection equipment, switchyard equipment (wherever necessary) and all other auxiliaries. The Contractor shall provide all testing instruments and shall perform the tests set out in the manual in the presence of the engineer. The testing requirements are briefly described below.

7.2.2 Tests Prior to First Rotation

The contractor shall demonstrate to the engineer that the following items of equipment operate satisfactorily and where applicable are correctly adjusted or calibrated.

Tests shall include but not be limited to:

- a) Initial charging, commissioning and testing of batteries.
- b) High voltage insulation testing of the following :
 - Cables
 - Transformers
 - Generators
 - Switchgear
- c) Full functional checking and setting up of the following
 - All ancillary AC apparatus
 - All ancillary DC apparatus –chargers/ distribution boards etc.
 - All alarms and trip circuits
 - All electrical protection
 - All hydraulic systems
 - All cooling systems
 - Switchgear (415V, 11 kV) wherever provided
 - All associated turbine and generator control protection and miscellaneous items

7.2.3 Initial Run, Test Runs and Test Service Period

The procedure for initial run and test runs including testing of speed and pressure transients on load acceptance and rejection shall be in accordance with IEC Publication 545 “Guide for Commissioning, Operation and Maintenance of Hydraulic Turbines” or relevant IS or standards of the country of origin.

7.2.4 Field Acceptance Test

All field acceptance test as specified in relevant Indian & International Codes for Turbine, Generator, Transformer, Control and Protection Equipment, Switchyard Equipment and Auxiliary etc. shall be performed.

7.2.5 Tests for turbine output

The guaranteed range of outputs for each scheme shall be tested.

The Contractor shall calibrate the pressure gauges with a mercury manometer prior to the testing.

The turbine output in each test will be determined by measuring the electrical output of each unit and subtracting generator losses calculated from the generator works test results.

7.2.6 Generator Output and Temperature Rise Test

The generator output in relation to guaranteed temperature rise shall be tested at site by performing a heat run in accordance with relevant IS. The resistance temperature detector installed in the generator stators shall be used to measure machine temperature.

7.2.7 Tests on Completion and Handing Over

The tests described in the foregoing subsection entitled “Field Testing” shall be the “Tests on Completion”. The tests must be completed to the Engineer’s satisfaction and the equipment retested where necessary before the taking over certificate will be issued

For successful completion of field tests of the mechanical equipment’s, the calibration of various instruments shall be done by ‘authorized agencies’ only as approved by the owner.

A separate handing over certificate will be issued in respect of each set of generating equipment.

7.3 COMMISSIONING

After the erection and testing of the equipments and all other connected works are done as above, commissioning of the plant and works shall be carried out and the term “Commissioning” shall mean the activities of functional testing of the complete system after erection and testing, including tuning or adjustment of the equipment for optimum performance and demonstrating to the Purchaser that the equipment performance meets the requirements of the specifications.

SECTION – VIII

ADDITIONAL INFORMATION ON TRANSPORTATION

The transportation of equipments and all materials, tools and accessories connected with the Project from Ex-works of manufacture up-to the site of installation will be the responsibility of the contractor. For local transportation and manual transportation where the contractor would like to avail the service of the Purchaser, the Purchaser will assist and liaise with the local people of the area for the transportation of the equipments, but the cost involved will be borne by the contractor on actual basis. The overall and entire cost and responsibility of transportation of equipments supplied by the contractor up-to the project site and their installation and commissioning will rest with the contractor only.

