pipelines, bends/ joints/ couplers, tap assemblies (at delivery points), jet nozzles, GI Nipple, Branded hose pipes etc.

V. Vendor shall install flow meter for measurement of water consumption. Water level Sensor shall be provided for automatic stopping of water pumping. Pressure gauge shall be installed at every pump end. P.R.V, A.R.V, pressure gauge, flow meter etc. as per the planning & design.

VI. Masonry chamber/ PVC Chamber shall be provided for Main gate valve at pump end. Whereas, as per requirements, at other locations either a masonry or CPVC/ GI/ HDPE pipe chamber may be provided. Module cleaning procedure and pressure requirement at discharge point shall be as per the recommendation of PV module manufacturer. However, discharge pressure at Pump outlet shall not be less than 2 Bar.

VII. All the pipes thus laid shall be buried in ground at least 200-300 mm below FGL or laid above ground clamping on suitable concrete support blocks. In case of above ground piping only Hume pipes shall be used.

VIII. Water supply pipe for module cleaning crossing the road shall be laid through Medium class Hume pipe of dia. minimum 100 mm. Suitable RCC pedestals shall be constructed for mounting the booster pumps that shall be housed within suitable shed/shelter arrangement.

IX. Supply, laying and termination of electrical cables shall be in vendor scope. Cables from inverter/Control rooms to the pumps/motors shall be laid underground by suitable method.

6.0. GENERAL GUIDELINES FOR DESIGN OF MODULE CLEANING SYSTEM

6.1 Specifications for Design of Module cleaning system:

a. The number of Storage tanks, pumps and piping network shall be decided for the following optimum parameters:

b. Water Storage capacity. (Minimum for 2 days)

c. Pump flow rate and discharge pressure should be Actual

d. Economic header and distribution pipe network.

e. Minimum and trouble free operation convenience Easy to Service.

6.2 Pump Station:

a. At each 5MW. (Each Block)

b. Isolation valve to be considered to interconnect the adjacent pump.

6.3 Flow rate:

a. Minimum Capacity of pump 3 m3/hr and Head 100 Meter for each network to clean the solar module.

b.Pump suction velocity considered 0.5 m/s to 1.0 m/s and discharge velocity considered in the range of 1.0 m/s - 1.5 m/s.

c.Total 02 No. of tap used simultaneously for each network.

6.4 Pressure:

Minimum pressure of water jet required to clean the solar module 2 bar.

6.5 Factor of safety:

Appropriate factor of safety to be considered in the design of Module cleaning system for the 50MW Plant. (For soundness piping network, rating of pump, electrical cabling etc.)

6.5. Piping and Storage of water:

a.Material of Construction of storage tanks considered as polyethylene water storage tank from BIS approved.

b.100 NB Hume pipe of suitable size for protecting Heavy duty rigid HDPE pipes in road crossings. Top of hume Pipe shall be 0.5 m approx. from NGL for road crossings.

c.Main header Heavy duty rigid HDPE pipes are buried in ground at least 300 mm approx from NGL/FGL.

d.The length of the hose pipe is 50 Meter and size 15 MM Pressure 15 KG.

6.6 Instrumentation:

a.Level gauge to be provided in the water storage tanks

b.Pressure gauge provided at the Pump Delivery Side.

c.Pressure Releasing Valve P.R.V 50 MM provided at the Pump Delivery Side.

d.Piping routes shall be marked with markers at every 50 m. (As per Piping std)

e.Air release valves (ARVs) shall be provided at all endings and relevant corners in the piping network.

f.Electrical starter panel to have a canopy arrangement.

g.Power supply cable to Motor should be armoured power cable of suitable rating or flexible with HDPE Conduct Pipe (as per Cable Laying Std)

Supply of Module cleaning System to be as the approved BOM only. Vendor to submit the detailed BOM after design approval by BHEL/End Customer. The GTP of all the supply items have to be submitted to BHEL for approval and supply of items to be as per approved make only.

Vendor shall provide the water test report, water requirement calculations, cleaning schedule and single line diagram of water washing arrangement to BHEL/End Customer for approval.

7.0. I& C OF THE MODULE CLEANING SYSTEM.

a. Vendor to submit the procedure for pipe laying methodology to BHEL for approval.

b. The whole piping system has to be tested and shown to BHEL representative.

c. The O&M methodology of the Module cleaning system has to be shown to BHEL Site Representative.

d. Demonstration of the Module cleaning system: Vendor has to install the entire Module cleaning system layout and demonstrate the working of the entire system to the satisfaction of the BHEL Engineer.

e. Vendor shall organize at his own expense, supply all tools, power, water, plant and equipment (hereinafter referred to as T & P) required for execution of contract, as specified in the tender documents. whole of the works shall be executed in perfect conformity with the specifications and drawings. No T & P shall be provided by BHEL.

f. Safety:

The vendor shall employ all safety related equipment such as safety ladder, safety harness, scaffolds, and PPE's for workmen for working at site.

g. Statutory obligation:

Vendor is required to meet all the statutory obligations with regard to workers employed by him for the contract. The Contractor shall provide and employ on Site in the installation of the Facilities such skilled, semiskilled and unskilled labor as is necessary for proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills.

Unless otherwise provided in the Contract, the Contractor shall be responsible for the recruitment, transportation, accommodation, sanitation, first aid facility and catering of all labor, local or expatriate, required for the execution of the Contract and for all payments in connection therewith.

The Contractor shall be responsible for obtaining all necessary permit(s) from the appropriate authorities for the entry of all labour and personnel to be employed by contractor on the Site including that of his sub-contractors.

The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous or disorderly conduct or behavior by or amongst its employees and the labour of its Subcontractors.

The Contractor shall, in all dealings with its labour and the labour of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labor.