SECTION – IX

TERMS OF PAYMENT

- i. Up to 25% of the contract value as mobilization advance against Bank Guarantee (BG) of equivalent amount from a scheduled nationalized bank. Validity of the B.G. shall remain till liquidation of the mobilization advance.
- ii. 50% of the Contract price on pro-rata basis on receipt of materials at site in good conditions and on submission of invoice accompanied by Delivery Challans, Packing Lists, Inspection Certificate / Inspection Waiver Certificate from Purchaser, Copy of Inland Transit Insurance and on furnishing of custody-cum-Indemnity Bond for full value of supplies. However, this payment shall be made based on agreed sequential supplies made in serviceable lots / complete sets of equipments. This payment shall be released based on certification by Purchaser and shall be released at the earliest but not later than 60 days from the date of receipt of material at site and on submission of the bills.
- iii. 25% balance amount of the Contract value after erection, testing, successful completion of trial run and commissioning of the project and on demonstration of performance guarantee parameters by contractor and against submission of Bank Guarantee for an amount equivalent to 10 % of the contract value as performance security to be kept valid till expiry of guarantee period as per the Contract Clause. Retention or release of the Earnest Money or part thereof will be decided based on the amount of Security Money which is 10% of the Contract Value and also based on the submission of Bank Guarantee against Security Money.

**SECTION – X
SCHEDULES**

(The schedules are not exhaustive, but indicative and may change as per requirement)

**SCHEDULE-10.1
FORM OF COMMITMENT**

(To be submitted by the contractor along with the Bid Document)

To

The Director,
Arunachal Pradesh Energy Development Agency,
Urja Bhawan, T.T. Marg, P.O. Itanagar,
District: Papum Pare, Arunachal Pradesh.,
PIN- 791 111.

Dear Sir,

We have examined the Conditions of Contract mentioned in various sections of the Tender Document. We have understood and checked these documents and have not found any errors in them. We, accordingly offer to design, manufacture, supply, execute, test and commission and complete the said Works and remedy any defects, etc. fit for purpose in conformity with these documents and the enclosed Proposal for the fixed lump sum payment equal to that quoted in the Price Schedules or other such sums as may be determined in accordance with the terms and conditions of the Contract.

We confirm our agreement with the appointment of *the arbitrator(s) as set out in relevant Clause on 'Arbitration' and procedural rules set out therein.*

We agree to abide by this Bid until the expiry of 120 days from the date of opening of the tender documents and it shall remain binding upon us and maybe accepted at any time before that date.

If our bid is accepted, we will provide the specified performance security, commence the Works as soon as reasonably possible after receiving the Purchaser's Representative's notice to commence, and complete the Works in accordance with the above-named documents within the time stated.

Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

We understand that you are not bound to accept the lowest or any bid you may receive.

Yours faithfully,

Signaturein the capacity ofduly authorized to sign bids
for and on behalf of

Address:

.....
.....

Date.....

SCHEDULE-10.2

FORM OF CONTRACT AGREEMENT

THIS AGREEMENT is made on thisday of2009,

BETWEEN

Arunachal Pradesh Energy Development Agency, Urja Bhawan, T.T. Marg, Itanagar,
Arunachal Pradesh, hereinafter referred to as the “ Purchaser” of the one part ,

AND

M/S

hereinafter called the “Contractor” of the other part.

WHEREAS, the purchaser has invited for tenders for design, manufacture, supply, erection, testing and commissioning of electro-mechanical equipments for a number of micro and mini hydro electric projects for rural and border villages electrification (hereinafter called “the works”) and for the purpose the terms and conditions, specifications, schedules, bid forms etc have been given in the tender documents.

WHEREAS, the contractor has participated in the tender process and their offer having accepted by the purchaser, both the parties hereby decide to enter into this agreement. All the relevant

documents, papers, terms and conditions specified, specifications, schedules, drawings, bid forms, covering letter and schedule of prices which, for the purpose of identification, have been signed by the representative of the Contractor and by the representative of the Purchaser form part of this Contract as though separately set out herein and are included in the expression "Contract" whenever herein used.

NOW THESE PRESENT WITNESSES and the parties hereto hereby agree and declare as follows, that is to say, in consideration of the payment to be made to the Contractor by the Purchaser as hereinafter mentioned the Contractor shall and will fully provide the plant and machinery for the said works on the terms and conditions mentioned in the Contract.

AND in consideration of the due provisions of the said plant and machinery by the Contractor and due performance of his part of contract, the Purchaser does hereby for himself, his successors or assigns covenant with the Contractor that he, the Purchaser, his successors or assigns will pay to the Contractor the said sum of the contract amount as per the terms of payment as agreed upon by both parties or such other sum as may be become payable to the Contractor under the provision of the Contract, such payments to be made at such time and in such manner as is provided by this contract.

IN WITNESS WHEREOF the parties hereto have signed this Deed hereunder on the dates respectively mentioned against the signatures of each.

Signed
(For and on behalf of the Purchaser)
Date:

Signed
(For and on behalf of the Contractor)
Date:

in the presence of

in the presence of

1.

1.

2.

2.

SCHEDULE 10.3
FORM OF PERFORMANCE BANK GUARANTEE

To

The Director,
Arunachal Pradesh Energy Development Agency,
Urja Bhawan, T.T. Marg, P.O. Itanagar,
District: Papum Pare, Arunachal Pradesh.,
PIN- 791 111.

Dear Sir,

THIS DEED OF GUARANTEE IS MADE ON THE day of2009, by..... (hereinafter called 'the Guarantor') on behalf of M/s....., a company within the meaning of the Companies Act and having its registered office at (hereinafter called the Contractor) and in favour of Arunachal Pradesh Energy Development Agency, Urja Bhawan, TT Marg, Itanagar, Arunachal Pradesh (hereinafter called the Purchaser).

WHEREAS in accordance with the contract agreement dated the day of2009 (hereinafter called the 'Contract) entered into between the purchaser and the contractor, the Contractor agrees to design, manufacture, supply, erect, test & commission electro-mechanical equipments to the satisfaction of the purchaser as provided in the said Contract.

AND WHEREAS the payment terms under the Contract provide that in order to take 100% payment of the Contract value the contractor shall furnish to the purchaser, a Performance Bank Guarantee in the sum of 10% of the contract value valid for the entire guarantee period reckoned from the date of commissioning.

Now This Deed Witnesses As Follows:

In consideration of the promises the Guarantor hereby undertakes that the Contractor shall duly supply, erect, test and commission (strike off which is not applicable) the aforesaid work /material of the correct quality and strictly in accordance with the said contract failing which the guarantor shall pay to the Purchaser on demand such amount or amounts as the Guarantor may be called upon to pay to the maximum aggregate of Rs. (Rupees.....) being 10% of the Contract value.

The Guarantor shall pay to the Purchaser on demand the sum under clause 1 above without demur and without requiring the Purchaser to invoke any legal remedy that may be available to it to compel the guarantor to pay the same or to compel such performance by the Contractor. Provided that where the Guarantor considers the demand of the Purchaser unjustified, it shall nevertheless pay the same though under protest to the Purchaser and shall not with-hold payment on that account.

This guarantee shall come into force the date hereof and shall remain valid for 12 (Twelve) calendar months from the date of the Commissioning. If however, the period of the Contract is for any reason extended thereby extending the said date and upon such extension, if the Contractor fails to furnish a fresh or renewed bank guarantee for the extended period, the Guarantor shall pay to the Purchaser the said sum of Rs..... or such lesser sum as the Purchaser may demand.

The guarantee herein contained shall not be affected by any change in constitution of the Guarantor or of the Contractor.

Any account settled between the Contractor and the Purchaser shall be conclusive evidence against the Guarantor of the amount due and shall not be questioned by the Guarantor.

6. The neglect or forbearance of the Purchaser in enforcement of payment of any moneys the payment whereof is intended to be hereby secured or the giving of time by the Purchaser for the payment thereof shall in no way relieve the Guarantor of its liability under this deed.

7. The Purchaser and the Contractor will be at liberty to carry out any modifications in the said Contract during the time of the said contract and any extension thereof, notice of which modifications to the guarantor is hereby waived.

8. The expressions 'The Purchaser' and 'The Guarantor' and 'The Contractor' shall unless there be any thing repugnant to the subject or context include their respective successors and assigns.

9. Notwithstanding anything contained above, the liability of the Guarantor hereunder is restricted to the said sum of Rs..... and this guarantee shall expire on the day of 20unless a claim under the guarantee is filed with the Guarantor within six months of such date, all claims shall lapse and the Guarantor shall be discharged from the guarantee.

IN WITNESS WHEREOF

The Guarantor has signed this deed on the day and year first above written.

Signed by

(For and on behalf of Guarantor).

Seal of the Bank:

Witness:

1.

2.

SCHEDULE- 10.4

DECLARATION

(To be executed on a non-judicial stamp paper of Rs.100.00 with a revenue stamp of Rs. 1/- affixed and be submitted by Bidder with the Bid Part – I)

To

The Director,
Arunachal Pradesh Energy Development Agency,
Urja Bhawan, T.T. Marg, P.O. Itanagar,
District: Papum Pare, Arunachal Pradesh.,
PIN- 791 111.

Dear Sir,

In consideration of the.....(Insert Designation and address of Purchaser/Purchaser's Representative). having treated the Bidder to be an eligible person whose Bid may be considered, the Bidder agrees to the condition that the proposal in response to the Notice Invitation Tender shall not be withdrawn within 120 days (or any extension thereof) from the date of opening of the Bid, also to the condition that if thereafter the Bidder does withdraw his proposal within the said period, the Earnest Money deposited by him shall be forfeited to the Director, APEDA, Itanagar (Innsert Designation and address of Purchaser/Purchaser's Representative) and at the discretion the Purchaser, the Purchaser may debar the Bidder from Bidding for a minimum period of one year reckoned form the date of opening of the Bid.

Signed on this day of.....20.....

Place

Date.....

Witness

Signature

Name

Address

Signed by

State title/Designation

(Proprietor/Partner)

Name of the firm

Address of the firm

Seal of the firm

SCHEDULE -10.5
GENERAL PARTICULARS
(To be Completed and Submitted by Bidder with the Bid Part – I)

1. Name of sole Bidder/Consortium leader/ members of the consortium/associates etc.

Sl No.	Name & Type of Firm	Regd. Office		Head office		Local Representative		Authorized Representative	
		Address	Phone No. Fax No.	Addresses	Phone No./ Fax No.	Address	Phone No./ Fax No.	Address	Phone No./ Fax No.
1	2	3	4	5	6	7	8	9	10

2. Other Details

Sl. No.	Items	Details
1	2	3
1 1.1 1.2	Total annual turnover of the firm during last 2 (Two) financial years	2007-2008 2008-2009
2.	State name and designation of your relative (s), if any, working in the State of Arunachal Pradesh.	
3.	Whether certificate of satisfactory performance of offered equipment enclosed or not. If yes, give details of the officer issuing certificate. If no, give location of plant, name & address of Owner, Plant-in-Charge address, telephone number etc.	Enclosed/ not enclosed
4.	Give Trade Tax/ Sales Tax Registration No.: i. Central ii. State	
5.	Income Tax clearance certificate of current and preceding year enclosed or not.	Yes/ No.
6.	Give two references (Name, Designation and complete postal address) who can certify financial status and capability to under-take such project orders. References should be from authorized officials of any scheduled nationalized	

	bank/ financial institutions/ credit rating agency in India.	
7.	Have you offered any discount? If yes, then details of rebate / discount	

Full Signature, Name, Designation....., Date....., Seal of the company.

SCHEDULE –10.6

**LIST OF DRAWINGS AND LITERATURE ENCLOSED
WITH THE BID
(To be Completed and Submitted by Bidder with the Bid Part – I)**

SI No.	Drawing/ Literature No.	Title
1.	2	3
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		

Seal of the company

Full Signature

Name

Date

Designation

SCHEDULE – 10.7

DEVIATION FROM “TECHNICAL SPECIFICATIONS” (To be Completed and Submitted by Bidder with the Bid Part – I)

(All deviations from the “Technical Specifications” shall be filled in clause by clause, in this schedule. Compliance with the Specification will be taken as granted, if the deviations are not specifically mentioned in this schedule. In case the Bidder is required to agree to the standard clause, then he may indicate the amount in Bid Part-II by which the Bid price will thereby be increased or decreased.)

Sl. No.	Page No.	Clause No. & Stipulation in Specification	Deviation, if any
1.	2	3	4
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

The Bidder hereby certifies that the above mentioned are the only deviations from the “Technical Specifications”

Seal of the company

Signature

Name

Designation

Date

Note:

IN CASE THERE IS NO DEVIATION(S) THE “NIL” INFORMATION SHOULD BE FURNISHED.

IN CASE THIS SCHEDULE IS NOT FILLED IN OR NOT SUBMITTED WITH THE BID IT WILL BE TAKEN FOR GRANTED THAT THE BIDDER SEEKS NO DEVIATIONS.

SCHEDULE – 10.8

DEVIATION FROM “SPECIAL CONDITIONS OF CONTRACT”

(To be Completed and Submitted by Bidder with the Bid Part - I)

(All deviations from the “Special Conditions of Contract” shall be filled in clause by clause, in this schedule. Compliance with the Specification will be taken as granted if the deviations are not specifically mentioned in this schedule. In case the Bidder is required to agree to the standard clause then he may indicate the amount in Bid Part-II by which the Bid price will thereby be increased or decreased.)

Sl. No.	Page No.	Clause No. & Stipulation in Specification	Deviation, if any
1	2	3	4
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

The Bidder hereby certifies that the above mentioned are the only deviations from the “Special Conditions of Contract”.

Seal of the company

Signature

Name

Date

Designation

Note:

IN CASE THERE IS NO DEVIATION(S) THE “NIL” INFORMATION SHOULD BE FURNISHED.

IN CASE THIS SCHEDULE IS NOT FILLED IN OR NOT SUBMITTED WITH THE BID IT WILL BE TAKEN FOR GRANTED THAT THE BIDDER SEEKS NO DEVIATIONS.

SCHEDULE – 10.9

LIST OF RECOMMENDED SPARE PARTS

(To be Completed and Submitted by Bidder with the Bid Part – I)

(Tenderer shall confirm to provide the following spares with their offer)

- A set of Bearings
- Lubricants like multipurpose grease and oils in dust free containers
- Instruments (voltmeter, ammeter, pressure gauge, etc)
- Bolts and nuts
- Fuses, MCBs and ELCBs
- Cable connectors
- Ballast heaters
- AVR
- Gaskets, O rings for all flange joints
- V-belts / flat belts and couplings
- Oil seals, rubber packing, gland ropes (one set)
- One type each of pipe fitting, connector, ferrules washer etc of hydraulic and water pipe lines
- One card of each type of electronic controller/ governor/ protection if applicable
- One set of indicating lamps and LEDs
- Thimbles.

(In addition to above list, the contractor shall give a list of recommended spares other than mandatory spares for 5 years trouble free operation of equipment offered by them).

SI No.	Catalogue No.	Name of the Component	Recommended Qty. in Nos.
1	2	3	4
1.			
2.			
3.			

Seal of the company

Signature

Name

Designation

Date

NOTE: PLEASE WRITE “NOT APPLICABLE” WHERE THIS SCHEDULE IS NOT RELEVANT.

SCHEDULE – 10.10

**LIST OF RECOMMENDED SPECIAL TOOLS AND TACKLES
(To be Completed and Submitted by Bidder with the Bid Part – I)**

(Tenderer shall confirm to provide the following tools and tackles with their offer)

A set of open-ended spanners
Flat and cross-head screwdrivers
Grease gun
Bearing puller
Tool rack to neatly place the tools
Emergency rechargeable lights
Digital Multimeter, Tong Tester
Special tools like chain-pulleys, slings, nylon rope etc
Test lamp and Tester
Special tools required to dismantle and assemble turbine parts
Tap and die set
Feeler gauges
Bench vice, Hammer, Hacksaw and 1m x 2m Table
Dial gauge
Spirit level

(Tenderers will give the list of recommended any other tools and plants which may be required for proper maintenance of the equipments not mentioned above)

Sl No.	Particulars	Recommended Qty. in Nos. Per/Unit
1	2	3
1.		

The Bidder hereby certifies that above are the only special tools and tackles for required erection, commissioning, operation and maintenance of the equipments offered by him.

Seal of the company

Signature

Name

Designation

Date

NOTE: PLEASE WRITE “NOT APPLICABLE” WHERE THIS SCHEDULE IS NOT RELEVANT.

SCHEDULE - 10.11

LIST OF RECOMMENDED TEST

(To be Completed and Submitted by Bidder with the Bid Part – I)

(Bidder shall give below a list of recommended test required for commissioning, operation and maintenance).

Sl No.	Particulars	Quantity	Purpose
1	2	3	4
1			
2.			
3.			
4.			

The Bidder hereby certifies that above are the only tests and testing instruments required for erection, commissioning, operation and maintenance of the equipment offered by him. The instruments required for erection & commissioning shall be brought by the Contractor on returnable basis (after commissioning) without extra cost whereas instruments required for operation & maintenance shall remain with the purchaser.

Seal of the company

Signature

Name

Designation

Date

NOTE: PLEASE WRITE “NOT APPLICABLE” WHERE THIS SCHEDULE IS NOT RELEVANT

SCHEDULE – 10.12

**SCHEDULE OF QUOTED GUARANTEED DELIVERY / PROJECT
COMPLETION SCHEDULE**

(To be Completed and Submitted by Bidder with the Bid Part - I)

(GUARANTEED DELIVERY/PROJECT COMPLETION SCHEDULE

(“Please indicate activity wise bar chart with date of start & finish of each activity of the work/ contract with submission/approval of drawings/ data, delivery, erection & commissioning, preliminary acceptance tests and final acceptance test/ handing over of the complete equipments /work in operating conditions” etc.).

Seal of the company

Signature

Name

Designation

SCHEDULE – 10.13

BID PART – II

(Technical Specifications and Price Bid)

(To be completed and submitted by bidder project-wise; a separate sheet should be given for each project)

Name of Project :
Capacity of Project :
No. of Unit :

Technical Specifications :

1. Turbine Specifications:

- (a) Type of Turbine :
- (b) Make :
- (c) Rated net head :
- (d) Flow Variation Capability :
- (e) Allowable Variation of net Head :
- (f) Rated output at rated Head :
- (g) Speed in RPM :
- (h) Discharge at rated output & rated Head :
- (i) Design Efficiency at rated flow :
- (j) Efficiency at 50% flow :
- (k) Shaft power at rated flow :
- (l) Shaft power at 50% flow :
- (m) Turbine efficiency at full load :
- (n) Turbine efficiency at part load :
of 25%, 50%, 75%
- (o) Run away speed :
- (p) Runner material :
- (q) Type of bearings:
 - (i) End side (should be Double Row Bearing) :
 - (ii) Generator side (should be Double Row Bearing) :

2. Drive:

- (a) Type :
- (b) Ratios :

3. Generator Specifications:

- (a) Make :
- (b) Type :
- (c) Rated Capacity :
- (d) Efficiency at rated flow :
- (e) Efficiency at 50% flow :
- (f) Voltage rating :
- (g) No. of phase :
- (h) Rated power factor :
- (i) Rated frequency :
- (j) Rated speed in RPM :
- (k) Voltage regulation :
- (l) Full load frequency :
- (m) Class of insulation :
- (n) Type of mounting :
- (o) Shaft orientation :
- (p) Type of Enclosure :
- (q) Capacity to withstand continuous run away speed:
- (r) Bearings:
 - (a) Type :
 - (i) End side :
 - (ii) Turbine side/ Driving end :
- (s) Details of termination :
- (t) Type of Brush :
- (u) Overall Efficiency of Turbine and Alternator together:

4. **Governor:**

- (a) Type :
- (b) Response time :

5. **Control Panels will have the following:**

- (a) Incoming Panel with switch gears :
- (b) Out-going Panel with switch gears :
- (c) Safety / Protection circuitry :
- (d) Excitation circuitry :
- (e) Electronic load controller / Programmed Load Controller :
- (f) Indicating lamps :
- (g) **Meters to be provided:**

- (i) Ammeter with selector switch :
- (ii) Voltmeter with selector switch :
- (ii) Frequency meter :
- (iii) Energy meter :
- (d) **Relays & Protection Systems should be provided to protect:**
 - (i) Under voltage :
 - (ii) Over Voltage :
 - (iii) Short circuit :
 - (iv) Over current :
 - (v) Earth fault :
 - (vi) Reverse power relay (for more than one machine and for grid connection) :
 - (vii) Winding overheating :

Dump load cubicle: Complete with water immersed heaters, cabling arrangements, etc. will be provided.

Motor operated Governor: The Governing system for the turbine can be of motor operated type also.

Synchronizing Panel: Synchronizing Panels are to be provided in those projects where more than one machines are going to be installed for parallel operation and also in those projects which are to be connected to the grid of 11 KV/ 33KV systems. It should have double voltmeter, double frequency meter, power factor meter and synchronizing lamps. For single machine project no synchronization panel is required.

Incoming & Outgoing Panel: The number of incoming panel will be decided based on the number of machines installed. There will be one incoming panel for one machine. All the essential meters like Ammeter, voltmeter, frequency meter should be provided in the incoming panel and the out going panel should be one and will have energy meter provided. Contactors of suitable rating of MCB or MCCB should be provided in the panel board wherever it is necessary.

Arrangement for future synchronization: Droop CT and other necessary arrangements may be provided in the systems so that they can be run on synchronization with the grid in future.

FORMAT FOR PRICE BID:

Sl. no.	Description of items (As per Purchaser's requirement)	Quantity	Ex-work s per Unit (Rs.)	Excise duty per unit (Rs.)	VAT 4%	Transport & Insurance (Rs.)	Service tax (if applicable)	Total Price (Rs.)
1	2	3	4	5	6	7		8
1.	Turbine to deliver above capacity at alternator terminal coupled to it complete with all necessary components and accessories like shaft, runner, casing, bearings, penstock adapter, common base frame for turbine-alternator alignment etc as required and as per international / national standards and specifications. The turbine should be designed to give 10% extra output.	1 set						

2.	Synchronous A.C.Generator (alternator) of above capacity generating at 415 volt , 3 phase, 0.8 power factor lag , 50 Hz, Class-H insulation for rotor, Class-P insulation for stator, capable of generating 10% continuous over rating, fitted with AVR, terminal box, suitable for coupling to above turbine etc as required	1 set						
3.	Control Panel complete with all necessary metering systems, control switch gears, protection systems, indicating lamps, incoming and out going panels etc as required.	1 set						
4.	ELC / PLC with dump load or with motor operated governor as required. (The contractor may indicate their choice and quote accordingly)	1 set						
5.	Earthing, 1 set for neutral, 1 set for body earthing of turbine-alternator set and chasis, 1 set for panel board.	1 Lot						

6.	Inlet butterfly valve	1 set						
7.	Synchronizing Panel complete with all the required meters-double voltmeter, double frequency meter, synchronoscope, indicating lamps, switchgear etc as required. (This is required for those projects where more than one set in to be installed)	1 set						
8.	Mandatory Spares (as given in the tender documents)	1 Lot						
9.	Mandatory tools (as given in the tender documents)	1 Lot						
10.	Set of lighting arrestor.	1 Lot						
11.	Transportation of all the equipments from ex-works to site	1 Lot						
12.	Installation, testing and commissioning.	1 Lot						
13.	Miscellaneous items.	1 Lot						
	Total							

Seal of the company

Signature

Name

Designation

Date

SCHEDULE –11.14

ANNUAL MAINTENANCE CONTRACT (AMC)
(To be completed and submitted by Bidder in Bid Part-II)

Sl. No.	Description of Works	Price (Rs.)
1	2	3
1.	1 st year will be warranty period	NIL
2.	2 nd year AMC	
3	3 rd year AMC	
4	4 th year AMC	
5.	5 th year AMC	
	Total Price Rs. (In figures and words)	

- Note:**
- 1. Purchaser's Work- Force for the O&M period of 5 years shall be trained by the contractor.**
 - 2. The spare parts required by the purchaser shall be promptly arranged and supplied by the contractor to the purchaser on order for which the cost will be paid on receipt.**

Seal of the company

Signature

Name

Designation

Date